

Needs For and Alternatives To

**APPENDIX D**  
**2013 Electric Load Forecast**

# 2013 ELECTRIC LOAD FORECAST

(For External Use)



MARKET FORECAST  
JUNE 2013

APPROVED JULY 2013

 Manitoba  
Hydro

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## EXECUTIVE SUMMARY

### Overview

Gross Firm Energy is forecast to grow from weather adjusted value of 24,404 GW.h in 2012/13 to 28,605 GW.h in 2022/23. This average growth is 420 GW.h or 1.6% per year for 10 years. By 2032/33, Gross Firm Energy is forecast to be 32,667 GW.h, a twenty-year growth rate of 413 GW.h or 1.5% per year.

Gross Total Peak is forecast to grow at about the same pace, growing 79 MW or 1.7% a year for the next 10 years, and 76 MW or 1.5% a year for the next 20 years. In 20 years, the peak will grow 1,527 MW to 5,959 MW.

Growth is expected in all sectors. The 20 year growth rates in the Residential Basic, General Service Mass Market and General Service Top Consumers sectors are forecast to be 1.4%, 1.5% and 1.6% respectively.

During the last 10 years, Gross Firm Energy has grown 266 GW.h or 1.2% per year. This ten year period includes the 2009 economic downturn that slowed growth.

The primary driver of growth in Manitoba is the population, with the secondary driver being the economy. Manitoba Hydro's 2013 Economic Outlook provides both the forecast of the population and the resulting forecast of Residential Basic customers that is used in this document. The population of Manitoba has grown from 1,156,600 people in 2002 to 1,267,000 people in 2012 averaging 0.9% growth per year. The forecast is that Manitoba's population will grow to 1,568,500 by 2032, averaging 1.1% per year. The primary reason for the expected increase of population growth in Manitoba is due to government immigration initiatives.

Residential Basic customer growth is expected to mimic population growth, growing 1.1% per year over the next 20 years. An increase in average use per customer adds 0.3% to the growth and is primarily due to increased use of electric space heating and electric water heating in homes.

General Service Mass Market is forecast to grow at an average 1.5% per year, comparable to its historic growth of 1.4% per year over the past ten years.

General Service Top Consumers is forecast to grow at 1.6% per year. This is higher than its 0.5% growth per year during the past ten years which included the loss of a customer and an economic downturn. But it is less than the 3.3% growth per year during the prior ten years. Combined, the 20 year historical growth of the Top Consumers has been 2.0% per year. Short term committed customer plans will amount to 355 GW.h of growth, even after accounting for the expected major load decrease by 2016 of one customer.

**Comparison with the 2012 Forecast**

The Gross Firm Energy forecast is down 495 GW.h in 2013/14 due to initial-year decreases to the GS Mass Market and GS Top Consumers forecasts and associated decreases to losses. The growth of Residential Basic customers has been reduced from the 2012 forecast resulting in a lower Residential and GS Mass Market forecast. Gross Firm Energy is down 717 GW.h (1½ years of load growth) in 2022/23 and down 1159 GW.h (almost 3 years of load growth) in 2031/32.

The reduction in peak in 2022/23 is 54 MW, about 2/3 of a year of load growth. The reduction in peak in 2031/32 of 146 MW amounts to a reduction of almost 2 years of load growth.

**Load Variability and Possible Events**

The forecast presented in this document is Manitoba Hydro’s best estimate of Manitoba’s future electricity requirements. Analysis of historical variation indicates there is an 80% chance that by 2032/33, the load could vary by ±2,471 GW.h (7.6%) from the forecast.

In addition, Manitoba Hydro examines possible events of interest for their potential impact on system load requirements. These events are deemed to be captured within the overall load variability analysis of the forecast, but are presented so their individual effects may be considered from a sensitivity perspective if the need arises:

	<b>Energy Effect (GW.h)</b>	<b>Peak Effect (MW)</b>
<b>Climate Change per Degree Celsius Warmer</b>	+100	-40
<b>One New Very Large Industrial Customer</b>	+1,500	+180
<b>One Less Very Large Industrial Customer</b>	-1,500	-180
<b>Additional Load if Electric Vehicles Grow to 70%</b>	+2,312	+289
<b>10% of all Res Customers switch to Electric Heat</b>	+746	+246
<b>10% of all Res Customers switch to Electric Water Heaters</b>	+198	+23

(For comparison, 1 year of load growth is approximately 420 GW.h or 80 MW)

Table 1 - Gross Energy and Peak

<b>GROSS FIRM ENERGY AND GROSS TOTAL PEAK</b>					
<b>History and Forecast</b>					
<b>2002/03 - 2032/33</b>					
<b>Fiscal Year</b>	<b>Gross Firm Energy</b>		<b>Gross Total Peak</b>		<b>Load Factor (%)</b>
	<b>(GW.h)</b>	<b>Growth (%)</b>	<b>(MW)</b>	<b>Growth (%)</b>	
2002/03	22110		3948		63.9%
2003/04	22069	-0.2%	3994	1.2%	63.1%
2004/05	22589	2.4%	4201	5.2%	61.4%
2005/06	22757	0.7%	4085	-2.8%	63.6%
2006/07	23464	3.1%	4208	3.0%	63.7%
2007/08	24122	2.8%	4304	2.3%	64.0%
2008/09	24417	1.2%	4509	4.8%	61.8%
2009/10	23412	-4.1%	4393	-2.6%	60.8%
2010/11	23892	2.1%	4286	-2.4%	63.6%
2011/12	23605	-1.2%	4367	1.9%	61.7%
2012/13	24759	4.9%	4559	4.4%	62.0%
2012/13 Wadj	24404	-1.4%	4432	-2.8%	62.9%
10 Year Avg Gr.	266	1.2%	48	1.2%	
2013/14	25239	3.4%	4601	3.8%	62.6%
2014/15	25676	1.7%	4680	1.7%	62.6%
2015/16	26013	1.3%	4742	1.3%	62.6%
2016/17	26322	1.2%	4801	1.2%	62.6%
2017/18	26606	1.1%	4857	1.2%	62.5%
2018/19	27003	1.5%	4930	1.5%	62.5%
2019/20	27398	1.5%	5002	1.5%	62.5%
2020/21	27789	1.4%	5074	1.4%	62.5%
2021/22	28197	1.5%	5147	1.5%	62.5%
2022/23	28605	1.4%	5222	1.4%	62.5%
10 Year Avg Gr.	420	1.6%	79	1.7%	
2023/24	29013	1.4%	5296	1.4%	62.5%
2024/25	29418	1.4%	5369	1.4%	62.5%
2025/26	29822	1.4%	5443	1.4%	62.6%
2026/27	30225	1.4%	5516	1.3%	62.6%
2027/28	30625	1.3%	5588	1.3%	62.6%
2028/29	31041	1.4%	5664	1.4%	62.6%
2029/30	31453	1.3%	5739	1.3%	62.6%
2030/31	31863	1.3%	5813	1.3%	62.6%
2031/32	32265	1.3%	5886	1.3%	62.6%
2032/33	32667	1.2%	5959	1.2%	62.6%
20 Year Avg Gr.	413	1.5%	76	1.5%	

Table 2 - Change in Energy and Peak

<b>GROSS FIRM ENERGY AND GROSS TOTAL PEAK</b>						
<b>Change from Previous Forecast</b>						
<b>2013/14 - 2032/33</b>						
<b>Fiscal Year</b>	<b>Gross Firm Energy</b>			<b>Gross Total Peak</b>		
	<b>2013 Forecast (GW.h)</b>	<b>2012 Forecast (GW.h)</b>	<b>Change (GW.h)</b>	<b>2013 Forecast (MW)</b>	<b>2012 Forecast (MW)</b>	<b>Change (MW)</b>
<b>2012/13 Act</b>	<b>24759</b>			<b>4559</b>		
<b>Weather Adj.</b>	<b>-356</b>			<b>-127</b>		
<b>2012/13 Wadj</b>	<b>24404</b>	<b>24961</b>	<b>(557)</b>	<b>4432</b>	<b>4491</b>	<b>(59)</b>
<b>2013/14</b>	<b>25239</b>	<b>25734</b>	<b>(495)</b>	<b>4601</b>	<b>4609</b>	<b>(8)</b>
<b>2014/15</b>	<b>25676</b>	<b>26071</b>	<b>(395)</b>	<b>4680</b>	<b>4677</b>	<b>3</b>
<b>2015/16</b>	<b>26013</b>	<b>26393</b>	<b>(380)</b>	<b>4742</b>	<b>4738</b>	<b>4</b>
<b>2016/17</b>	<b>26322</b>	<b>26677</b>	<b>(355)</b>	<b>4801</b>	<b>4794</b>	<b>7</b>
<b>2017/18</b>	<b>26606</b>	<b>27128</b>	<b>(522)</b>	<b>4857</b>	<b>4874</b>	<b>(17)</b>
<b>2018/19</b>	<b>27003</b>	<b>27616</b>	<b>(614)</b>	<b>4930</b>	<b>4959</b>	<b>(29)</b>
<b>2019/20</b>	<b>27398</b>	<b>27919</b>	<b>(521)</b>	<b>5002</b>	<b>5024</b>	<b>(22)</b>
<b>2020/21</b>	<b>27789</b>	<b>28400</b>	<b>(611)</b>	<b>5074</b>	<b>5109</b>	<b>(35)</b>
<b>2021/22</b>	<b>28197</b>	<b>28859</b>	<b>(661)</b>	<b>5147</b>	<b>5192</b>	<b>(45)</b>
<b>2022/23</b>	<b>28605</b>	<b>29322</b>	<b>(717)</b>	<b>5222</b>	<b>5276</b>	<b>(54)</b>
<b>10 Year Avg Gr.</b>	<b>420</b> <b>1.6%</b>	<b>436</b> <b>1.6%</b>		<b>79</b> <b>1.7%</b>	<b>79</b> <b>1.6%</b>	
<b>2023/24</b>	<b>29013</b>	<b>29779</b>	<b>(766)</b>	<b>5296</b>	<b>5360</b>	<b>(64)</b>
<b>2024/25</b>	<b>29418</b>	<b>30239</b>	<b>(821)</b>	<b>5369</b>	<b>5445</b>	<b>(76)</b>
<b>2025/26</b>	<b>29822</b>	<b>30691</b>	<b>(869)</b>	<b>5443</b>	<b>5528</b>	<b>(85)</b>
<b>2026/27</b>	<b>30225</b>	<b>31138</b>	<b>(913)</b>	<b>5516</b>	<b>5611</b>	<b>(95)</b>
<b>2027/28</b>	<b>30625</b>	<b>31594</b>	<b>(968)</b>	<b>5588</b>	<b>5695</b>	<b>(107)</b>
<b>2028/29</b>	<b>31041</b>	<b>32053</b>	<b>(1012)</b>	<b>5664</b>	<b>5779</b>	<b>(115)</b>
<b>2029/30</b>	<b>31453</b>	<b>32511</b>	<b>(1058)</b>	<b>5739</b>	<b>5863</b>	<b>(124)</b>
<b>2030/31</b>	<b>31863</b>	<b>32967</b>	<b>(1104)</b>	<b>5813</b>	<b>5947</b>	<b>(134)</b>
<b>2031/32</b>	<b>32265</b>	<b>33425</b>	<b>(1159)</b>	<b>5886</b>	<b>6032</b>	<b>(146)</b>
<b>19 Year Avg Gr.</b>	<b>414</b> <b>1.5%</b>	<b>445</b> <b>1.5%</b>	<b>-32</b> <b>-0.1%</b>	<b>77</b> <b>1.5%</b>	<b>81</b> <b>1.6%</b>	<b>-5</b> <b>-0.1%</b>

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## INTRODUCTION

This document is prepared annually as Manitoba Hydro's forecast of its future load requirements for its service area. The service area consists of all of Manitoba (99.83% of sales), as well as two resale customers that supply energy to Creighton, Sask. (0.14% of sales) and the Northwest Angle, Minn. (0.03% of sales). Exports of power to other utilities are not included.

This information is provided for several purposes. Rate making and accounting require short term forecasts of sales by billing month within rate groups so they can forecast revenue. Operations and power planning require short and long term forecasts of energy and peak by calendar month so they can determine supply requirements.

A "customer" in this document usually refers to a metered electrical service. Unmetered services, such as flat rate water heating and sentinel rentals do not count as customers, and street lights group a number of services as one customer. A customer is not the same as a building. One building can have multiple electric services and may count as more than one customer, or multiple buildings may have only one service and may count as only one customer. A customer in this document is also not the same as a customer on the billing system. The latter is a person or organization that Manitoba Hydro serves. One billing customer may pay the bill for multiple services and thus count as multiple customers in this document.

Electric consumption is read from a customer's meter in units of kilowatt-hours (kW.h). A typical home not using electricity for heating might use 10,000 kW.h per year. This document reports electric use in terms of gigawatt-hours (GW.h). One GW.h equals one million kW.h, which is approximately the energy of 100 typical homes not using electricity for heating.

The highest load requirement for a time period is known as the peak load. It is given in terms of megawatts (MW). One MW equals one thousand kilowatts (kW). A typical home not using electricity for heating would use a maximum of about 2.5 kW sometime during the year. However, homes will not all be at their maximum use at the same hour. The maximum use at the same hour is known as the coincident load at the system peak hour. A typical home not using electricity for heating would use about 1.6 kW at the coincident peak. Therefore 1 MW is approximately the coincident peak requirement of 600 typical homes not using electricity for heating.

## **Components of Manitoba's Electricity Use – 2012/13**

General Consumers Sales (also referred to as Total Sales) includes the energy supplied to all of Manitoba Hydro's individually billed customers. In 2012/13, Manitoba Hydro averaged 545,660 General Consumers Sales customers who used 21,477 GW.h.

The major groups include

- (1) Residential Basic, with 456,130 customers who used 7,223 GW.h or 33.6% of Sales. These are mostly residences that include single-family homes, multi-family homes and apartment suites.
- (2) General Service Mass Market, with 65,974 customers who used 8,434 GW.h or 39.3% of Sales. These are small to large Commercial and Industrial customers.
- (3) General Service Top Consumers, with 31 customers who used 5,560 GW.h or 25.9% of sales. These are 17 high-usage companies (some count as multiple customers) that are forecast individually.

The remaining customers include Seasonal customers (billed twice a year rather than monthly), Diesel customers (four remote towns not connected to the integrated grid system), Flat Rate Water Heating and Area and Roadway Lighting. Their electricity use totals only 260 GW.h or 1.2% of Total Sales. Over 50,000 of these services do not count as customers.

Manitoba Load at Common Bus is the total load metered at all the substations in the province that supplies Manitoba Hydro's non-Diesel customers and includes Distribution Losses and Construction Power. In 2012/13, Common Bus was 22,699 GW.h or about 5.7% more than Total Sales.

Gross Firm Energy is the total load needed to be generated for domestic firm load requirements on the Integrated System (excludes diesel). It includes Transmission Losses and Station Service. Some customers are on non-firm contracts (Surplus Energy Program), and their load is not included as part of Manitoba Hydro's generation requirement. In 2012/13, Gross Firm Energy was 24,759 GW.h or about 15.3% more than Total Sales.

Table 3 - Components of Manitoba Electricity Use

<b>COMPONENTS OF MANITOBA ELECTRICITY USE</b>				
<b>2012/13</b>				
<b>(Customers, Consumption and Average Use)</b>				
<b>Forecast Group</b>	<b>Cust/Serv</b>	<b>GW.h</b>	<b>% of Sales</b>	<b>kW.h/cust</b>
Residential Basic	456,130	7,223	33.6%	15,836
Residential Diesel	577	8	0.0%	14,632
Residential Seasonal	20,731	81	0.4%	3,911
Residential Flat Rate Water Heating	4,089	21	0.1%	5,088
<b>Total Residential</b>	<b>477,438</b>	<b>7,334</b>	<b>34.1%</b>	
GS Mass Market	65,974	8,434	39.3%	127,839
GS Top Consumers	31	5,560	25.9%	179,345,515
GS Diesel	175	5	0.0%	31,069
GS Seasonal	850	5	0.0%	6,048
GS Flat Rate Water Heat	408	7	0.0%	18,236
GS Surplus Energy Program	28	28	0.1%	996,707
<b>Total General Service</b>	<b>67,058</b>	<b>14,040</b>	<b>65.4%</b>	
Sentinal Flat Rate	20,238	12	0.1%	568
Sentinal Rental	25,613	-	0.0%	-
Street Lighting	1,164	92	0.4%	78,979
<b>Total Lighting</b>	<b>1,164</b>	<b>103</b>	<b>0.5%</b>	
<b>Total General Consumer Sales</b>	<b>545,660</b>	<b>21,477</b>	<b>100.0%</b>	
Less Diesel Sales		(14)	-0.1%	
Distribution Losses		1,176	5.5%	
Construction Power		59	0.3%	
<b>Manitoba Load at Common Bus</b>		<b>22,699</b>	<b>105.7%</b>	
Transmission Losses		1,952	9.1%	
Less Non-Firm Energy		(28)	-0.1%	
Station Service		137	0.6%	
<b>Gross Firm Energy</b>		<b>24,759</b>	<b>115.3%</b>	
* flat rate and rental services are shown in yellow, which do not count as customers				

## FORECAST OVERVIEW

### General Consumers Customer Forecast

In 2012/13, there was an average of 545,660 General Consumer Sales customers. These were made up of 456,130 Residential Basic customers, 65,974 General Service Mass Market customers, 31 General Service Top Consumers customers, 28 SEP (Surplus Energy Program, i.e. non-firm) customers, with the rest being Diesel, Seasonal and Area and Roadway Lighting.

During the last 10 years, Residential Basic customers have grown at an average of 4,232 (1.0%) per year. Manitoba Hydro's 2013 Economic Outlook provides the forecast of Residential Basic customers, and this document uses that forecast. It calls for a growth of 5,577 (1.2%) per year over the next ten years and 5,423 (1.1%) per year over the next 20 years. The primary reason for the increase is an expectation of increased population growth in Manitoba due to government immigration initiatives which will impact both the Residential and Commercial Sectors.

General Service Mass Market customers have grown 571 (0.9%) per year over the last 10 years. They are forecast to grow 545 (0.8%) over the next ten years and 512 (0.7%) over the next 20 years.

Residential Seasonal customers, who are mainly cottages with lower usage, are growing at a slower rate than Residential Basic averaging 51 (0.3%) customers per year over the last 10 years. They are forecast to grow at 96 (0.5%) over the next 10 years and 98 (0.5%) over the next 20 years.

Area and Roadway Lighting customers were re-grouped in 2006 when Manitoba Hydro changed its billing system, and the lighting customer counts changed at that time. Area and Roadway Lighting is expected to grow at 4 (0.4%) customers over the next 10 years and 5 (0.4%) over the next 20 years.

Manitoba Hydro purchased Winnipeg Hydro in September 2002. Their customers were integrated into the Manitoba Hydro billing system in June 2004. Historical customer and energy numbers in this document include Winnipeg Hydro customers.

Table 4 - General Consumers Sales Customers

GENERAL CONSUMERS SALES (Ave. Customers)										
History and Forecast										
2002/03 - 2032/33										
Fiscal Year	Residential			General Service					Lighting	Total Custs
	Basic	Diesel	Seas	Mass Mkt	Top Cons	Diesel	Seas	SEP		
2002/03	413,812	499	20,219	60,265	26	148	786	33	755	496543
2003/04	416,690	500	20,056	60,672	27	151	788	33	757	499674
2004/05	420,135	508	20,075	60,924	26	160	793	31	759	503411
2005/06	423,742	519	20,145	61,491	26	168	814	28	793	507726
2006/07	427,886	525	20,312	63,596	26	169	783	28	1129	514454
2007/08	432,144	531	20,437	63,855	26	175	798	27	1,142	519135
2008/09	437,263	540	20,648	64,140	26	178	818	24	1,175	524812
2009/10	441,710	539	20,839	64,758	26	177	830	24	1,191	530094
2010/11	445,882	550	20,950	65,193	26	176	842	24	1,184	534827
2011/12	450,748	568	20,844	65,546	32	174	847	26	1,155	539940
2012/13	456,130	577	20,731	65,974	31	175	850	28	1,164	545660
10 Year Avg Gr.	4232	8	51	571	1	3	6	-1	41	4912
	1.0%	1.5%	0.3%	0.9%	1.8%	1.7%	0.8%	-1.6%	4.4%	0.9%
2013/14	461,763	581	20,786	66,568	30	176	851	32	1,163	551950
2014/15	467,291	588	20,886	67,106	30	178	856	34	1,168	558137
2015/16	472,817	595	20,986	67,654	30	179	861	36	1,173	564331
2016/17	478,333	602	21,086	68,224	30	181	866	38	1,178	570538
2017/18	483,871	610	21,186	68,789	31	182	871	40	1,183	576763
2018/19	489,452	617	21,286	69,332	31	184	876	40	1,188	583006
2019/20	495,061	624	21,386	69,862	31	185	881	40	1,193	589263
2020/21	500,681	631	21,486	70,387	31	187	886	40	1,198	595527
2021/22	506,300	638	21,586	70,908	31	188	891	40	1,203	601785
2022/23	511,900	645	21,686	71,426	31	190	896	40	1,208	608022
10 Year Avg Gr.	5577	7	96	545	0	2	5	1	4	6236
	1.2%	1.1%	0.5%	0.8%	0.0%	0.8%	0.5%	3.6%	0.4%	1.1%
2023/24	517,463	652	21,786	71,939	31	191	901	40	1,213	614216
2024/25	522,976	659	21,886	72,446	31	193	906	40	1,218	620355
2025/26	528,431	666	21,986	72,945	31	194	911	40	1,223	626427
2026/27	533,822	673	22,086	73,437	31	196	916	40	1,228	632429
2027/28	539,143	680	22,186	73,922	31	197	921	40	1,233	638353
2028/29	544,387	687	22,286	74,397	31	199	926	40	1,238	644191
2029/30	549,550	694	22,386	74,864	31	200	931	40	1,243	649939
2030/31	554,634	702	22,486	75,322	31	202	936	40	1,248	655601
2031/32	559,644	709	22,586	75,771	31	203	941	40	1,253	661178
2032/33	564,585	716	22,686	76,214	31	205	946	40	1,258	666681
20 Year Avg Gr.	5423	7	98	512	0	2	5	1	5	6051
	1.1%	1.1%	0.5%	0.7%	0.0%	0.8%	0.5%	1.8%	0.4%	1.0%



## **General Consumers Sales Forecast**

During 2012/13, Total General Consumer Sales was 21,477 GW.h. The fiscal billing year (using weather from March 16, 2012 to March 15, 2013) was warmer than normal in the winter months resulting in a winter weather adjustment of 98 GW.h, and was hotter than normal in the summer resulting in a summer weather adjustment of -130 GW.h. Overall, the weather adjustment for the year was -32 GW.h giving a weather adjusted Total Sales value of 21,445 GW.h.

During the last 10 years, Total Sales have grown at 258 GW.h (1.3%) per year. The growth was 1.8% per year in Residential Basic, 1.4% per year in General Service Mass Market, but only 0.5% in General Service Top Consumers due to the economic downturn in 2009 that included the loss of one Top Consumer customer. This historical growth includes the effect of past Demand Side Management (DSM) initiatives.

Sales are forecast to grow at 364 GW.h (1.6%) per year over the next 10 years and 361 GW.h (1.5%) over the next 20 years before accounting for future market-based DSM programs as outlined on page 57.

Most of the growth is forecast to occur in General Service Mass Market, growing 144 GW.h (1.5%) per year over the next twenty years, followed by Residential Basic at 112 GW.h (1.4%). Top Consumers are expected to return to their normal growth rate and are forecast to grow at 103 (1.6%) per year.

Table 5 - General Consumers Sales Energy

GENERAL CONSUMERS SALES (GW.h)												
History and Forecast												
2002/03 - 2032/33												
Fiscal Year	Residential				General Service						Lighting	Total Sales
	Basic	Diesel	Seas	FRWH	Mass Mkt	Top Cons	Diesel	Seas	FRWH	SEP		
2002/03	6266	6	54	35	7467	5282	4	4	14	25	90	19246
2003/04	6170	6	56	34	7460	5423	5	5	13	17	91	19280
2004/05	6275	7	58	31	7516	5714	5	5	10	25	91	19735
2005/06	6171	7	59	30	7587	5948	5	5	9	23	91	19935
2006/07	6443	7	60	29	7839	5989	5	4	9	23	101	20510
2007/08	6736	7	68	27	8006	6075	5	4	9	24	101	21061
2008/09	6847	7	74	25	8049	6065	5	5	8	22	102	21210
2009/10	6786	7	81	24	7985	5461	6	5	8	20	102	20486
2010/11	6952	8	77	23	8258	5324	5	5	8	24	103	20786
2011/12	6818	8	83	22	8162	5531	5	5	8	25	103	20771
2012/13	7223	8	81	21	8434	5560	5	5	7	28	103	21477
Weather Adj.	-4	0	0	0	-28	0	0	0	0	1	0	-32
2012/13 Wadj	7219	8	81	21	8406	5560	5	5	7	29	103	21445
10 Year Wadj	121	0	3	-1	107	28	0	0	-1	0	1	258
Avg Gr.	1.8%	3.6%	4.2%	-5.1%	1.4%	0.5%	2.1%	1.7%	-6.0%	1.7%	1.4%	1.3%
2013/14	7339	8	83	20	8550	5925	5	5	7	30	104	22076
2014/15	7458	9	85	19	8701	6036	5	5	7	32	104	22460
2015/16	7538	9	86	18	8858	6110	6	5	6	34	105	22774
2016/17	7624	9	88	17	9018	6145	6	5	6	36	106	23059
2017/18	7730	9	90	16	9174	6140	6	5	6	38	106	23319
2018/19	7842	9	92	15	9325	6232	6	5	5	38	107	23677
2019/20	7953	10	93	15	9470	6322	6	5	5	38	107	24024
2020/21	8063	10	95	14	9613	6412	6	5	5	38	108	24369
2021/22	8173	10	97	13	9756	6517	6	5	5	38	108	24728
2022/23	8290	10	99	12	9898	6615	6	5	4	38	109	25087
10 Year	107	0	2	-1	149	106	0	0	0	1	1	364
Avg Gr.	1.4%	2.0%	2.0%	-5.0%	1.6%	1.8%	0.7%	0.6%	-5.0%	2.8%	0.5%	1.6%
2023/24	8405	11	101	12	10040	6715	6	5	4	38	109	25446
2024/25	8520	11	103	11	10179	6815	6	6	4	38	110	25802
2025/26	8635	11	105	11	10318	6915	6	6	4	38	110	26158
2026/27	8750	11	106	10	10456	7015	6	6	4	38	111	26513
2027/28	8864	11	108	10	10592	7115	6	6	3	38	111	26865
2028/29	8983	12	110	9	10736	7215	6	6	3	38	112	27230
2029/30	9102	12	112	9	10878	7315	6	6	3	38	112	27593
2030/31	9219	12	114	8	11020	7415	6	6	3	38	113	27954
2031/32	9337	12	116	8	11154	7515	6	6	3	38	113	28308
2032/33	9454	13	118	7	11288	7615	6	6	3	38	114	28662
20 Year	112	0	2	-1	144	103	0	0	0	0	1	361
Avg Gr.	1.4%	2.0%	1.9%	-5.0%	1.5%	1.6%	0.8%	0.6%	-5.0%	1.4%	0.5%	1.5%

## **Manitoba Energy Forecast**

The actual Gross Firm Energy was 24,759 GW.h in 2012/13. Gross Firm Energy has grown 266 GW.h (1.2%) per year for the past 10 years. This historical growth reflects the effect of past Demand Side Management (DSM) initiatives. Gross Firm energy is forecast to grow to 32,667 GW.h by 2032/33 at an average growth of 413 GW.h or 1.5% per year. This is before accounting for future market-based DSM programs as noted on page 57.

Distribution losses, which is the difference between Manitoba Hydro's substations and the customers' meters, has a wide variance from year to year and has ranged between 3.5% and 5.5% of Total Sales. It is forecast to be 4.4% of Sales for the entire forecast.

Transmission Losses which is the difference between the generators and the substations is forecast to be 9.3% of Total Sales for the entire forecast.

Distribution Losses, Transmission Losses, Construction and Station Service amount to an additional 14% that needs to be added to Total Sales to estimate Gross Firm Energy. This 14% value should generally be used to estimate load at generation when only load at the customer's meter is known, for example to convert Power Smart program savings from the customer meter to generation. The exception is for large General Service customers who own their own transformation and incur minimal Distribution Losses. For these customers, a 10% value should be used.

Table 6 - Components of Manitoba Energy

<b>MANITOBA FIRM ENERGY (GW.h)</b> <b>History and Forecast</b> <b>2002/03 - 2032/33</b>										
Fiscal Year	General Consumer Sales less Diesel	Dist. Losses	Dist. Loss %	Const. Power	Manitoba Load at Common Bus	Trans. Losses	Trans. Loss %	Less Non Firm Energy	Station Service	Gross Firm Energy
2002/03	19236	671	3.5%	46	19953	2012	10.5%	24	170	22110
2003/04	19269	804	4.2%	43	20116	1792	9.3%	17	179	22069
2004/05	19724	830	4.2%	46	20600	1852	9.4%	26	163	22589
2005/06	19923	797	4.0%	42	20761	1860	9.3%	23	158	22757
2006/07	20497	900	4.4%	45	21442	1885	9.2%	22	159	23464
2007/08	21049	940	4.5%	47	22036	1949	9.3%	24	161	24122
2008/09	21198	1052	5.0%	56	22305	1979	9.3%	22	154	24417
2009/10	20473	813	4.0%	75	21361	1934	9.4%	20	137	23412
2010/11	20773	947	4.6%	85	21806	1977	9.5%	25	134	23892
2011/12	20757	736	3.5%	67	21560	1939	9.3%	25	131	23605
2012/13	21463	1176	5.5%	59	22699	1952	9.1%	28	137	24759
Weather Adj.	-32	-295		0	-327	-29		0	0	-356
2012/13 Wadj	21431	881	4.1%	59	22372	1923	9.0%	28	137	24404
10 Year Wadj	258	16		1	275	-6		0	-3	266
Avg Gr.	1.3%	2.0%		2.7%	1.3%	-0.3%		1.4%	-2.1%	1.2%
2013/14	22062	971	4.4%	43	23076	2058	9.3%	30	134	25239
2014/15	22446	988	4.4%	45	23479	2094	9.3%	32	134	25676
2015/16	22759	1001	4.4%	29	23790	2122	9.3%	34	134	26013
2016/17	23044	1014	4.4%	17	24075	2148	9.3%	36	134	26322
2017/18	23304	1025	4.4%	9	24338	2171	9.3%	38	134	26606
2018/19	23661	1041	4.4%	0	24703	2204	9.3%	38	134	27003
2019/20	24009	1056	4.4%	0	25065	2236	9.3%	38	134	27398
2020/21	24353	1072	4.4%	0	25425	2268	9.3%	38	134	27789
2021/22	24712	1087	4.4%	0	25799	2301	9.3%	38	134	28197
2022/23	25071	1103	4.4%	0	26174	2335	9.3%	38	134	28605
10 Year	364	22		-6	380	41		1	0	420
Avg Gr.	1.6%	2.3%		-100.0%	1.6%	2.0%		3.0%	-0.2%	1.6%
2023/24	25429	1119	4.4%	0	26548	2368	9.3%	38	134	29013
2024/25	25786	1135	4.4%	0	26920	2401	9.3%	38	134	29418
2025/26	26141	1150	4.4%	0	27291	2435	9.3%	38	134	29822
2026/27	26496	1166	4.4%	0	27661	2468	9.3%	38	134	30225
2027/28	26847	1181	4.4%	0	28029	2500	9.3%	38	134	30625
2028/29	27213	1197	4.4%	0	28410	2534	9.3%	38	134	31041
2029/30	27575	1213	4.4%	0	28788	2568	9.3%	38	134	31453
2030/31	27936	1229	4.4%	0	29165	2602	9.3%	38	134	31863
2031/32	28290	1245	4.4%	0	29534	2635	9.3%	38	134	32265
2032/33	28643	1260	4.4%	0	29903	2667	9.3%	38	134	32667
20 Year	361	19		-3	377	37		0	0	413
Avg Gr.	1.5%	1.8%		-100.0%	1.5%	1.7%		1.5%	-0.1%	1.5%

## **Comparison of the 2012 Forecast to Actuals**

### **Comparison of the 2012 Forecast to the 2012/13 Weather Adjusted Actuals**

The weather adjusted General Consumer Sales for 2012/13 was 21,445 GW.h which was 352 GW.h lower than the 2012 forecast of 21,797 GW.h.

The weather adjusted Residential Basic sector for 2012/13 was 7,219 GW.h which was 9 GW.h lower than the 2012 forecast of 7,227 GW.h. The weather adjusted General Service Mass Market sector for 2012/13 was 8,406 GW.h which was 82 GW.h lower than the 2012 forecast of 8,488 GW.h.

The Top Consumers sector for 2012/13 was 5,560 GW.h which was 261 GW.h lower than the 2012 forecast of 5,821 GW.h primarily due to project delays by two Top Consumers. Projected load growth for those specific projects is still expected and is included in the 2013 Forecast.

Distribution losses were forecast to be 950 GW.h, but came in at 1,176 GW.h. Distribution Losses account for the difference between Common Bus and General Consumer Sales. Common Bus is measured month-end to month-end at the substation level, whereas Sales are measured at the customer's meter and by billing cycle, which generally map to mid-month. The extreme warm weather that occurred from March 16 to 31, 2012 combined with the extreme cold weather experienced from March 16 to 31, 2013 resulted in about 300 Heating Degree Days difference between the two measurements. This also caused a very large weather adjustment of -295 GW.h. After accounting for weather adjustment, Distribution Losses were 881 GW.h which was 69 GW.h lower than the 2012 forecast of 950 GW.h.

Weather adjusted transmission losses were 1,923 GW.h which was 112 GW.h less than the 2012 forecast of 2,034 GW.h.

Overall, the weather adjusted Gross Firm Energy was 24,404 GW.h which was 557 GW.h lower than the 2012 forecast of 24,961 GW.h due to delays in the plans of two Top Consumers and lower than normal Distribution and Transmission Losses.

Table 7 - 2012/13 Forecast to Actual

<b>2012 FORECAST COMPARED TO WEATHER ADJUSTED ACTUALS</b>					
<b>2012/13 (GW.h)</b>					
<b>Forecast Group</b>	<b>Weather</b>		<b>Wthr Adj</b>	<b>2012</b>	<b>WA Actuals</b>
	<b>Actuals</b>	<b>Adjustment</b>	<b>Actuals</b>	<b>Forecast</b>	<b>less Forecast</b>
<b>Residential Basic</b>	7,223	(4)	7,219	7,227	(8)
<b>Residential Diesel</b>	8	-	8	8	0
<b>Residential Seasonal</b>	81	-	81	85	(4)
<b>Residential Flat Rate Water Heating</b>	21	-	21	21	(0)
<b>Total Residential</b>	<b>7,334</b>	<b>(4)</b>	<b>7,330</b>	<b>7,341</b>	<b>(11)</b>
<b>GS Mass Market</b>	8,434	(28)	8,406	8,488	(82)
<b>GS Top Consumers</b>	5,560	-	5,560	5,821	(261)
<b>GS Diesel</b>	5	-	5	6	(0)
<b>GS Seasonal</b>	5	-	5	5	0
<b>GS Flat Rate Water Heat</b>	7	-	7	7	0
<b>GS Surplus Energy Program</b>	28	1	29	27	2
<b>Total General Service</b>	<b>14,040</b>	<b>(27)</b>	<b>14,012</b>	<b>14,353</b>	<b>(340)</b>
<b>Sentinal Flat Rate</b>	12	-	12	12	(0)
<b>Sentinal Rental</b>	-	-	-	-	-
<b>Street Lighting</b>	92	-	92	92	(0)
<b>Total Lighting</b>	<b>103</b>	<b>-</b>	<b>103</b>	<b>104</b>	<b>(0)</b>
<b>Total General Consumer Sales</b>	<b>21,477</b>	<b>(32)</b>	<b>21,445</b>	<b>21,797</b>	<b>(352)</b>
<b>Less Diesel Sales</b>	(14)	-	(14)	(14)	(0)
<b>Distribution Losses</b>	1,176	(295)	881	950	(69)
<b>Construction Power</b>	59	-	59	78	(18)
<b>Manitoba Load at Common Bus</b>	<b>22,699</b>	<b>(327)</b>	<b>22,372</b>	<b>22,812</b>	<b>(440)</b>
<b>Transmission Losses</b>	1,952	(29)	1,923	2,034	(112)
<b>Less Non-Firm Energy</b>	(28)	0	(28)	(27)	(2)
<b>Station Service</b>	137	-	137	141	(4)
<b>Gross Firm Energy</b>	<b>24,759</b>	<b>(356)</b>	<b>24,404</b>	<b>24,961</b>	<b>(557)</b>

## Change between the 2012 and 2013 Forecasts

### Change Between the 2012 and 2013 Residential Basic Forecast

The Residential Basic Forecast is down from the 2012 forecast. By 2031/32 the difference is 423 GW.h or 4.3%. This is equivalent to about 1 year of Manitoba system load growth (1 year = approximately 420 GW.h).

Changes made (and the 2031/32 effect):

1. The customer forecast was reduced by 16,901 customers (-282 GW.h).
2. The appliance unit energy consumptions (UECs) or average use per appliance per year were updated in the Residential End Use model. The update was done using a preliminary Conditional Demand Analysis of the 2009 Residential Energy Use Survey data with customer billing data (+212 GW.h).
3. An adjustment to reflect initiatives being undertaken by Manitoba Hydro was included to reduce the number of customers choosing electric space and water heat (-366 GW.h).

Figure 1 - Change of Res Basic Forecast

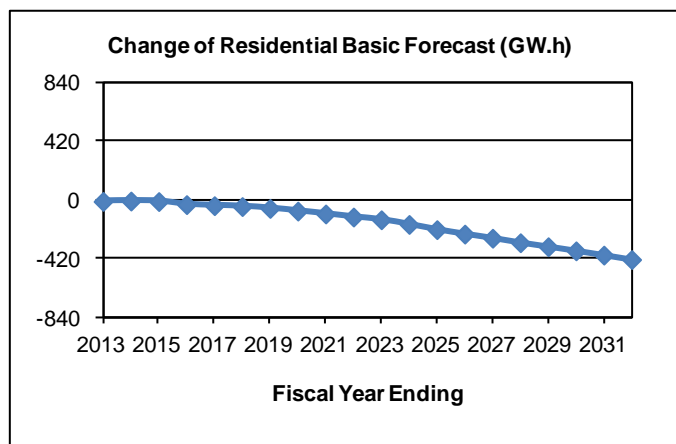


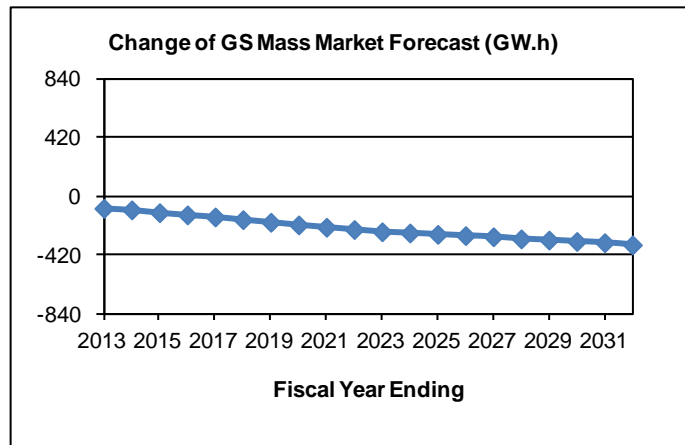
Table 8 - Change of Res Basic Forecast

CHANGE OF RESIDENTIAL BASIC FORECAST (GW.h)									
Comparison of 2012 to 2013 forecast									
Fiscal Year	2012 Fcst	2013 Fcst	Change	%	Fiscal Year	2012 Fcst	2013 Fcst	Change	%
2012/13	7227	7219	(8)	-0.1%	2022/23	8429	8290	(139)	-1.6%
2013/14	7344	7339	(5)	-0.1%	2023/24	8577	8405	(172)	-2.0%
2014/15	7467	7458	(9)	-0.1%	2024/25	8730	8520	(210)	-2.4%
2015/16	7569	7538	(31)	-0.4%	2025/26	8877	8635	(241)	-2.7%
2016/17	7662	7624	(38)	-0.5%	2026/27	9021	8750	(271)	-3.0%
2017/18	7774	7730	(45)	-0.6%	2027/28	9167	8864	(303)	-3.3%
2018/19	7900	7842	(58)	-0.7%	2028/29	9315	8983	(332)	-3.6%
2019/20	8030	7953	(77)	-1.0%	2029/30	9463	9102	(361)	-3.8%
2020/21	8161	8063	(97)	-1.2%	2030/31	9611	9219	(392)	-4.1%
2021/22	8292	8173	(119)	-1.4%	2031/32	9760	9337	(423)	-4.3%

## Change Between the 2012 and 2013 GS Mass Market Forecast

Figure 2 - Change of GS Mass Market Forecast

The General Service Mass Market Forecast is down 343 GW.h in 2031/32, primarily due to the reduction in the residential customer forecast, which also affects commercial growth. This represents less than a year of Manitoba system load growth (1 year = approximately 420 GW.h).



Changes made (and the 2031/32 effect):

1. The residential customer forecast was reduced leading to a reduction in the GS Mass Market customers (-191 GW.h).
2. The average use per customer in each size class was updated and reduced the overall GS Mass Market load. (-107 GW.h).

Table 9 - Change of GS Mass Market Forecast

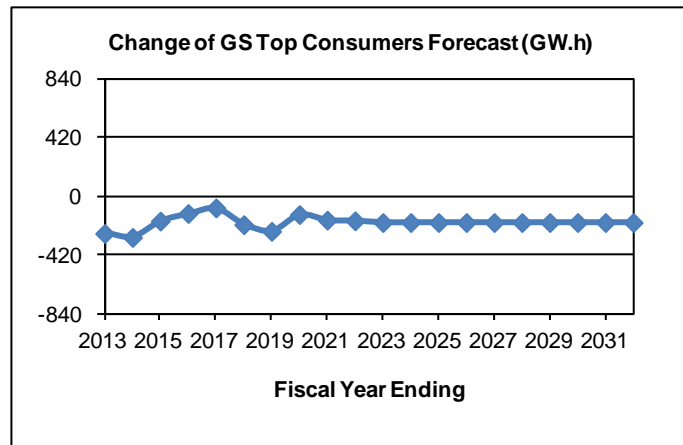
CHANGE OF GS MASS MARKET FORECAST (GW.h)									
Comparison of 2012 to 2013 forecast									
Fiscal Year	2012 Fcst	2013 Fcst	Change	%	Fiscal Year	2012 Fcst	2013 Fcst	Change	%
2012/13	8488	8406	(82)	-1.0%	2022/23	10147	9898	(249)	-2.5%
2013/14	8643	8550	(93)	-1.1%	2023/24	10298	10040	(258)	-2.5%
2014/15	8814	8701	(113)	-1.3%	2024/25	10447	10179	(268)	-2.6%
2015/16	8986	8858	(128)	-1.4%	2025/26	10595	10318	(276)	-2.6%
2016/17	9161	9018	(143)	-1.6%	2026/27	10741	10456	(285)	-2.7%
2017/18	9336	9174	(163)	-1.7%	2027/28	10892	10592	(300)	-2.8%
2018/19	9506	9325	(181)	-1.9%	2028/29	11045	10736	(308)	-2.8%
2019/20	9670	9470	(200)	-2.1%	2029/30	11197	10878	(319)	-2.8%
2020/21	9830	9613	(217)	-2.2%	2030/31	11347	11020	(327)	-2.9%
2021/22	9989	9756	(233)	-2.3%	2031/32	11497	11154	(343)	-3.0%



## Change Between the 2012 and 2013 GS Top Consumers Forecast

Figure 3 - Change of GS Top Consumer Forecast

The General Service Top Consumers is down 289 GW.h in 2013/14 due to delays in some of the short term committed customer plans. By 2031/32, the decrease is 182 GW.h. This is equal to the loss of slightly less than a half year of Manitoba system load growth (1 year = approximately 420 GW.h).



Changes made (and the 2031/32 effect):

1. Short term committed plans of two Top Consumers were delayed with an effect of 305 GW.h in the first two years of the forecast (0 GW.h)
2. Potential Large Industrial Loads begins in the 4<sup>th</sup> year of the forecast, which in the 2013 forecast is one year later giving one less year of PLIL growth (-100 GW.h).
3. Changes to the forecasts of the Top Consumers up to 2021/22 mostly in the Primary Metals sector (-83 GW.h).

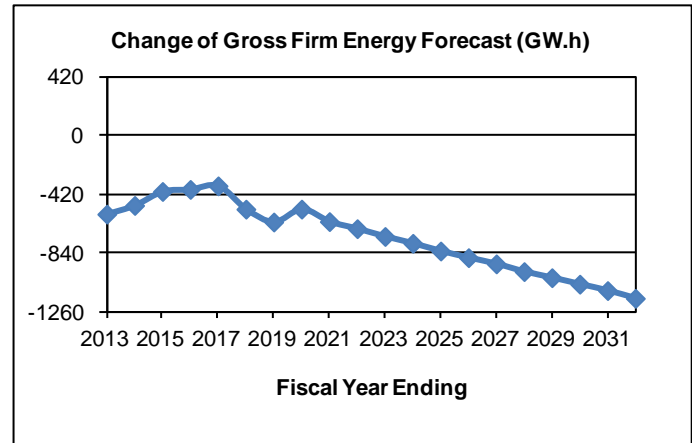
Table 10 - Change of GS Top Consumer Forecast

CHANGE OF GS TOP CONSUMERS FORECAST (GW.h)									
Comparison of 2012 to 2013 forecast									
Fiscal Year	2012 Fcst	2013 Fcst	Change	%	Fiscal Year	2012 Fcst	2013 Fcst	Change	%
2012/13	5821	5560	(261)	-4.5%	2022/23	6798	6615	(183)	-2.7%
2013/14	6214	5925	(289)	-4.7%	2023/24	6898	6715	(183)	-2.7%
2014/15	6208	6036	(172)	-2.8%	2024/25	6998	6815	(183)	-2.6%
2015/16	6228	6110	(118)	-1.9%	2025/26	7098	6915	(183)	-2.6%
2016/17	6223	6145	(78)	-1.3%	2026/27	7198	7015	(183)	-2.5%
2017/18	6338	6140	(198)	-3.1%	2027/28	7298	7115	(183)	-2.5%
2018/19	6478	6232	(246)	-3.8%	2028/29	7398	7215	(183)	-2.5%
2019/20	6448	6322	(126)	-2.0%	2029/30	7498	7315	(183)	-2.4%
2020/21	6578	6412	(166)	-2.5%	2030/31	7598	7415	(183)	-2.4%
2021/22	6688	6517	(171)	-2.6%	2031/32	7698	7515	(183)	-2.4%

## Change Between the 2012 and 2013 Gross Firm Energy Forecast

Figure 4 - Change of Energy Forecast

The Gross Firm Energy forecast is down 557 GW.h in 2013/14 due to initial-year decreases to the GS Mass Market and GS Top Consumers forecasts and associated decreases to losses. This difference grows to 1159 GW.h by 2031/32 due to the reduction of the Residential Basic customer forecast and its effect on the Residential and GS Mass Market forecasts. This is a 3.5% reduction in the forecast of 2031/32, which is equivalent to a loss of almost 3 years of load growth (1 year = approximately 420 GW.h).



Changes made (and the 2031/32 effect):

1. Residential Basic forecast (-423 GW.h), primarily due to the decrease in the forecast of Residential Basic customers and heating fuel choice initiatives being undertaken by Manitoba Hydro.
2. General Service Mass Market forecast (-343 GW.h), primarily due to the decrease in the forecast of Residential Basic customers.
3. General Service Top Consumers forecast (-183 GW.h), mostly in the Primary Metals sector.
4. Other Sales and Losses (-210 GW.h).

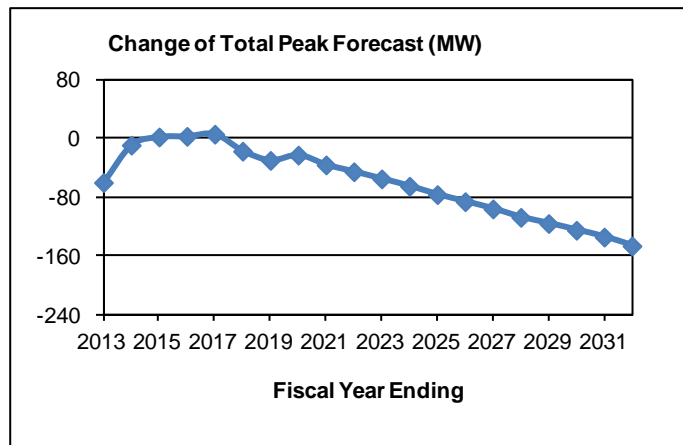
Table 11 - Change of Energy Forecast

GROSS FIRM ENERGY (GW.h)									
Comparison of 2012 to 2013 forecast									
Fiscal Year	2012 Fcst	2013 Fcst	Change	%	Fiscal Year	2012 Fcst	2013 Fcst	Change	%
2012/13	24961	24404	(557)	-2.2%	2022/23	29322	28605	(717)	-2.4%
2013/14	25734	25239	(495)	-1.9%	2023/24	29779	29013	(766)	-2.6%
2014/15	26071	25676	(395)	-1.5%	2024/25	30239	29418	(821)	-2.7%
2015/16	26393	26013	(380)	-1.4%	2025/26	30691	29822	(869)	-2.8%
2016/17	26677	26322	(355)	-1.3%	2026/27	31138	30225	(913)	-2.9%
2017/18	27128	26606	(522)	-1.9%	2027/28	31594	30625	(968)	-3.1%
2018/19	27616	27003	(614)	-2.2%	2028/29	32053	31041	(1012)	-3.2%
2019/20	27919	27398	(521)	-1.9%	2029/30	32511	31453	(1058)	-3.3%
2020/21	28400	27789	(611)	-2.2%	2030/31	32967	31863	(1104)	-3.3%
2021/22	28859	28197	(661)	-2.3%	2031/32	33425	32265	(1159)	-3.5%

## Change Between the 2012 and 2013 Gross Total Peak Forecast

Figure 5 - Change of Peak Forecast

The Gross Total Peak forecast is down 146 MW (2.4%) by 2031/32 from the 2012 forecast. The peak forecast very closely follows the energy forecast, and the reasons for reduction in peak are similar to those for energy.



The reduction in peak in 2022/23 amounts to 54 MW, less than one year of load growth. The reduction in peak in 2031/32 of 146 MW amounts to a reduction of almost 2 years of load growth. (1 year = approximately 80 MW).

Table 12 - Change of Peak Forecast

GROSS TOTAL PEAK (MW)									
Comparison of 2012 to 2013 forecast									
Fiscal Year	2012 Fcst	2013 Fcst	Change	%	Fiscal Year	2012 Fcst	2013 Fcst	Change	%
2012/13	4491	4432	(59)	-1.3%	2022/23	5276	5222	(54)	-1.0%
2013/14	4609	4601	(8)	-0.2%	2023/24	5360	5296	(64)	-1.2%
2014/15	4677	4680	3	0.1%	2024/25	5445	5369	(76)	-1.4%
2015/16	4738	4742	4	0.1%	2025/26	5528	5443	(85)	-1.5%
2016/17	4794	4801	7	0.1%	2026/27	5611	5516	(95)	-1.7%
2017/18	4874	4857	(17)	-0.3%	2027/28	5695	5588	(107)	-1.9%
2018/19	4959	4930	(29)	-0.6%	2028/29	5779	5664	(115)	-2.0%
2019/20	5024	5002	(22)	-0.4%	2029/30	5863	5739	(124)	-2.1%
2020/21	5109	5074	(35)	-0.7%	2030/31	5947	5813	(134)	-2.2%
2021/22	5192	5147	(45)	-0.9%	2031/32	6032	5886	(146)	-2.4%

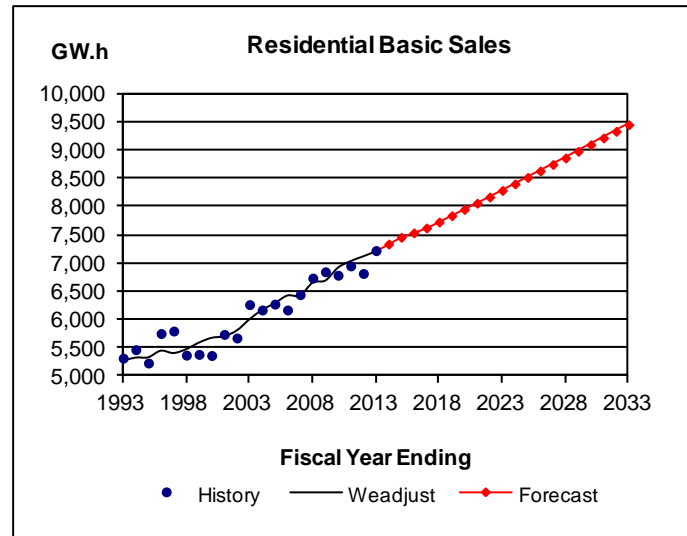
## FORECAST DETAILS

### Residential Basic

In 2012/13, there were 456,130 Residential Basic customers. 80% are single detached, 7% multi attached, and 13% individually metered apartment suites. 54% are in Winnipeg where natural gas is available, 28% in natural gas available areas outside Winnipeg, and 18% do not have natural gas available.

Residential Basic has grown 99 GW.h (1.6%) per year for the past 20 years and 121 GW.h per year (1.8%) for the past 10 years which includes the effect of past Demand Side Management (DSM) initiatives. It is forecast to grow 107 GW.h (1.4%) per year for the next 10 years and 112 GW.h (1.4%) per year for the next 20 years.

Figure 6- Residential Basic Sales



The primary drivers of Residential Basic growth are population and average use per customer. The population is forecast to grow 1.1% per year over both the next 10 and next 20 years. The increase in average use per customer is expected to add another 0.3% to the growth.

Table 13 - Residential Sales

RESIDENTIAL BASIC (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Sales	Weather Adjust	Adjusted Sales	Fiscal Year	Forecast Sales
1993/94	5467	-135	5332	2013/14	7339
1994/95	5230	107	5337	2014/15	7458
1995/96	5753	-299	5454	2015/16	7538
1996/97	5797	-385	5412	2016/17	7624
1997/98	5370	111	5481	2017/18	7730
1998/99	5384	213	5597	2018/19	7842
1999/00	5364	318	5682	2019/20	7953
2000/01	5737	-26	5711	2020/21	8063
2001/02	5674	140	5814	2021/22	8173
2002/03	6266	-255	6011	2022/23	8290
2003/04	6170	10	6181	2023/24	8405
2004/05	6275	22	6297	2024/25	8520
2005/06	6171	263	6434	2025/26	8635
2006/07	6443	-9	6434	2026/27	8750
2007/08	6736	-71	6664	2027/28	8864
2008/09	6847	-146	6701	2028/29	8983
2009/10	6786	144	6930	2029/30	9102
2010/11	6952	94	7046	2030/31	9219
2011/12	6818	313	7131	2031/32	9337
2012/13	7223	-4	7219	2032/33	9454

**Table 14 - Residential Basic Sales**

RESIDENTIAL BASIC SALES											
History and Forecast											
2011/12 - 2031/32											
Fiscal Year	Electric Heat Billed			Other			Total Basic			% Elec Space Heat	% Elec Water Heat
	Custs	GW.h	kW.h/cust	Custs	GW.h	kW.h/cust	Custs	GW.h	kW.h/cust		
2012/13	165576	4255	25701	290554	2964	10201	456130	7219	15827	36.3%	49.0%
2013/14	169399	4342	25635	292364	2997	10250	461763	7339	15894	36.7%	50.1%
2014/15	173080	4425	25568	294212	3033	10309	467292	7458	15961	37.0%	51.2%
2015/16	176666	4492	25428	296150	3046	10284	472816	7538	15943	37.4%	52.2%
2016/17	180099	4559	25313	298234	3065	10277	478333	7624	15938	37.7%	53.2%
2017/18	183380	4629	25244	300492	3100	10318	483872	7730	15975	37.9%	54.1%
2018/19	186502	4698	25191	302950	3144	10378	489452	7842	16023	38.1%	54.8%
2019/20	189479	4763	25140	305582	3190	10439	495061	7953	16065	38.3%	55.6%
2020/21	192355	4826	25089	308326	3237	10500	500681	8063	16105	38.4%	56.2%
2021/22	195141	4886	25041	311159	3286	10562	506300	8173	16142	38.5%	56.9%
2022/23	197812	4947	25010	314088	3343	10643	511900	8290	16194	38.6%	57.5%
2023/24	200399	5006	24978	317064	3399	10721	517463	8405	16242	38.7%	58.0%
2024/25	202950	5064	24950	320026	3456	10800	522976	8520	16292	38.8%	58.6%
2025/26	205463	5121	24925	322968	3514	10880	528431	8635	16341	38.9%	59.1%
2026/27	207935	5178	24903	325887	3572	10960	533822	8750	16391	39.0%	59.6%
2027/28	210365	5235	24884	328778	3630	11040	539143	8864	16442	39.0%	60.1%
2028/29	212752	5292	24876	331635	3691	11130	544387	8983	16502	39.1%	60.6%
2029/30	215094	5349	24870	334457	3752	11219	549551	9102	16562	39.1%	61.1%
2030/31	217392	5406	24866	337243	3814	11308	554635	9219	16622	39.2%	61.6%
2031/32	219649	5462	24866	339995	3875	11397	559644	9337	16684	39.2%	62.0%
2032/33	221868	5518	24869	342718	3937	11487	564586	9454	16746	39.3%	62.5%

**Electric Heat Billed:** Customers who have electric space heating included with their electric bill.

**Other:** Customers who do not have electric space heating included with their electric bill.

**% Elec Space Heat:** The proportion of Total Basic customers who are Electric Heat Billed.

**% Elec Water Heat:** The proportion of Total Basic customers who have Electric Water Heaters.

The average use (kW.h/customer) for Electric Heat Billed customers is decreasing as apartments are making up a higher proportion of the growth and as existing homes become better insulated. The average use for Other customers is increasing primarily due to the increase in electric water heaters.

## **Residential Diesel, Seasonal, and Flat Rate Water Heating**

### **Residential Diesel**

There were 577 Residential Diesel customers that used 8 GW.h in 2012/13 at an average of 14,640 kW.h per customer. They have 60 amp service that does not allow for electric space heating. Space heating in these four communities is mainly provided by fuel oil. The number of customers is expected to grow to 716 and usage is expected to increase 2.0% a year to 13 GW.h by 2032/33 under the assumption that the communities continue to be separate from the Integrated System.

### **Residential Seasonal**

There were 20,731 Residential Seasonal customers in 2012/13. The number of customers is expected increase to 22,686 customers by 2032/33. Seasonal customers are billed only twice a year either due to low usage (being a seasonal residence or cottage) or because of a location that makes it difficult to access for more frequent meter readings. The average use of a seasonal customer is 3,911 kW.h per year. The usage of Residential Seasonal customers is expected to increase 1.9% a year to 118 GW.h in 2032/33.

### **Residential Flat Rate Water Heating**

Residential Water Heating is a flat rate unmetered service. This service has not been available to new customers since November 12, 1969. There were 4,089 remaining services in 2012/13. The number of services and usage is expected to decrease 5% per year throughout the forecast period. Usage was 21 GW.h in 2012/13 and that will decrease to 7 GW.h by 2032/33.

## General Service Mass Market

General Service Mass Market includes all Commercial and Industrial customers, excluding the General Service Top Consumers. There were 65,974 General Service Mass Market customers in 2012/13. Approximately 85% are Commercial and the others are Industrial.

GS Mass Market has grown 118 GW.h (1.7%) per year for the past 20 years and 107 GW.h per year (1.4%) for the past 10 years. This historical growth includes the effect of past Demand Side Management (DSM) initiatives. It is forecast to grow 149 GW.h (1.6%) per year for the next 10 years and 144 GW.h (1.5%) per year for the next 20 years.

The primary driver for growth in the GS Mass Market is the number of Residential Basic customers. As population grows, commercial and industrial services grow to service the population. The secondary driver is the economy. Changes in the Manitoba Gross Domestic Product (GDP) are reflected in the GS Mass Market's electricity use.

Figure 7 - General Service Mass Market

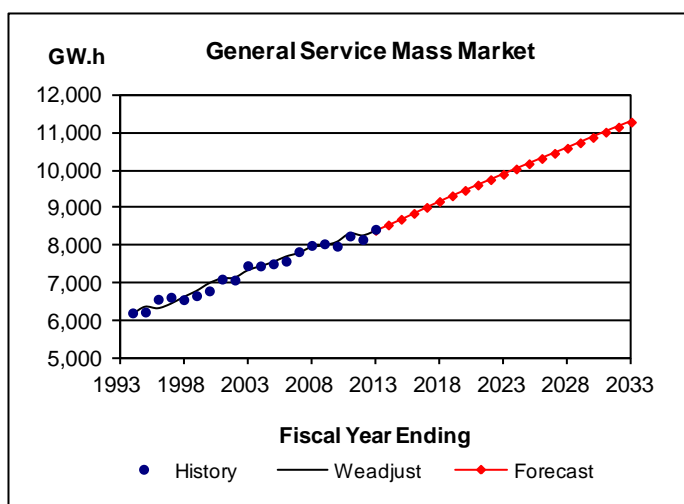


Table 15 - General Service Mass Market

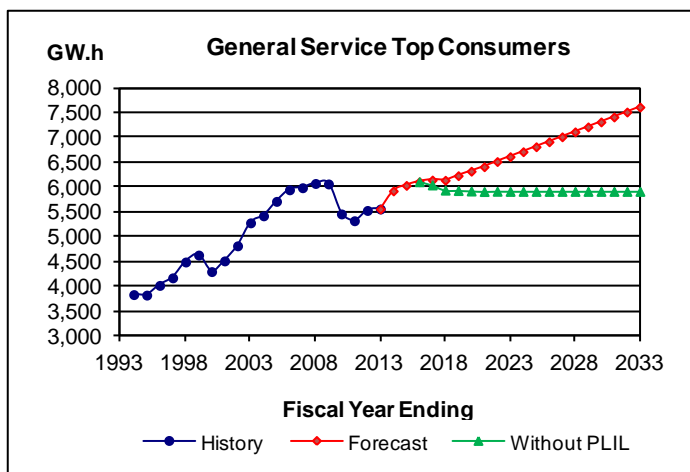
GENERAL SERVICE MASS MARKET (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT			FORECAST		
Fiscal Year	Sales	Weather Adjust	Adjusted Sales	Fiscal Year	Forecast Sales
1993/94	6210	-53	6158	2013/14	8550
1994/95	6233	130	6363	2014/15	8701
1995/96	6573	-251	6322	2015/16	8858
1996/97	6627	-186	6441	2016/17	9018
1997/98	6562	60	6623	2017/18	9174
1998/99	6668	116	6784	2018/19	9325
1999/00	6796	197	6993	2019/20	9470
2000/01	7110	15	7125	2020/21	9613
2001/02	7084	60	7144	2021/22	9756
2002/03	7467	-129	7338	2022/23	9898
2003/04	7460	-9	7451	2023/24	10040
2004/05	7516	48	7564	2024/25	10179
2005/06	7587	124	7711	2025/26	10318
2006/07	7839	-31	7808	2026/27	10456
2007/08	8006	-39	7967	2027/28	10592
2008/09	8049	-36	8012	2028/29	10736
2009/10	7985	124	8109	2029/30	10878
2010/11	8258	76	8333	2030/31	11020
2011/12	8162	117	8279	2031/32	11154
2012/13	8434	-28	8406	2032/33	11288

## General Service Top Consumers

General Service Top Consumers includes the top energy consuming businesses in Manitoba and represents 26% of all General Consumers Sales. GS Top Consumers includes 17 companies that account for 31 customers in the Primary Metals, Chemicals, Petrol/Oil/Natural Gas, Pulp/Paper, Food/Beverage and Colleges/Universities sectors.

Figure 8 - General Service Top Consumers

GS Top Consumers has grown 91 GW.h (2.0%) per year over the past 20 years and but only 28 GW.h per year (0.5%) over the past 10 years. The loss of one Top Consumer and the effect of the economic downturn from 2008 to 2011 lowered the past 10 year growth rate. The 2013 forecast is expected to grow 106 GW.h (1.8%) per year for the next 10 years and 103 GW.h (1.6%) per year for



the next 20 years. A loss of a major load is expected by 2016. This loss is more than offset by confirmed plans and expected increases of other Top Consumers. In the long term, GS Top Consumers is expected to grow at a rate reflective of its historic growth.

Table 16 - General Service Top Consumers

GENERAL SERVICE TOP CONSUMERS (GW.h)					
HISTORICAL/FORECAST WITH PLIL					
Fiscal Year	Sales	Fiscal Year	Individual	PLIL	Total
1993/94	3836	2013/14	5925	0	5925
1994/95	3825	2014/15	6036	0	6036
1995/96	4021	2015/16	6110	0	6110
1996/97	4173	2016/17	6045	100	6145
1997/98	4493	2017/18	5940	200	6140
1998/99	4632	2018/19	5932	300	6232
1999/00	4299	2019/20	5922	400	6322
2000/01	4515	2020/21	5912	500	6412
2001/02	4818	2021/22	5917	600	6517
2002/03	5282	2022/23	5915	700	6615
2003/04	5423	2023/24	5915	800	6715
2004/05	5714	2024/25	5915	900	6815
2005/06	5948	2025/26	5915	1000	6915
2006/07	5989	2026/27	5915	1100	7015
2007/08	6075	2027/28	5915	1200	7115
2008/09	6065	2028/29	5915	1300	7215
2009/10	5461	2029/30	5915	1400	7315
2010/11	5324	2030/31	5915	1500	7415
2011/12	5531	2031/32	5915	1600	7515
2012/13	5560	2032/33	5915	1700	7615



GS Top Consumers are forecast individually as their usage does not grow in a slow, steady, predictable pattern. These types of load changes are not conducive to econometric forecasting models and must be examined on an individual basis. The forecast for each company includes their short term committed plans and expectations over the next several years, but excludes longer term plans that are uncommitted and subject to change.

The sum of the individual company forecasts grow from 5,560 GW.h in 2012/13 to 5,915 GW.h by 2022/23. This growth of 355 GW.h includes the load changes due to committed plans of companies, and also includes an expected major load decrease by 2016 of one customer.

Top Consumers do not add small amounts of load on a regular basis. Instead, they make major changes that add or remove a large amount of load at one time. Load changes are related to individual business cycles and it may be years between one of these changes.

For the longer term, an average expected growth is included for all customers together. This added growth is called Potential Large Industrial Loads (PLIL). It includes consideration for company expansions, cutbacks and shutdowns, new startups of 100 GW.h a year or more, and the long term normal incremental growth of all the companies within the Top Consumers sector combined. Since customer intentions are generally known for the first three years, PLIL is not added until 2016/17, the fourth year of the forecast.

GS Top Consumers has grown at 91 GW.h (2.0%) per year over the past twenty years. During that time, there were four new customers totaling 1,100 GW.h of consumption, nine instances of customers with major expansions totaling 1,400 GW.h, and two existing customers who closed operations reducing consumption by 700 GW.h. None of these events could have been predicted five years before they occurred. One new customer and four expansions occurred within the past 10 years despite the economic downturn. These major events amount to a net 1,800 GW.h increase in the past 20 years. On this basis, PLIL has been set to be 100 GW.h (1.5%) per year starting in the fourth year of the forecast and will total 1,700 GW.h by 2032/33, the 20<sup>th</sup> year of the forecast.

1,700 GW.h is approximately equivalent to the load of Manitoba Hydro's largest consumer. If only one other customer of similar size starts up in Manitoba within the next 20 years, this one new customer alone would consume all of the provision that PLIL has allowed.

## **General Service Diesel, Seasonal, and Flat Rate Water Heat**

### **General Service Diesel**

In 2012/13, there were 175 General Service Diesel Full Cost customers. They used 5 GW.h in 2012/13. The group is forecast to use 6 GW.h by 2032/33.

### **General Service Seasonal**

There were 850 General Service Seasonal customers in 2012/13. Consumption was 5 GW.h in 2012/13 and is expected to grow to 6 GW.h by 2032/33.

### **General Service Flat Rate Water Heating**

General Service Water Heating is a flat rate unmetered service that has not been available to new customers since November 12, 1969. There were 408 remaining services in 2012/13. The number of services is expected to decrease 5% per year throughout the forecast period. Consumption was 7 GW.h in 2012/13 and that is forecast to decrease to 3 GW.h by 2032/33.

### **General Service Surplus Energy Program**

Participants in the Surplus Energy Program (SEP) used 28 GW.h in 2012/13 and are expected to grow to use 38 GW.h per year by 2017/18 and continue at that rate for the remainder of the forecast. This energy is considered to be “interruptible” and thus “non-firm”. The energy used by these customers is included in Sales. But it is excluded from the Gross Firm Energy forecast.

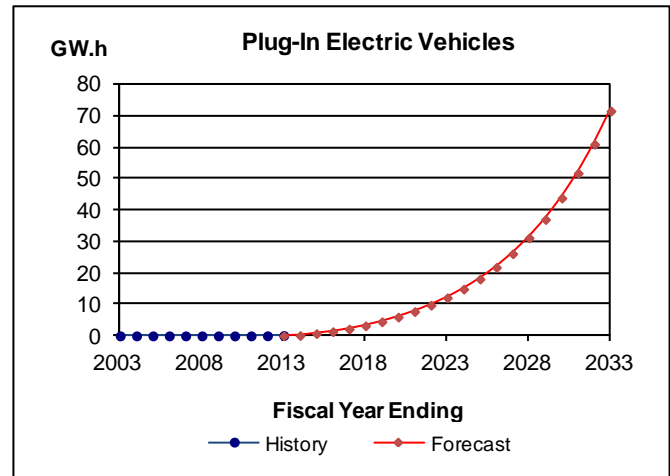
## Plug-In Electric Vehicles

This forecast includes an estimate of the future adoption of Plug-In Electric Vehicles (PEVs). This is made up of two types:

(1) Plug-In Hybrid Electric Vehicles (PHEVs) that run on an electric battery but use an internal combustion engine (ICE) when the electricity runs low. An example is the Chevrolet Volt.

(2) Battery Electric Vehicles (BEVs) that run only on electric battery power, such as the Nissan Leaf.

Figure 9 - Plug-In Electric Vehicles



The forecast of PEVs does not include Hybrid Electric Vehicles (HEVs). These vehicles, such as the Toyota Prius, have an internal combustion engine as well as a battery and electric motor to drive the wheels. The HEV battery is charged with power from the ICE and through regenerative braking. It is not charged by plugging in and therefore does not affect electricity consumption in Manitoba. As of March 1, 2013 and after 12 years in the market, there were only 3,581 HEVs registered in Manitoba, making up about 0.46% of all registered vehicles.

For the most part, electric cars have not enjoyed their expected success anywhere. Range anxiety and price are cited as the main reasons for limited sales. In general, electric vehicles are part of a niche market whose demographic is the environmentally aware, very well educated, upper-middle class white male in his late 40s to early 50s with a garage equipped with an electric outlet. General Motors expected to sell 60,000 Chevy Volts globally in 2012, but sold just half that many. Sales of Nissan's all-electric Leaf grew 22% around the world last year to 26,000, short of Nissan's projected 50% growth. One exception has been American high end electric car maker Tesla Motors, which recently posted the first profitable quarter in its 10-year history and whose share price exceeded \$100 US for the first time on May 28, 2013. The price of Tesla shares has almost tripled this year, and its \$90,000 Model S sedan got a near-perfect rating from May 2013 Consumer Reports. On March 1, 2013 there were 4 Tesla vehicles registered in Manitoba with one more on order.

## The Electric Vehicle Forecast

As of March 1<sup>st</sup>, 2013, there were 37 plug-in electric vehicles registered in Manitoba according to the Manitoba Public Insurance Corporation. The 2012 Load Forecast had predicted 34 such vehicles to be registered in Manitoba at fiscal year ending 2013. The number of new PEVs is expected to slowly increase until it reaches about 1.3% of vehicle sales (828 per year) in 2022/23 and 5.4% of sales (4,576 per year) in 2032/33. The total number of electric vehicles on the road is expected to be 4,038 (0.4%) in 2022/23 and 23,879 (2.1%) in 2032/33.

The EPA rating for the pure electric 2012 Nissan Leaf is 3,400 kW.h for 16,000 km. Other electric vehicles, including the plug-in hybrid Chevrolet Volt, have similar EPA ratings. Actual usage depends on the distance driven. For this forecast, the average PEV is assumed to use 3,000 kW.h per year, which is almost equivalent to the annual energy use of an electric hot water tank. There are different opinions on average peak contribution per vehicle, but an acceptable expectation is that peak load use will approximately be equal to non-peak use. A load factor of 91% was chosen to derive the load coincident to Manitoba Hydro's system peak on a cold winter day.

The following table provides the estimate of the number of new vehicles and total vehicles each year in Manitoba, as well as the corresponding numbers for Plug-In Electric Vehicles. The PEV MW is at Hydro's system peak. Forecast energy usage for PEVs in Manitoba is expected to be 12 GW.h in 2022/23 and 72 GW.h in 2032/33. Forecast peak usage at system peak is expected to be 1.5 MW in 2022/23 and 9.0 MW in 2032/33.

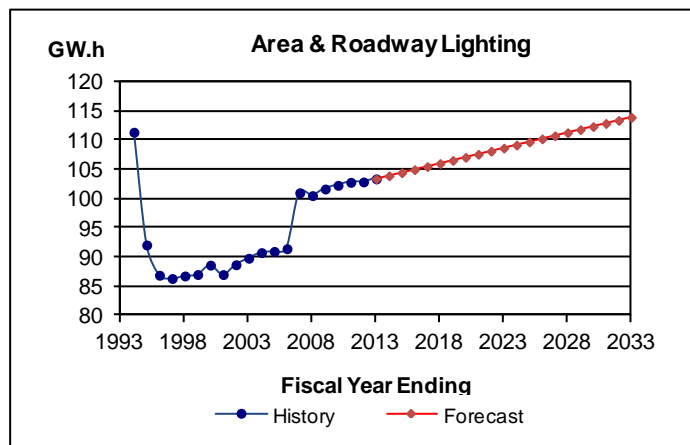
Table 17 - Plug-In Electric Vehicles

<b>PLUG-IN ELECTRIC VEHICLE FORECAST</b> <b>History and Forecast</b> <b>2002/03 - 2032/33</b>								
Fiscal Year	New Vehicles Purchased	New PEV Purchased	New PEV %	Total Vehicles	Total PEV	Total % PEV	Cumul Total PEV GW.h	Cumul Total PEV MW
2002/03	47770	-	0.0%	634798	-	0.0%	0	0
2003/04	44825	-	0.0%	646925	-	0.0%	0	0
2004/05	43412	-	0.0%	657773	-	0.0%	0	0
2005/06	44931	-	0.0%	665911	-	0.0%	0	0
2006/07	45924	-	0.0%	677922	-	0.0%	0	0
2007/08	47099	-	0.0%	696186	-	0.0%	0	0
2008/09	48029	-	0.0%	711412	-	0.0%	0	0
2009/10	43995	-	0.0%	723823	-	0.0%	0	0
2010/11	45355	1	0.0%	738299	1	0.0%	0	0
2011/12	48546	8	0.0%	762214	9	0.0%	0	0
2012/13	52236	28	0.1%	779935	37	0.0%	0	0
2013/14	52949	66	0.1%	798369	103	0.0%	0	0.0
2014/15	53669	134	0.3%	816707	237	0.0%	1	0.1
2015/16	54397	204	0.4%	834962	441	0.1%	1	0.2
2016/17	55129	276	0.5%	853141	717	0.1%	2	0.3
2017/18	55867	349	0.6%	871253	1066	0.1%	3	0.4
2018/19	56606	425	0.8%	889303	1491	0.2%	4	0.6
2019/20	57348	502	0.9%	907296	1992	0.2%	6	0.7
2020/21	58089	591	1.0%	925233	2573	0.3%	8	1.0
2021/22	58828	697	1.2%	943116	3250	0.3%	10	1.2
2022/23	59564	828	1.3%	960944	4038	0.4%	12	1.5
2023/24	60296	977	1.5%	978715	4955	0.5%	15	1.9
2024/25	61024	1167	1.7%	996427	6022	0.6%	18	2.3
2025/26	61745	1392	2.0%	1014077	7264	0.7%	22	2.7
2026/27	62461	1665	2.3%	1031660	8709	0.8%	26	3.3
2027/28	63170	1980	2.7%	1049176	10389	1.0%	31	3.9
2028/29	63873	2374	3.1%	1066619	12343	1.2%	37	4.6
2029/30	64571	2832	3.5%	1083988	14614	1.3%	44	5.5
2030/31	65262	3370	4.0%	1101280	17255	1.6%	52	6.5
2031/32	65949	3928	4.7%	1118494	20323	1.8%	61	7.6
2032/33	66471	4576	5.4%	1135467	23879	2.1%	72	9.0

## Area & Roadway Lighting

Figure 10 - Area & Roadway Lighting

The Area and Roadway Lighting sector represents 0.5% of all sales within Manitoba. This sector includes electricity sales for the Sentinel Lighting and Street Lighting rate groups. Sentinel Lighting is an outdoor lighting service where units are available either as rentals to an existing metered service or on an unmetered, flat rate basis. Street Lighting includes all roadway lighting in Manitoba.



Energy-efficient street lighting initiatives caused the significant drop in usage in the mid 1990's. In 2006, a readjustment of the rate classes moved some flat rate General Service meters into the Lighting sector. Only Street Lights count as customers.

The Area and Roadway Lighting sector is forecast to increase from 103 GW.h in 2012/13 to 114 GW.h by 2032/33 at an average growth rate of 1 GW.h or 0.5% per year.

Table 18 - Area & Roadway Lighting

AREA & ROADWAY LIGHTING (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Sales	Weather Adjust	Adjusted Sales	Fiscal Year	Forecast Sales
1993/94	111	0	111	2013/14	104
1994/95	92	0	92	2014/15	104
1995/96	87	0	87	2015/16	105
1996/97	86	0	86	2016/17	106
1997/98	87	0	87	2017/18	106
1998/99	87	0	87	2018/19	107
1999/00	89	0	89	2019/20	107
2000/01	87	0	87	2020/21	108
2001/02	89	0	89	2021/22	108
2002/03	90	0	90	2022/23	109
2003/04	91	0	91	2023/24	109
2004/05	91	0	91	2024/25	110
2005/06	91	0	91	2025/26	110
2006/07	101	0	101	2026/27	111
2007/08	101	0	101	2027/28	111
2008/09	102	0	102	2028/29	112
2009/10	102	0	102	2029/30	112
2010/11	103	0	103	2030/31	113
2011/12	103	0	103	2031/32	113
2012/13	103	0	103	2032/33	114

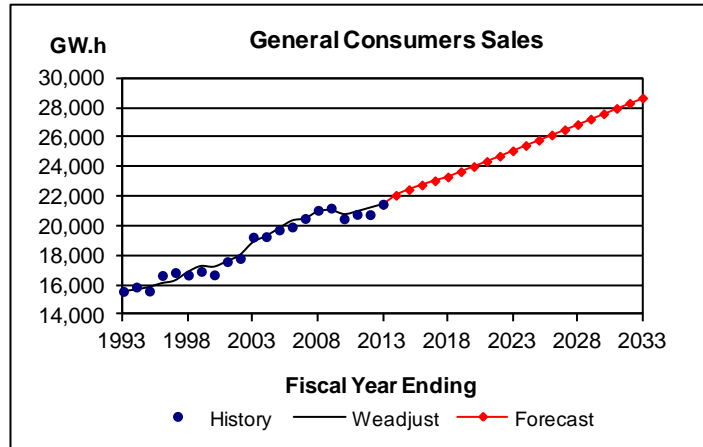
Table 19 - Area &amp; Roadway Lighting

AREA AND ROADWAY LIGHTING								
History and Forecast								
2002/03 - 2032/33								
Fiscal Year	Sentinal Flat Rates		Sentinal Rentals		Street Lighting		Total Lighting	
	(Services)	(GW.h)	(Services)	(GW.h)	(Custs)	(GW.h)	(Custs)	(GW.h)
2002/03	19446	10	5477	0	755	80	755	90
2003/04	19527	10	5505	0	757	81	757	91
2004/05	19648	10	5519	0	759	81	759	91
2005/06	19652	10	7826	0	793	81	793	91
2006/07	18669	11	23994	0	1129	90	1129	101
2007/08	18947	11	24272	0	1142	90	1142	101
2008/09	19228	11	24542	0	1175	91	1175	102
2009/10	19539	11	24886	0	1191	91	1191	102
2010/11	19835	11	25216	0	1184	92	1184	103
2011/12	20033	11	25427	0	1155	91	1155	103
2012/13	20238	12	25613	0	1164	92	1164	103
2013/14	20472	12	25862	0	1163	92	1163	104
2014/15	20705	12	26130	0	1168	93	1168	104
2015/16	20938	12	26398	0	1173	93	1173	105
2016/17	21171	12	26666	0	1178	93	1178	106
2017/18	21404	12	26934	0	1183	94	1183	106
2018/19	21637	12	27202	0	1188	94	1188	107
2019/20	21870	12	27470	0	1193	95	1193	107
2020/21	22103	13	27738	0	1198	95	1198	108
2021/22	22336	13	28006	0	1203	95	1203	108
2022/23	22569	13	28274	0	1208	96	1208	109
2023/24	22802	13	28542	0	1213	96	1213	109
2024/25	23035	13	28810	0	1218	97	1218	110
2025/26	23268	13	29078	0	1223	97	1223	110
2026/27	23501	13	29346	0	1228	97	1228	111
2027/28	23734	13	29614	0	1233	98	1233	111
2028/29	23967	14	29882	0	1238	98	1238	112
2029/30	24200	14	30150	0	1243	99	1243	112
2030/31	24433	14	30418	0	1248	99	1248	113
2031/32	24666	14	30686	0	1253	99	1253	113
2032/33	24899	14	30954	0	1258	100	1258	114

## Total General Consumers Sales

General Consumers Sales includes sales to all of Manitoba Hydro’s individually billed customers, but excludes export sales. This includes the total of all sales from the Residential, General Service and Lighting sectors. The General Service sector makes up about two-thirds, the Residential sector makes up about one-third and the Lighting group is only 0.5% of all sales.

Figure 11 - General Consumers Sales



Weather adjusted General Consumers Sales has grown 303 GW.h (1.7%) per year for the past 20 years and 258 GW.h (1.3%) per year over the past 10 years. This historical growth includes the effect of past Demand Side Management (DSM) initiatives. Sales are forecast to grow 364 GW.h (1.6%) per year for the next 10 years and 361 GW.h (1.5%) per year for the next 20 years.

Table 20 - General Consumers Sales

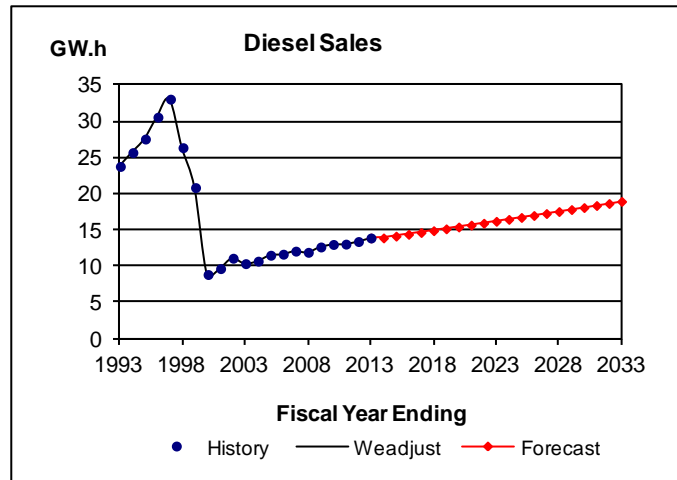
GENERAL CONSUMERS SALES (GW.h) HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Sales	Weather Adjust	Adjusted Sales	Fiscal Year	Forecast Sales
1993/94	15870	-190	15681	2013/14	22076
1994/95	15600	236	15836	2014/15	22460
1995/96	16654	-550	16104	2015/16	22774
1996/97	16851	-572	16279	2016/17	23059
1997/98	16681	172	16852	2017/18	23319
1998/99	16929	329	17258	2018/19	23677
1999/00	16696	517	17213	2019/20	24024
2000/01	17590	-12	17578	2020/21	24369
2001/02	17805	201	18006	2021/22	24728
2002/03	19246	-384	18862	2022/23	25087
2003/04	19280	2	19282	2023/24	25446
2004/05	19735	69	19804	2024/25	25802
2005/06	19935	389	20323	2025/26	26158
2006/07	20510	-39	20471	2026/27	26513
2007/08	21061	-111	20950	2027/28	26865
2008/09	21210	-184	21026	2028/29	27230
2009/10	20486	269	20755	2029/30	27593
2010/11	20786	169	20956	2030/31	27954
2011/12	20771	432	21202	2031/32	28308
2012/13	21477	-32	21445	2032/33	28662



## Diesel Sales

Figure 12 - Diesel Sales

There are four communities served by diesel generation in Manitoba: Brochet, Lac Brochet, Tadoule Lake and Shamattawa. Sales within these communities are included in General Consumers Sales, but are not part of the Integrated System, and are thus not part of Common Bus or Gross Firm Load.



Between 1997 and 1999, eleven communities previously served by diesel generation were connected to the Integrated System resulting in the drop in overall sales. The four sites that were to remain diesel were converted from 15 amp service to 60 amp service between 1991 and 2001 causing the increase in those years.

Diesel customers do not have electric heat, which requires a minimum 200 amp service, therefore there is no weather effect.

Table 21 - Diesel Sales

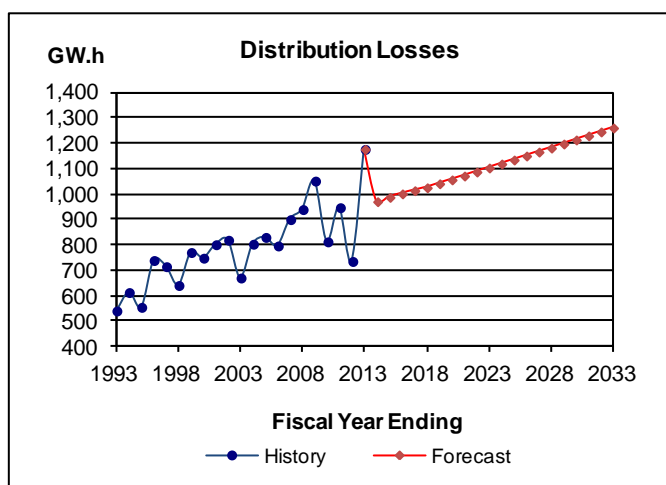
DIESEL SALES (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Sales	Weather Adjust	Adjusted Sales	Fiscal Year	Forecast Sales
1993/94	26	0	26	2013/14	14
1994/95	28	0	28	2014/15	14
1995/96	31	0	31	2015/16	14
1996/97	33	0	33	2016/17	15
1997/98	26	0	26	2017/18	15
1998/99	21	0	21	2018/19	15
1999/00	9	0	9	2019/20	15
2000/01	10	0	10	2020/21	16
2001/02	11	0	11	2021/22	16
2002/03	10	0	10	2022/23	16
2003/04	11	0	11	2023/24	16
2004/05	12	0	12	2024/25	17
2005/06	12	0	12	2025/26	17
2006/07	12	0	12	2026/27	17
2007/08	12	0	12	2027/28	18
2008/09	13	0	13	2028/29	18
2009/10	13	0	13	2029/30	18
2010/11	13	0	13	2030/31	18
2011/12	13	0	13	2031/32	19
2012/13	14	0	14	2032/33	19

## Distribution Losses

Figure 13 - Distribution Losses

Distribution Losses are made up of the power loss between the distribution substation (Manitoba Load at Common Bus less Construction) and the customer's meter (General Consumers Sales less Diesel), as well as all other differences between what was billed and what was metered. The other differences include:

1. The offset between cycle billing (General Consumers Sales) and actual calendar month usage (Common Bus).
2. Customer Accounting adjustments,
3. Inaccuracies associated with estimated billing (including flat rate estimates),
4. The metered but unbilled consumption of Manitoba Hydro offices, and
5. Energy lost due to theft.



Distribution Losses are forecast in 2013/14 to be 4.4% of the General Consumers Sales less Diesel and remain at about that level throughout the forecast.

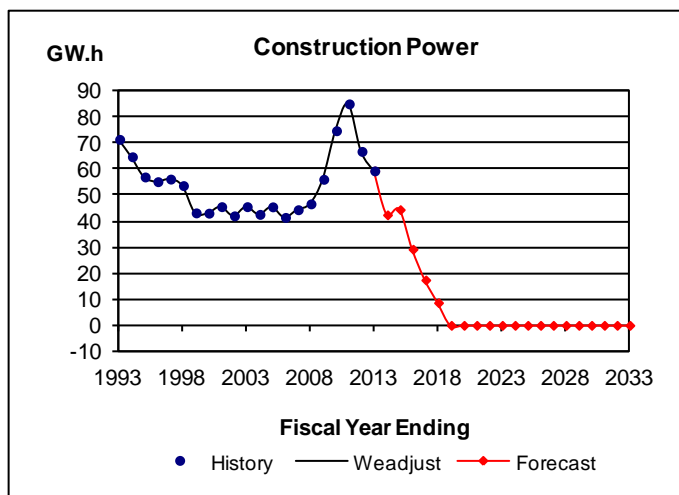
Table 22 - Distribution Losses

DISTRIBUTION LOSSES (GW.h)							
HISTORICAL / PERCENT OF SALES / FORECAST							
Fiscal Year	Losses	Sales less Diesel	% Losses	Fiscal Year	Forecast Losses	Sales less Diesel	% Losses
1993/94	614	15845	3.9%	2013/14	971	22062	4.4%
1994/95	556	15572	3.6%	2014/15	988	22446	4.4%
1995/96	740	16623	4.4%	2015/16	1001	22759	4.4%
1996/97	715	16818	4.3%	2016/17	1014	23044	4.4%
1997/98	641	16655	3.9%	2017/18	1025	23304	4.4%
1998/99	771	16908	4.6%	2018/19	1041	23661	4.4%
1999/00	749	16687	4.5%	2019/20	1056	24009	4.4%
2000/01	802	17580	4.6%	2020/21	1072	24353	4.4%
2001/02	819	17793	4.6%	2021/22	1087	24712	4.4%
2002/03	671	19236	3.5%	2022/23	1103	25071	4.4%
2003/04	804	19269	4.2%	2023/24	1119	25429	4.4%
2004/05	830	19724	4.2%	2024/25	1135	25786	4.4%
2005/06	797	19923	4.0%	2025/26	1150	26141	4.4%
2006/07	900	20497	4.4%	2026/27	1166	26496	4.4%
2007/08	940	21049	4.5%	2027/28	1181	26847	4.4%
2008/09	1052	21198	5.0%	2028/29	1197	27213	4.4%
2009/10	813	20473	4.0%	2029/30	1213	27575	4.4%
2010/11	947	20773	4.6%	2030/31	1229	27936	4.4%
2011/12	736	20757	3.5%	2031/32	1245	28290	4.4%
2012/13	1176	21463	5.5%	2032/33	1260	28643	4.4%

## Construction Power

Construction Power represents the energy used by Manitoba Hydro and its contractors in the construction of major capital works such as generating stations, converter stations and major transmission lines. Construction Power also includes Station Service until a plant is commissioned. Until 2013, about 48 GW.h of heating load at the Gillam, Limestone and Kettle town sites was included in Construction Power. This energy is now included in Distribution Losses.

Figure 14 - Construction Power



The Construction Power forecast includes: (1) the Wuskwatim generating station, now in-service with completion expected in 2013/14, (2) the Pointe Du Bois spillway replacement started in April 2013 with expected completion in January 2015, and (3) the Keewatinoow Converter Station, started in January 2012 with expected completion in December 2017. Construction Power does not include construction power estimates for any sites that do not yet have a committed inservice date (e.g. Keeyask and Conawapa).

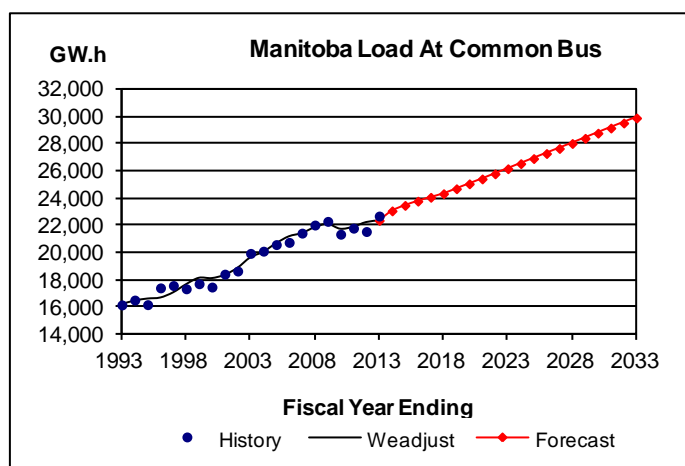
Table 23 - Construction Power

CONSTRUCTION POWER (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Usage	Weather Adjust	Adjusted Usage	Fiscal Year	Forecast Usage
1993/94	65	0	65	2013/14	43
1994/95	57	0	57	2014/15	45
1995/96	55	0	55	2015/16	29
1996/97	56	0	56	2016/17	17
1997/98	54	0	54	2017/18	9
1998/99	43	0	43	2018/19	0
1999/00	43	0	43	2019/20	0
2000/01	46	0	46	2020/21	0
2001/02	42	0	42	2021/22	0
2002/03	46	0	46	2022/23	0
2003/04	43	0	43	2023/24	0
2004/05	46	0	46	2024/25	0
2005/06	42	0	42	2025/26	0
2006/07	45	0	45	2026/27	0
2007/08	47	0	47	2027/28	0
2008/09	56	0	56	2028/29	0
2009/10	75	0	75	2029/30	0
2010/11	85	0	85	2030/31	0
2011/12	67	0	67	2031/32	0
2012/13	59	0	59	2032/33	0

## Manitoba Load at Common Bus

Manitoba Load at Common Bus is the total load measured from all the distribution points (i.e. substations) within Manitoba. It includes all energy supplied to General Consumers Sales customers, Construction Power plus associated Distribution Losses, but excludes Diesel customers, Transmission Losses and Station Service.

Figure 15 - Manitoba Load at Common Bus



Common Bus is metered and totaled to correspond exactly to each calendar month. Weather adjustment is done on a calendar month basis.

Weather adjusted Common Bus has grown 314 GW.h (1.6%) per year for the past 20 years and 275 GW.h (1.3%) per year during the past 10 years reflecting the recent economic downturn. This historical growth includes the effect of past Demand Side Management (DSM) initiatives. Common Bus is forecast to grow 380 GW.h (1.6%) per year for the next 10 years and 377 GW.h (1.5%) per year for the next 20 years.

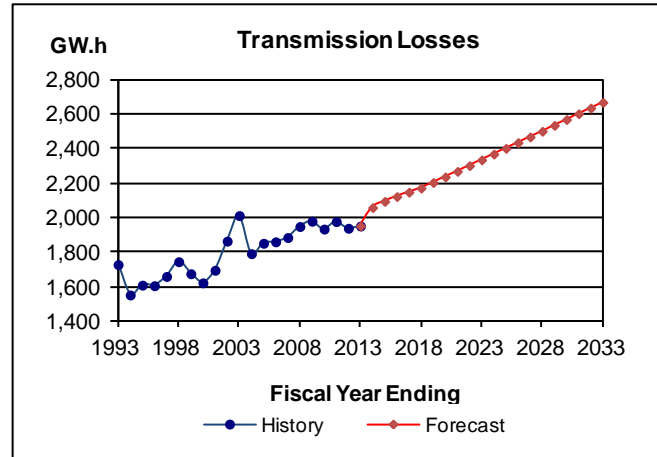
Table 24 - Manitoba Load at Common Bus

MANITOBA LOAD AT COMMON BUS (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Energy	Weather Adjust	Adjusted Energy	Fiscal Year	Forecast Energy
1993/94	16523	-124	16399	2013/14	23076
1994/95	16185	366	16550	2014/15	23479
1995/96	17418	-792	16626	2015/16	23790
1996/97	17590	-579	17011	2016/17	24075
1997/98	17350	264	17614	2017/18	24338
1998/99	17722	374	18096	2018/19	24703
1999/00	17479	595	18073	2019/20	25065
2000/01	18428	-111	18316	2020/21	25425
2001/02	18655	185	18839	2021/22	25799
2002/03	19953	-335	19618	2022/23	26174
2003/04	20116	-83	20033	2023/24	26548
2004/05	20600	67	20667	2024/25	26920
2005/06	20761	426	21187	2025/26	27291
2006/07	21442	-14	21429	2026/27	27661
2007/08	22036	-175	21861	2027/28	28029
2008/09	22305	-196	22109	2028/29	28410
2009/10	21361	390	21751	2029/30	28788
2010/11	21806	94	21900	2030/31	29165
2011/12	21560	688	22247	2031/32	29534
2012/13	22699	-327	22372	2032/33	29903

## Transmission Losses

Figure 16 - Transmission Losses

Transmission Losses are the amount of energy lost while delivering power from the generation stations to all of the distribution substations that make up Common Bus. Transmission Losses only contains losses associated with supplying Manitoba customers. Losses attributable to exports and the gains attributable to imports are excluded. Transmission Losses are substantial because most of the



northern generation is transmitted to southern distribution points 900 kilometers away. Transmission Losses vary year to year depending on water conditions, system configuration, outages and the magnitude of the load. Losses were up significantly in 2002/03 due to two High Voltage Direct Current (HVDC) transformer failures.

Transmission Losses are forecast to be 9.3% of the General Consumers Sales less Diesel Sales.

Table 25 - Transmission Losses

TRANSMISSION LOSSES (GW.h)							
HISTORICAL / PERCENT OF SALES / FORECAST							
Fiscal Year	Losses	Sales less Diesel	% Losses	Fiscal Year	Forecast Losses	Sales less Diesel	% Losses
1993/94	1552	15845	9.8%	2013/14	2058	22062	9.3%
1994/95	1609	15572	10.3%	2014/15	2094	22446	9.3%
1995/96	1606	16623	9.7%	2015/16	2122	22759	9.3%
1996/97	1660	16818	9.9%	2016/17	2148	23044	9.3%
1997/98	1745	16655	10.5%	2017/18	2171	23304	9.3%
1998/99	1675	16908	9.9%	2018/19	2204	23661	9.3%
1999/00	1623	16687	9.7%	2019/20	2236	24009	9.3%
2000/01	1696	17580	9.6%	2020/21	2268	24353	9.3%
2001/02	1864	17793	10.5%	2021/22	2301	24712	9.3%
2002/03	2012	19236	10.5%	2022/23	2335	25071	9.3%
2003/04	1792	19269	9.3%	2023/24	2368	25429	9.3%
2004/05	1852	19724	9.4%	2024/25	2401	25786	9.3%
2005/06	1860	19923	9.3%	2025/26	2435	26141	9.3%
2006/07	1885	20497	9.2%	2026/27	2468	26496	9.3%
2007/08	1949	21049	9.3%	2027/28	2500	26847	9.3%
2008/09	1979	21198	9.3%	2028/29	2534	27213	9.3%
2009/10	1934	20473	9.4%	2029/30	2568	27575	9.3%
2010/11	1977	20773	9.5%	2030/31	2602	27936	9.3%
2011/12	1939	20757	9.3%	2031/32	2635	28290	9.3%
2012/13	1952	21463	9.1%	2032/33	2667	28643	9.3%

## Station Service

Station Service is the energy used by power plants to generate power and service their own load. Station Service energy was not measured prior to 1993/94 but was previously included within Transmission Losses.

Station Service energy is forecast to be 134 GW.h from 2013/14 to 2032/33. Station Service for non-committed sites

(e.g. Conawapa and Keeyask) is not included in the forecast.

Figure 17 - Station Service

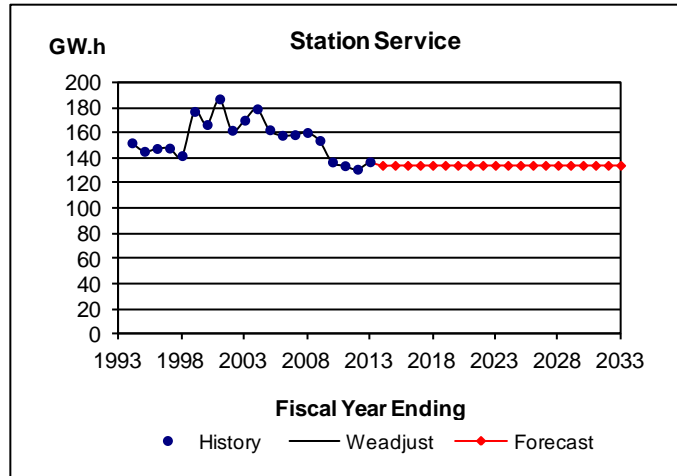


Table 26 - Station Service

STATION SERVICE (GW.h)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Usage	Weather Adjust	Adjusted Usage	Fiscal Year	Forecast Usage
1993/94	152	0	152	2013/14	134
1994/95	146	0	146	2014/15	134
1995/96	148	0	148	2015/16	134
1996/97	148	0	148	2016/17	134
1997/98	142	0	142	2017/18	134
1998/99	177	0	177	2018/19	134
1999/00	167	0	167	2019/20	134
2000/01	187	0	187	2020/21	134
2001/02	162	0	162	2021/22	134
2002/03	170	0	170	2022/23	134
2003/04	179	0	179	2023/24	134
2004/05	163	0	163	2024/25	134
2005/06	158	0	158	2025/26	134
2006/07	159	0	159	2026/27	134
2007/08	161	0	161	2027/28	134
2008/09	154	0	154	2028/29	134
2009/10	137	0	137	2029/30	134
2010/11	134	0	134	2030/31	134
2011/12	131	0	131	2031/32	134
2012/13	137	0	137	2032/33	134

Table 27 - Monthly Station Service Energy

<b>MONTHLY STATION SERVICE ENERGY (GW.h)</b>													
<b>History and Forecast</b>													
<b>Fiscal Year</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Total</b>
2002/03	15.5	13.9	9.4	13.8	8.6	8.2	11.3	14.0	17.6	19.9	18.6	19.4	170.3
2003/04	16.0	11.6	9.7	11.7	12.5	12.7	13.3	17.7	18.6	23.2	16.8	15.6	179.4
2004/05	11.8	10.4	8.1	8.1	8.0	9.6	12.0	15.9	21.2	21.6	17.9	18.0	162.7
2005/06	12.6	11.0	10.0	11.1	10.1	9.6	11.8	15.2	18.4	16.7	17.0	14.9	158.3
2006/07	10.2	8.9	8.4	10.3	9.3	8.6	13.4	16.1	16.7	18.6	19.7	18.7	158.8
2007/08	15.7	12.1	9.1	8.2	8.4	7.3	8.7	14.7	19.2	18.6	19.7	18.8	160.5
2008/09	13.8	9.4	7.5	9.5	10.4	7.1	10.6	15.1	20.1	20.4	14.9	15.5	154.2
2009/10	11.8	10.3	7.9	7.2	7.4	7.2	10.8	14.2	18.8	15.5	13.3	12.7	137.1
2010/11	10.2	9.9	7.3	6.7	7.2	7.4	9.5	12.9	16.4	17.1	14.4	15.0	134.1
2011/12	12.0	9.9	7.5	7.1	7.3	6.7	9.5	13.1	15.1	16.0	13.8	13.1	131.3
2012/13	11.0	9.4	7.7	7.0	6.7	8.0	11.5	14.3	16.2	16.6	13.7	15.2	137.2
2013/14 - 2032/33	11.1	9.7	7.5	6.9	7.1	7.4	10.2	13.5	15.9	16.6	14.0	14.5	134.4

Table 28 - Monthly Station Service Peak

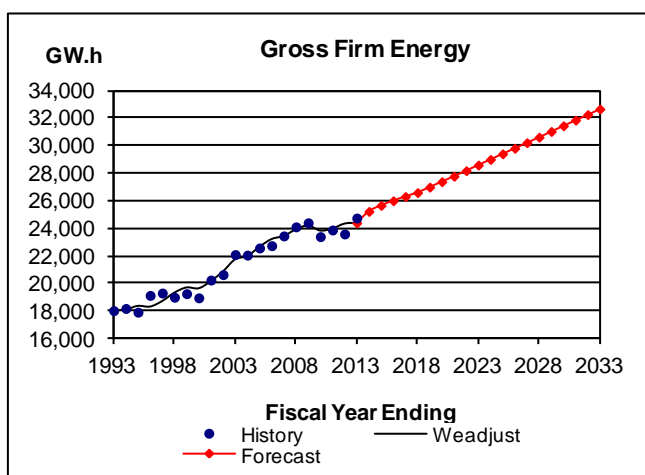
<b>MONTHLY STATION SERVICE PEAK (MW)</b>													
<b>History and Forecast</b>													
<b>Fiscal Year</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Annual</b>
2012/13 Actual	19	14	9	9	8	10	16	26	26	25	26	24	26
2013/14 - 2032/33	18	14	9	11	8	10	17	23	24	25	24	23	24

## Gross Firm Energy

Gross Firm Energy is the energy required to serve Manitoba Hydro’s customers on the Integrated System. It excludes exports, interruptible (non-firm) loads, Diesel Sales and Station Service for non-committed plants.

Gross Firm Energy has grown steadily during the past twenty years, except for the economic slowdown in the early 1990’s and more recently in 2009.

Figure 18 - Gross Firm Energy



Weather adjusted Gross Firm Energy has grown 334 GW.h (1.6%) per year for the past 20 years and 266 GW.h (1.2%) per year during the past 10 years reflecting the recent economic downturn. This historical growth includes the effect of past Demand Side Management (DSM) initiatives. Energy is forecast to grow 420 GW.h (1.6%) per year for the next 10 years and 413 GW.h (1.5%) per year for the next 20 years.

Table 29 - Gross Firm Energy

GROSS FIRM ENERGY (GW.h) HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Energy	Weather Adjust	Adjusted Energy	Fiscal Year	Forecast Energy
1993/94	18201	-134	18067	2013/14	25239
1994/95	17929	404	18334	2014/15	25676
1995/96	19148	-864	18284	2015/16	26013
1996/97	19321	-631	18690	2016/17	26322
1997/98	19014	290	19304	2017/18	26606
1998/99	19273	408	19681	2018/19	27003
1999/00	18971	651	19622	2019/20	27398
2000/01	20262	-118	20144	2020/21	27789
2001/02	20656	202	20859	2021/22	28197
2002/03	22110	-367	21743	2022/23	28605
2003/04	22069	-93	21976	2023/24	29013
2004/05	22589	75	22663	2024/25	29418
2005/06	22757	463	23220	2025/26	29822
2006/07	23464	-15	23449	2026/27	30225
2007/08	24122	-188	23934	2027/28	30625
2008/09	24417	-210	24207	2028/29	31041
2009/10	23412	426	23838	2029/30	31453
2010/11	23892	105	23998	2030/31	31863
2011/12	23605	746	24351	2031/32	32265
2012/13	24759	-356	24404	2032/33	32667



Table 30 - Monthly Gross Firm Energy

MONTHLY GROSS FIRM ENERGY (GW.h)													
History and Forecast													
2002/03 - 2032/33													
Fiscal Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2002/03	1727	1629	1538	1617	1554	1535	1811	1964	2149	2341	2142	2104	22110
2003/04	1657	1579	1520	1573	1685	1548	1688	2024	2198	2479	2088	2029	22069
2004/05	1699	1683	1545	1579	1575	1574	1793	1952	2411	2539	2098	2140	22589
2005/06	1727	1698	1660	1735	1649	1610	1781	2045	2301	2240	2171	2139	22757
2006/07	1712	1690	1681	1826	1746	1622	1870	2092	2303	2458	2304	2159	23464
2007/08	1842	1701	1663	1820	1727	1650	1836	2108	2490	2584	2427	2273	24122
2008/09	1881	1737	1662	1730	1787	1681	1874	2154	2652	2702	2226	2331	24417
2009/10	1861	1744	1671	1667	1644	1672	1888	1935	2560	2524	2213	2032	23412
2010/11	1699	1692	1611	1716	1698	1638	1778	2129	2563	2682	2322	2364	23892
2011/12	1862	1751	1603	1789	1741	1643	1814	2125	2435	2526	2251	2064	23605
2012/13	1802	1698	1693	1870	1727	1606	1941	2265	2665	2765	2342	2386	24759
11/12 Wadj	1856	1746	1700	1716	1731	1583	1906	2215	2618	2757	2343	2233	24404
10 Year Hist	19	18	18	15	14	6	24	28	34	39	32	18	266
Avg Growth	1.1%	1.1%	1.1%	0.9%	0.8%	0.4%	1.4%	1.3%	1.4%	1.6%	1.5%	0.9%	1.1%
2013/14	1914	1813	1734	1845	1808	1734	1955	2228	2704	2772	2385	2347	25239
2014/15	1947	1845	1764	1877	1840	1764	1989	2267	2750	2820	2426	2387	25676
2015/16	1972	1869	1787	1902	1865	1788	2015	2296	2786	2857	2458	2418	26013
2016/17	1996	1891	1809	1925	1887	1809	2039	2323	2819	2890	2486	2446	26322
2017/18	2017	1912	1829	1947	1908	1829	2061	2348	2849	2921	2513	2473	26606
2018/19	2047	1940	1856	1976	1937	1857	2092	2383	2891	2964	2550	2509	27003
2019/20	2077	1969	1883	2005	1966	1884	2122	2417	2933	3008	2588	2546	27398
2020/21	2106	1997	1910	2034	1994	1911	2153	2452	2975	3051	2625	2582	27789
2021/22	2137	2026	1938	2064	2023	1939	2184	2488	3019	3095	2663	2620	28197
2022/23	2168	2055	1967	2093	2052	1967	2216	2524	3063	3140	2702	2658	28605
10 Year Fest	31	31	27	38	32	38	31	31	44	38	36	42	420
Avg Growth	1.6%	1.6%	1.5%	2.0%	1.7%	2.2%	1.5%	1.3%	1.6%	1.3%	1.4%	1.8%	1.6%
2023/24	2199	2085	1995	2123	2081	1995	2247	2560	3106	3185	2740	2696	29013
2024/25	2230	2114	2022	2153	2111	2023	2279	2596	3150	3229	2779	2734	29418
2025/26	2260	2143	2050	2183	2140	2051	2310	2631	3193	3274	2817	2771	29822
2026/27	2291	2172	2078	2212	2168	2079	2341	2667	3236	3318	2855	2809	30225
2027/28	2321	2201	2105	2241	2197	2106	2372	2702	3279	3362	2893	2846	30625
2028/29	2353	2230	2134	2272	2227	2135	2404	2739	3323	3407	2932	2884	31041
2029/30	2384	2260	2162	2302	2257	2163	2436	2775	3367	3453	2971	2923	31453
2030/31	2415	2290	2191	2332	2286	2191	2468	2811	3411	3498	3010	2961	31863
2031/32	2446	2318	2218	2361	2315	2219	2499	2847	3454	3542	3048	2998	32265
2032/33	2476	2347	2246	2391	2344	2246	2530	2882	3497	3586	3085	3036	32667
20 Year Fest	31	30	27	34	31	33	31	33	44	41	37	40	413
Avg Growth	1.5%	1.5%	1.4%	1.7%	1.5%	1.8%	1.4%	1.3%	1.5%	1.3%	1.4%	1.5%	1.5%

## Gross Total Peak

Gross Total Peak is the maximum integrated (i.e. average) hourly load required to serve Manitoba Hydro’s customers on the Integrated System. It excludes exports and Diesel Sales. It includes Station Service and Curtailable Loads.

Typically, the peak occurs on a very cold winter weekday either in the morning (often from 8 a.m. to 9 a.m.) or in the afternoon, (from 5 p.m. to 6 p.m.) Electric heating contributes by placing the peak on one of the coldest days, whereas the operation or lack thereof of large industrials often makes the difference as to the specific day and peak hour.

Weather adjusted Gross Total Peak has grown from 3,547 MW in 1993/94 to 4,559 MW in 2012/13 at an average growth of 44 MW or 1.2% per year. It is forecast to grow to 5,959 MW at 76 MW (1.5%) per year by 2032/33.

Figure 19 - Gross Total Peak

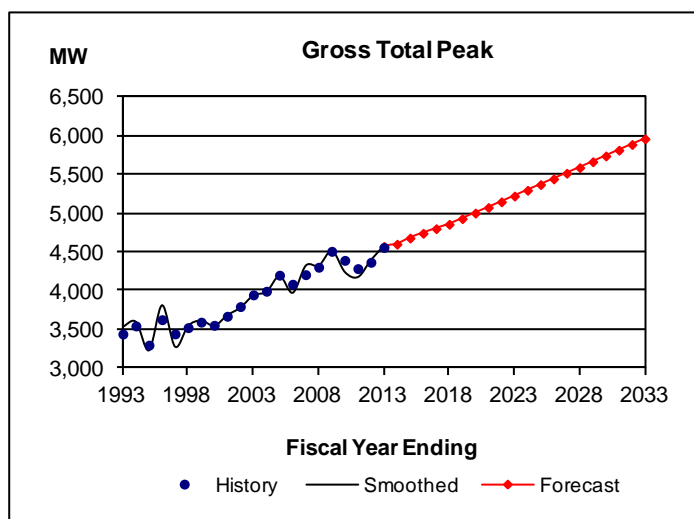


Table 31 – Gross Total Peak

GROSS TOTAL PEAK (MW)					
HISTORICAL/WEATHER ADJUSTMENT/FORECAST					
Fiscal Year	Peak	Weather Adjust	Adjusted Peak	Fiscal Year	Forecast Peak
1993/94	3547	0	3546	2013/14	4601
1994/95	3299	251	3550	2014/15	4680
1995/96	3628	-126	3502	2015/16	4742
1996/97	3444	83	3528	2016/17	4801
1997/98	3525	73	3598	2017/18	4857
1998/99	3596	20	3616	2018/19	4930
1999/00	3555	20	3575	2019/20	5002
2000/01	3672	-7	3665	2020/21	5074
2001/02	3797	-1	3795	2021/22	5147
2002/03	3948	2	3950	2022/23	5222
2003/04	3994	0	3994	2023/24	5296
2004/05	4201	-82	4119	2024/25	5369
2005/06	4085	136	4220	2025/26	5443
2006/07	4208	46	4254	2026/27	5516
2007/08	4304	43	4347	2027/28	5588
2008/09	4509	-108	4401	2028/29	5664
2009/10	4393	-55	4338	2029/30	5739
2010/11	4286	73	4359	2030/31	5813
2011/12	4367	56	4423	2031/32	5886
2012/13	4559	-127	4432	2032/33	5959

Table 32 - Monthly Gross Total Peak

MONTHLY GROSS TOTAL PEAK (MW)													
History and Forecast													
2002/03 - 2032/33													
Fiscal Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
2002/03	3079	2820	2781	2911	2738	2691	3039	3397	3660	3848	3948	3813	3948
2003/04	3242	2587	2871	2877	2921	2901	2988	3467	3791	3994	3743	3465	3994
2004/05	2868	2773	2713	2893	2632	2748	2980	3598	4057	4201	3843	3577	4201
2005/06	2959	2845	3052	3116	3050	2837	2948	3672	3912	3630	4085	3498	4085
2006/07	3092	2821	3015	3141	3040	2954	3220	3789	4011	4208	4203	3847	4208
2007/08	3494	2736	3042	3294	3033	2777	2979	3996	4078	4304	4289	4095	4304
2008/09	3221	2893	2952	2920	3110	2726	3159	3804	4427	4509	4196	4223	4509
2009/10	3196	2933	3000	2758	2933	2982	3054	3297	4393	4256	4092	4235	4393
2010/11	2905	2843	2805	2991	3163	2709	3056	3927	4195	4286	4250	4169	4286
2011/12	3183	2886	3056	3278	3189	3045	3129	3756	4095	4367	4270	3608	4367
2012/13	3328	2775	3161	3260	3253	2870	3312	4087	4410	4559	4543	4013	4559
10 Year Hist	25	-5	38	35	51	18	27	69	75	71	60	20	61
Avg Growth	0.8%	-0.2%	1.3%	1.1%	1.7%	0.6%	0.9%	1.9%	1.9%	1.7%	1.4%	0.5%	1.5%
2013/14	3320	2991	3110	3290	3224	3046	3260	3931	4530	4577	4493	4107	4601
2014/15	3373	3040	3157	3340	3275	3103	3319	4002	4611	4658	4573	4182	4680
2015/16	3417	3080	3200	3384	3319	3143	3363	4054	4671	4719	4633	4237	4742
2016/17	3458	3117	3239	3423	3361	3181	3403	4103	4726	4775	4688	4288	4801
2017/18	3496	3152	3277	3462	3401	3216	3441	4148	4777	4826	4739	4335	4857
2018/19	3549	3199	3326	3509	3458	3264	3492	4209	4848	4897	4809	4399	4930
2019/20	3601	3246	3375	3561	3509	3312	3543	4271	4919	4969	4880	4464	5002
2020/21	3652	3292	3423	3612	3559	3359	3593	4332	4989	5040	4950	4527	5074
2021/22	3706	3341	3473	3664	3611	3408	3646	4395	5063	5114	5022	4594	5147
2022/23	3759	3389	3524	3717	3663	3458	3699	4459	5136	5188	5095	4660	5222
10 Year Fcst	43	61	36	46	41	59	39	37	73	63	55	65	66
Avg Growth	1.2%	2.0%	1.1%	1.3%	1.2%	1.9%	1.1%	0.9%	1.5%	1.3%	1.2%	1.5%	1.4%
2023/24	3813	3437	3574	3770	3715	3507	3751	4522	5209	5262	5167	4726	5296
2024/25	3866	3485	3624	3823	3767	3556	3804	4585	5282	5336	5240	4792	5369
2025/26	3919	3533	3673	3875	3819	3605	3856	4648	5354	5409	5311	4858	5443
2026/27	3972	3581	3723	3928	3871	3653	3908	4711	5427	5482	5383	4924	5516
2027/28	4025	3628	3772	3980	3922	3702	3959	4773	5499	5554	5454	4989	5588
2028/29	4079	3677	3823	4034	3975	3752	4013	4838	5573	5630	5528	5056	5664
2029/30	4133	3726	3874	4087	4028	3802	4066	4902	5647	5704	5602	5123	5739
2030/31	4187	3775	3924	4140	4080	3851	4119	4966	5721	5779	5675	5190	5813
2031/32	4240	3823	3974	4193	4132	3900	4171	5028	5793	5852	5747	5255	5886
2032/33	4293	3870	4023	4245	4183	3948	4223	5091	5865	5925	5818	5321	5959
20 Year Fcst	48	55	43	49	47	54	46	50	73	68	64	65	70
Avg Growth	1.3%	1.7%	1.2%	1.3%	1.3%	1.6%	1.2%	1.1%	1.4%	1.3%	1.2%	1.4%	1.3%

Peak load is measured and recorded differently than energy data. The system load at every hour is calculated by System Operations as:

Hourly Gross Total Peak (t)

$$\begin{aligned}
 &= \text{Hourly Total Generation (t)} \\
 &- \text{Hourly Metered Exports (t)} + \text{Hourly Metered Imports (t)} \\
 &- \text{Losses Associated with Exports (t)} + \text{Gains Associated with Imports (t)} \\
 &+ \text{Curtailments (t)}
 \end{aligned}$$

Losses for exports and gains for imports are only known on a monthly energy basis. The hourly value is obtained by using the ratio of exports/imports for the hour to the total exports/imports for the month and applying that to the total metered loss/gain for the month. The remaining difference between the balance of the load and Common Bus is taken as the Transmission Losses associated with Manitoba load.

Curtailments for individual customers are calculated as the difference between what the customer would have used if not curtailed versus what they did use. This is not the same as the calculation used for billing.

## Annual Peak

The forecast annual peak is higher than the maximum of the monthly peaks. This is due to the peak being possible in any of the winter months and must be higher than the peak of the other months. For studies requiring yearly data, the annual peak should be used.

## 16 Hour Peak

The peaks in this document are integrated hourly peaks. For some studies and analysis of avoided cost or DSM savings, an estimate of the average peak during onpeak hours (from 6 a.m. to 10 p.m.) may be desired. To convert hourly peak to 16 hour peak, multiply the hourly peak in the associated month by the following percentages:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
94.4%	94.9%	95.8%	96.0%	96.3%	96.0%	96.6%	95.6%	95.8%	96.6%	95.6%	95.5%	94.8%

## VARIABILITY AND ACCURACY

### Weather Effect and Weather Adjustment

The weather effect is determined in any sector by regressing the last two years of actual monthly energies against the actual DDH and DDC for the month. This results in a GW.h per DDH effect and a GW.h per DDC effect for that sector.

Only sectors whose major variation is due to weather can have a weather effect estimated. Sectors that vary primarily due to industrial output levels or seasonal but non-weather reasons may yield false weather effects if estimated. Weather effects are not determined for the GS Top Consumers, Seasonal, Diesel, Water Heating and Lighting sectors. Assigning them a weather affect and weather adjusting them will not improve their forecast.

For sectors where a weather effect is calculated, this document will show energy as the reported value and as a weather adjusted value. Forecasts are based on the weather adjusted values. The calculations are:

$$\begin{aligned} \text{Weather Adjustment} = & \text{DDH weather effect} * (\text{DDH actual} - \text{DDH normal}) \\ & + \text{DDC weather effect} * (\text{DDC actual} - \text{DDC normal}) \end{aligned}$$

$$\text{Weather Adjusted Actual} = \text{Actual} - \text{Weather Adjustment}$$

Following are the DDH and DDC weather effect factors by sector:

Residential: 0.6 GW.h / DDH, 1.1 GW.h / DDC

GS Mass Market: 0.3 GW.h / DDH, 0.9 GW.h / DDC

General Consumers Sales: 0.8 GW.h / DDH, 2.0 GW.h / DDC

Gross Firm Energy: 1.1 GW.h / DDH, 2.3 GW.h / DDC

Gross Total Peak: 40 MW / degree (at -30 degrees Celsius),  
120 MW / degree (at +30 degrees Celsius)

## Effect of Extreme Weather

A record cold winter will increase load 4% and a record warm winter will decrease it 4%. An additional 2% load increase is possible due to a record hot summer and a 1% decrease due to a record cool summer.

The effect of extreme weather is larger on a monthly basis, and even larger on a daily basis.

Effect of Weather due to Winter Extremes on Gross Firm Energy									
GW.h/DDH	1.1	Normal		Record Warm			Record Cold		
		DDH	GW.h	DDH	GW.h	Effect	DDH	GW.h	Effect
Year:	2013/14	4541	25239	3678	24289	-4%	5439	26227	4%
Month:	Jan 2014	944	2772	663	2463	-11%	1261	3122	13%
Day:	Jan 2014	30	89	6	63	-30%	56	118	31%

Effect of Weather due to Summer Extremes on Gross Firm Energy									
GW.h/DDC	2.3	Normal		Record Cool Summer			Record Hot Summer		
		DDC	GW.h	DDC	GW.h	Effect	DDC	GW.h	Effect
Year:	2013/14	190	25239	69	24960	-1%	364	25639	2%
Month:	July 2013	71	1845	6	1695	-8%	142	2007	9%
Day:	July 2013	2	60	0	54	-9%	14	86	45%

The residential sector has a larger proportional effect of weather, varying from an increase of 7% in a record cold winter to a decrease of 7% in a record warm winter, and a possible additional increase of 3% due to a record hot summer and a 2% decrease due to a record cool summer.

Effect of Weather due to Winter Extremes on Residential Energy									
GW.h/DDH	0.6	Normal		Record Warm			Record Cold		
		DDH	GW.h	DDH	GW.h	Effect	DDH	GW.h	Effect
Year:	2013/14	4541	7339	3678	6821	-7%	5439	7878	7%
Month:	Jan 2014	944	996	663	827	-17%	1261	1187	19%
Day:	Jan 2014	30	32	6	18	-45%	56	47	48%

Effect of Weather due to Summer Extremes on Residential Energy									
GW.h/DDC	1.1	Normal		Record Cool Summer			Record Hot Summer		
		DDC	GW.h	DDC	GW.h	Effect	DDC	GW.h	Effect
Year:	2013/14	190	7339	69	7206	-2%	364	7531	3%
Month:	July 2013	71	426	6	355	-17%	142	504	18%
Day:	July 2013	2	14	0	11	-18%	14	27	94%

## Load Variability

Uncertainty is an inherent characteristic of forecasting. The load will vary both year to year and long term because of underlying changes in population growth, economic growth, changes in the operations of Top Consumers, and overall use patterns. An economic recession will slow energy growth. An economic boom will increase it. Cycles cannot be predicted in advance so some appropriate midpoint must be chosen as the forecast.

This forecast was created as Manitoba Hydro's best estimate of Manitoba's future energy requirement. The expectation is that there will be a 50% chance that actual growth will be higher than the forecast, and a 50% chance that actual growth will be lower than the forecast.

To evaluate the potential for variation, historic load variability has been analyzed using a probabilistic-based approach. Variations in annual weather adjusted load that have occurred in the past are used to estimate future variation. Doing this provides an estimate of the magnitude of the potential load variation from the forecast due to population, economy and other effects. 10% and 90% confidence bands (-/+ 1.28 standard deviations) were selected to be a proxy for the Low and High Load Forecast Scenarios for use in risk analysis studies. They are calculated as follows:

Load = Base Forecast +/- 1.28 x Standard Deviation

For other probability points, substitute for the 1.28 the following numbers:

Prob	0.1%	2.5%	10%	20%	50%	80%	90%	97.5%	99.9%
Z(Prob)	-3.09	-1.96	-1.28	-0.84	0.00	0.84	1.28	1.96	3.09

This calculation gives the variability due to long term economic effects. It does not include variability due to weather which was removed through the use of weather adjusted load.

If variability due to weather is needed, the standard deviation of annual energy or annual peak due to weather has been found to be approximately 2% of the load. This 2% of load can be used as the standard deviation in a probability point calculation. The resulting variance can be added to the economic-based variance if a combined variance is needed. A straight addition of variances can be done because the weather is mostly independent of the economy.

The following four charts and tables summarize the variability for energy and peak. By 2032/33, the Load Forecast has an 80% probability of being accurate to within  $\pm 2,471$  GW.h or  $\pm 7.6\%$ . Due to the inherent variability of the load, this is the best level of accuracy possible.

Figure 20 - Energy Variability

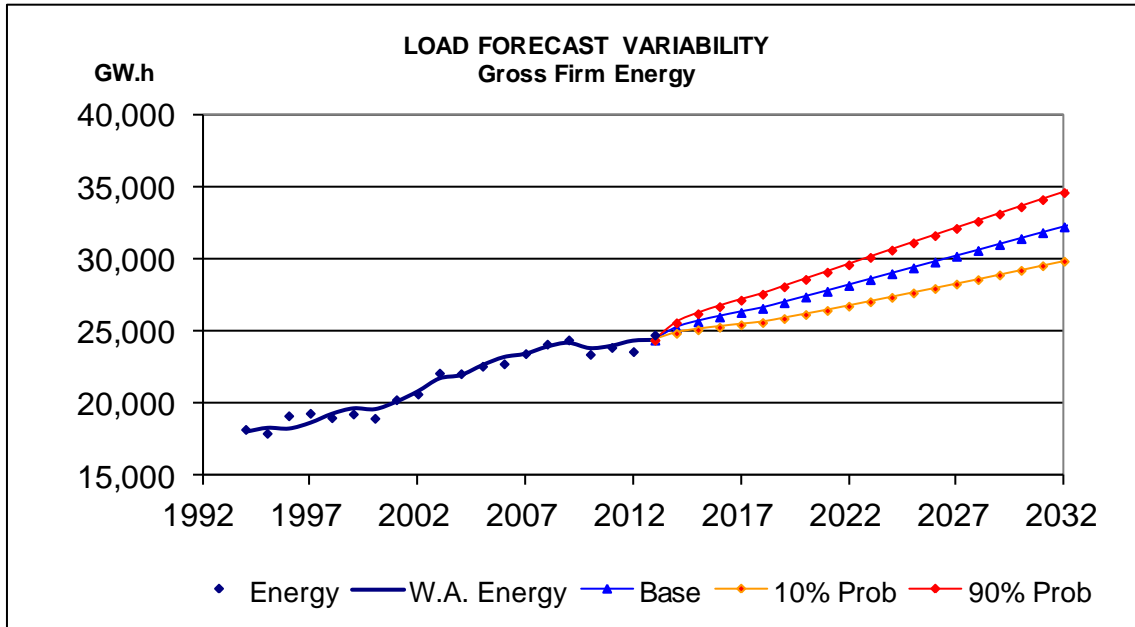


Table 33 – Energy Variability

Fiscal Year	Gross Firm Base Fcst	Long Term Economic Std Dev	10.0% Prob Point	90.0% Prob Point
2013/14	25239	284	24875	25603
2014/15	25676	434	25119	26232
2015/16	26013	557	25299	26727
2016/17	26322	667	25468	27176
2017/18	26606	767	25623	27589
2018/19	27003	862	25898	28107
2019/20	27398	951	26178	28617
2020/21	27789	1038	26460	29119
2021/22	28197	1121	26761	29634
2022/23	28605	1202	27065	30145
2023/24	29013	1280	27372	30654
2024/25	29418	1357	27679	31157
2025/26	29822	1433	27986	31658
2026/27	30225	1507	28295	32156
2027/28	30625	1579	28602	32649
2028/29	31041	1651	28925	33156
2029/30	31453	1721	29246	33659
2030/31	31863	1791	29568	34159
2031/32	32265	1860	29882	34649
2032/33	32667	1928	30196	35138



Figure 21 - Peak Variability

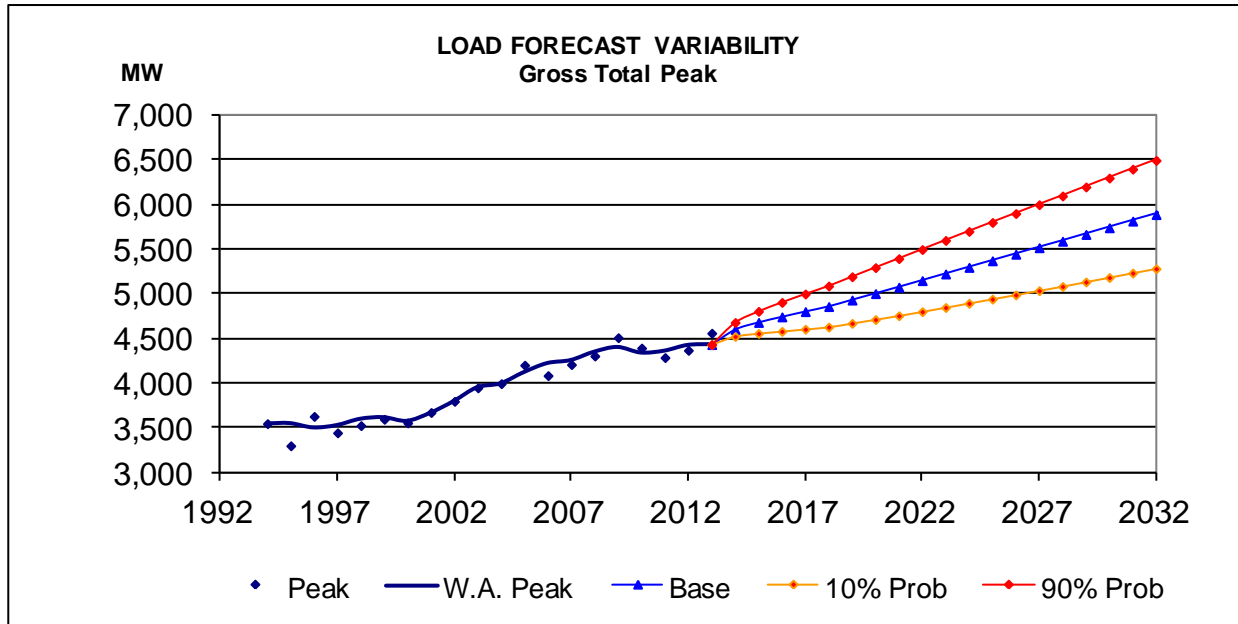


Table 34 – Peak Variability

Fiscal Year	Gross Total Peak Base Fcst	Long Term Economic Std Dev	10.0% Prob Point	90.0% Prob Point
2013/14	4601	61	4522	4679
2014/15	4680	97	4556	4804
2015/16	4742	127	4579	4904
2016/17	4801	154	4603	4998
2017/18	4857	179	4628	5087
2018/19	4930	204	4669	5191
2019/20	5002	227	4711	5293
2020/21	5074	249	4754	5393
2021/22	5147	271	4800	5495
2022/23	5222	293	4846	5597
2023/24	5296	314	4893	5698
2024/25	5369	335	4940	5798
2025/26	5443	355	4988	5898
2026/27	5516	375	5035	5997
2027/28	5588	395	5082	6095
2028/29	5664	415	5132	6195
2029/30	5739	434	5182	6295
2030/31	5813	454	5232	6395
2031/32	5886	473	5280	6492
2032/33	5959	492	5329	6590

## **5 and 10 Year Forecast Accuracy**

Due to the load variation caused by population growth and economic growth, there is only a certain level of accuracy possible. Recognizing the inherent uncertainty of forecast, historic forecast variation has been tracked. Manitoba Hydro's objective is that a five year forecast is within 5% and a ten year forecast is within 10%.

The following four figures and tables compare previous load forecasts to actual results 5 and 10 years later.

The energy savings achieved under Manitoba Hydro's market-based DSM programs between the year the forecast was prepared and the year being forecast was subtracted first from the forecast value. The difference is taken as the accuracy of the forecast.

The following figures and tables may seem to give the impression that there may be cycles in the forecast made up of alternating periods of over-forecasting and under-forecasting. But these are not so much due to a bias in the forecast as they are due to unexpected periods of recession or economic growth. Once one of these unexpected periods occur, it will affect the accuracy of the previous five 5-year forecasts for 5 years, and the accuracy of the previous ten 10-year forecasts for ten years.

Compensation for these periods of over and under-forecasting cannot be applied until after the events occur and only then can be identified and quantified. The forecast assumes average expected economic conditions. When that does not occur, the forecast will be high or low.

The weather adjusted Gross Firm Energy is shown in two separate columns in the Energy Accuracy table and they vary in each year due to the difference in weather normals used in each of the respected forecasts. Those weather normals differences are due to the use of a 25 year rolling average which relies on the previous 25 years of weather data at the time the forecast is created.

Figure 22 - Energy Accuracy

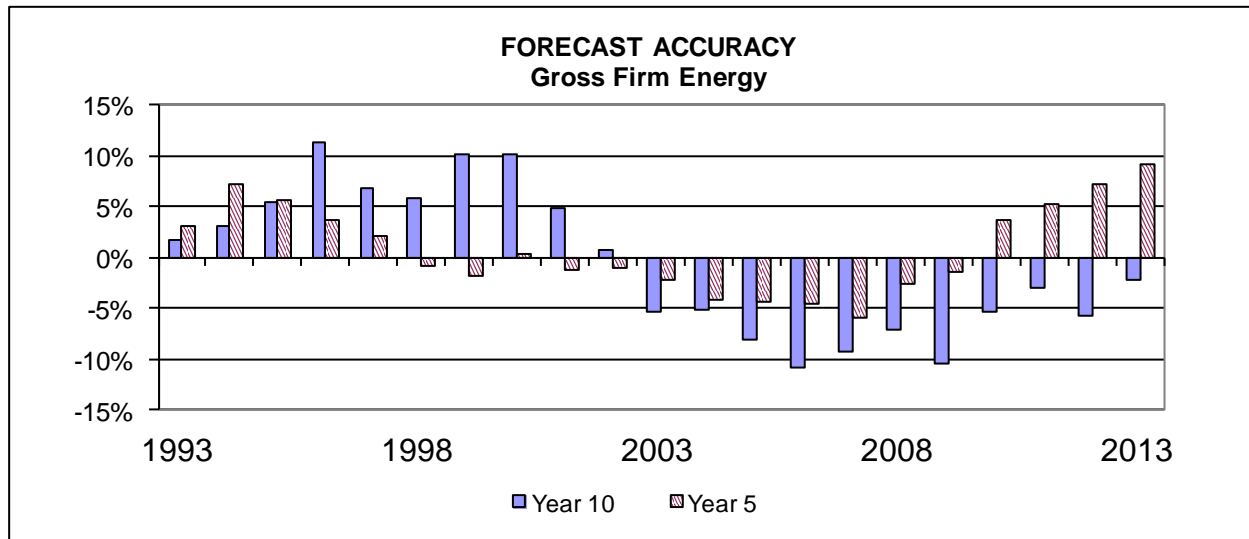


Table 35 - Energy Accuracy

Fiscal Year	Actual Gross Firm Energy	Forecast Prepared 5 Years Previous	W.A. Gross Firm Energy	5 Year Percent Accuracy	Forecast Prepared 10 Years Previous	W.A. Gross Firm Energy	10 Year Percent Accuracy
1992/93	17894	18533	17974	3.1%	18253	17950	1.7%
1993/94	18201	19440	18113	7.3%	18674	18101	3.2%
1994/95	17929	19400	18365	5.6%	19357	18365	5.4%
1995/96	19148	18985	18318	3.6%	20450	18370	11.3%
1996/97	19321	19198	18810	2.1%	19970	18716	6.7%
1997/98	19014	19258	19429	-0.9%	20452	19320	5.9%
1998/99	19273	19476	19818	-1.7%	21696	19708	10.1%
1999/00	18971	19767	19703	0.3%	21611	19629	10.1%
2000/01	20262	20018	20241	-1.1%	21083	20103	4.9%
2001/02	20656	20783	20980	-0.9%	21146	20979	0.8%
2002/03	22110	21395	21861	-2.1%	20703	21868	-5.3%
2003/04	22069	21134	22062	-4.2%	20975	22107	-5.1%
2004/05	22589	21693	22664	-4.3%	20870	22714	-8.1%
2005/06	22757	22216	23277	-4.6%	20812	23346	-10.9%
2006/07	23464	22107	23489	-5.9%	21395	23595	-9.3%
2007/08	24122	23353	23962	-2.5%	22328	24034	-7.1%
2008/09	24417	23926	24259	-1.4%	21756	24320	-10.5%
2009/10	23412	24734	23850	3.7%	22611	23892	-5.4%
2010/11	23892	25270	24020	5.2%	23330	24071	-3.1%
2011/12	23605	25951	24202	7.2%	22966	24376	-5.8%
2012/13	24759	26522	24280	9.2%	23902	24443	-2.2%

Figure 23 - Peak Accuracy

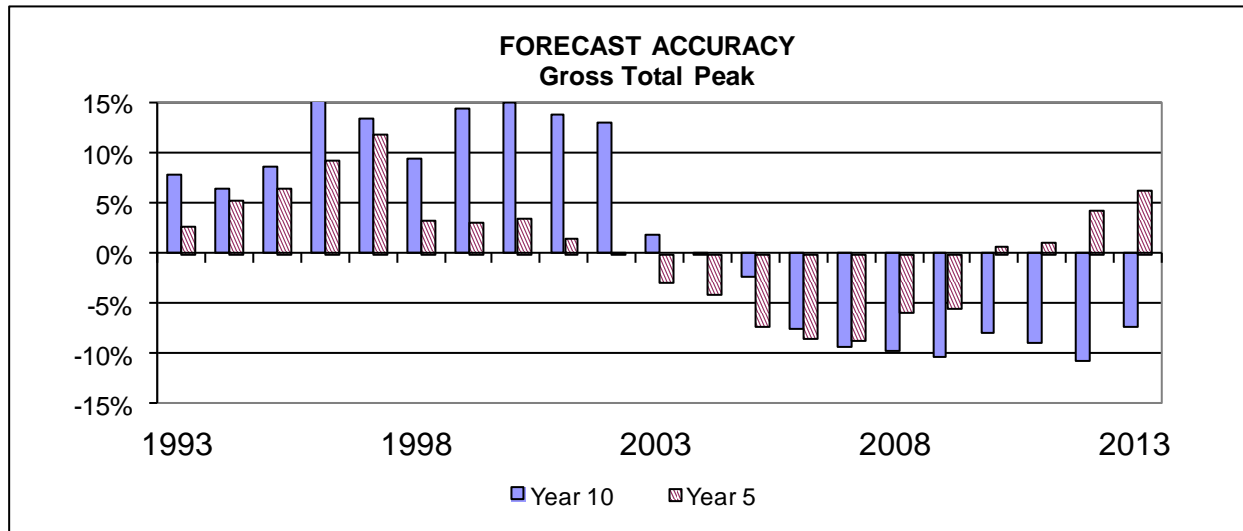


Table 36 - Peak Accuracy

Fiscal Year	Actual Gross Total Peak	Forecast Prepared 5 Years Previous	W.A. Gross Total Peak	5 Year Percent Accuracy	Forecast Prepared 10 Years Previous	W.A. Gross Total Peak	10 Year Percent Accuracy
1992/93	3443	3621	3523	2.8%	3799	3523	7.8%
1993/94	3547	3754	3567	5.3%	3799	3567	6.5%
1994/95	3299	3829	3593	6.6%	3904	3593	8.7%
1995/96	3628	3850	3523	9.3%	4081	3523	15.8%
1996/97	3444	3906	3491	11.9%	3962	3491	13.5%
1997/98	3525	3768	3646	3.3%	3990	3646	9.4%
1998/99	3596	3703	3592	3.1%	4108	3592	14.4%
1999/00	3555	3738	3608	3.6%	4152	3608	15.1%
2000/01	3672	3758	3699	1.6%	4210	3699	13.8%
2001/02	3797	3759	3758	0.0%	4251	3758	13.1%
2002/03	3948	3801	3917	-3.0%	3989	3917	1.8%
2003/04	3994	3833	3994	-4.0%	3990	3994	-0.1%
2004/05	4201	3817	4119	-7.3%	4023	4119	-2.3%
2005/06	4085	3860	4221	-8.5%	3899	4221	-7.6%
2006/07	4208	3894	4267	-8.7%	3868	4267	-9.4%
2007/08	4304	4097	4351	-5.8%	3927	4351	-9.8%
2008/09	4509	4161	4401	-5.4%	3948	4401	-10.3%
2009/10	4393	4371	4338	0.8%	3993	4338	-8.0%
2010/11	4286	4406	4359	1.1%	3967	4359	-9.0%
2011/12	4367	4616	4423	4.4%	3952	4423	-10.6%
2012/13	4559	4715	4434	6.3%	4108	4434	-7.3%

## POSSIBLE EVENTS

Manitoba Hydro examines possible events of interest for their potential impact on system load requirements. These events are deemed to be captured within the overall load variability analysis of the forecast. Although not specifically identified within the analysis, they are presented so their individual effects may be considered from a sensitivity perspective if the need arises. These events are summarized in the following table.

	<b>Energy Effect (GW.h)</b>	<b>Peak Effect (MW)</b>
<b>Climate Change per Degree Celsius Warmer</b>	+100	-40
<b>One New Very Large Industrial Customer</b>	+1,500	+180
<b>One Less Very Large Industrial Customer</b>	-1,500	-180
<b>Additional Load if Electric Vehicles Grow to 70%</b>	+2,312	+289
<b>10% of all Res Customers switch to Electric Heat</b>	+746	+246
<b>10% of all Res Customers switch to Electric Water Heaters</b>	+198	+23

To provide context for the previous table, one year of energy growth is approximately 420 GW.h and one year of peak growth is approximately 80 MW.

## Climate Change

The Intergovernmental Panel on Climate Change projects an increase in global temperature as a result of rising concentrations of greenhouse gases in the atmosphere. Changes to temperature and extreme events have the potential to influence future energy demands.

In the last 100 years, the city of Winnipeg's 25-year average temperature has resulted in Degree Days Heating (DDH) in the range of 4500 to 5000 each year. A 25 year moving average has been selected for the forecast to help minimize the effects of year to year variability and to represent the long term climatology. This section quantifies the general effect caused by a 1°C increase in average daily temperature throughout the year.

In Manitoba Hydro's case, if Winnipeg experienced a uniform 1°C warming throughout the year, winter months would be subject to less heating while summer months would be subject to more cooling. Over 200 winter days, every degree Celsius of temperature rise above average conditions will result in an approximate decrease of 200 Degree Days Heating (DDH) per year, and a corresponding approximate increase of 100 Degree Days Cooling (DDC) per year over 100 summer days.

Applying the Weather effect for Manitoba Hydro at Generation gives:

Decrease of 200 DDH → -200 GW.h and -40 MW in the winter

Increase of 100 DDC → +300 GW.h and +120 MW in the summer

The resulting total effect of every one degree increase in temperature would be:

An increase of 100 GW.h to annual energy and a decrease of 40 MW to system peak.

	Energy (GW.h)	Peak (MW)
Climate Change per Degree Celsius Warmer	+100	-40

## Potential Load from Very Large Industrial Customers

This forecast includes an expectation that there may be new large industrial users of electricity that may come to Manitoba. GS Top Consumers includes a Potential Large Industrial Loads category that adds 1,700 GW.h to GS Top Consumers by 2031/32. This is expected to be made up of increases and decreases by current top consumers, additions of new top consumers and company closures. However, this forecast does not anticipate the scenario of a single customer using up the entire PLIL category.

Manitoba Hydro's largest customer currently uses in excess of 1,500 GW.h annually and has a coincident peak load of about 180 MW. It is feasible that one or more customers of this size could decide to start up in Manitoba in the next 20 years. A single large new customer could use the entire 1,700 GW.h of energy that has been reserved in the Potential Large Industrial Loads category.

Similarly, there is a chance that one or more very large customers can close down. This could also be the equivalent of losing Manitoba Hydro's largest customer.

	Energy (GW.h)	Peak (MW)
<b>Additional Load for one new very large customer</b>	+1,500	+180
<b>Loss of Load for the loss of our largest customer</b>	-1,500	-180

## Potential Load from High Adoption of Electric Vehicle Technology

This forecast already assumes there will be a noticeable impact due to adoption of electric vehicles within Manitoba over the next twenty years. The specifics have been detailed in the Plug-In Electric Vehicles section of this document.

But there is a possibility that the current technological challenges will be solved, price will match those of internal combustion vehicles, and range anxiety will be alleviated. Should breakthroughs and advances in battery technology, changes in consumer perceptions, and price reductions happen in the next few years, it is possible that electric vehicles may grow to be the dominant vehicle. Under this assumption, electric vehicles may grow to be 70% of the market share in 20 years.

Assuming 70% of all vehicles in Manitoba in 2032/33 are Plug-In Electric Vehicles (PEVs), then these vehicles would use 2,384 GW.h and 298 MW. Currently, the forecast includes 72 GW.h and 9 MW for PEVs, therefore 70% saturation would be an increase of 2,312 GW.h (5½ years of load growth) and 289 MW (about 3½ years of peak growth).

	Energy (GW.h)	Peak (MW)
<b>Additional Load with 70% Electric Vehicle Saturation Rate</b>	+2,312	+289



### Increased Residential Use of Electricity for Space heat

Under current natural gas prices, it is cheaper to heat one's home with a high efficiency natural gas furnace than with electricity. This forecast assumes that natural gas will retain its price advantage over electricity over the next 20 years. The forecast is that by 2032/33, 221,868 or 39.3% of Residential Basic customers will heat their home with electricity.

However, there is a possibility that more customers could switch to electric space heat. If the percentage of electric heat billed customers rises by 10% to 49.3%, then by 2032/33, 278,341 electric heat customers would use 24,869 kW.h each, and 286,245 other customers would use 11,487 each. Total usage would be 746 GW.h higher than forecast (almost 2 years of load growth) in 2032/33. At a 35% load factor, this would add 246 MW to the peak (3 years of peak growth).

	Energy (GW.h)	Peak (MW)
<b>10% of all Res Customers switch to Electric Heat</b>	+756	+246

### Increased Residential Use of Electricity for Water heat

New homes are now primarily built with electric water heaters rather than natural gas water heaters regardless of their space heat fuel choice. In existing homes, as standard and mid-efficiency gas furnaces are being replaced with a high efficiency gas furnace, some homeowners are choosing to replace their existing natural gas water heaters with electric water heaters.

However, there is a possibility that more customers could switch to electric water heaters. If the percentage of customers with electric water heaters rises by 10% to 72.5%, then by 2032/33, 56,459 additional electric water heaters would use 3,500 kW.h each. Additional usage would be 198 GW.h (about ½ year of load growth). At a 100% load factor, this would add 23 MW to the peak (about ¼ of a year of peak growth).

	Energy (GW.h)	Peak (MW)
<b>10% of all Res Customers switch to Electric Water Heaters</b>	+198	+23

## ASSUMPTIONS

### Economic Assumptions

Economic forecast assumptions are taken from the 2013 Economic Outlook and the 2013 Energy Price Outlook. These documents contain Manitoba Hydro's forecasts of economic variables including prices of electricity, natural gas and oil, Gross Domestic Product (GDP), Manitoba population and residential customers.

The following are the economic variables used in the preparation of this Electric Load Forecast:

**Residential Customers** - The number of Residential Basic customers in Manitoba is forecast to increase by 1.2% (5,633 units) in 2013/14 and averages 1.1% per year over the forecast period. This compares to a historical average increase of 1.0% per year over the last ten years. This is used in the Residential and GS Mass Market customer forecasts.

**Electricity Prices** - The electricity price forecast is based on CPI and rate increase projections contained in the Integrated Financial Forecast. The real electricity price is forecast to increase by 1.7% in 2013/14, and then increase by 2.0% per year throughout the rest of the forecast period.

**Natural Gas Prices** – Manitoba Hydro views the natural gas price forecast as commercially sensitive information. Consistent with the Clean Environment Commission and Electric General Rate Application, this information will not be publicly disclosed.

**Gross Domestic Product (GDP)** - Real economic growth in Manitoba is forecast to be 2.4% in 2013/14. It is expected to stay at approximately that level for several years, then decline to 1.7% by 2019/20 and remain at that level for the remainder of the forecast period. This is used in the GS Mass Market customer forecast.

## Normal Weather Assumptions

Weather for forecast purposes is measured by degree days. Winnipeg temperatures are used, as Winnipeg is central to most of the weather-dependent load (Residential and General Service Mass Market) in Manitoba.

Cold weather is expressed in Degree Days Heating (DDH), which is the number of average degrees colder than 14 degrees Celsius each day. Hot weather is expressed in Degree Days Cooling (DDC), which is the number of average degrees warmer than 18 degrees Celsius each day. Daily temperature is the average of the high and low temperature for the day. The equations are:

$$\text{DDH} = \text{sum} (\max(0, 14 - (\text{Daily high} + \text{Daily low}) / 2))$$

$$\text{DDC} = \text{sum} (\max(0, (\text{Daily high} + \text{Daily low}) / 2 - 18))$$

The base temperature of 14 degrees for DDH is the temperature below which most buildings have their heating systems (furnaces) running.

The base temperature of 18 degrees for DDC is the temperature above which buildings start to run their space cooling systems (air-conditioning).

The forecast is prepared assuming normal weather. Normal weather is determined from the 25 year average of Degree Days Heating and Degree Days Cooling in Winnipeg over the period April 1988 to March 2013.

The 25 year weather normals used for every year of this forecast are 4,541.3 DDH and 190.1 DDC. This is an increase of 22.9 DDH from last year's normal of 4,518.4 DDH, and an increase of 2.0 DDC from last year's normal of 188.1 DDC.

The range of DDH from 1988 to 2013 was from a warm winter of 3,677.6 DDH in 2011/12 (863.7 DDH below normal) to a cold winter of 5,439.3 DDH in 1995/96 (898.0 DDH above normal).

The range of DDC from 1988 to 2013 was from a cool summer of 71.8 DDC in 2004/05 (118.3 DDC below normal) to a hot summer of 364.1 DDC in 1988/89 (174.0 DDC above normal).

## **Demand Side Management (DSM) in the Forecast**

This forecast reflects future DSM savings associated with existing Provincial building codes and improved equipment efficiency standards (Codes and Standards). This is the only DSM initiative that is specifically accounted for in the forecast.

Savings due to DSM programs to date are embedded in the historical data that is the basis for this forecast. The current level of past achieved DSM savings is assumed to remain in place throughout the future. Future DSM savings arising from future Power Smart offerings and market engagement above the current level and incremental to the above mentioned Codes and Standards are treated as a supply-side resource and are not included in this forecast. They are accounted for separately in Manitoba Hydro's Power Smart Plan and Power Resource Plan.

As a result, historical growth rate in this document are not directly comparable to future growth rates because the history includes the effect of past DSM initiatives, but the forecast does not.

For customers involved in DSM initiatives such as the Load Displacement and Alternative Energy, the most recent years of history are used as the basis of their forecast. Any increase or loss to their alternative energy supply will not be included in the forecast, and are accounted for with the other DSM initiatives within the Power Smart Plan.



## METHODOLOGY

### Residential Basic Methodology

The Residential Basic forecast was determined using a combined electricity and natural gas end use approach. The end use assumptions include usage information and efficiency improvement information. The number of appliances and their estimated usage were multiplied together to calculate an energy forecast for each end use, and then all uses were combined to calculate the total use for the Residential End Use Forecast. The following steps were used:

1. **Total Number of Residential Customers** - The forecast of the total number of Residential Basic customers for the 2013/14 to 2032/33 period is taken from Manitoba Hydro's 2003 Economic Outlook that is produced by the Economic Analysis Department. This customer forecast was the primary input for the Residential End Use Model.
2. **Residential Survey Data** – The 2009 Residential Survey was used to provide estimates as of November 2009 of the following:
  - a) **Customers by Dwelling Type and Area:** Dwelling types include: Single Detached, Multi-family Attached, and Individually-Metered Apartments. Single detached dwelling types are sub classified into three Areas: Winnipeg, Gas Available Areas Outside of Winnipeg, and Gas Unavailable Areas.
  - b) **Customers by Heating Type** - Each combination of Dwelling Type and Area are divided into three Heating Types: Electric Heat Billed customers, Natural Gas Heat Billed customers and Other Heat customers. Electric Heat Billed customers pay for their space heat with their electricity bill. Natural Gas Heat Billed customers pay for their space heat with their natural gas bill. Other Heat customers may use fuel oil, propane or wood, or may use electric or natural gas heat but are not billed on their own electricity or natural gas bill for their heat.
  - c) **Age of Home and Heating System** – Home age was used to determine new home construction rates by dwelling type, area and heating type. Heating system age was used to determine heating system replacement rates.

- d) Appliance Saturations and Ages** – Appliance saturations were used to estimate the number of various types of appliances, and appliance ages were used to estimate their replacement rates.
3. **Determination of Average Use** – Conditional Demand Analysis was then performed on the Residential Survey data combined with the Billing data to derive the average annual energy use per appliance calibrated to the whole-house usage. Usage of newer appliances can differ from that of older appliance. Average use for new appliances was determined where there was a difference.
4. **Calibrate Starting Year** – Customers, saturations and average usage were combined to give starting values for the 2009/10 fiscal year corresponding to the 2009 Residential Survey results. These were also calibrated to the billing data for 2009/10.
5. **Calibrate History** – Growth and replacement rates from the Survey were applied to starting year values to derive values for 2010/11, 2011/12 and 2012/13. These were calibrated to billing data for those same years.
6. **Future Growth** – Forecasts of the number of homes, heating systems and appliances, their average usage and their total use were calculated as follows:
- a) **New Construction** - The percentage of newly constructed homes choosing electric space heat was forecast for each area using the 2009 Residential Survey estimate. This estimate was adjusted to reflect Manitoba Hydro’s initiatives being undertaken to reduce the number of customers choosing electricity for space and water heat.
  - b) **Appliance Forecast** - Historical saturation and age distribution data was collected from the 2009 Manitoba Hydro Residential Survey. Saturations were forecast using a birth/death/replacement model.
  - c) **New Appliance Usage** - Average use for new appliances was taken from Conditional Demand Analysis.

d) **Total Energy Use** - The forecast number of appliances was multiplied by the forecast average use to get the total forecast usage for each appliance. The appliance usages were summed to get the total forecast energy use for the Residential Basic rate class.

7. **Final Adjustments** – Electric Vehicles were added, and savings from Standards and Codes are subtracted.

Ninety percent of the Plug-In Electric Vehicle forecast was added to the Residential GW.h. (The other ten percent of the electric vehicle forecast was allocated to the General Service Mass Market forecast.)

Estimates of improvements due to future Codes and Standards that were not handled by the new appliance average usages were obtained from the Power Smart Planning and Evaluation Research Department and were subtracted.

## **General Service Mass Market Methodology**

### **A) General Service Mass Market Customer Forecast**

Econometric analysis of sales data is used to develop models for the number of customers. Forecasts of Manitoba GDP and Manitoba Hydro Residential Customers from the Manitoba Hydro 2013 Economic Outlook are then input into the models, which generate forecasts for the number of customers for each year of the forecast period.

The number of customers at fiscal yearend was forecast using the following calculations for each year (t):

Number of Customers (t)  
= Number of Customers (t-1)  
+ Change in the Number of Customers (t)

Change in the Number of Customers (t)



$$= \text{Number of Customers (t-1)} \\ \times \text{Percentage Change in Number of Customers (t)}$$

The percentage change in number of customers was modeled using yearend historical customer data from 1984/85 to 2012/13. The resulting model and parameters are as follows:

Percentage Change in Number of Customers (t)

$$= -0.003 + 0.132 \times \text{CGDP} + 0.660 \times \text{CRES}$$

CGDP - Annual Percentage Change in Manitoba Gross Domestic Product

CRES - Annual Percentage Change in Residential Basic Customers

R-squared: 58.9%

T-stats:

Constant : -1.58

CGDP : 3.72

CRES : 4.05

General Service Mass Market customer growth is allocated to Medium and Large classes using their 10 year average percentage of Mass Market customer growth, the Small Non-Demand class is allocated 10% of new customers, and the rest of the growth is allocated to the Small Demand class.

## **B) General Service Mass Market Average Use Forecast**

Average use for new customers in each rate class is forecast to be the five year average use of its respective class for the duration of the forecast period. Specifically these are:

- i) Small Non-Demand - 31,075 kW.h per year
- ii) Small Demand – 166,315 kW.h per year
- iii) Medium - 1,572,917 kW.h per year
- iv) Large - 5,834,523 kW.h per year

Top Consumer customers are excluded from these classes for forecasting purposes.

Customers are assigned to a rate class depending on their usage. If usage by an individual customer increases (or decreases) sufficiently then they will be re-assigned to the appropriate rate class. These shifts tend to offset each other over time so individual classes have not shown significant upward or downward trends in average use. By definition, the truncation of these classes results in relatively stable average use for each class.

### **C) General Service Mass Market Total Use Forecast**

Total GW.h for the General Service Mass Market sector is forecast by multiplying the forecast number of customers in each rate class by the forecast average use per customer in each rate class. The total number of customers in the GS Mass Market sector is forecast using econometric models, and then the total is allocated among the rate classes based on historical data. The average use per customer is forecast using the five year average for each rate class.

Ten percent of the Plug-In Electric Vehicle forecast is added to the GW.h for the Small Non-Demand rate class. (The other ninety percent of the electric vehicle forecast is allocated to the Residential forecast.) Forecast savings from future Codes and Standards are taken off of the forecast to calculate the Total Use.

Total Use (t) in GW.h

- = Weather Adjusted Actual Usage for the Current Year
- + Number of New Small Non-Demand Customers (t)
  - x Average Annual Use of Small Non-Demand Customers (t)
- + 10% of Plug-in Electric Vehicle Forecast
- + Number of New Small Demand Customers (t)
  - x Average Annual Use of Small Customers (t)
- + Number of New Medium Customers (t)
  - x Average Annual Use of Medium Customers (t)
- + Number of New Large Customers (t) x Average Annual Use of Large Customers (t)
- Forecast Savings from Codes and Standards (t)

## **General Service Top Consumers Methodology**

Top Consumers is made up of the largest electricity users of Manitoba Hydro. The general criterion is that a company needs to have used 80 GW.h in a year, or have the potential to consume 80 GW.h in a year. A Top Consumer is not necessarily located in one place, but may consist of services at number of locations throughout the Province. A Top Consumer will be one company, but may count as multiple billing customers.

Each company in the Top Consumers group is forecast individually. Information on individual company operating plans is collected from industry news, Manitoba Hydro's economic experts and Manitoba Hydro's Key & Major Account representatives. This information is used to prepare company specific forecasts.

Normally, information is only available over the next 3 to 5 years for any company. These short term considerations are taken into account, and then the company's individual forecast is held constant.

To account for longer term growth in this group of consumers, a special classification called Potential Large Industrial Loads (PLIL) has been created. PLIL is used instead of attempting to forecast each consumer individually for the long term. It represents the natural growth of all the top consumers as a group, as well as unexpected major expansions, new customers, or loss of customers from GS Top Consumers.

Starting in 2014/15, 100 GW.h a year is forecast for PLIL to account for unforeseen expansion, contraction and growth. This will result in the addition of 1,700 GW.h of PLIL after 20 years.

## **Electric Vehicles**

The methodology for forecasting Electric Vehicles was to research relevant recent literature and to apply appropriate assumptions from this literature to Manitoba's situation. Historical data on automobile registrations per year in Manitoba was used to help estimate future trends. The forecast section on Electric Vehicles provides the details.

## **Other Sectors**

### **Seasonal, Water Heating, Lighting**

Most of the smaller sales sectors, including Seasonal, Flat Rate Water Heating and Area and Roadway Lighting were done by analysis of changes in the number of customers or services and in changes in average use per customer or service. Growth rates were applied based on history and a best estimate as to what the future will bring.

### **Diesel**

Each of the diesel towns was individually forecast and included in the forecast under the assumption that the diesel towns will not be part of the Integrated System during the forecast period.

## **Monthly Sales Allocations**

Monthly percentages of customer growth through the year and GW.h for the month of the year were averaged for the past five years. These were then applied to the forecast annual customers and kW.h to get the monthly forecast.

## **Monthly and Annual Gross Firm Energy and Gross Total Peak**

The 5 year monthly percentage of Common Bus and Station Service are applied to their annual energy to calculate their monthly values. Transmission Losses are calculated using a 5 year average of their ratio to Common Bus. Monthly Common Bus, Transmission Losses and Station Service are added up to give the Monthly System Energy. Monthly Common Bus, Transmission Losses, Station Service and Gross Firm Energy are totaled to give the Annual Gross Firm Energy.

The Gross Total Peak is calculated from Load Factors applied to the forecast monthly Gross Total Energy. Prior to calculating the Load Factors, the Top Consumer energy and peak are subtracted because the Top Consumers have a higher average hourly energy relative to their peak value than the Residential and General Service Mass Market Customers. A 10 year

historical average Load Factor is calculated for the remaining energy and is applied to the forecast monthly and annual energy to get the peaks for the remaining energy. The Top Consumer peaks are added using an 85% Load Factor applied to the Top Consumer monthly and annual energy.

A 10 year average Load Factor is used instead of a 5 year average due to its variability from year to year. Historical weather adjusted energy is used to calculate Load Factors. The number of hours in the month is used to calculate monthly Load Factors and the number of hours in the year is used to calculate annual Load Factors.

## GLOSSARY OF TERMS

**Area and Roadway Lighting sector** - includes electricity sales for the Sentinel Lighting and Street Lighting rate groups.

**Common Bus** - is the total load measured from all the distribution points (i.e. substations) within Manitoba. It includes all energy supplied to General Consumers Sales customers, Construction Power plus associated Distribution Losses, but excludes Diesel customers, Transmission Losses and Station Service.

**Customer** – Most metered electrical services count as a customer. Unmetered services such as flat rate water heating and sentinel rental services do not count as a customer. Street lighting counts all the services grouped as a premise as one customer.

**Codes and Standards** – A Demand Side Management (DSM) initiative associated with existing Provincial building codes and improved equipment efficiency standards. This is the only DSM initiative that is specifically accounted for in the forecast.

**Curtaillable** - is a load that can be curtailed on short notice. A discount is given for subscribing to this program. Curtailable loads can affect peak demand because some periods of curtailment may be at or near the system peak.

**Degree Days Cooling (DDC)** - DDC is a measurement designed to reflect the demand for energy needed to cool a building. DDC is the number of degrees warmer than 18 degrees Celsius each day is, based on the average of the high and low temperature of the day.

$$\text{DDC} = \text{sum} (\text{max}(0, (\text{Daily high} + \text{Daily low}) / 2) - 18)$$

**Degree Days Heating (DDH)** – DDH is a measurement designed to reflect the demand for energy needed to heat a building. DDH is the number of degrees colder than 14 degrees Celsius each day is, based on the average of the high and low temperature of the day.

$$\text{DDH} = \text{sum} (\text{max}(0, 14 - (\text{Daily high} + \text{Daily low}) / 2))$$

**Gas Available Area** – A city or town in Manitoba where customers have natural gas service available and can choose to heat their home with either natural gas or electricity.

Approximately 82% of Residential Basic customers, including the entire city of Winnipeg, have gas available.

**General Consumers Sales** - includes the energy supplied to all of Manitoba Hydro's individually billed customers. It excludes export sales.

**General Service Mass Market** - includes all Commercial and Industrial customers, excluding the Top Consumers group.

**General Service sector** - made up of sales to Commercial and Industrial businesses served by Manitoba Hydro. This sector consists of five rate groups (Basic, Diesel, Seasonal, Flat Rate Water Heating and Surplus Energy Program).

**General Service Top Consumers** - is made up of the largest electricity users of Manitoba Hydro.

**Gross Firm Energy** - is the energy required to serve Manitoba Hydro's customers on the Integrated System. It excludes exports, interruptible (non-firm) loads and diesel customers.

**Gross Total Peak** - is the maximum integrated (i.e. average) hourly load required to serve Manitoba Hydro's customers on the Integrated System. It excludes exports and diesel customers. It includes curtailable loads.

**GW.h (gigawatt-hour):** The unit of energy primarily used in this document. One GW.h equals one million kW.h (kilowatt-hours), which is approximately equal to the energy of 100 typical homes not using electricity for heating, or 40 homes that use electricity for heating.

**Integrated System** - is the power grid that connects Manitoba Hydro's generation sources to its customers. All Manitoba Hydro's customers except diesel are on the Integrated System.

**Interruptible (Non-Firm) Energy** - includes all energy sold to Manitoba customers on a non-firm basis. Currently, the only rate group for this is the Surplus Energy Program (SEP).

**kW.h/cust (kilowatt-hours per customer):** The unit of energy primarily used in this document to represent the average use of one customer. The total usage in GW.h of a group of customers is divided by the number of customers and then multiplied by one million.

**Load Factor** - is the ratio of the average hourly energy over a period, usually a year, divided by the energy used at a specific hour, usually the hour of system peak. A load factor of 25% means that the average energy is one-quarter of what is used at system peak. A load factor greater than 100% means that the average hourly energy is more than what is used at system peak. Given a specific energy, a lower load factor means a higher peak. The equation is:

$$\text{Load Factor} = (\text{Total Energy} / \text{Hours}) / (\text{Energy over the hour of system peak})$$

**Manitoba Load at Common Bus** - is the total load measured from all the distribution points (i.e. substations) within Manitoba. It includes all energy supplied to General Consumers Sales customers plus associated Distribution Losses, but excludes diesel customers, Transmission Losses and Station Service.

**MW (megawatt):** The unit of peak demand primarily used in this document. One MW is a million watts. One thousand MW of peak demand for one hour equals one GW.h of energy. Alternatively, one MW for a thousand hours also equals one GW.h of energy.

**Net Firm Energy** and **Net Total Peak** - are the same as Gross Firm Energy and Gross Total Peak except they exclude Station Service. The reporting of Manitoba Load in the Load Forecast used “Net” until 2008. It presented both until 2011. Starting with the 2012 forecast, only the “Gross” is presented. Net can be calculated when needed by subtracting Station Service from the Gross.

**Residential Basic** – is the primary residential customer group made up of single detached and multi-family dwellings as well as individually metered apartment suites.

**Residential sector** - made up of sales to residential customers for non-business operations. The Residential sector is comprised of four rate groups (Basic, Diesel, Seasonal, and Flat Rate Water Heating).

**Station Service** - is the energy used by power plants to generate power and service their own load.