

**TO:** Dayna Steinfeld, on behalf of the Manitoba Public Utilities Board

**FROM:** John Athas of Daymark Energy Advisors

**DATE:** January 3, 2020

**SUBJECT:** Independent Expert Report: Demand Side Management & Energy Efficiency Corrections

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The following corrections have been made to Daymark Energy Advisors report *Independent Expert Report: Demand Side Management & Energy Efficiency* dated December 9, 2019, all additions are highlighted, and removals are crossed out:

- p. 3: ~~Forty-two~~ **Forty** percent expire within five years. ~~Eight-four~~ **Ninety-three** percent expire within fifteen years.
- p. 5: The complete text of Order No. 162/19, including the list of specific in-scope and out-of-scope issues, is attached to this report as ~~Attachment X~~ **Appendix B**.
- p. 5: The Scope of Work for Daymark is attached as Appendix ~~X~~ **D**.
- p. 7: In addressing the issues raised in the Scope of Work, Daymark has divided our analysis into broad categories and structured our report around these categories. ~~A detailed table showing where each element of the Scope of Work is addressed in our report is attached as Attachment X.~~ The general categories, and the overall structure of the report, are as follows:
- p. 8:
  - **VII. Savings Targets.** Here, we examine what the cost effectiveness and other considerations related to the Plan's initiatives might indicate about whether savings targets should be increased or decreased.
  - ~~VIII. Additional Considerations.~~ This section addresses additional issues relevant to the analysis of the Plan, such as the potential use of conservation rates and the role of solar programs and net metering.
  - **VIII. Summary of Findings.** We conclude by summarizing our findings.
- p. 8: The Efficiency Manitoba proposed Plan calls for spending approximately \$200 million over three years to attain **total three-year energy savings, inclusive of both program related and codes & standards,** ~~cumulative total energy of 403 GWh~~ **1,136 GWh** for the electric portfolio and 37.7 million meters cubed for the natural gas portfolio.
- p. 9: **Projected annual savings for electric portfolio, inclusive of program-related and codes & standards, are estimated to be 373 GWh in year 1, followed by 386 GWh in year 2, and 377 GWh**

in year 3. Projected savings rise from an estimated 85 GWh savings in year 1 of the electric portfolio to 93 GWh in years 2 and 3. On the natural gas side, annual savings, inclusive of program related and codes & standards, rise from 11.7 million cubic meters in year 1 to 13.2 million cubic meters in year 3.

- p. 10: In the electric portfolio, the largest share of the budget (39%) goes to the commercial segment, with 20% going to the industrial segment and (39%) goes to the industrial segment, with 36% going to the commercial segment, 19% going to the residential segment, and 4% to the agricultural segment
- p. 11: Overall, then, the plan budgets show significant investments in the industrial, and commercial, and residential sectors
- p. 13: MIPUG/DAYMARK I-7a regarding Table 1: Cost-Benefit Analysis using PACT

CUSTOMER SEGMENT(S)	NATURAL GAS			ELECTRICITY		
	C/B	NPV (000'S)	LEVELIZED COST (¢/m <sup>3</sup> )	C/B	NPV	LEVELIZED COST
RESIDENTIAL	1.01	\$179	19.49	2.74	\$40,338	3.19
Income Qualified	0.49	(\$8,888)	40.29	2.8	\$7,576	3.7
Commercial, Industrial, and Agricultural	2.52	\$31,429	7.19	1.84	\$6,792	4.67
Emerging Technologies	0.89	(\$104)	21.4	2.96	\$4,156	2.11

CUSTOMER SEGMENT(S)	NATURAL GAS			ELECTRICITY		
	C/B	NPV (000'S)	LEVELIZED COST (¢/m <sup>3</sup> )	C/B	NPV	LEVELIZED COST
RESIDENTIAL	1	\$179	19.49	2.74	\$40,338	3.19
Income Qualified	0.5	(\$8,888)	40.29	2.8	\$7,576	3.7
Commercial, Industrial, and Agricultural	2.5	\$31,429	7.19	4.43	\$310,159	1.59
Emerging Technologies	0.9	(\$104)	21.4	2.96	\$4,156	2.11

- p. 28: account for 31% percent,
- p. 31: Figure 7 depicts program budgets for Canada and Efficiency Manitoba’s natural gas spending by sector, and similar to the electric sector differences are due to the customer makeup in Manitoba. Figure X-Natural Gas Budget by Sector Canada and Efficiency Manitoba
- p. 35: Table 4a: Cumulative savings by sector and portfolio for New Efficiency Manitoba 3-year plan offerings

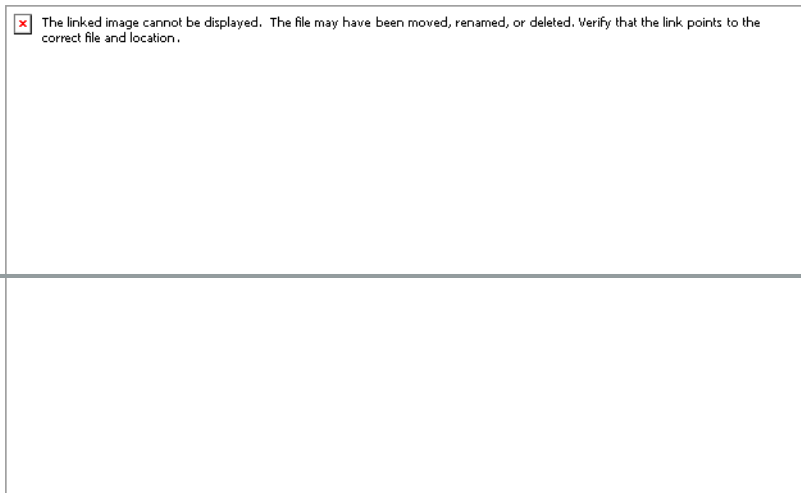
<b>New Efficiency Manitoba Offerings - 3 Year Plan</b>		
<b>Cumulative savings by Sector and Portfolio (*)</b>		
<b>Sector</b>	<b>Energy GWh</b>	<b>Natural Gas Mil m<sup>3</sup></b>
Commercial	8.6	0.65
Indigenous	1.5	0.16
Residential	4.3	0
Total New Offerings	14.4	0.81
Total Sector Budget	1179	37.7
% of Budget	1.2%	2.1%
(*) Est. Based on measure-level projected savings		

- p. 43: A modest increase to 1,499 projects is forecast for Efficiency Manitoba
- p. 46: Table 7: Electric Savings, Budget, and Energy Consumption by Sector in 3-Year Plan

<b>Customer segment/category</b>	<b>2020-23 Average</b>		<b>2017/2018</b>
	<b>Savings (%)</b>	<b>Budget (%)</b>	<b>Energy Consumption (%)</b>
Industrial	29%	9%	
Agricultural	1%	1%	60.50%
Commercial	25%	27%	
Residential	37%	21%	
Income Qualified	7%	30%	33.90%
Indigenous	0.30%	2%	
Enabling Strategies	-	8%	-
Overhead	-	3%	-
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

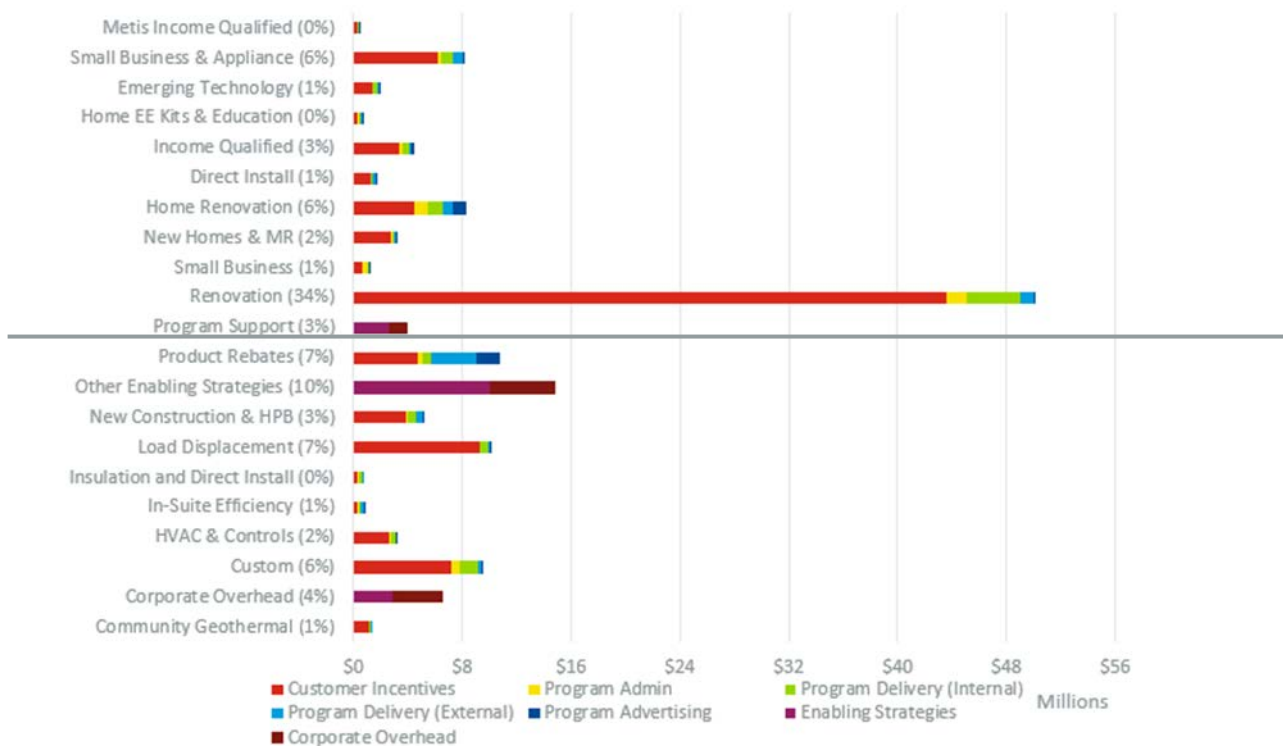
Customer segment/category	2020-23 Average		2017/2018
	Savings (%)	Budget (%)	Energy Consumption (%)
Industrial	39%	20%	66.10%
Agricultural	3%	4%	
Commercial	35%	36%	33.90%
Residential	22%	19%	
Income Qualified	1%	3%	
Indigenous	0.50%	3%	
Enabling Strategies	-	10%	-
Overhead	-	4%	-
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

- p. 52: The Indigenous population has been singled out
- p. 54: Table 9: Electric Savings, Budget and Energy Consumption by Section in 3-Year Plan

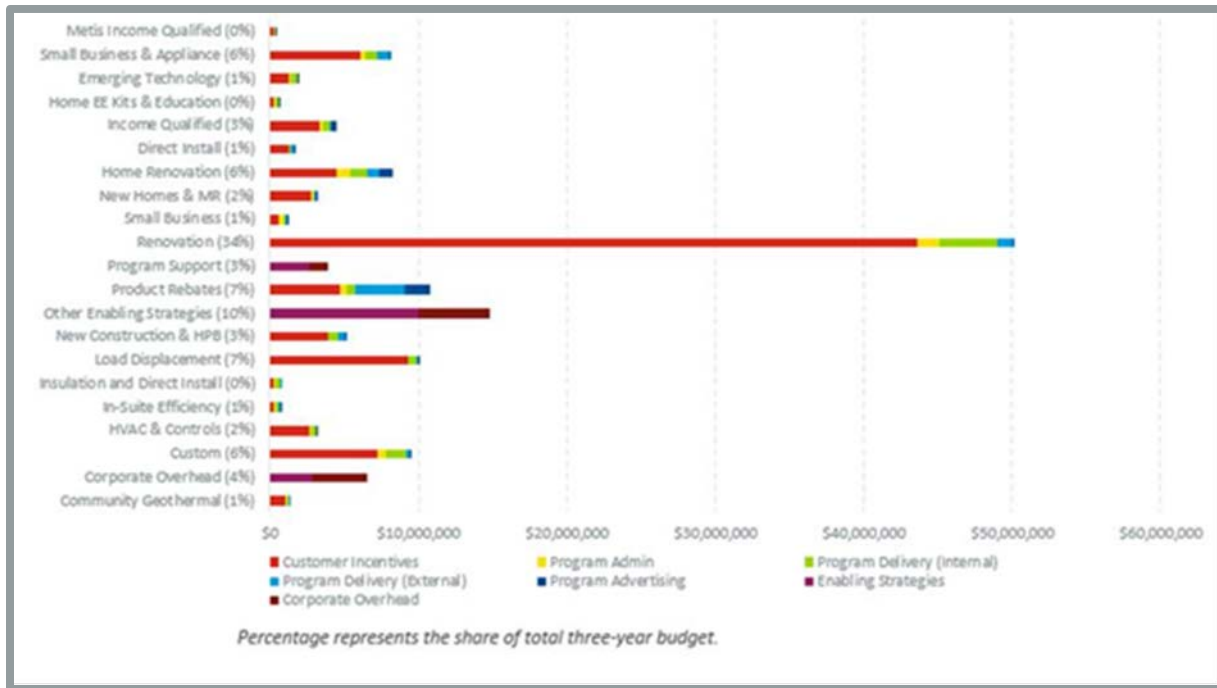


Customer segment/category	2020-23 Average		2017/2018
	Savings (%)	Budget (%)	Energy Consumption (%)
Industrial	39%	20%	66.10%
Agricultural	3%	4%	
Commercial	35%	36%	
Residential	22%	19%	33.90%
Income Qualified	1%	3%	
Indigenous	0.50%	3%	
Enabling Strategies	-	10%	-
Overhead	-	4%	-
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

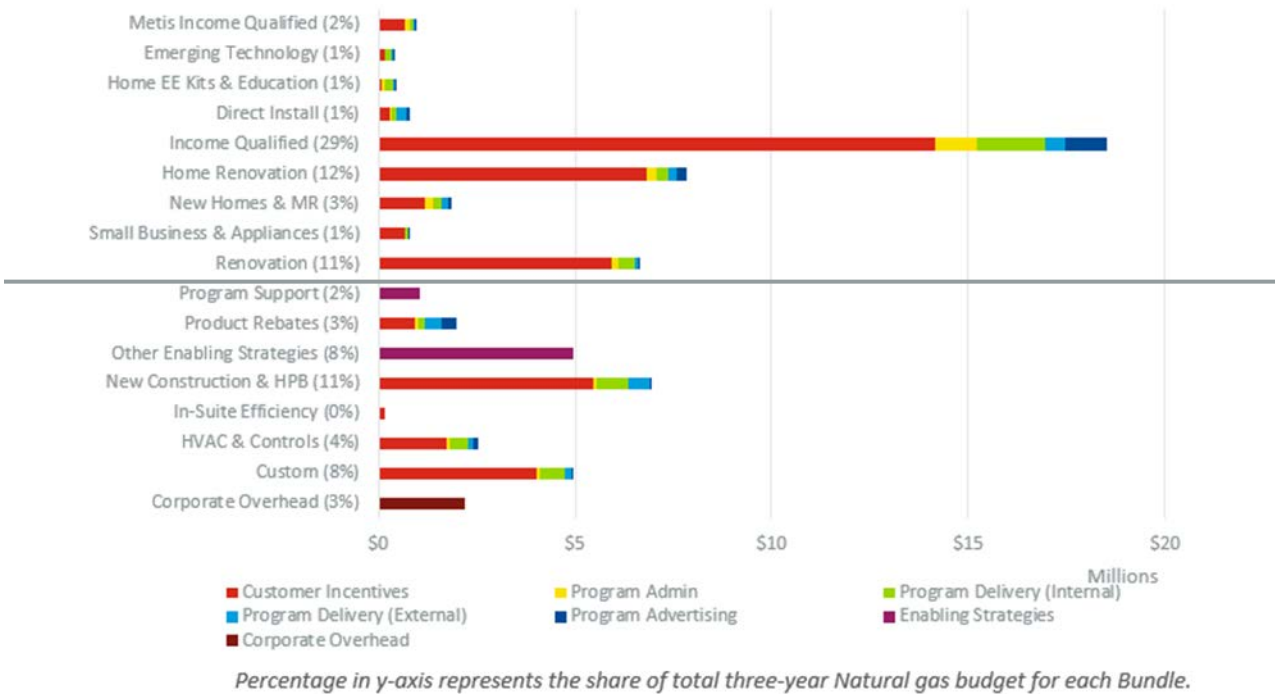
- p. 69: Figure 13: Electric Portfolio Costs

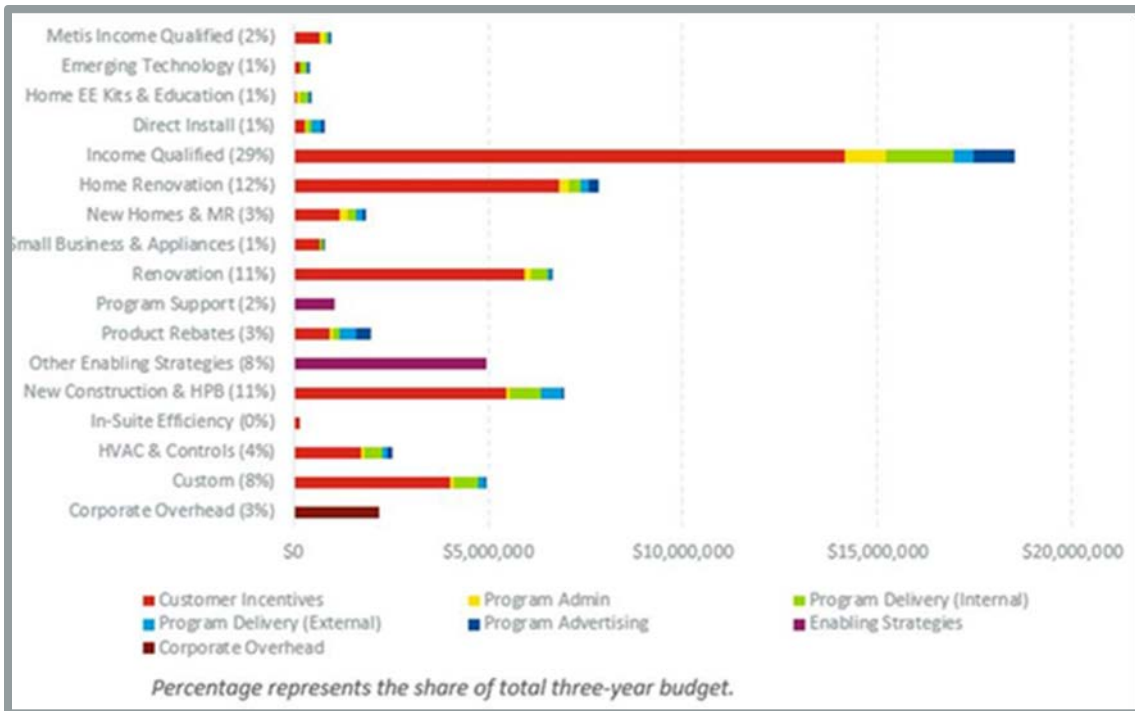


Percentage in y-axis represents the share of total three-year electric budget for each bundle.



• p. 69: Figure 14: Natural Gas Portfolio Costs





- p. 73-74: the measures expected in the plan total 40.42% of projected three-year electric portfolio savings. For the second group of measures (measures with a lifespan of 6-10 years) the percent of total savings is 7.3%, and for the third group (11-15 years), the percent of total savings is 4.639%. The cumulative column shows that these three groups total 93.84% -- that is, it shows that 93.84% of the electric savings project in the Plan come from measures with expected lives of 15 years or less.
- p. 74: PUB/DAYMARK I-7a regarding Table 17: Savings by measure-life strata – electric

Year Range	Total Three-Year Savings (kWh)	Savings as % of Total	Cumulative Savings %
1-5	371,112,450	42%	42%
6-10	27,286,730	3%	45%
11-15	345,589,248	39%	84%
16-20	76,082,351	9%	93%
21-25	42,615,692	5%	98%
26-30	12,264,138	1%	99%
31+	5,767,240	1%	100%
<b>Total</b>	<b>880,717,849</b>		

Year Range	Total Three-Year Savings (kWh)	Savings as % of Total	Cumulative Savings %
1-5	348,505,184	40%	40%
6-10	65,873,774	7%	47%
11-15	400,879,233	46%	93%
16-20	21,957,879	2%	95%
21-25	24,329,811	3%	98%
26-30	13,404,729	2%	99%
31+	5,767,240	1%	100%
<b>Total</b>	<b>880,717,849</b>		

- p. 84: As shown in Error! Reference source not found., As shown in Table 22, the electric portfolio included in 2020-2023 Plan has a PACT ratio of 3.27
- p. 89: Error! Reference source not found. Table 26 shows PACT results with and without considering interactive effects
- p. 94: Table 31 below we show that at the electric portfolio level 47% of the savings come from measures for which the measure cost alone is larger than the benefits. We calculate how removing those measures from the Plan would increase the PACT ratio and the TRC ratio. Similarly, the natural gas portfolio gets 25% of its savings
- p. 94: Table 31: Portfolio-level results after the pure measure value test

Description	Total Three-Year Energy Savings (GWh or million cu m)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios <1
2020-2023 Electric EE Plan	880.1	3.27	2.05	7%
2020-2023 Natural Gas EE Plan	25.7	0.99	1.00	26%

Description	Total Three-Year Energy Savings (GWh or million cu m)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios <1
2020-2023 Electric EE Plan	880.1	3.27	2.05	4%
2020-2023 Natural Gas EE Plan	25.7	0.99	1.00	25%



- p. 95:
  - Emerging Technology
  - New construction & HPB
  - Home renovation
  - HVAC & Controls
  - Direct Install
  - In Suite efficiency
  - Product rebates
- p. 95: Table 32: Bundle-level results after pure measure value test – electric portfolio

DSM Bundle	Total Three-Year Electric Savings (GWh)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios <1
New Homes & MR	10.6	6.56	1.74	0%
Custom	70.6	5.18	1.58	12%
Renovation	309.3	4.97	2.52	2%
Community Geothermal	3.3	4.03	22.26	0%
Load Displacement	330.0	3.72	5.64	0%
Emerging Technology	6.9	2.96	0.56	72%
New Construction & HPB	21.9	2.95	1.19	70%
Home Renovation	15.3	2.90	1.92	37%
HVAC & Controls	10.3	2.81	2.24	-2%
Income Qualified	7.9	2.80	3.46	13%
Metis Income Qualified	0.6	2.58	2.94	12%
In Suite Efficiency	3.0	2.48	3.09	45%
Small Business & Appliance	45.7	2.30	2.40	7%
Insulation and Direct Install	0.8	1.90	2.07	3%
Product Rebates	34.7	1.74	1.24	44%
Home EE Kits & Education	2.5	1.61	3.14	8%
Direct Install	5.7	1.53	1.99	19%
Small Business	1.2	0.57	0.80	-8%
Program Support	-	-	-	-
<b>Total</b>	<b>880.1</b>	<b>3.27</b>	<b>2.05</b>	<b>7%</b>

DSM Bundle	Total Three-Year Electric Savings (GWh)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios < 1
New Homes & MR	10.6	6.56	1.74	0%
Custom	70.6	5.18	1.58	4%
Renovation	309.3	4.97	2.52	0%
Community Geothermal	3.3	4.03	22.26	0%
Load Displacement	330.0	3.72	5.64	0%
Emerging Technology	6.9	2.96	0.56	11%
New Construction & HPB	21.9	2.95	1.19	22%
Home Renovation	15.3	2.90	1.92	91%
HVAC & Controls	10.3	2.81	2.24	41%
Income Qualified	7.9	2.80	3.46	-2%
Metis Income Qualified	0.6	2.58	2.94	18%
In-Suite Efficiency	3.0	2.48	3.09	0%
Small Business & Appliance	45.7	2.30	2.40	0%
Insulation and Direct Install	0.8	1.90	2.07	1%
Product Rebates	34.7	1.74	1.24	9%
Home EE Kits & Education	2.5	1.61	3.14	8%
Direct Install	5.7	1.53	1.99	19%
Small Business	1.2	0.57	0.80	-8%
Program Support	-	-	-	-
<b>Total</b>	<b>880.1</b>	<b>3.27</b>	<b>2.05</b>	<b>4%</b>

- p. 96: MIPUG/DAYMARK I-18a regarding Table 33: Bundle-level results after pure measure value test – natural gas portfolio **\*\*has been revised/updated from the IR**

DSM Bundle	Total Three-Year Electric Savings (GWh)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios <1
New Homes & MR	10.6	6.56	1.74	0%
Custom	70.6	5.18	1.58	12%
Renovation	309.3	4.97	2.52	2%
Community Geothermal	3.3	4.03	22.26	0%
Load Displacement	330.0	3.72	5.64	0%
Emerging Technology	6.9	2.96	0.56	72%
New Construction & HPB	21.9	2.95	1.19	70%
Home Renovation	15.3	2.90	1.92	37%
<del>HVAC &amp; Controls</del>	<del>10.3</del>	<del>2.81</del>	<del>2.24</del>	<del>-2%</del>
Income Qualified	7.9	2.80	3.46	13%
Metis Income Qualified	0.6	2.58	2.94	12%
In Suite Efficiency	3.0	2.48	3.09	45%
Small Business & Appliance	45.7	2.30	2.40	7%
Insulation and Direct Install	0.8	1.90	2.07	3%
Product Rebates	34.7	1.74	1.24	44%
Home EE Kits & Education	2.5	1.61	3.14	8%
Direct Install	5.7	1.53	1.99	19%
Small Business	1.2	0.57	0.80	-8%
Program Support	-	-	-	-
<b>Total</b>	<b>880.1</b>	<b>3.27</b>	<b>2.05</b>	<b>7%</b>

*\*\*This was the table used in the MIPUG/DAY I-18a response, has been revised and updated further to following table*

<b>DSM Bundle</b>	<b>Total Three- Year Savings (m3)</b>	<b>PACT Ratio</b>	<b>TRC Ratio</b>	<b>Savings from measures with PMVT ratios &lt;1</b>
Custom	13,348,583	6.51	3.62	3%
In Suite Efficiency	346,736	3.15	4.47	27%
HVAC & Controls	2,268,681	2.59	1.88	5%
Small Business & Appliance	958,599	1.75	6.83	13%
Renovation	3,387,948	1.60	1.84	3%
Home Renovation	2,737,423	1.20	0.79	35%
Emerging Technology	332,286	0.89	0.32	100%
Product Rebates	1,205,670	0.79	0.49	61%
Direct Install	499,384	0.78	1.81	23%
New Homes & MR	401,910	0.72	0.32	100%
New Construction & HPB	2,287,686	0.59	0.37	90%
Income Qualified	3,237,979	0.49	0.92	37%
Metis Income Qualified	157,774	0.44	0.84	33%
Home EE Kits & Education	139,893	0.41	2.97	0%
Program Support	-	-	0.00	0%
Interactive Effects	(5,585,543)	-	-	
<b>Total</b>	<b>25,725,008</b>	<b>0.99</b>	<b>1.0</b>	<b>26%</b>

DSM Bundle	Total Three-Year Savings (m3)	PACT Ratio	TRC Ratio	Savings from measures with PMVT ratios < 1
Custom	13,348,583	6.51	3.62	1%
In Suite Efficiency	346,736	3.15	4.47	27%
HVAC & Controls	2,268,681	2.59	1.88	0%
Small Business & Appliance	958,599	1.75	6.83	13%
Renovation	3,387,948	1.60	1.84	3%
Home Renovation	2,737,423	1.20	0.78	55%
Emerging Technology	332,286	0.89	0.32	100%
Product Rebates	1,205,670	0.79	0.49	61%
Direct Install	499,384	0.78	1.81	23%
New Homes \$ MR	401,910	0.72	0.32	100%
New Construction & HPB	2,287,686	0.59	0.37	71%
Income Qualified	3,237,979	0.49	0.92	38%
Metis Income Qualified	157,774	0.44	0.84	35%
Home EE Kits & Education	139,893	0.41	2.97	0%
Program Support	-	-	0.00	0%
Interactive Effects	(5,585,543)	-	-	
<b>Total</b>	<b>25,725,008</b>	<b>0.99</b>	<b>1.0</b>	<b>25%</b>

- p. 97: the measures expected in the plan total 4042% of projected three-year electric portfolio savings. For the second group of measures (measures with a lifespan of 6-10 years) the percent of total savings is 73%, and for the third group (11-15 years), the percent of total savings is 4639%. The cumulative column shows that these three groups total 9384% -- that is, it shows that 9384% of the electric savings project in the Plan come from measures with expected lives of 15 years or less.
- p. 97: PUB/DAYMARK I-7a regarding Table 34: Savings by measure-life group – electric

Year Range	Total Three-Year Savings (kWh)	Savings as % of Total	Cumulative Savings %
1-5	371,112,450	42%	42%
6-10	27,286,730	3%	45%
11-15	345,589,248	39%	84%
16-20	76,082,351	9%	93%
21-25	42,615,692	5%	98%
26-30	12,264,138	1%	99%
31+	5,767,240	1%	100%
<b>Total</b>	<b>880,717,849</b>		

Year Range	Total Three-Year Savings (kWh)	Savings as % of Total	Cumulative Savings %
1-5	348,505,184	40%	40%
6-10	65,873,774	7%	47%
11-15	400,879,233	46%	93%
16-20	21,957,879	2%	95%
21-25	24,329,811	3%	98%
26-30	13,404,729	2%	99%
31+	5,767,240	1%	100%
<b>Total</b>	<b>880,717,849</b>		

- p. 101: Table 39 and Table 39 show the LRI measures for the entire electric and natural gas portfolios respectively
- p. 102: from the current average base rates for electric and natural gas portfolios as shown in Table 39 and Table 39.
- p. 103: the measures expected in the plan total 42% of projected three-year electric portfolio savings. For the second group of measures (measures with a lifespan of 6-10 years) the percent of total savings is 7%, and for the third group (11-15 years), the percent of total savings is 46%. The cumulative column shows that these three groups total 93% -- that is, it shows that 93% of the electric savings project in the Plan come from measures with expected lives of 15 years or less.
- p. 104: PUB/DAYMARK I-7a regarding Table 40: Savings by measure-life group – electric

Year Range	Total Three-Year Savings (kWh)	Savings as % of Total	Cumulative Savings %
1-5	371,112,450	42%	42%
6-10	27,286,730	3%	45%
11-15	345,589,248	39%	84%
16-20	76,082,351	9%	93%
21-25	42,615,692	5%	98%
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<b>Total</b>	<b>880,717,849</b>		

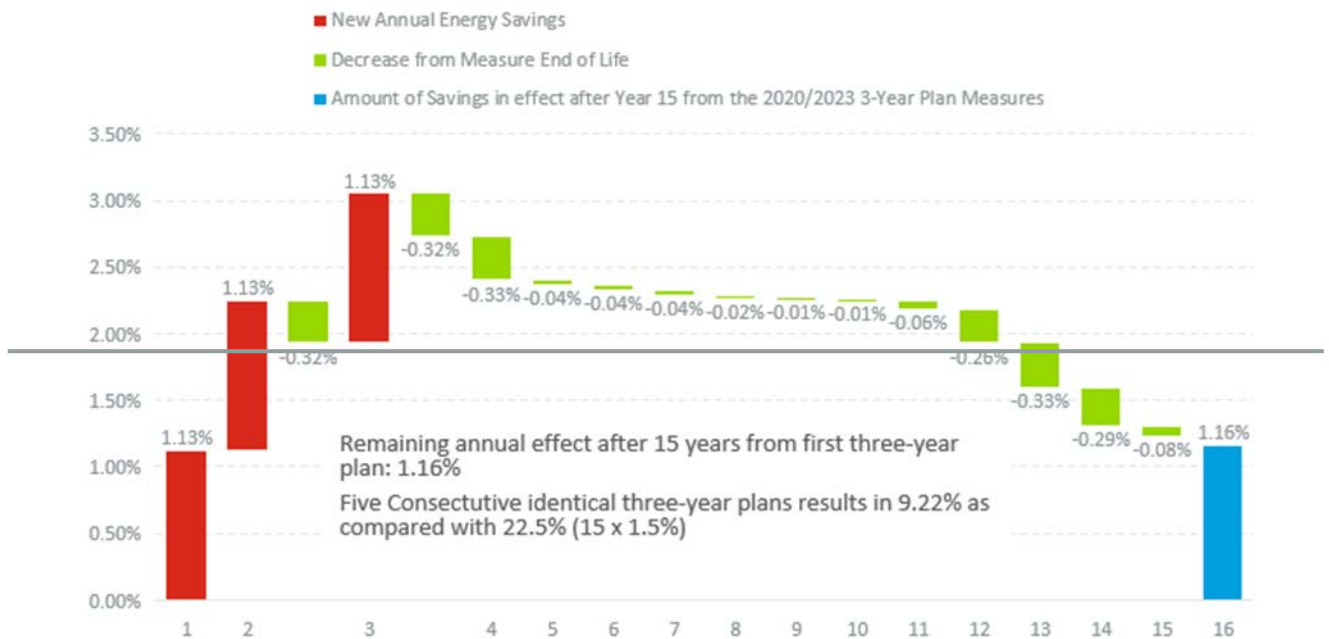
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<b>Total</b>	<b>880,717,849</b>		

- p. 118: Daymark has analyzed the calculation for savings concerns discussed above. We have collected the impact of these savings, and show them on the bar chart below to see if they put delivering the savings at risk.
- p. 119-120: We should discuss interactive effects increasing natural gas uses as electric waste heat increases natural gas usage for heating. We should highlight discussions from the One of the inherent challenges faced by the natural gas program comes from interactive effects with electricity savings—the more efficient lighting becomes, the less waste heat it emits. This can increase the need for natural gas, pushing the natural gas portfolio towards growth. This effect is nothing that can or should be prevented. It is simply important to keep in mind in planning for natural gas savings. As discussed in our Deliverability Section where we see potential risk to below target accomplishments Daymark has analyzed the calculation for savings concerns discussed above. We have collected the impact of them and shown them in the bar chart below section, certain general risks may pose threats to see if they are put delivering the savings at risk The delivery of projected natural gas savings. These include the following items are either open to interpretation as to whether they should be included or have risk of not being delivered to the extent forecasted:
  - Savings that would be reduced if bundle offering were reduced to eliminate measures that might be uneconomic (as discussed in the cost effectiveness section, 32% of natural gas savings to be attributable to uneconomic measures);
  - Savings at deliverability risk due to program design, to the extent that some programs might overlap or seem to overlap, making marketing more difficult;

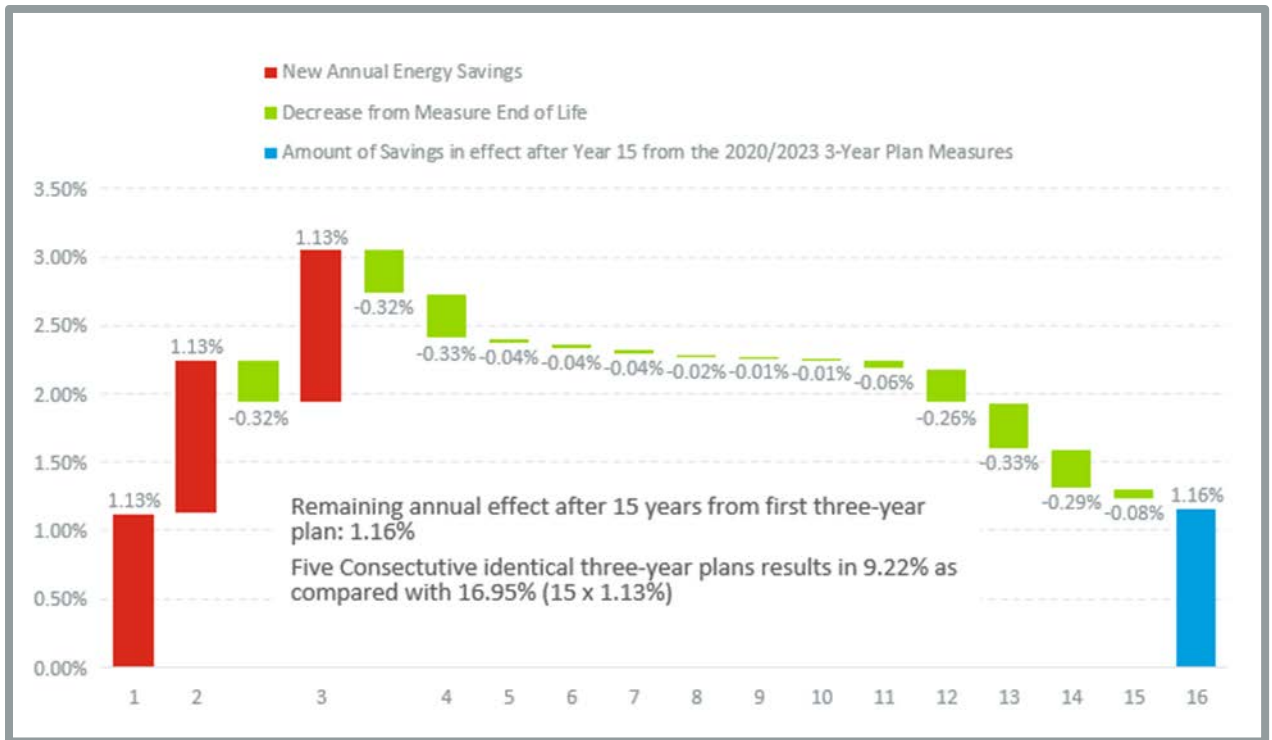
- Savings at deliverability risk due to resource constraints—there is, of course, the fact that natural gas savings in the first year fall a little short of target, but a potentially much more important issue is whether third party contractor relationships will be fully in place in time to deliver programs;
- Savings at deliverability risk due to new start-up or substantially changed delivery approaches from what Manitoba Hydro has been assuming; and
- Savings at risk due to aggressive penetration number assumptions.

Given that natural gas savings is already projected to just barely make targets, these issues, taken together, have the potential to bring actual realized savings significantly below targeted levels.

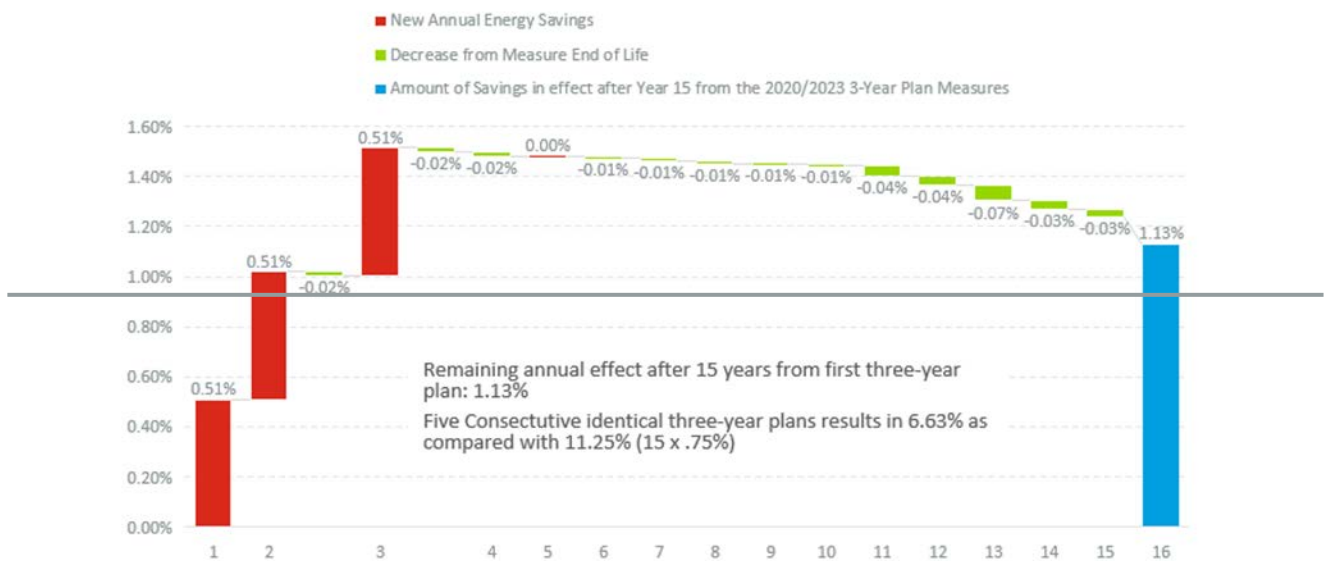
- p. 130: PUB/DAYMARK I-18 regarding Figure 20: Savings in effect after year 15 from electric 2020/23 Plan measures

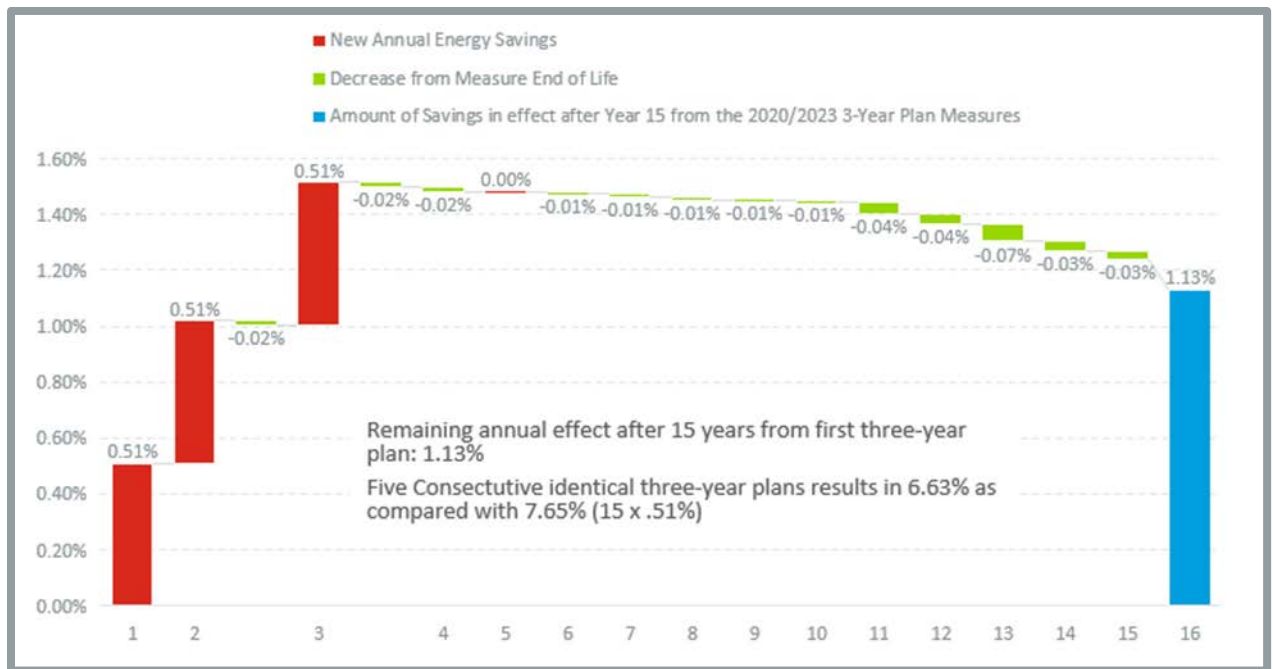






- p. 131: PUB/DAYMARK I-18 regarding Figure 21: Savings in effect after year 15 from natural gas 2020/23 Plan measures





- p. 133: Efficiency Manitoba’s achievement of the savings targets is relying on the establishment of a few compliance coordinators to successfully move codes & standards compliance by the end on this plan from the current estimate of 50% to 100.85%
- p. 134: Efficiency Manitoba has based its cost effectiveness and benefit/cost analysis fit or concerns
- p. 134: Approximately 93.84% of the Electric Portfolio savings comes from measures with lives of 15 years or less, half of that, 40.42%, with lives of 5 years or less
- p. 134: The Efficiency Manitoba LRI metric methodology underestimates for overestimates the rate impact of the natural gas portfolio but to a lesser extent than the electric portfolio

These corrections are only to increase consistency and update issues due to version control – there have been no updates in the analysis or Daymark Energy Advisors’ findings.