CAC-GAC/MH I-1

Subject: **Annual Savings – Interpretation**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

a) **Please confirm that the values provided are cumulative annual, not incremental annual.**

ANSWER:

Confirmed.

CAC-GAC/MH I-1

Subject: **Annual Savings – Interpretation**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

b) **If cumulative, please confirm if the values have been adjusted to account for measures whose estimated useful life (EUL) is less than the forecasted savings time span. For example, if a measure was installed in year 1 with an EUL (estimated useful life) of 5 years, please confirm if the measure's energy savings are no longer accounted for as of year 6.**

ANSWER:

In general, the values are adjusted to account for measures whose EUL is less than the forecasted savings time span. However, where the program is designed to achieve market transformation, a percentage of the measures are forecast to be reinvested and therefore subsequent EULs are included for those measures along with associated costs and savings.

CAC-GAC/MH I-1

Subject: **Annual Savings – Interpretation**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

c) In the affirmative to b) above, please provide a detailed breakdown, for each program and for each year, of the non-recurring savings due to EUL. The table below provides an illustration for a measure with a 4-year EUL.

	2012/13	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Program A						
Incremental savings	**10**	**12**	**14**	**16**	**18**	**20**
Non-recurring savings (incremental)	**--**	**--**	**--**	**--**	**(10)**	**(12)**
Cumulative Savings	**10**	**22**	**36**	**52**	**60**	**68**

ANSWER:

The requested information would require a substantive effort to compile due to the large volume of measures within programs with varying estimated EULs for each measure.

The table below illustrates Manitoba Hydro's approach using the Network Energy Management Program as an illustration with a 5-year EUL.

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Network Energy Manager															
Incremental Savings	1.3	1.5	1.5	1.7	1.7	2.6	2.9	3.1	3.5	3.7	0.2	0.1	0.1	0.1	0.1
Non-recurring savings (incremental)	0.0	0.0	0.0	0.0	0.0	(1.3)	(1.5)	(1.5)	(1.7)	(1.7)	(2.6)	(2.9)	(3.1)	(3.5)	(3.7)
Cumulative Savings	**1.3**	**2.9**	**4.4**	**6.1**	**7.8**	**9.0**	**10.4**	**12.0**	**13.8**	**15.7**	**13.3**	**10.5**	**7.6**	**4.2**	**0.6**

CAC-GAC/MH I-1

Subject: **Annual Savings – Interpretation**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

d) **Still in the affirmative to b) above, where savings are not totally reduced after the end of the useful life of a measure, please explain why, noting in particular your assumptions about continued market effects and/or future adoption of codes and standards.**

ANSWER:

Please refer to Appendix 7.1 – Power Smart Plan Section 1.1 Portfolio Strategy and Appendix F – Program Evaluation Criteria (Other DSM Program Assumptions) for details on market transformation and reinvestment assumptions.

CAC-GAC/MH I-1

Subject: **Annual Savings – Interpretation**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

e) **In the negative to b) above, please provide the same information, i.e. the breakdown of incremental annual savings, non-recurring savings (drop-offs), and resulting cumulative savings for each program and each year.**

ANSWER:

Please see Manitoba Hydro's response to CAC-GAC/MH I-1(b).

CAC-GAC/MH I-2

Subject: **Annual Savings – Assumptions**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

a) Please provide, for each measure in each sector*, the following information:

1) The energy savings of the measure in the form of:

- **The energy usage of the base case,**
- **The energy usage of the upgrade case, and**
- **The delta between the two.**

2) The total market size

3) Projected annual penetration rate for the measure for each year of the plan

4) Any net-to-gross assumptions used (free ridership, spillover, and other market effects) for each year of the plan

*** Note: if doing so for all measures is deemed too onerous, please provide the information for the Top 15 measures within each sector.**

ANSWER:

The requested information would require a substantive effort to compile. Similar information has been previously submitted during the 2010/11 & 2011/12Electric General Rate Application under the following information requests with copies of the responses attached:

Attachment 1, 2 & 3 – CAC/MSOS I-79(a), (b), (c)
Attachment 4 & 5 – PUB/MH I–130(a), (b)
Attachment 6 – PUB/MH I-131(a)

CAC/MSOS/MH I-79

Subject: **Power Smart Plan 2009/2010**
Reference: **Tab 9 Appendix (1) Power Smart Plan 2009 Appendix E2**

a) **Provide a schedule that lists all of the Input assumptions and estimated Annual unit gas and electric savings for each Residential program and measure**

ANSWER:

Residential Program or Measure	Input Assumptions	Annual Electric Savings (kWh)
New Homes Program - Building Envelope	▪ Average House size - 1300 square feet ▪ Attic insulation upgrade from R40 to R50 ▪ Basement wall and joist header insulation upgrade from R20 to R24 ▪ Exterior above grade wall insulation upgrade from R20 to R22 ▪ Windows upgrade from triple pane clear to triple pane with one Low E coating ▪ Air tightness maximum 1.5 ACH	3,779
New Home Program - Permanently wired car plug timer	▪ Based on savings between 500 hours per year of block heater use without a timer and 200 hours of block heater use with a timer.	150
New Home Program - Heat Recovery Ventilator (HRV)	▪ Upgrade over central exhaust system ▪ Average House size 1300 square feet	2,296
New Home Program - Energy efficient lighting Compact Fluorescent Lamps (CFLs) in 10 sockets	▪ Annual savings based on product mix used for the CFL Program	587
New Home Program - Drain Water Heat Recovery System	▪ Average occupancy of 2.5 people per home.	825

Residential Program or Measure	Input Assumptions	Annual Electric Savings (kWh)
Home Insulation Program - Attic Insulation - upgrade to R50	▪ Average area insulated: 1050 sq ft ▪ Starting R value: R0 - 5%; R10 - 47%; R20 - 37%; R30-11% ▪ Customer distribution: South 95%; North 5%	3,094
Home Insulation Program - Wall Insulation - fill uninsulated cavities to minimum R10 and/or add minimum R2.75 exterior when residing	▪ Average area insulated: 1200 sq ft exterior when residing; 900 sq ft cavities ▪ Starting R value: R8 - 18%; R12 - 75%; R20 - 7%; R30-11% ▪ Customer distribution: South 89%; North 11%	3,249
Home Insulation Program - Basement Wall Insulation - upgrade uninsulated wall to R24	▪ Average area insulated: 840 sq ft ▪ Customer distribution: South 90%; North 10%	7,880
Home Insulation Program - Crawlspace Wall Insulation - upgrade uninsulated wall to R24	▪ Average area insulated: 350 sq ft ▪ Customer distribution: South 70%; North 30%	5,662
Water and Energy Saver Program - Showerhead	▪ Average water pressure: 50 PSI urban, 40 PSI rural ▪ Average water temperature increase for washing: 47.8ºF urban, 57.8ºF rural ▪ Customer distribution: urban 79%; Rural 21% ▪ Average number of people per household: 2.4 ▪ likelihood that unit will be used for entire product life 84% ▪ Replace 2.5 GPM unit ▪ Actual tested flow rate of a 1.5 GPM showerhead at 40 PSI is 1.87 GPM ▪ Actual tested flow rate of a 1.5 GPM showerhead at 50 PSI is 2.01 GPM ▪ gallons (US) used per household per day base technology: 17.5 urban, 15 rural	219

Residential Program or Measure	**Input Assumptions**	**Annual Electric Savings (kWh)**
	▪ gallons (US) used per household per day low flow technology: 14.6 urban, 13.75 rural	
Water and Energy Saver Program - Bathroom Faucet	▪ Average water pressure: 50 PSI urban, 40 PSI rural ▪ Average water temperature increase for washing: 47.8ºF urban, 57.8ºF rural ▪ Customer distribution: urban 79%; Rural 21% ▪ Average number of people per household: 2.4 ▪ likelihood that unit will be used for entire product life 84% ▪ Replace 2.25 GPM unit ▪ Actual flow rate of a 1.0 GPM aerator is average 0.81 GPM ▪ gallons (US) used per household per day base technology: 7.7 average ▪ gallons (US) used per household per day low flow technology: 3.6 average	143
Water and Energy Saver Program - Kitchen Faucet	▪ Average water pressure: 50 PSI urban, 40 PSI rural ▪ Average water temperature increase for washing: 47.8ºF urban, 57.8ºF rural ▪ Customer distribution: urban 79%; Rural 21% ▪ Average number of people per household: 2.4 ▪ likelihood that unit will be used for entire product life 84% ▪ Actual flow rate of a 1.5 GPM aerator is average 1.66 GPM ▪ gallons (US) used per household per day base technology: 8.0 average ▪ gallons (US) used per household per day low flow technology: 7.5 average	19

Residential Program or Measure	**Input Assumptions**	**Annual Electric Savings (kWh)**
Residential Lighting - CFL Program - replace one incandescent lamp with an Energy Star-qualified compact fluorescent lamp (CFL)	▪ Average savings per lamp replaced is based on the following product mix: ▪ 40 watt incandescent to 9 watt CFL - 9% ▪ 60 watt incandescent to 13 watt CFL - 38% ▪ 60 watt incandescent to 15 watt CFL - 17% ▪ 100 watt incandescent to 23 watt CFL - 32% ▪ 100 watt dimmable incandescent to 26 watt dimmable CFL - 1% ▪ 100 watt flood to 25 watt CFL flood - 2% ▪ incandescent trilight to CFL trilight- 1%	59
Residential Lighting - EE Light Fixtures Program - Replace one standard screw-based light fixture using incandescent lamps with an Energy Star-qualified light fixture using pin-based compact fluorescent lamps (CFLs)	▪ Average savings per fixture replaced is based on the following product mix: ▪ 60 watt incandescent to 13 watt CFL - 70% ▪ 100 watt incandescent to 26 watt CFL - 70% ▪ 300 watt halogen torchiere to 55 watt CFL - 6% ▪ Chandeliers, 60-watt incandescent to 13 watt CFL - 3%	204
Residential High Efficiency Furnace/Boiler Program (ECM) - replace permanent split capacitor (PSC) fan motor with dc variable speed (ECM) motor	▪ Average savings is highly dependent upon customer choice of furnace motor operation: ▪ 30% of participants will continue to run their furnace motor on a continuous basis ▪ 30% of participants will continue to run their furnace motor intermittently (ie. only when the furnace is in heating mode) ▪ 40% of participants will switch their furnace motor operation from intermittent to continuous operation.	310
Fridge/Freezer Recycling Program - Removal of older (15 years old or more) refrigerator from home	▪ Removal of an older refrigerator results in annual savings per unit of 1126 kWh ▪ 23% of refrigerators removed will be replaced with a new non-Energy Star unit ▪ 22% of refrigerators removed will be replaced with an Energy Star unit	969

Residential Program or Measure	**Input Assumptions**	**Annual Electric Savings (kWh)**
Fridge/Freezer Recycling Program - Removal of older (15 years old or more) freezer from home	▪ Removal of an older freezer results in annual savings per unit of 701 kWh ▪ 10% of freezers removed will be replaced with a new non-Energy Star chest freezer ▪ 10% of freezers removed will be replaced with an Energy Star chest freezer ▪ 10% of freezers removed will be replaced with a new non-Energy Star upright freezer ▪ 10% of freezers removed will be replaced with an Energy Star upright freezer	563

CAC/MSOS/MH I-79

Subject: Power Smart Plan 2009/2010
Reference: Tab 9 Appendix (1) Power Smart Plan 2009 Appendix E2

b) List the sources and details of the calculation of Annual Energy Savings for each measure

ANSWER:

New Home Program - Building Envelope Measures
Annual energy savings for building envelope measures were calculated by using Natural Resource Canada's HOT2000 building energy simulation software. Two models were developed for a new home in Manitoba- one with the characteristics of common building practice, and one with the requirements of the Power Smart Gold prescriptive standard. The energy consumption of the two model homes was compared to derive energy savings. A home size of 1,300 square feet was used based on historical participation in the Program.

New Home Program - Permanently wired car plug timer
Average annual savings were calculated based on savings between 500 hours per year of block heater use without a timer and 200 hours of block heater use with a timer. Average block heater wattage was estimated to be 500 watts based on the availability of 400 watt and 600 watt heaters in the Manitoba market. Hours of use were based on data collected through Manitoba Hydro's 2003 Residential Energy Use Survey.

New Home Program - Heat Recovery Ventilator (HRV)
Annual energy savings for an HRV as compared to a central ventilation system were calculated by using Natural Resource Canada's HOT2000 building energy simulation software. Two models were compared, one with a central ventilation system and one with an HRV, to derive energy savings. A home size of 1,300 square feet was used based on historical participation in the Program.

New Home Program - Energy efficient lighting Compact Fluorescent Lamps (CFLs) in 10 sockets
Savings were calculated as follows:

Wattage of base incandescent lamp - wattage of CFL X annual hours of use

Hours of use were estimated to be 1,500 hours per year based on data collected from a Manitoba Hydro 2006/07 CFL customer follow-up survey.

New Home Program - Drain Water Heat Recovery System

Annual savings per home were calculated using Natural Resources Canada's Drain Water Heat Recovery Energy Savings Calculator (http://www.ceati.com/calculator/) Based on average occupancy of 2.5 people per home.

Home Insulation Program

For all insulation measures, annual electricity savings were calculated using the ASHRAE calculation known as the 'modified degree day method' that takes into account the location of the home (south or north of the 53rd parallel) the insulation levels before and after upgrade, and the square footage of the area insulated. The square footage used for calculations for all measures is based on historical participation in the Program.

Water and Energy Saver Program

For all technologies, Annual energy savings per customer were calculated as follows:

> (US gallons of water consumed X density of water in lbs X temperature rise of water in ºFahrenheit)/ BTU's per energy source / efficiency percentage

Inputs:

- Gallons of water consumed - based on field testing conducted by Manitoba Hydro for the base device and the water-saving device
- Density of water - 8.33 lbs. per US gallon
- Temperature Rise - 57.8 Fahrenheit for rural customers and 47.8 F for urban customers, based on an average hot water tank setting of 130ºF.
- Efficiency - 100% (estimated efficiency of electric hot water as most of energy that is used goes to heating the water)
- BTU's per KW.h - 3 413

Energy use was calculated for both the base and the efficient technologies and the results compared to derive savings.

Residential CFL Program

Savings were calculated as follows:

Wattage of base incandescent lamp - wattage of CFL X annual hours of use

Hours of use were estimated to be 1,500 hours per year based on data collected from a Manitoba Hydro 2006/07 CFL customer follow-up survey.

EE Light Fixtures Program

Savings were calculated as follows:

Wattage of base incandescent fixture - wattage of CFL fixture X annual hours of use

Hours of use were estimated to be 1,500 hours per year based on data collected from a Manitoba Hydro 2006/07 CFL customer follow-up survey.

Residential High Efficiency Furnace/Boiler Program (ECM)

Savings were determined using the following calculation:

Motor watts per hour X hours of operation for PSC motor less motor watts per hour for ECM motor

The motor watts per hour of 423 and 246 for PSC motors and ECM motors respectively is based on the National Research Council's Canadian Centre For Housing Technology's Report on the Effects of ECM Furnace Motors on Electricity and Gas Use (NRCC-38500). Hours of operation for motors that run only with the furnace is 1,000 based on annual average natural gas consumption for an average 60,000 BTU high-efficiency furnace. The homeowner furnace motor operation assumptions were based on extrapolating trend data from past Manitoba Hydro Residential Energy Use Surveys.

Fridge/Freezer Recycling Program

Annual energy savings were calculated by averaging the consumption of older refrigerators and freezers still in use. The 2008 Major Appliance Industry Trends and Forecast report produced by the Canadian Appliance Manufacturers Association was utilized to obtain the consumption number for older units and Manitoba Hydro's Residential Energy Use Survey was utilized to determine the vintage of units operating in residences. Energy savings were discounted based on the likelihood that the removed refrigerator or freezer would be replaced by a new unit, and the energy efficiency of the replacement unit. Natural Resource Canada's web site was utilized to obtain the annual energy consumption of new refrigerators and freezers.

CAC/MSOS/MH I-79

Subject: **Power Smart Plan 2009/2010**
Reference: **Tab 9 Appendix (1) Power Smart Plan 2009 Appendix E2**

c) Provide a Comparison Table that compares MH input assumptions for the following mass market and residential measures to those of the Ontario Power Authority Mass Market Measures and Assumptions list (Available on the OPA Web site):

- **i. CFL- Screw in Energy Star 13/15W**
- **ii. Seasonal LEDs**
- **iii. Low flow Showerheads**
- **iv. Faucet aerators**
- **v. Programmable thermostat electric heat**
- **vi. Programmable Thermostat Gas Heat**
- **vii. Refrigerator retirement**
- **viii. Attic Insulation**
- **ix. Basement Insulation**
- **x. Weatherization**

ANSWER:

Manitoba Hydro has reviewed three versions of the referenced document found on the Ontario Power Authority (OPA) web site and for comparison purposes has utilized the latest version that was issued February 1, 2010. Comparison data has been provided for technologies included in current or potential programs.

i. CFL- Screw in Energy Star 13/15W

Small 15 W General Service Lamp, Screw-In

Manitoba Hydro	Ontario Power Authority
Efficient Equipment and Technologies Description	
15 W CFL, Screw-In	15 W CFL, Screw-In
Base Equipment and Technologies Description	
60 W Incandescent Lamp	60 W Incandescent Lamp
Decision Type	
New / Retrofit / Replacement	New / Retrofit / Replacement
Target Market	
Residential existing homes, single-family / multi-family	Existing Homes / Multi-Family / New Homes / Residential / Single-Family / Small Commercial
Resource Savings	
Effective useful life: 4.5 years	Effective useful life: 8 years
Annual unit savings: 55 kWh	Annual unit savings: 44.4 kWh
Total unit savings: 247.5 kWh	Total unit savings: 354.8 kWh
Summer demand savings: 0.005 kW	Summer demand savings: 0.001 kW
Winter demand savings: 0.012 kW	Winter demand savings: 0.012 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$0.37	$0.00 (see details below)

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Annual electric savings are calculated by subtracting the wattage of a CFL from the wattage of the base incandescent lamp, multiplying by annual hours of use. The end result is adjusted for interactive effects with heating and cooling systems. A persistence factor of 92% is used to discount savings, based on Manitoba Hydro CFL customer surveys from past years.

Peak Demand Savings
Energy Distributions and Load Factors were developed from an end use model developed by another utility, which was modified to incorporate daylight hours experienced in Manitoba regions. This data was analyzed and summarized to produce the tables.
Effective Useful Life
A Manitoba Hydro 2006/07 CFL Customer Follow-Up Survey found that customers leave their lights on for an average of 4.4 hours per day or 1,606 hours per year. Manitoba Hydro has assumed a slightly more conservative 1,500 hours of use per year. Internal testing in Manitoba Hydro's lighting laboratory in March 2007 indicated the actual life of a CFL is about 6,500 hours. A CFL is therefore assumed to have an effective useful life of 4.5 years.
Base & Conservation Measure Equipment and O&M Costs
Based on retailer pricing surveys conducted by Manitoba Hydro staff in 2008, the average cost of a 60 watt incandescent bulb is $0.64. Assuming that 4.5 incandescent bulbs would need to be purchased over time to equal the life of a CFL, Manitoba Hydro concluded through a Net Present Value calculation that the total cost to use an incandescent bulb is $2.45. Based on the same retailer survey, Manitoba Hydro determined that the average price of CFLs that replace 60 watt incandescent bulbs is $2.82.

ii. Seasonal LEDs

C-7 Seasonal LED Light Strings

Manitoba Hydro	**Ontario Power Authority**
Efficient Equipment and Technologies Description	
C-7 Seasonal LED Light String (70 bulbs / string)	C-7 Seasonal LED Lights (25 bulbs / string)
Base Equipment and Technologies Description	
C-7 Incandescent Light String (25 bulbs / string, 5 watts ea)	C-7 Incandescent Light String (25 bulbs / string)

Decision Type	
Retirement / Replacement	New / Retrofit / Replacement
Target Market	
Residential / Existing Homes / New Homes / Multi-Family / Single-Family	Existing Homes / Multi-Family / New Homes / Residential / Single-Family / Small Commercial
Resource Savings	
Effective useful life: 20 years	Effective useful life: 5 years
Annual unit savings: 30.1 kWh	Annual unit savings: 13.5 kWh
Total unit savings: 602 kWh	Total unit savings: 67.5 kWh
Summer demand savings: 0.00 kW	Summer demand savings: 0.00 kW
Winter demand savings: 0.002 kW	Winter demand savings: 0.006 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$-33.53	$1.59

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Energy savings are calculated by taking the wattage of the base incandescent light and subtracting the wattage of the LED light string. As different colours of LED light strings have different wattages, a product mix that reflects the variety available in retailers was used to calculate an average. Hours of use are 262 hours per year based on a customer survey conducted in 2005. Note: The Seasonal LED Program ended in 2008. Assumptions have not been updated since the program ended.
Peak Demand Savings
Energy Distributions and Load Factors were developed from an end use model developed by another utility, which was modified to incorporate daylight hours experienced in Manitoba regions. This data was analyzed and summarized to produce the tables.

Effective Useful Life
ENERGY STAR qualified SLEDs last up to 10 times longer than incandescent bulbs. (www.energystar.gc.ca) An incandescent bulb has a life of approximately 750 hours, therefore it is assumed SLEDs will last 7,500 hours. With an annual use of only 262 hours, SLEDs could last almost 30 years. However, Manitoba Hydro uses a conservative estimate of 20 years.
Base & Conservation Measure Equipment and O&M Costs
According to a product survey conducted in 2006, the majority of C7 LED products for sale in Manitoba had 70 lights per string. Incremental pricing and energy savings are based on replacing the average C7 25-light incandescent light string with a C7 LED 70-light string.

iii. Low flow Showerheads

Low Flow Showerhead - Electric Water Heat

Manitoba Hydro	**Ontario Power Authority**
Efficient Equipment and Technologies Description	
1.5 GPM low flow showerhead	1.25 GPM low flow showerhead
Base Equipment and Technologies Description	
2.5 GPM	2.5 GPM
Decision Type	
Retrofit	Retrofit
Target Market	
Residential - Existing Home / Single Family /Multi-family	Existing Home / Multi-family / New Homes / Residential / Single-Family / Small Commercial
Resource Savings	
Effective useful life: 15 years	Effective useful life: 10 years
Annual unit savings: 219 kWh	Annual unit savings: 377 kWh
Total unit savings: 3,285 kWh	Total unit savings: 3,770 kWh

Sumer demand savings: 0.02 kW	Summer demand savings: 0.029 kW
Winter demand savings: 0.03 kW	Winter demand savings: 0.07 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$0	$7.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Savings are calculated using the following formula: (US gallons of water consumed X density of water in lbs X temperature rise of water in Fahrenheit /BTU's per energy source / efficiency percentage. • Average water pressure is 40 to 50- PSI • 2.3 Showers/day/household • Average showering time of 7.57 minutes • Average hot water tank setting is 130ºF
Peak Demand Savings
Energy Distributions and Load Factors were developed from a Manitoba Hydro Residential End Use Study project. Hourly metered data of hot water tanks at 81 residences were analyzed and summarized to produce the tables
Effective Useful Life
Manitoba Hydro's effective useful life of 15 years is based on informal surveys of various product suppliers and looking at the water quality in Manitoba. Experience has been that showerheads in Manitoba are not replaced regularly due to water quality issues but rather are replaced for aesthetic reasons during a home renovation, which does not occur on a frequent basis.
Base & Conservation Measure Equipment and O&M Costs
Based on market research, Manitoba Hydro did not find a product cost premium for low flow showerhead models. A wide range of price points occur in the market, based on aesthetics.

iv. Faucet aerators

Bathroom Aerator - Electric Water Heat

Manitoba Hydro	**Ontario Power Authority**
Efficient Equipment and Technologies Description	
1.0 GPM Aerator	1.5 GPM Aerator
Base Equipment and Technologies Description	
2.25 GPM	2.2 GPM
Decision Type	
Retrofit	Retrofit
Target Market	
Residential - Existing Home / Single Family /Multi-family	Existing Home / Multi-family / New Homes / Residential / Single-Family / Small Commercial
Resource Savings	
Effective useful life: 15 years	Effective useful life: 10 years
Annual unit savings: 143 kWh	Annual unit savings: 176 kWh
Total unit savings: 2,145 kWh	Total unit savings: 1,763 kWh
Sumer demand savings: 0.01 kW	Summer demand savings: 0.014 kW
Winter demand savings: 0.02 kW	Winter demand savings: 0.033 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$0	$5.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Savings are calculated using the following formula: (US gallons of water consumed X density of water in lbs X temperature rise of water in Fahrenheit /BTU’s per energy source / efficiency percentage. • Average water pressure is 40 to 50- PSI • Water temperature rise is 57.8ºF rural, 47.8ºF urban

• Average water consumption of base bathroom faucet is 29 litres per day • Average water consumption of efficient bathroom faucet is 13.8 litres per day • Average hot water tank setting is 130ºF.
Peak Demand Savings
Energy Distributions and Load Factors were developed from a Manitoba Hydro Residential End Use Study project. Hourly metered data of hot water tanks at 81 residences were analyzed and summarized to produce the tables.
Effective Useful Life
Manitoba Hydro's effective useful life of 15 years is based on informal surveys of various product suppliers and looking at the water quality in Manitoba. Experience has been that showerheads in Manitoba are not replaced regularly due to water quality issues but rather are replaced for aesthetic reasons during a home renovation, which does not occur on a frequent basis.
Base & Conservation Measure Equipment and O&M Costs
Based on market research, Manitoba Hydro did not find a product cost premium for low flow showerhead models. A wide range of price points occur in the market, based on aesthetics.

Kitchen Aerator - Electric Water Heat

Manitoba Hydro **Ontario Power Authority**

Efficient Equipment and Technologies Description	
1.5 GPM Aerator	1.5 GPM Aerator
Base Equipment and Technologies Description	
2.25 GPM	2.2 GPM
Decision Type	
Retrofit	Retrofit
Target Market	
Residential - Existing Home / Single Family /Multi-family	Existing Home / Multi-family / New Homes / Residential / Single-Family / Small Commercial

Resource Savings	
Effective useful life: 15 years	Effective useful life: 10 years
Annual unit savings: 19 kWh	Annual unit savings: 176 kWh
Total unit savings: 285 kWh	Total unit savings: 1,763 kWh
Sumer demand savings: 0.002 kW	Summer demand savings: 0.014 kW
Winter demand savings: 0.003 kW	Winter demand savings: 0.033 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$0	$5.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Savings are calculated using the following formula: (US gallons of water consumed X density of water in lbs X temperature rise of water in Fahrenheit /BTU's per energy source / efficiency percentage. • Average water pressure is 40 to 50- PSI • Water temperature rise is 57.8ºF rural, 47.8ºF urban • Average water consumption of base kitchen faucet is 30.3 litres per day • Average water consumption of efficient kitchen faucet is 28.2 litres per day • Average hot water tank setting is 130ºF.
Peak Demand Savings
Energy Distributions and Load Factors were developed from a Manitoba Hydro Residential End Use Study project. Hourly metered data of hot water tanks at 81 residences were analyzed and summarized to produce the tables
Effective Useful Life
Manitoba Hydro's effective useful life of 15 years is based on informal surveys of various product suppliers and looking at the water quality in Manitoba. Experience has been that showerheads in Manitoba are not replaced regularly due to water quality issues but rather are replaced for aesthetic reasons during a home renovation, which does not occur on a frequent basis.
Base & Conservation Measure Equipment and O&M Costs
Based on market research, Manitoba Hydro did not find a product cost premium for low flow showerhead models. A wide range of price points occur in the market, based on aesthetics

v. Programmable thermostat electric heat

Manitoba Hydro's programmable thermostat program ended March 31, 2008. Manitoba Hydro has not updated savings assumptions since this time. Due to the fact that the Energy Star technical specifications for thermostats have been rescinded and energy savings are based on consumer behaviour with respect to programming, a program is not planned at this time.

vi. Programmable Thermostat Gas Heat

Natural Gas technologies are outside the scope of this hearing.

vii. Refrigerator retirement

Refrigerator Retirement

Manitoba Hydro	**Ontario Power Authority**
Efficient Equipment and Technologies Description	
Retirement of Refrigerator	Retirement of Refrigerator
Base Equipment and Technologies Description	
Existing Stock greater than 15 years old	Average Existing Stock
Decision Type	
Retirement	Retirement
Target Market	
Residential existing homes, Single-Family/multi-family	Residential / Small Commercial, Existing Homes, Single-Family/Multi-Family
Resource Savings	
Effective useful life: 13 years	Effective useful life: 9 years
Annual unit savings: 968.5 kWh	Annual unit savings: 1,227.9 kWh
Total unit savings: 12,545 kWh	Total unit savings: 11,050.7 kWh
Winter demand savings: 0.09 kW	Winter demand savings: 0.152 kW
Summer demand savings: 0.18 kW	Summer demand savings: 0.171 kW

Incremental Equipment & O&M Costs of Conservation Measure	
$209.25	$100.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Per unit savings before any adjustments were estimated at 1,350 kWh. After interactive effects, savings were estimated as follows: • If the unit is not replaced: 1,126 kWh • If the unit is replaced with an Energy Star unit: 806 kWh • If the unit is replaced with a standard unit: 746 kWh
Peak Demand Savings
Energy Distributions and Load Factors were developed from a Manitoba Hydro Residential End Use Study. Hourly metered data of 34 statistically sampled appliances from 8-channel recorders at 113 residences were analyzed and summarized to produce the tables.
Effective Useful Life
Remaining useful life of a unit to be retired is estimated to be 13 years.
Base & Conservation Measure Equipment and O&M Costs
Average incremental cost to the consumer is estimated to be $209.25 based on the following assumptions: If the customer removed the unit but does not replace it, there is no cost to the consumer. This situation applies to 55% of participants. If the customer replaces their removed fridge with a current model, the estimated cost is $450 for a standard fridge and $480 an Energy Star fridge. It is estimated that 45% of the removed units will be replaced. Within this group, 50% will purchase a standard model, and 50% will purchase an Energy Star model. The base case cost is estimated to be zero. It is assumed that if a program did not exist, the consumer would not incur any additional cost as they would take no action.

viii. Attic Insulation

Attic Insulation, Electric Heat

Manitoba Hydro	**Ontario Power Authority**
Efficient Equipment and Technologies Description	
Attic insulation to R50	Attic insulation to R40
Base Equipment and Technologies Description	
Existing attic insulation R30 or less	Attic insulation R10
Decision Type	
Retrofit	Retrofit
Target Market	
Existing residential homes built 1999 or earlier: single detached, duplex, row housing,	Existing homes / residential / single-family
Resource Savings	
Effective useful life: 30 years	Effective useful life: 20 years
Annual unit savings: 3,094 kWh	Annual unit savings: 3,937.5 kWh
Total unit savings: 92,820 kWh	Total unit savings: 78,750 kWh
Summer demand savings: 0 kW	Summer demand savings: 0.130 kW
Winter demand savings: 1.52 kW	Winter demand savings: 1.13 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$901.58	$1,000.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Annual electricity savings are calculated using the ASHRAE calculation known as the 'modified degree day method' that takes into account the location of the home (south or north of the 53rd Parallel), attic insulation levels (before and after), and the square foot area insulated. Based on an estimated customer mix of existing attic insulation levels (R0/R10/R20/R30 to R50), the average savings for a customer insulating an attic is 3,094

kWh. The average attic area insulated is assumed to be 1,050 square feet based on an average of past participants.
Peak Demand Savings
Peak demand savings are calculated using the ASHRAE calculation known as the 'modified degree day method' that takes into account the location of the home (south or north of the 53rd Parallel), attic insulation levels (before and after), and the square foot area insulated. Based on an estimated customer mix of existing attic insulation levels (R0/R10/R20/R30 to R50), the average savings for a customer insulating an attic is 1.52 kW Winter Peak and 0 kW Summer Peak. Note: Manitoba Hydro does not claim summer energy and demand savings related to air conditioner usage from increased insulation levels. Due to the short cooling season in Manitoba and relatively high variable nature of internal heat gains and household behavior (opening and closing windows), summer energy and demand savings are not claimed to be conservative.
Effective Useful Life
The effective useful life of insulation is estimated to be the term of the planning horizon, which is 30 years. In reality, insulation upgrades have an average effective useful life of 50 years as in the majority of cases the insulation measure is installed for the remaining life of the home.
Base & Conservation Measure Equipment and O&M Costs
Costs for upgrading insulation levels are calculated based on receipts from contractors and retailers. Based on past program participation, it is assumed that 50% of participants will incur labour costs as part of their insulation upgrade.

ix. Basement Insulation

Basement Wall Insulation, Electric Heat

Manitoba Hydro	Ontario Power Authority
Efficient Equipment and Technologies Description	
Basement walls to R24	Basement walls to R22
Base Equipment and Technologies Description	
Uninsulated basement walls	Uninsulated basement walls
Decision Type	
Retrofit	Retrofit

Target Market	
Existing residential homes built 1999 or earlier: single detached, duplex, row housing	Existing homes / residential / single-family
Resource Savings	
Effective useful life: 30 years	Effective useful life: 20 years
Annual unit savings: 7,880 kWh	Annual unit savings: 1,218.1 kWh
Total unit savings: 236,400 kWh	Total unit savings: 24,362.8 kWh
Summer demand savings: 0 kW	Summer demand savings: 0.116 kW
Winter demand savings: 3.80 kW	Winter demand savings: 0.325 kW
Incremental Equipment & O&M Costs of Conservation Measure	
$1,225.14	$134.00

Manitoba Hydro Resource Savings Assumptions

Annual Electricity Savings
Annual electricity savings are calculated using the ASHRAE calculation known as the 'modified degree day method' that takes into account the location of the home (south or north of the 53rd Parallel), basement wall insulation levels (before and after), and the square foot area insulated. The average savings for a customer insulating their basement walls is 7,880 kWh. The average basement wall area is 840 square feet.
Peak Demand Savings
Peak demand savings are calculated using the ASHRAE calculation known as the 'modified degree day method' that takes into account the location of the home (south or north of the 53rd Parallel), basement wall insulation levels (before and after), and the square foot area insulated. The average savings for a customer insulating their basement walls is: 3.8 kW Winter Peak and 0 kW Summer Peak Note: Manitoba Hydro does not claim summer energy and demand savings related to air conditioner usage from increased insulation levels. Due to the short cooling season in Manitoba and relatively high variable nature of both internal heat gains and household behavior (opening and closing windows), summer energy and demand savings are not claimed to be conservative.

Effective Useful Life
The effective useful life of insulation is estimated to be the term of the planning horizon, which is 30 years. In reality, insulation upgrades have an average effective useful life of 50 years.
Base & Conservation Measure Equipment and O&M Costs
Costs for upgrading insulation levels are calculated based on receipts from contractors and retailers. Based on past program participation, it is assumed that 50% of participants will incur labour costs as part of their insulation upgrade.

x. Weatherization

Manitoba Hydro does not currently offer a weatherization program therefore formal assumptions have not been developed for weatherization technologies.

PUB/MH I-130

Subject: Tab 9: Demand Side Management
Reference: 2007/08 Power Smart Review exhibits 4.3.2.1B, 4.3.2.2B

a) Please explain how the energy savings and the demand savings for each of the following DSM programs were determined:

i. Seasonal LED Lighting;
ii. Parking Lot Controllers;
iii. Custom; and
iv. Spray Valves.

ANSWER:

i. Seasonal LED Lighting

- Per unit energy savings were determined by calculating the average energy use of LED light strings versus inefficient incandescent light strings. This energy savings estimate was then multiplied by the number of rebated participants for the 2007/08 year.
- Total energy savings were then adjusted to take into account free riders.
- The total figure found in the 2007/08 Power Smart Review in exhibits 4.3.2.1B, 4.3.2.2B (see Appendix 9.2 of this Application), includes the energy savings achieved during 2007/08 and the energy savings persisting from participation during previous years.

ii. Parking Lot Controllers

- Energy savings per controller were based on an estimate of plug in hours over the year and weather history. Given that a controlled parking plug restricts power to the plug during periods of warmer temperatures, the weather history allowed for an estimate of how much off time, and therefore energy savings, a controlled plug would experience versus an uncontrolled plug which would be drawing power 100 per cent of the time. The per unit energy savings were then multiplied by the number units installed by the rebated participants for the 2007/08 year.
- 2007/08 program savings were adjusted to take into account free riders.

- The total figure provided in the 2007/08 Power Smart Review exhibits 4.3.2.1B, 4.3.2.2B (see Appendix 9.2 of this Application), takes the energy savings from 2007/08 year participants and adds the energy savings from past years' participants that are still be realized in 2007/08.

iii. Custom

- Energy savings were determined through an analysis of the actual work performed by the rebated participants for the 2007/08 year. Program participation requires the completion of an engineering feasibility study which provides detailed energy savings associated with the projects and technologies.
- The total figure found in the 2007/08 Power Smart Review exhibits 4.3.2.1B, 4.3.2.2B (see Appendix 9.2 of this Application), takes the energy savings from 2007/08 year participants and adds the energy savings from past years' participants that are still be achieved in 2007/08.

iv. Spray Valves

- Per unit energy savings were determined by calculating the energy use of the energy efficient low flow spray valve at 4.7 litres per minutes versus the existing installed valve which was deemed to have an average flow rate of 10.6 litres per minute. The per unit savings were then multiplied by the number units installed by the rebated participants for the 2007/08 year.
- The 2007/08 program energy savings were adjusted to take into account free ridership.
- The total figure found in the 2007/08 Power Smart Review exhibits 4.3.2.1B, 4.3.2.2B (see Appendix 9.2 of this Application), takes the energy savings from 2007/08 year participants and adds the energy savings from past years' participants that are still be realized in 2007/08.

PUB/MH I-130

Subject: **Tab 9: Demand Side Management**
Reference: **2007/08 Power Smart Review exhibits 4.3.2.1B, 4.3.2.2B**

b) Please identify the period of time in a year over which MH estimates the energy and demand savings experience for each of the programs listed in [a]. Please explain how 1.0 GWh of energy were saved with the Seasonal LED Lighting Program, yet negligible demand savings were achieved.

ANSWER:

i. Seasonal LED Lighting

Holiday lights are typically used in the evening for a few weeks during the winter. These lights are typically used during off peak hours and as a result, the Seasonal LED Lighting Program achieves a significantly higher level of energy savings relative to demand savings.

ii. Parking Lot Controllers

All electricity savings were achieved during the winter in 2007/08.

iii. Custom

For 2007/08, 53% of the electricity savings were achieved during the winter and 47% during the summer.

iv. Spray Valves

For 2007/08, 50% of the electricity savings were achieved during the winter and 50% during the summer.

<u>PUB/MH I-131</u>

Subject: **Tab 9: Demand Side Management**
Reference: **2009 Power Smart Plan Appendix A.1-A.3 Power Smart Targets**

a) Please explain how the energy savings and the demand savings for each of the following DSM programs were estimated:

i. Fridge Recycling;
ii. HVAC- Chiller;
iii. Parking Lot Controller;
iv. Agriculture Heat Pad;
v. Power Smart Energy Manager; and
vi. C02 Sensors.

<u>ANSWER</u>:

i. Fridge Recycling

- The average energy savings per removed unit was calculated by determining the estimated energy consumption of the unit removed. This was determined through research undertaken which included assessing assumptions used with other utility programs, published NRCan EnerGuide data, and conversations with existing fridge recycling service providers delivering programs in the market.
- Average energy savings per unit removed were then discounted by estimating that 55% of these units would remain off the system permanently, and 45% of the removed units would be replaced with a new model.
- The expected remaining useful life of the removed appliance was estimated and energy savings per unit were multiplied by this number.
- Interactive effects with heating and cooling equipment were taken into account and incorporated into the net average energy savings per unit.
- Total participants were estimated by determining the number of units that could reasonably be expected to be collected. This was determined through research undertaken which included assessing assumptions used with other utility programs and contact with existing fridge recycling service providers. The net energy savings per unit were then multiplied by the expected number of participants to estimate total program energy savings.

- The total program energy savings were adjusted to take into account free ridership.

ii. HVAC - Chiller

- Annual per unit energy savings were based on the difference in energy usage between standard air-cooled chillers versus efficient water-cooled chillers and the energy savings were calculated using the customer's full load operating hours and equipment capacity in tons.
- The per unit energy savings were then multiplied by the program participation forecast.
- The total program energy savings were then adjusted to take into account free ridership.

iii. Parking Lot Controller

- Energy savings per controller were based on an estimate of plug in hours over the year and weather history. Given that a controlled parking plug restricts power to the plug during periods of warmer weather temperatures, the weather history allowed for an estimate of how much off time, and therefore energy savings, a controlled plug would experience versus an uncontrolled plug which would be drawing power 100 per cent of the time while being plugged in.
- The per unit energy savings were then multiplied by the program participation forecast.
- The total program energy savings were adjusted to take into account free ridership.

iv. Agriculture Heat Pad

- Per unit electricity energy savings were calculated through an analysis of the difference in electricity consumption between standard heating lamps and energy efficient heat pads, multiplied by the annual hours of operation.
- The per unit energy savings were then multiplied by the program participation forecast.
- The total program energy savings were then adjusted to take into account free ridership.

v. Power Smart Energy Manager

- Per participant annual electricity savings were estimated by reviewing the energy savings achieved through Manitoba Hydro's pilot Energy Manager Program delivered in the Pembina Trails School Division in 2001 through 2005.
- The per participant energy savings were then multiplied by a program participation forecast.

vi. CO2 Sensors

- Annual energy savings were estimated based on average target building operating hours, occupancy rates, and heating and cooling system efficiencies. These sensors measure actual CO2 levels and reduce ventilation frequency based on observed CO2 levels, therefore, energy savings are achieved through the reduced amount of outside air needing heating or cooling as compared to a building that does not have a sensor.
- The per participant energy savings were then multiplied by a program participation forecast.
- The total program energy savings were then adjusted to take into account free ridership.

CAC-GAC/MH I-2

Subject: **Annual Savings – Assumptions**
Reference: **2011 Power Smart Plan, Appendix A.3**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

b) **Please confirm that savings are net of interactive effects and provide all assumptions, for each measure and program (where relevant), regarding the treatment of interactive effects. Interactive effects exist where an electricity saving measure, by reducing the production of waste heat, leads to an increase in heating loads (whether electric or other fuels) or a decrease in cooling loads.**

ANSWER:

The requested information would require a substantive effort to compile. All savings assumptions for technologies supported under the Power Smart Program are calculated net of interactive effects.

For instances, interactive effects are related to the impacts of implementing certain electric efficiency opportunities. As a consequence of implementing a more efficient technology, less heat is also produced. The interactive effect refers to the offsetting need to supplement heat as a result of implementing the energy efficient technology.

The interactive effect is calculated by determining the amount of additional energy that will be required to either heat or cool a building after implementing the more energy efficient technology. In assessing the overall impacts of implementing an energy efficient opportunity, the combined or net impact on energy use as a consequence is considered.

CAC-GAC/MH I-3

Subject: **Codes & Standards**
Reference: **2011 Power Smart Plan, Chapter 5**

Preamble: **In order to assess the strength of the Power Smart Plan, it is essential to properly understand and interpret the savings values included in the evidence.**

a) **Please provide all inputs and assumptions for energy savings attributed to each recent or anticipated code and standard for the duration of the plan's 15 year projection. Please include a textual description and indicate notably the following information: the year of anticipated implementation; the degree of savings (e.g. as a % of a measure's load); the total savings; and, the attribution model/approach aimed at determining the share of the savings attributable directly to Manitoba Hydro's activities.**

ANSWER:

The table below provides the information that Manitoba Hydro was able to compile:

Code	Description	Implementation Year	Degree of Savings (% of measure's load)	Total Savings	
				Capacity (MW) (2025/26)	Energy (GW.h) (2025/26)
Residential Building Code - Insulation	Refer to Appendix 7.1 of this Application - Page 31	2008	5%	8.6	14.3
Residential Building Code - Various measures	Refer to Appendix 7.1 of this Application - Page 31	2010	16%	16.0	44.7
Residential Building Code - Various measures	Refer to Appendix 7.1 of this Application - Page 32	2016	10%	11.7	32.4
Residential Appliances	Refer to Appendix 7.1 of this Application - Page 33	Various	28%	64.7	452.6
Residential Electric Hot Water Tank	Refer to Appendix 7.1 of this Application - Page 34	2004	56%	5.2	44.4
Residential Central Air Conditioning	Refer to Appendix 7.1 of this Application - Page 34	2006	31%	n/a	83.5
Commercial Building Code	Refer to Appendix 7.1 of this Application - Page 36	2013	17%	12.2	63.5
Commercial Fluorescent Lighting	Refer to Appendix 7.1 of this Application - Page 37	1996	15%	1.3	4.8
Commercial Exit Signs	Refer to Appendix 7.1 of this Application - Page 37	2004	96%	0.0	0.5
Commercial Fluorescent lamp ballasts (New)	Refer to Appendix 7.1 of this Application - Page 38	2006	19%	5.1	15.3
Commercial Fluorescent lamp ballasts (Reno)	Refer to Appendix 7.1 of this Application - Page 38	2010	22%	19.0	57.0
Commercial Electric Steamers	Refer to Appendix 7.1 of this Application - Page 38	2018	71%	0.9	2.6

Manitoba Hydro was unable to compile all information requested within the timeframe of this Application due to the substantive effort this would require.

For the purposes of determining the long term impact and cost effectiveness of program intervention in the marketplace, some program designs include the projected future savings from anticipated code. For example, with the Power Smart New Home Program, it was forecasted that roughly 60% of the savings from the recommended energy efficient technologies within the standard would be successfully adopted into future code and 100% of new home starts would contribute to those future savings. Once the code is in place, the associated energy reduction is no longer presented within the program, but is reflected within Manitoba Hydro's load forecast.

CAC-GAC/MH I-4

Subject: **Avoided Costs**
Reference: **2011 Power Smart Plan, Chapter 2**

Preamble: **The value of DSM depends primarily on utility avoided costs. Most utilities base their avoided costs on the long-run cost of new generation and associated T&D costs, and provide both the values and the underlying assumptions as part of the rate hearing.**

a) **Please provide the utility's annual production, transmission and distribution avoided costs (and/or projected unitary export revenue, if used instead) associated with DSM over the next 30 years.**

ANSWER:

Using Manitoba Hydro's established methodology, the forecast marginal cost to serve a domestic customer, levelized over the next 30 years is 8.52 cents per kWh. in 2011 dollars. This includes all generation costs and all capital costs associated with transmission and distribution.

The current estimates of transmission and distribution marginal costs in 2011 dollars are as follows:

- Transmission: $57.63/kW/yr
- Distribution: $67.65/kW/yr

The marginal costs provided herein are consistent with the values used in the 2011 Power Smart Plan.

CAC-GAC/MH I-4

Subject: **Avoided Costs**
Reference: **2011 Power Smart Plan, Chapter 2**

Preamble: **The value of DSM depends primarily on utility avoided costs. Most utilities base their avoided costs on the long-run cost of new generation and associated T&D costs, and provide both the values and the underlying assumptions as part of the rate hearing.**

b) **If Manitoba Hydro uses separate values for capacity and energy, please provide them as well as a blended average for each major sector/end use.**

ANSWER:

Average marginal costs for each major sector/end use are provided as blended average marginal cost values, as follows:

a) At the generation level, the blended average marginal cost is 6.2 ¢/kW.h.
b) At the transmission level, the blended average marginal cost is 7.5 ¢/kW.h.
c) At the distribution level, the blended average marginal cost is 8.5 ¢/kW.h.

Manitoba Hydro does use separate values for capacity and energy but respectfully declines to provide this break-down as this information is commercially sensitive.

All values provided were levelized over the next 30 years. The marginal costs provided herein are consistent with the values used in the 2011 Power Smart Plan.

CAC-GAC/MH I-4

Subject: **Avoided Costs**
Reference: **2011 Power Smart Plan, Chapter 2**

Preamble: **The value of DSM depends primarily on utility avoided costs. Most utilities base their avoided costs on the long-run cost of new generation and associated T&D costs, and provide both the values and the underlying assumptions as part of the rate hearing.**

c) **Please explain the rationale behind the determination of the avoided costs and/or export revenue (e.g. avoided costs are based on what schedule of and what type of new power generation).**

ANSWER:

Manitoba Hydro interprets marginal cost to mean the cost or value to the system of an incremental quantity of energy and/or capacity. The marginal cost includes a generation component as well as transmission and distribution components as applicable. For example, if a new residential customer is connected to the system, the incremental power consumed will require utilization of an increment of distribution facilities, bulk transmission facilities and generation plant.

The current methodology for determining the generation component of marginal cost is based on the value to the Manitoba Hydro system of an increment of energy and capacity under a range of water flow conditions. This methodology is based on the premise that Manitoba Hydro may be able to create additional export sales from the energy and capacity associated with a reduction in domestic load. In some flow conditions the most economic use of a load reduction is to reduce the requirement for high priced thermal and import energy rather than export the power.

From the bulk transmission and distribution perspective, incremental increases in the load will eventually result in a requirement to upgrade transmission and distribution facilities. Manitoba Hydro determines the cost that an additional increment of load can be expected to incur from the transmission and distribution perspective.

CAC-GAC/MH I-5

Subject: **Cost Benefit Analysis – Inputs**
Reference: **2011 Power Smart Plan, Appendix F**

Preamble: **Cost-effectiveness tests reflect a variety of perspectives and can be computed in a variety of ways.**

a) **Please confirm that the benefits and costs, as detailed in Appendix F for each test, are the only benefits and costs that are included in the calculation for each respective test.**

ANSWER:

Confirmed.

CAC-GAC/MH I-5

Subject: **Cost Benefit Analysis – Inputs**
Reference: **2011 Power Smart Plan, Appendix F**

Preamble: **Cost-effectiveness tests reflect a variety of perspectives and can be computed in a variety of ways.**

b) **For each test (MRC, TRC, SCT, RIM, Customer payback), please provide the inputs, assumptions (e.g.: utility discount rate, social discount rate, marginal electric prices, EULs, net participant costs, participant bill savings) and resulting values for each NEB (non- energy benefit) accounted for, including:**

1) **Participant NEBs,**

2) **Societal (environmental and social externalities) NEBs**

3) **Utility NEBs, and**

4) **Any other priced or "non-priced" NEBs accounted for in the tests.**

ANSWER:

Please see Manitoba Hydro's response to PUB/MH I-108(a) for inputs and assumptions relating to MRC, TRC, SCT and RIM. The following table provides additional inputs for the SCT and Customer Payback tests.

	TRC Ratio	SCT Ratio (TRC with 10% adder)	Net Participant Costs (Incremental Cost - Incentive)	Annual Participant Bill Savings
Residential				
New Home Program	1.6	1.7	$ 542,684	$ 64,554
Home Insulation Program	4.1	4.6	$ 727,970	$ 266,660
Water and Energy Saver Program	6.3	6.9	$ -	$ 302,974
Lower Income Energy Efficiency Program	2.3	2.5	$ 1,972,836	$ 185,405
EE Light Fixtures	1.9	2.1	$ -	$ 39,127
Fridge Recycling Program	1.8	2.0	$ 1,071,125	$ 392,535
Commercial				
Commercial Lighting Program	1.8	2.0	$ 5,641,824	$ 1,327,542
Commercial Custom Measures Program	1.8	2.0	$ 242,518	$ 25,545
Commercial Windows Program	11.7	12.8	$ 61,641	$ 172,858
Commercial HVAC Program - Chiller	1.3	1.5	$ 324,659	$ 25,710
City of Winnipeg Power Smart Agreement	13.4	14.8	$ 2,059	$ 33,270
Commercial Refrigeration Program	4.8	5.2	$ 166,232	$ 97,809
Commercial Insulation Program	6.8	7.5	$ 451,645	$ 257,647
Commercial Earth Power Program	2.4	2.6	$ 648,989	$ 86,914
Commercial New Construction Program	5.4	5.9	$ 691,020	$ 224,213
Commercial Building Optimization Program	6.0	6.6	$ 49,818	$ 44,242
Internal Retrofit Program	1.3	1.4	$ -	$ -
Commercial Kitchen Appliance Program	6.8	7.5	$ 1,750	$ 57,034
Commercial Clothes Washers Program	2.1	2.3	$ 120,245	$ 24,644
Network Energy Management Program	2.1	2.3	$ 69,068	$ 58,886
CO2 Sensors	8.5	9.3	$ 3,365	$ 2,334
Industrial				
Performance Optimization Program	2.7	2.9	$ 1,760,000	$ 552,718
Emergency Preparedness Program	2.8	3.0	$ 550,000	$ 170,251
Customer Self Generation				
Bioenergy Optimization Program	1.7	1.8	$ 2,466,928	$ 2,494,253

Assumptions:

- Utility discount rate – Please see Manitoba Hydro's response to PUB/MH I-108(b).
- Social discount rate – n/a.
- Levelized marginal value – Please see Manitoba Hydro's response to PUB/MH I-107 (a).
- EULs - Please see Manitoba Hydro's response to CAC-GAC/MH I-1(c).

Values for NEBs:

1. Participant NEB – Water Benefits – Please see Manitoba Hydro's response to PUB/MH I-108(a).
2. Societal NEB – The SCT is calculated using a 10% adder to the TRC as a proxy of societal externalities and "non-priced" participant benefits. Please see Appendix 7.1, the 2011 Power Smart Plan – Appendix F – Program Evaluation Criteria – Economic Effectiveness Ratios c) Societal Cost Test.
3. Utility NEBs – n/a.
4. Other NEBs – n/a.

CAC-GAC/MH I-5

Subject: **Cost Benefit Analysis – Inputs**
Reference: **2011 Power Smart Plan, Appendix F**

Preamble: **Cost-effectiveness tests reflect a variety of perspectives and can be computed in a variety of ways.**

c) **For the above, insofar as values are used for distinct measures or groups or measures, please provide precise values with associated distinctions.**

ANSWER:

For the items identified in Manitoba Hydro's response to CAC-GAC/MH I-5(b), unless otherwise noted in that response, the values are the same for all measures and groups of measures (e.g. utility discount rate, electric marginal values.)

CAC-GAC/MH I-6

Subject: **Cost Benefit Analysis – Framework**
Reference: **2011 Power Smart Plan, Appendix F**

Preamble: **Cost-effectiveness tests can be used in a variety of ways to screen measures or otherwise influence what measures are pursued within a given DSM plan.**

a) Please describe Manitoba Hydro's cost-effectiveness policy regarding DSM. In other words, how and to what extent do the various cost-effectiveness tests influence and/or determine which measures and/or programs are included in the plan.

ANSWER:

Manitoba Hydro uses a number of tests to assess energy efficiency opportunities. The results of these tests are used to determine whether to pursue an opportunity, how aggressively to pursue an opportunity, the effectiveness of program design options and the relative investment between ratepayers (via utility incentives and other costs) and participants. In addition to quantitative assessments, Manitoba Hydro also considers various qualitative factors, including equity (i.e. reasonable participation by various ratepayer sectors such as lower income) and overall contribution toward having a balanced energy conservation strategy and plan.

Manitoba Hydro prefers using the Levelized Utility Cost as it provides a specific cost on a per unit of energy basis; however, all tests are used in aggregate in determining which opportunities to pursue and which program design is best suited to meeting the Corporation's energy conservation efforts. Please refer to Appendix F - Program Evaluation Criteria of Appendix 7.1, the 2011 Power Smart Plan, of this Application for details of the cost effectiveness tests used to assess opportunities.

<u>CAC-GAC/MH I-6</u>

Subject: **Cost Benefit Analysis – Framework**
Reference: **2011 Power Smart Plan, Appendix F**

Preamble: **Cost-effectiveness tests can be used in a variety of ways to screen measures or otherwise influence what measures are pursued within a given DSM plan.**

b) **Please provide a complete list of measures and/or programs that the utility has chosen not to pursue, or to pursue in a less aggressive way (e.g. in a pilot project rather than province- wide, or with a focus on education rather than incentives) because of its results on one or several cost-effectiveness tests.**

<u>ANSWER</u>:

Please see Manitoba Hydro's response to GAC/MH I-9 (b).

Also, Manitoba Hydro previously outlined under RCM/TREE/MH II-4(a) of the 2010/11 & 2011/12 Electric General Rate Application those measures that are not being pursued due to the results on their cost-effectiveness tests. Please see the attached.

RCM/TREE/MH II-4

Subject: **Demand-Side Management**
Reference: **2007-2008 Power Smart Annual Review, Appendix 9.2**

a) **Please identify all DSM programs and measures that MH has evaluated and rejected, and for each provide the following information:**

i. **The results of the MRC, TRC, RIM, LUC, Simple Customer Payback, and PC tests, and**
ii. **the reason for rejection of the program and measure.**

ANSWER:

i. Manitoba Hydro conducts analysis on new energy efficient measures on a continuous basis. The table below outlines measures that have recently been screened and rejected as a potential program offering. When a technology is screened using the MRC and the ratio falls below 1.0, generally no program is pursued and thus the TRC, RIM and LUC are not calculated. In some cases, research undertaken indicates that there isn't an energy efficiency opportunity (i.e. large portion of products being purchased are already energy efficient).

Measure	**MRC**	**TRC**	**RIM**	**LUC**	**Payback**	**PC**
Residential dishwashers	0.7	n/a	n/a	n/a	17 yrs	0.5
Residential window air conditioners	n/a	n/a	n/a	n/a	n/a	n/a
Residential dehumidifiers	n/a	n/a	n/a	n/a	n/a	n/a
Residential Instantaneous Electric Water Heaters	0.5	n/a	n/a	n/a	34 yrs	0.3
Commercial ice machines	n/a	2.41	1.02	2.2¢	1 yr	4.4
Commercial griddles	0.4	n/a	n/a	n/a	86 yrs	0.2
Commercial convection ovens	0.7	n/a	n/a	n/a	47 yrs	0.4
Commercial combi-ovens	0.9	n/a	n/a	n/a	19 yrs	0.5
Commercial food holding cabinets	0.5	n/a	n/a	n/a	75 yrs	0.3
Commercial electric deep fryers	0.2	n/a	n/a	n/a	158 yrs	0.1

ii. In addition to metrics identified in RCM/TREE/MH II-4(i), there are other considerations that influence the decision on whether to offer a program targeting a specific energy efficient measure. The following outlines some of these factors for each of the measures listed in the table above.

Residential dishwashers were not included under the Power Smart appliance program as they did not pass the MRC or PC tests and had a long customer payback. Market research revealed that over 50% of dishwashers sold in Manitoba were already Energy Star qualified models.

Residential window air conditioners were researched as a potential program. Market research indicated that that the most common size of units purchased (6 000 BTU, 10 000 BTU, 12 000 BTU and 14 000 BTU) are only available in Energy Star qualified models and therefore no energy efficient opportunity was identified.

Residential dehumidifiers were researched as a potential program. Market research indicated that that all dehumidifiers sold in Manitoba are Energy Star qualified models and therefore no energy efficient opportunity was identified.

Residential instantaneous electric water heaters were evaluated as part of a domestic water heating conservation strategy. No program was pursued as the opportunity was not economic.

Commercial ice machines passed the various economic tests however, during the design stage of the program, federal regulations were proposed and implemented which increased the minimum performance standard of these ice machines to the level for which the program was intended to be promoted.

Commercial griddles did not pass the MRC test and the customer payback was very long. As such, the technology was not pursued.

Commercial convection ovens did not pass the MRC test and the customer payback was very long. The energy savings were too small for the customer energy bill savings to recoup the incremental cost of the equipment over its useful life and a program was not pursued.

Commercial combi-ovens had a high incremental product cost resulting in a very long customer payback period. A program to pursue this opportunity was not advanced however the market will be monitored for potential changes in economics due to such factors as reduced product market prices.

Commercial food holding cabinets did not pass the MRC test and the customer payback was very long. As such, no program was designed to pursue this opportunity.

Commercial electric deep fryers did not pass the MRC and TRC and the payback was very long. As such, no program was designed to pursue this opportunity.

CAC-GAC/MH I-7

Subject: **Cost Benefit Analysis – Sensitivity**
Reference: **2011 Power Smart Plan**

Preamble: **A sensitivity analysis is important tool to help assess the robustness of the 2011 Power Smart Plan.**

a) **Please confirm that a sensitivity analysis was conducted on the results of the 2011 Power Smart Plan.**

b) **In the affirmative to a) above, please provide all relevant assumptions, data and methodology used to conduct the sensitivity analysis.**

ANSWER:

A sensitivity analysis was not conducted on the results of the 2011 Power Smart Plan. Manitoba Hydro develops its Power Smart Plan using a bottom up approach. As such, each program design undergoes rigorous scrutiny at the initial design stage and annually thereafter as the Power Smart Plan is updated. Given Manitoba Hydro's approach to developing its Power Smart Plan, there would be little value in undertaking a post-facto sensitivity analysis.

CAC-GAC/MH I-8

Subject: **DSM Budget Projections**
Reference: **2011 Power Smart Plan, Appendix A.5**

Preamble: **The DSM Plan seems to suggest a ramping up in the first few years, followed by a ramping down and eventual stabilization thereafter.**

a) Please describe the reasons for the trend of declining DSM utility investments for each program in each sector.

ANSWER:

For all DSM programs in each sector, declining utility investment over time typically reflects program activity slowing or ceasing as the energy efficient technology(ies) become mainstream and target markets are transformed (i.e. market transformation). The products or practices supported through DSM programming pass through distinct stages including market introduction, growth, maturity, and saturation. As energy efficient product/measures move to the later stages, less utility intervention is required. Manitoba Hydro's Power Smart Plan reflects this market transformation process.

Manitoba Hydro's Power Smart Plan is reviewed annually allowing for new cost effective measures/programs to be incorporated into the overall portfolio as they are identified.

CAC-GAC/MH I-8

Subject: **DSM Budget Projections**
Reference: **2011 Power Smart Plan, Appendix A.5**

Preamble: **The DSM Plan seems to suggest a ramping up in the first few years, followed by a ramping down and eventual stabilization thereafter.**

b) **Please describe the reasons for choosing the date on which program funding is terminated, for each program in each sector. For example the Annual Budget in Appendix A.5 shows program spending of $0 for Home Insulation Program starting in 2015/16, $0 for Water and Energy Saver Program starting in 2015/16 and of $0 for EE light fixtures starting in 2012/13.**

ANSWER:

For all DSM programs in each sector, utility investment typically decreases/ends at the point in time when the product or practice encouraged by the program is deemed mainstream or the new market standard. Over time, economic factors, driven primarily from increased demand and economies of production, tend to result in increased product/measure availability and decreased pricing to the point where utility intervention may no longer be required to influence the customer's purchase decision or the utility's intervention is no longer economic. For some measures, the introduction of codes, regulations or standards by the federal and provincial governments are anticipated. As mentioned in Manitoba Hydro's response to CAC-GAC I-8(a), Manitoba Hydro's Power Smart Plan and portfolio of programs is reviewed annually allowing for the measurement of the state of the market and program, from which program end dates are identified, monitored, adjusted, and implemented.

Specific to the Home Insulation Program, utility intervention is not projected to end until March 31, 2017. This is the point in time when the program design anticipates having captured most of the market opportunities that remain for insulating existing homes. For the Water and Energy Saver Program, the program anticipates reaching 60% market share of water efficient fixtures and to influence future availability of low flow product through distribution channels and retailers by the end of 2015/16; Manitoba Hydro will be advocating for potential product regulations under *The Manitoba Energy Act* once the market can offer a wide range of efficient products. Savings from EE Light Fixtures were to be captured by the Federal regulation that was due to be implemented in 2012 which resulted in the corresponding termination of the program in that year.

CAC-GAC/MH I-9

Subject: **DSM Savings Projections**

Reference: **2010-2011 Power Smart Annual Review, Executive Summary, 2008-2009 Power Smart Annual Review, Executive Summary**

- **2008-2009 Power Smart Annual Review, Executive Summary**
- **2007-2008 Power Smart Annual Review, Executive Summary**
- **2005-2006 Power Smart Annual Review, Executive Summary**

Preamble: **Recognizing the difficultly in forecasting DSM savings, the historical trend in the differences between forecasted savings and actual savings gives insights into appreciating the 2011 Power Smart Plan. The table below lists the planned and actual incremental annual savings of Power Smart programs for the years where the information is publicly available.**

		2005/06	2007/08	2008/09	2010/11
Incentive Based Programs	Plan (GWh)	64	97	262	191
	Actual (GWh)	97	189	210	216
	Difference	52%	95%	-20%	13%

a) **Please provide an explanation for the differences between the planned savings and the actual savings for each of the years listed above, except for the year 2008/09 since the reasons for the differences are described in the annual review for that year.**

ANSWER:

In 2005/06, higher than expected participation in the Commercial Construction & Renovation Program and the Performance Optimization Program resulted in a positive variance between actual and planned GW.h savings. Participation in the Commercial Construction & Renovation Program was 307% greater than planned due to increased promotion of parking lot controllers, which represented 99% of total program sales and 65% of total energy savings achieved. Participation in the Performance Optimization Program was 77% greater than planned, yielding greater energy savings as a result.

In 2007/08, there were no planned savings for the Bioenergy Optimization Program formerly called the Customer Load Displacement Pilot. However, one project was completed in that fiscal year, resulting in a positive variance.

The variance between actual and planned savings by program for the 2010/11 fiscal year is discussed in Exhibit 4.4.1.1. – B: *Annual GW.h Savings – Electric Incentive-Based Programs* on page 59 and 60 of the 2010/11 Power Smart Annual Review. The 2010/11 Power Smart Annual Review can be found in Appendix 7.2 of this Application.

CAC-GAC/MH I-9

Subject: **DSM Savings Projections**

Reference: **2010-2011 Power Smart Annual Review, Executive Summary, 2008-2009 Power Smart Annual Review, Executive Summary**

- **2008-2009 Power Smart Annual Review, Executive Summary**
- **2007-2008 Power Smart Annual Review, Executive Summary**
- **2005-2006 Power Smart Annual Review, Executive Summary**

Preamble: **Recognizing the difficultly in forecasting DSM savings, the historical trend in the differences between forecasted savings and actual savings gives insights into appreciating the 2011 Power Smart Plan. The table below lists the planned and actual incremental annual savings of Power Smart programs for the years where the information is publicly available.**

		2005/06	2007/08	2008/09	2010/11
Incentive Based Programs	Plan (GWh)	64	97	262	191
	Actual (GWh)	97	189	210	216
	Difference	52%	95%	-20%	13%

b) Regarding a) above, please provide details on any methodology differences (e.g. evolving reporting practices) that may affect a fair comparison of previous forecasts with actual (reported) savings. If such differences are substantial, please provide adjusted forecasts or actual savings to allow for a fair comparison.

ANSWER:

There were no changes to methodologies which would impact the comparison of previous forecasts to actual savings.

CAC-GAC/MH I-10

Subject: **DSM Potential Study**

Reference: **In February 2011, Manitoba Hydro issued an RFP for a DSM Potential Study with a stated purpose to define the maximum attainable market potential (MERX, Request for Proposal 035349)**

Preamble: **In order to assess the strength of the 2011 Power Smart Plan, it is important to know what the potential market for DSM is in Manitoba**

a) **Please provide the most recent electric potential study completed for Manitoba. If the most recent potential study has not yet been finalized, please provide the expected date of completion.**

ANSWER:

The most recent potential study for DSM in Manitoba was completed in 2003. As the market potential study is no longer reflective of Manitoba's market, Manitoba Hydro is undertaking a new market potential study. Manitoba Hydro anticipates the completion of above referenced DSM Potential Study by the end of the year, at which point it would be reviewed by senior management.

CAC-GAC/MH I-10

Subject: **DSM Potential Study**

Reference: **In February 2011, Manitoba Hydro issued an RFP for a DSM Potential Study with a stated purpose to define the maximum attainable market potential (MERX, Request for Proposal 035349)**

Preamble: **In order to assess the strength of the 2011 Power Smart Plan, it is important to know what the potential market for DSM is in Manitoba**

b) **Please confirm if Manitoba Hydro has performed an analysis of various scenarios of DSM savings and spending, such as a case where DSM activities are pursued more aggressively than what is currently stated in the 2011 Power Smart Plan.**

ANSWER:

As stated in Manitoba Hydro's response to GAC/MH I-9(i), Manitoba Hydro undertakes a bottom up approach in determining the energy savings targets and associated budgets required to pursue these targets. Economic energy efficient opportunities are identified and programs are designed to pursue those opportunities. The individual programs and their associated budgets are combined into an overall Power Smart Plan. Opportunities which are not economic are not pursued. Within this process, more aggressive program designs are considered and assessed.

<u>CAC-GAC/MH I-10</u>

Subject: **DSM Potential Study**

Reference: **In February 2011, Manitoba Hydro issued an RFP for a DSM Potential Study with a stated purpose to define the maximum attainable market potential (MERX, Request for Proposal 035349)**

Preamble: **In order to assess the strength of the 2011 Power Smart Plan, it is important to know what the potential market for DSM is in Manitoba**

c) **In the affirmative to b) above, please provide all relevant details and assumptions for the various scenarios.**

<u>ANSWER</u>:

As outlined in Manitoba Hydro's response to CAC-GAC/MH I-10(b), economic energy efficient opportunities are identified and subsequently, programs are designed to pursue those opportunities. This process is an integral component of the overall program design process with varying levels of market intervention considered and assessed. The recommended design is reviewed and examined by various levels of management, with final approval by Manitoba Hydro's Executive Committee. At each level, design options are considered and reviewed to ensure the program offerings are most appropriate for pursuing a particular energy efficient opportunity.

CAC-GAC/MH I-10

Subject: **DSM Potential Study**

Reference: **In February 2011, Manitoba Hydro issued an RFP for a DSM Potential Study with a stated purpose to define the maximum attainable market potential (MERX, Request for Proposal 035349)**

Preamble: **In order to assess the strength of the 2011 Power Smart Plan, it is important to know what the potential market for DSM is in Manitoba**

d) **In the affirmative to b) above, please provide details on how the most recent potential study was used to help prepare the scenarios.**

ANSWER:

Please see Manitoba Hydro's response to CAC-GAC/MH I-10(a) and CAC-GAC/MH I-10(b). Manitoba Hydro uses the best available market data at the time each program design is developed and when subsequently reviewed. Data may include, but is not limited to: customer billing data; customer energy use surveys; industry/association research, market availability/capacity consultations with suppliers, distributors, retailers and supporting industries; and, past and current program results. Similar data is being used in the preparation of the DSM Potential Study.

CAC-GAC/MH I-10

Subject: **DSM Potential Study**

Reference: **In February 2011, Manitoba Hydro issued an RFP for a DSM Potential Study with a stated purpose to define the maximum attainable market potential (MERX, Request for Proposal 035349)**

Preamble: **In order to assess the strength of the 2011 Power Smart Plan, it is important to know what the potential market for DSM is in Manitoba**

e) **In the affirmative to b) above, please indicate whether or not a DSM resource acquisition scenario sufficient to displace or defer planned new generation was analysed. If so, please provide details and assumptions per c) above. If not, why not?**

ANSWER:

Examination of matters related to Manitoba Hydro's major capital development plans and alternatives, including DSM, is expected to take place in the context of a Needs For and Alternatives To (NFAT) hearing, which is expected to commence in 2013.

CAC-GAC/MH I-11

Subject: **Targeted DSM scenarios**
Reference: **Tab 7.2, p. 15**

Preamble: **DSM is justified both as a resource option and a value to customers (Tab 7.2, p. 15). The latter justification includes the role of DSM as the only bill mitigation option acceptable to Hydro for low-income customers.**

a) **Has Manitoba Hydro contemplated, analysed or evaluated a DSM resource acquisition scenario sufficient to displace or defer planned new generation? If so, please provide all relevant details and assumptions, comparing the capacity and energy targets and costs with the planned outputs and costs of Keeyask and Conawapa, and describe how the realization of such a scenario affects, or could affect, plans for Keeyask and Conawapa.**

ANSWER:

Examination of matters related to Manitoba Hydro's major capital development plans and alternatives, including DSM, is expected to take place in the context of a Needs For and Alternatives To (NFAT) hearing, which is expected to commence in 2013.

CAC-GAC/MH I-11

Subject: **Targeted DSM scenarios**
Reference: **Tab 7.2, p. 15**

Preamble: **DSM is justified both as a resource option and a value to customers (Tab 7.2, p. 15). The latter justification includes the role of DSM as the only bill mitigation option acceptable to Hydro for low-income customers.**

b) **Has Manitoba Hydro contemplated, analysed or evaluated a DSM resource acquisition scenario that targets the conversion of a proportion (e.g. 25% or 50%) of existing or planned electric resistance heated homes to geothermal heat? If so, please provide all relevant details and assumptions and the expected costs and outputs in capacity and energy.**

ANSWER:

In screening potential opportunities with geothermal applications, Manitoba Hydro has discussed the potential of converting homes heated with electric resistance to geothermal. The discussions were undertaken in an informal manner and at a high level. Through this process, a number of factors have been identified which make this option challenging, including:

- Although most heat pumps have a Coefficient of Performance (i.e. efficiency) rating of over 3.0 (or 300% efficient), most systems operate with a lower Seasonal Coefficient of Performance (SCOP) in the range of 2.0 – 3.0 (200% to 300% efficient) depending upon the quality and configuration of the installed system. Based upon the 2011 Load Forecast, residential space heating represents approximately 2,200 GWh. Assuming a SCOP of 2.0 – 3.0, this potential opportunity represents a theoretical maximum reduction of 1,100 – 1,470 GWh.
- 33% of electrically heated homes (not including apartments) use baseboard heating where duct working would need to installed at a significant cost and disruption to the homeowner.
- High capital/installation costs of geothermal systems with potential for considerable maintenance issues. These high costs significantly impact the economics of geothermal applications, particularly for homes with smaller heating loads (typically smaller homes or homes with improved envelope measures).
- Customers are less likely to change their existing heating system if it was recently replaced (31% of electric forced air furnaces are 6 years old or less).

- As system designs are unique to each home, actual performance can vary significantly from manufacturer reported performance based upon the home size, ground conditions, lot size, contractor training and overall system design.
- Ground conditions may not economically support geothermal (e.g. dry sandy soil and gravel, bedrock or glacial till).
- As systems are beginning to age, maintenance problems are beginning to become an issue such as Freon leaks, early failure of heat exchangers/compressors, etc. which can be at a significant cost to the customer (e.g. approximately $11,000 to $15,000 to replace the heat pump unit).

CAC-GAC/MH I-11

Subject: **Targeted DSM scenarios**
Reference: **Tab 7.2, p. 15**

Preamble: **DSM is justified both as a resource option and a value to customers (Tab 7.2, p. 15). The latter justification includes the role of DSM as the only bill mitigation option acceptable to Hydro for low-income customers.**

c) **In Order 116/08, p. 225, the PUB reports that low-income households are "at least in the order of 100,000 households." Has Manitoba Hydro contemplated, analysed or evaluated a DSM bill mitigation program that would target the installation of energy efficiency measures in, say, the highest-consuming 50% of low-income households in the next five years? If so, please provide all relevant details and assumptions and the expected costs, predicted bill savings and predicted capacity and energy savings.**

ANSWER:

Manitoba Hydro has determined that 105,086 households in Manitoba would meet the LICO-125 income criteria. However, the energy efficiency opportunities for customers within this category differ depending upon the type and condition of the home. Manitoba Hydro has identified that the greatest opportunities exist in single detached and multi-attached homes and with those customers who own their homes; this reduces the number of households to 74,057 (please see Manitoba Hydro's response to PUB/MH I-109(a). Of these 74,057 homes, 34% are electrically heated and 7% report that their insulation levels are poor or fair representing the homes which provide opportunity for realizing greater electricity savings.

Manitoba Hydro has recognized this opportunity and in December of 2007 introduced the Lower Income Energy Efficiency Program (LIEEP). Under LIEEP, income qualifying customers are visited by an energy advisor who reviews the energy efficiency of their home and based on the results will recommend free upgrades to attic, basement, crawlspace and/or wall cavity insulation (improving the insulation to Power Smart levels). During the energy efficiency review, the advisor also provides free basic energy efficient items, such as low-flow showerheads and compact fluorescent lights. Please refer to Manitoba Hydro's response to PUB/MH I-109(b) for detail of projected participation and expenditures. In addition, partnerships with community and government housing organizations are key to accessing opportunities in the single detached/multi-attached rental housing sector.

To date, Manitoba Hydro has insulated 1,145 electrically heated homes (including 131 customer-owned homes, 523 rental homes and 491 First Nation homes). In addition, basic energy efficiency measures have been installed in 1,221 electrically heated and 3,269 natural gas heated homes (includes customer-owned, rental and First Nation homes). Similar to other jurisdictions, Manitoba Hydro has experienced challenges in reaching customers in the lower income target group. Recent customer surveys have indicated that slightly more than 70% program awareness has been achieved amongst those in the target market; however, less than 30% have applied or intend to apply for upgrades under the program. The most common reasons given by customers for not applying were: they did not identify themselves as qualifying as lower income; they did not believe their home needed the upgrade; or, they perceived that the savings were not worth the time and effort to participate and undertake the upgrade.

Recognizing these barriers and in its efforts to increase reach participation, Manitoba Hydro has undertaken many different approaches, including: a comprehensive advertising campaign, mass marketing through Manitoba Hydro bill inserts to more targeted media placements and direct mail focused in low income neighborhoods; outreach to seniors and organizations serving seniors; leveraging other programs to identify and contact specific households which may meet the eligibility requirements; and continuing to work with community groups and non-profit organizations to reach customers at the community level. Please also see Manitoba Hydro’s response to GAC/MH I-35.

CAC-GAC/MH I-11

Subject: **Targeted DSM scenarios**
Reference: **Tab 7.2, p. 15**

Preamble: **DSM is justified both as a resource option and a value to customers (Tab 7.2, p. 15). The latter justification includes the role of DSM as the only bill mitigation option acceptable to Hydro for low-income customers.**

d) **For each of the above targeted scenarios that Manitoba Hydro has not analysed or evaluated in detail, please indicate what technical, economic or other considerations would offer grounds for removing the scenario from further analysis and evaluation.**

ANSWER:

Please see Manitoba Hydro's responses to CAC-GAC/MH I-11(c).

CAC-GAC/MH I-12

Subject: **Bill 24: The Energy Savings Act**
Reference: **Bill 24: The Energy Savings Act**

Preamble: **Bill 24, passed in June, provides for the continuation of the Affordable Energy Fund, annual update and review of Hydro's energy efficiency plan, and on-metre financing of efficiency improvements. The last of these provides a new financing option for DSM.**

a) **Please provide Manitoba Hydro's views on how the act's provisions, particularly on-metre financing, can affect Manitoba Hydro's Power Smart program strategies, targets and forecasts.**

b) **Please provide any analysis Manitoba Hydro has performed estimating the impact of the Energy Savings Act on Manitoba Hydro's targets and forecasts.**

ANSWER:

Please see Manitoba Hydro’s response to PUB/MH I-47(c).

CAC-GAC/MH I-13

Subject: **DSM**
Reference: **Tab 7, Appendix 7.1**

Preamble: **Bill 24, passed in June, provides for the continuation of the Affordable Energy Fund, annual update and review of Hydro's energy efficiency plan, and on-metre financing of efficiency improvements. The last of these provides a new financing option for DSM.**

a) With respect to Appendices A.4 and B.4 of Appendix 7.1, to the extent the evaluation uses export prices, do the values for Total Resource Costs and the TRC ratio referenced in this report reflect the outlook for lower future export prices as discussed in Tab 4 (page 3). If not, what would be the impact?

ANSWER:

Confirmed.

CAC-GAC/MH I-13

Subject: **DSM**
Reference: **Tab 7, Appendix 7.1**

Preamble: **Bill 24, passed in June, provides for the continuation of the Affordable Energy Fund, annual update and review of Hydro's energy efficiency plan, and on-metre financing of efficiency improvements. The last of these provides a new financing option for DSM.**

b) **Similarly, do the TRC calculation results referenced in Appendix 7.2 (pages (a) and 131) reflect the current (lower) outlook for future export prices? If not, what would be the impact?**

ANSWER:

The information contained in the 2010-2011 Power Smart Annual Review includes an assessment of the results for that time period compared with the 2010/11 planned targets as were outlined in the 2010 Power Smart Plan, which was approved in December 2010. The TRC calculation results referenced in Appendix 7.2 (pages (a) and 131) reflect the marginal values used in the preparation of the 2010 Power Smart Plan and is deemed appropriate to compare against as it represents the best information available at the time of making the decision to invest.

It is not appropriate to run a sensitivity analysis using an alternate, more current outlook as it does not add value to the evaluation of past Power Smart activity. However, if the outlook for future export prices is lower, it is generally expected that the TRC values would be less favourable.

<u>CAC-GAC/MH I-13</u>

Subject: **DSM**
Reference: **Tab 7, Appendix 7.1**

Preamble: **Bill 24, passed in June, provides for the continuation of the Affordable Energy Fund, annual update and review of Hydro's energy efficiency plan, and on-metre financing of efficiency improvements. The last of these provides a new financing option for DSM.**

c) **Please provide the levelized value attributed to a peak period kWh of DSM savings (at point of Generation) based on the ten-year period 2011/12 to 2020/2 as used to determine cost effectiveness in:**

i) **The current 2011 Power Smart Plan underlying IFF11-2, and**

ii) **The 2009 Power Smart Plan underlying IF09-1.**

Please use the same basis (i.e., real dollars in the same year) for both values and indicate what year is used.

<u>ANSWER</u>:

The levelized value assigned to a peak period kWh of DSM savings (at the point of generation) based on the ten year period 2011/12 to 2020/21 in 2011 real dollars:

i) 2011 Power Smart Plan (IFF11-2) - 5.38 cents per kilowatt hour.
ii) 2009 Power Smart Plan (IFF09-1) - 6.00 cents per kilowatt hour.