THE BRETON LAW GROUP

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File No. 41736-72

February 28, 2019

Nova Scotia Utility & Review Board
PO Box 1692, Unit "M"
Halifax, Nova Scotia
B3J 3S3

Attention: Doreen Friis, Regulatory Affairs Officer / Clerk

Dear Ms. Friis:

Re: 2020-2022 DSM Resource Plan and Supply Agreement

This letter is an accompaniment to EfficiencyOne's filing before the Nova Scotia Utility and Review Board ("Board"), seeking approval of a form of Supply Agreement for Electricity Efficiency and Conservation Activities between EfficiencyOne and Nova Scotia Power Inc. (the "Parties"), the establishment of a final agreement between the Parties setting out Performance Targets for the period 2020-2022, including approval of EfficiencyOne's proposed DSM Resource Plan and a proposed new lifetime energy savings Performance Target.

EfficiencyOne is pleased to submit the following in support of its Application for Approval of the 2020-2022 DSM Resource Plan:

- Notice of Application

- Evidence on behalf of EfficiencyOne, which includes:
    a. Appendix A: 2020-2022 DSM Plan;
    b. Appendix B: Forward Looking Rate & Bill Impact Analysis;
    c. Appendix C: Alternate Scenario;
    d. Appendix D: Direct Testimony of Dr. David Hill;
    e. Appendix E: Direct Testimony of Glenn Reed;
    f. Appendix F: HST Allocation Tables;
    g. Appendix G: Proposed form of 2020-2022 Supply Agreement; and
    h. Appendix H: eTRM Presentation.

EfficienyOne requests approval to file the following documents, which form part of the Appendices above, in electronic form only as they are in the nature of Excel Models:

- Appendix A, Technical Tables;
- Appendix B, rate impact models for both Preferred Plan and Alternate Scenario
- Appendix F, HST refund by rate class values

EfficiencyOne's Annual Progress Report and Evaluation Reports will be filed on or before March 31, 2019, subsequent to receipt of the evaluation reports, anticipated by EfficiencyOne by mid-March.

In accordance with Section 79 of the *Public Utilities Act,* EfficiencyOne and NS Power entered into negotiations aimed at reaching an agreement (the "DSM Supply Agreement") through which EfficiencyOne would provide NS Power with electricity efficiency and conservation activities ("EECA") in accordance with the *Electricity Efficiency and Conservation Restructuring (2014) Act* ("Act") for the 2020-2022 term. The proposed DSM Supply Agreement included with this filing substantially conforms with agreements reached between EfficiencyOne and NS Power for the 2016-2018 and 2019 terms, updated to reflect both the proposed new Performance Target of lifetime energy savings and related reporting requirements of the recently adopted Standardized Filing Framework.

It is a commercial agreement governing the relationship between the parties and manner in which EECA will be provided by EfficiencyOne to NS Power. It incorporates the requirements of the Act which provide that the Agreement:

(a) Not be terminable or terminated unless the franchise holder's franchise is terminated or the termination is approved by the Board;
(b) Describe the EECA that the franchise holder will provide to NSPI; and
(c) Identify the amount that NS Power will pay to the franchise holder for the supply of EECA.

Consistent with the reporting requirements adopted through the Standardized Filing Framework, EfficiencyOne confirms it will report quarterly (among other factors) on performance indicators by program and rate class with respect to the Performance Indicators set out in Schedule C to the Supply Agreement including:

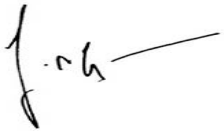
- Annual incremental energy savings (reported by program and rate class);
- Cumulative annual energy savings (reported by program and rate class);
- Annual lifetime energy savings (reported by program and rate class);
- Annual incremental system-peak demand savings (reported by program and rate class);
- Cumulative annual system-peak demand savings (reported by program and rate class);
- Total ratepayer benefits;
- Total spending (reported by program and rate class);
- Customer satisfaction;
- An analysis of the impact on rates through the implementation of the programs; and

- Reporting on low-income program participation, expenditures, and savings through a variety of methods, including estimation based on geographic census information.

In accordance with the direction of the Board arising from the 2016-2018 DSM Plan regulatory proceeding, EfficiencyOne has also included an Alternate Scenario for review and consideration in this proceeding.

Yours very truly,

THE BRETON LAW GROUP



James R. Gogan

cc. Bruce Outhouse, Q.C., Board Counsel
Brian Curry, NSPI Counsel
Stephen MacDonald, Efficiency One
John Aguinaga, EfficiencyOne
Gina Thompson, EfficiencyOne
Kate McDonald, EfficiencyOne

NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF: *The Public Utilities Act, R.S.N.S. 1989, c. 380* as amended

- and -

IN THE MATTER OF: An Application by EfficiencyOne for Approval of Supply Agreement for Electricity Efficiency and Conservation Activities between EfficiencyOne and Nova Scotia Power Inc., the establishment of a final agreement between the parties, and approval of a 2020 - 2022 Demand Side Management ("DSM") Resource Plan

NOTICE OF APPLICATION

TO: The Nova Scotia Utility and Review Board ("UARB" or "the Board")

1. EfficiencyOne is the holder of the Franchise issued by the Minister of Energy on November 28, 2014 effective January 1, 2015, to provide electricity efficiency and conservation activities to Nova Scotia Power Inc ("NS Power").

2. Pursuant to section 79J of the *Public Utilities Act*, EfficiencyOne, as the franchise holder, is required to enter in an agreement for a term of three (3) years with NS Power for the supply of electricity efficiency and conservation activities ("Supply Agreement"), which agreement is subject to approval of the Board pursuant to section 79L of the *Public Utilities Act.*

3. There is currently in place a Supply Agreement between EfficiencyOne and NS Power for the year 2019.

4. EfficiencyOne makes this Application to the Board, pursuant to the *Public Utilities Act* for the approval of a final Supply Agreement between EfficiencyOne and NS Power for a three year term for the calendar years 2020, 2021 and 2022, on such terms as the Board considers appropriate.

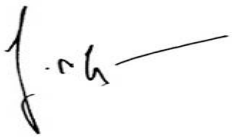
5. In support of this Application is filed the Evidence of EfficiencyOne, which includes Appendices A through H containing additional materials supporting the Application.

6. On the Evidence filed in support of this Application, EfficiencyOne asserts that the Order sought by the Application is in the Public Interest.

7. EfficiencyOne therefore seeks an Order finalizing and approving a Supply Agreement between EfficiencyOne and NS Power, approving a 2020 – 2022 Demand Side Management resource plan, and the inclusion of a Lifetime Energy Savings Performance Target.

Dated this 28th day of February 2019.

EFFICIENCYONE



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Per: James R. Gogan, EfficiencyOne Counsel

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EfficiencyOne

IN THE MATTER OF The Public Utilities Act, R.S.N.S. 1989, c.380, as amended.

- and -

IN THE MATTER OF An Application by EfficiencyOne for Approval of the 2020-2022 Supply Agreement for Electricity Efficiency and Conservation Activities between EfficiencyOne and Nova Scotia Power Inc., the establishment of a final agreement between the parties, and approval of a 2020-2022 Demand Side Management (DSM) Resource Plan.

Application of EfficiencyOne as Holder of the Efficiency Nova Scotia Franchise

FILED
February 28, 2019

Evidence

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1. INTRODUCTION

1.1 Approval of Preferred Plan

EfficiencyOne requests approval by the Nova Scotia Utility and Review Board (the "Board"), of its Preferred DSM Plan for the term 2020 through 2022 (the "Preferred Plan"), which is attached hereto as Appendix "A".

The Preferred Plan is the DSM Plan which will provide the best value to Nova Scotians by delivering the most energy and demand savings at an affordable price and within a balanced portfolio over the 2020-2022 term.

The Preferred Plan will deliver approximately 141 GWh of affordable incremental, first-year energy savings to Nova Scotians during each year of its operation. It builds on the historic success of energy efficiency programs and establishes new initiatives and enhanced service offerings to achieve greater energy and demand savings from 2020 through 2022.

1.2 Approval of Supply Agreement with NS Power

EfficiencyOne also requests the Board's approval of its form of Supply Agreement with Nova Scotia Power Inc. ("NS Power"). The operating terms and conditions of the Supply Agreement are substantially consistent with the Supply Agreements approved by the Board for both the 2016 – 2018 and 2019 DSM Plans, with the exception of the addition of an additional Performance Target – lifetime energy savings - together with revised reporting requirements, which have been updated to reflect the requirements of the Standardized Filing Framework

1.3 Approval of Lifetime Energy Savings Performance Target

EfficiencyOne further requests the Board's approval to implement a new Performance Target: Lifetime Energy Savings.

EfficiencyOne proposes this target be included as a measure of its DSM performance, together with established targets of cumulative-annual (over 2020-2022), net, at generator energy savings, and system -peak demand savings. These three Performance Targets measure a DSM Plan's direct achievements for electricity ratepayers. While cumulative annual net energy and cumulative annual net system-peak demand savings provide useful information on the annual level of first-year energy and capacity savings as a result of a measure, Lifetime Energy Savings demonstrates the savings provided over the effective useful lifetime of a particular measure. While measures may have identical annual energy savings, they may have significantly different Lifetime Energy Savings. Ratepayers should be aware of these differences. Introduction of Lifetime Energy Savings as a Performance Target will ensure this performance metric continues to be a factor in DSM planning in future.

1.4 Good Faith Negotiations

EfficiencyOne and NS Power have engaged in negotiations aimed at reaching general agreement with respect to the level of energy savings and investment for the 2020-2022 DSM Plan. Despite these good faith efforts, the parties were unable to reach agreement in advance of this filing. Accordingly, EfficiencyOne respectfully presents this evidence to demonstrate that the Preferred Plan will provide the best value to Nova Scotians over the next three-year term.

2. BACKGROUND

A brief review of contextual factors aiding the development of the Preferred Plan is provided below.

2.1 Public Utilities Act

EfficiencyOne is the current holder of Nova Scotia's electricity efficiency and conservation franchise, making it a public utility in relation to its franchise activities.[1]

As the franchise holder, EfficiencyOne has the exclusive right to supply NS Power with "reasonably available, cost-effective electricity efficiency and conservation activities".[2] The *Public Utilities Act*, RSNS 1989, c 380, ("*PUA*") requires that NS Power "undertake cost-effective electricity efficiency and conservation activities that are reasonably available in an effort to reduce costs for its customers".[3]

The *PUA* requires EfficiencyOne and NS Power to enter into an agreement describing the electricity and conservation activities that EfficiencyOne will provide to NS Power over a term of three years.[4] In the event that EfficiencyOne and NS Power are unable to finalize an agreement, the *PUA* authorizes the Board to establish and finalize an agreement on terms it considers appropriate and in the best interests of NS Power's customers.[5]

[1] *Public Utilities Act*, RSNS 1989, c 380, at s. 79G(2) [*PUA*].
[2] *Ibid* at s 79G(2).
[3] *Ibid* at s. 79I(1).
[4] *Ibid* at s 79J.
[5] Ibid at s 79J and 79L

2.2 Nova Scotia's Energy Strategy and Electricity Plan

Energy efficiency is a key component of Nova Scotia's Energy Strategy. This Strategy emphasizes the importance of energy efficiency in minimizing the costs of meeting future demand requirements.[6] Investments in efficiency will help provide longer-term electricity price stability.[7]

Nova Scotia's Electricity Efficiency and Conservation Plan emphasizes the financial benefits of electricity efficiency initiatives for ratepayers.[8] Reducing electricity consumption also helps keep electricity rates stable. The Electricity Efficiency and Conservation Plan recognizes that saving electricity is cheaper than producing electricity and delays or avoids the longer-term need to build new electricity generation infrastructure.

Energy efficiency is also a key component of Nova Scotia's Electricity Plan for 2015-2040, in which the government noted the importance of increasing Nova Scotia's electricity efficiency, and the cost savings generated by these initiatives.[9]

This comes at a time when household perception of the importance of reducing energy use is at an all-time high in Nova Scotia. In the fourth quarter of 2018, 87 percent of Nova Scotians placed a high level of importance on reducing household energy use.[10]

[6] Nova Scotia Department of Energy, "*Toward a Greener Future: Nova Scotia's 2009 Energy Strategy*", online: Nova Scotia Department of Energy and Mines <https://energy.novascotia.ca/sites/default/files/Energy-Strategy-2009.pdf> at page 11.
[7] Government of Nova Scotia, "*Using Less Energy: Nova Scotia's Electricity Efficiency and Conservation Plan*", online: Nova Scotia Department of Energy and Minds < https://energy.novascotia.ca/resources-and-publications/document-database#results> at p 11.
[8] Government of Nova Scotia, "*Using Less Energy: Nova Scotia's Electricity Efficiency and Conservation Plan*", online: Nova Scotia Department of Energy and Minds, p.3 < https://energy.novascotia.ca/resources-and-publications/document-database#results>.
[9] Government of Nova Scotia, "*Our Electricity Future: Nova Scotia's Electricity Plan 2015-2040*", online: Nova Scotia Department of Energy and Mines <https://energy.novascotia.ca/sites/default/files/Our-Electricity-Future.pdf> at p 18.
[10] Corporate Research Associates, "Autumn 2018 Atlantic Quarterly"

Approval of the Preferred Plan is key to ensuring Nova Scotia's goals in relation to electricity efficiency can be achieved and addresses the high level of importance Nova Scotians place on reducing household energy use.

2.3 Standardized Filing Framework

This Application adopts the Standardized Filing Framework, intended to ensure consistent content in DSM Plan filings, which was developed in consultation among EfficiencyOne, NS Power, and stakeholders, and filed with the Board in a Consensus Agreement on July 20, 2016. [11]

The framework outlines required content, including standard DSM information items, and one or more alternate scenarios of DSM savings and budgets. It also establishes DSM standards, including overall DSM planning and evaluation processes, and identifies objectives for pursuing DSM activities.

The Standardized Filing Framework directs that the Preferred Resource Plan identified in Nova Scotia Power's Integrated Resource Plan ("IRP") will serve to inform the development of a preferred DSM Resource Plan by EfficiencyOne. EfficiencyOne's Preferred Plan does exactly that.

The Standardized Filing Framework also provides that DSM Plans will balance multiple aspects of DSM for the benefit of customers and establishes a "balanced plan approach" to guide the development of DSM Plans.

The Preferred Plan is presented in accordance with the Standardized Filing Framework.

[11] Filed with the Board July 20, 2016.

3. PREFERRED DSM PLAN

3.1 Summary

The Preferred Plan sets out the level of energy and demand savings which will provide the best value for Nova Scotians at an affordable investment level while delivering a carefully balanced portfolio that has been developed through EfficiencyOne's expertise and DSM market knowledge.

The Preferred Plan focuses on program enhancements as well as new initiatives that: increase accessibility of programs to underserved markets; remove barriers to participation; and achieve a greater degree of energy savings from non-lighting measures.

The Preferred Plan will produce incremental, first-year energy savings approximating 141 GWh per year over the three- year plan period. The Preferred Plan will require an investment of approximately $43 million per year, as shown in Table 1 below.

Table 1: 2020-2022 Preferred Plan Performance Metrics

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Weighted-Average Measure Life (years)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	41.9	195.6	140.2	1,967.9	14.0	38.7	1.9	4.7
2021	43.3	208.7	141.3	2,014.5	14.3	40.3	1.9	4.8
2022	43.9	218.4	140.2	2,013.9	14.4	41.1	2.0	5.0
Total	**129.1**	**622.7**	**421.7**	**5,996.3**	**14.2**	**120.1**	**2.0**	**4.8**

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Portfolio total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

3.2 Highlights of the Preferred Plan

Highlights of the Preferred Plan include:

- First-Year energy savings = 1.3 percent of electricity generation;
- Cumulative net lifetime CO_2 reductions = 3,180 MT[12];
- Lifetime unit cost = $0.022/kWh;
- Weighted average measure life = 14.2 years;
- Net system benefits = $493.6 million[13]; and
- Percentage of non-lighting energy savings over historical levels = +55 percent.

3.3 Key Considerations that informed the Preferred Plan

EfficiencyOne was guided by three key considerations in developing the Preferred Plan:

- Maximizing Energy Savings (customer value);
- Ensuring a Balanced Portfolio (customer need); and
- Establishing an Appropriate Investment Level (customer affordability).

The level of energy savings in the Preferred Plan was informed by the 2014 IRP and reinforced by trends in leading jurisdictions both of which demonstrated that Nova Scotia is not operating at the optimal level of DSM for ratepayers. The Preferred Plan moves directionally closer to the level of DSM in the 2014 IRP Preferred Resource Plan by taking a responsible step forward, moving from 1.2 to 1.3 percent annual energy savings as compared to annual generation. This results in a level of energy savings of approximately 141 GWh per year for each of the three years in the plan period. The cost to deliver these savings while balancing the portfolio is an average of $43 million annually for 2020 to 2022.

[12] Estimates are based on current electricity emissions intensity and reductions in emissions intensity in accordance with Nova Scotia Greenhouse Gas Emissions Regulations emissions caps, §4 (1)
[13] $622.7 million of lifetime benefits - $129.1 million of DSM investment = $493.6 million of net benefit

Each of these considerations is discussed in further detail below.

4. DETERMINING THE APPROPRIATE LEVEL OF ENERGY SAVINGS

Energy savings of approximately 141 GWh per year, over the 3-year DSM Plan period is the appropriate level of energy savings in Nova Scotia to pursue in the 2020–2022 term. This level of energy savings was determined based on the following factors:

- 2014 Integrated Resource Plan (Preferred Resource Plan);
- industry trends and historical achievement;
- other considerations:
  - DSM Supply Sector capacity; and
  - 2018 Load Forecast.

The impact and effect of each of these factors in determining the appropriate level of energy savings is discussed below.

4.1 The 2014 Integrated Resource Plan

4.1.1 Why Rely upon the 2014 IRP in determining the appropriate level of energy savings to pursue in the 2020-2022 DSM Plan?

NS Power's current Integrated Resource Plan (the "2014 IRP"), and the DSM level identified in the 2014 IRP Preferred Resource Plan, are essential inputs to the development of a DSM Plan.[14]

Integrated Resource Plans now form the industry standard when considering both demand-side management (to reduce electricity demand) and supply-side management (to redistribute or add types of generation among fuel types, locations, etc.). The

[14] June 30, 2016 Consensus Agreement

planning process is used to evaluate the optimal mix of utility resources and options.

The 2014 IRP is the result of an extensive and collaborative process with stakeholders and Board consultants.

In 2013, the Board ordered an update to the 2009 IRP, noting significant changes which occurred after the 2009 IRP was developed, including greater clarity around emissions compliance plans, seasonal operation of the Lingan generating plant, introduction of a large biomass generation plant, higher renewable energy targets, additional large and small independent power producer facilities, multi-year DSM programs and the proposed Maritime Link project.

The regulatory and consultative process used to develop the 2014 IRP took place from 2013 through 2014, spanning almost a year. This process included the participation of industry stakeholders and interested parties, including expert consultant engagement. As a result of this collaborative and in-depth process, the 2014 IRP represents the most recent and rigorously tested data available in identifying the lowest cost long-term revenue requirements from electricity ratepayers with respect to energy efficiency and conservation activities in Nova Scotia. This data must therefore be considered as the road map for utility planning and as the seminal tool available to assess demand side opportunities to deliver the lowest cost electricity to Nova Scotians.

The 2014 IRP forms the foundation of NS Power's long-term planning and investment decisions. It uses supply-side and demand-side options to determine the most cost-effective blend of energy resources to allow NS Power to meet electricity demand over the 25-year IRP planning period from 2015-2040.[15]

[15] M05522 2014 IRP Update

One of the core inputs for the 2014 IRP is the DSM Potential Study, developed by Navigant. The DSM Potential Study set out the achievable energy savings potential in Nova Scotia (i.e., how much DSM Nova Scotia can feasibly achieve).[16]

One of the core outputs of the 2014 IRP was the Preferred Resource Plan, which identified the mid-level of DSM as the optimal level that Nova Scotia should invest in to achieve the lowest long-term cost of electricity ("Mid-Level DSM"). This Mid-Level DSM is considered "optimal" from the perspective that it sets out the level of energy and demand savings that can provide the lowest long-term electricity costs for Nova Scotians.

In the course of the 2014 IRP process, Board Consultant Synapse identified the Mid-Level -DSM scenario as part of the least-cost utility resource plan over the planning period (2015-2039) based on the net present value of NS Power revenue requirements.[17]

The Board confirmed the importance and relevance of the IRP Preferred Resource Plan when it directed NS Power to file it together with the IRP in 2014. In correspondence to NS Power in the course of the 2014 IRP process, the Board stated:

> The value in conducting a long term IRP exercise is its ability to consider the potential impact of all decisions both to add capital and to add DSM over the longer term. The reference to test that in future decisions is the Preferred Resource Plan. Without a Preferred Resource Plan against which to test decisions, there is a risk uneconomic decisions may be made. That is the whole point of the exercise. NSPI, in its IRP Report, cites as concerns affordability and nearterm rate impacts. Those are important and legitimate concerns for all ratepayers and for the Board. These concerns will be dealt with as part of both the DSM and general ratemaking processes and parties

[16] M05522, Navigant: *Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study*, January 7, 2015, Exhibit N-1

[17] M05522, Synapse Energy Economics, *Key Planning Observations and Action Plan Elements*, Exhibit N-7

will be heard on those points.[18]

NS Power ultimately filed Mid-Level DSM as its Preferred Resource Plan (Synapse model). This was modelled as the lowest cost plan over the 25-year planning horizon.[19]

In its Decision approving the 2016 – 2018 DSM Resource Plan, the Board acknowledged that it is in the best interest of ratepayers that they be provided a reasonable opportunity to achieve the overall long-term cost savings identified in the IRP.[20]

The *PUA* requires the filing of three-year DSM Plans.[21] The IRP is a long-term outlook used to inform short term planning; ensuring energy efficiency initiatives are responsive to industry changes on a regular basis while meeting long term planning needs. In establishing this three-year time horizon, the *PUA* also ensures that DSM Plans are approved in durations that react to changes to the electricity utility's supply and demand realities such as industry and market-related changes. Until such time as an updated IRP has been vetted by stakeholders and approved by the Board, the 2014 IRP forms the best verified data upon which DSM investment decisions can, and should, be made.

NS Power has been directed to file a new IRP in mid-July 2020, after the 2020 – 2022 DSM Plan has been approved by the Board and program delivery commences. By the time the next IRP is filed, and progresses through the regulatory process for approval, planning for the 2023-2025 DSM Plan will have begun. At that time, the new IRP will form the key planning document for the 2023-2025 DSM Plan.

The 2014 IRP process established that the IRP Preferred Resource Plan should be relied

[18] M05522, November 5, 2014 Board correspondence to NSPI
[19] M05522, December 10, 2014 filing by NSPI re Preferred Resource Plan and Appendix A
[20] M06733, decision and para cite
[21] *Public Utilities Act*, RSNS 1989, c 380, at s. 79J(2) [*PUA*].

upon when developing near term DSM Plans as a resource against which to test decisions regarding DSM initiatives. EfficiencyOne is entitled to, and must, rely upon the 2014 IRP Preferred Resource Plan as the best available data to guide development of its Preferred Plan.

4.1.2 What Role did the 2014 IRP Play in establishing the appropriate level of energy savings in the Preferred Plan?

The level of energy savings identified in the IRP Preferred Resource Plan establishes an objective DSM target which is considered to provide the greatest benefits to Nova Scotians over the long-term planning period.

To provide Nova Scotians with a reasonable opportunity to realize the significant long-term benefits identified by the IRP, the average proposed energy savings level of the Preferred Plan of 141 GWh per year must, at least, move toward the Mid-Level DSM levels. Any annual energy savings targets that remain flat or decline away from this level would be suboptimal and not in the best interest of ratepayers. Suboptimal targets create a risk that uneconomic decisions may be made on DSM expenditures, particularly in the near term. As the Board stated in the 2014 IRP process:

> Without a Preferred Resource Plan against which to test decisions, there is a risk uneconomic decisions may be made.[22]

The energy savings outlined in the Preferred Plan more closely align with the Mid-Level DSM, establishing a level of energy savings that are in the best interest of the ratepayers.

[22] M05522, NSUARB Letter re. IRP filing, November 5, 2014, Document 229821, page 3

4.2 IRP Preferred Resource Plan Trend

4.2.1 Lost DSM Savings Opportunities to Nova Scotians

For the period 2015 through 2019, the average annual Board-approved energy savings target from DSM was 130.9 GWh/year. The approved level of energy savings is below the average Mid-Level DSM savings of 170.0 for each of those years. As a result, Nova Scotia has been falling behind and is left to "catch up" in order to realize the significant benefits associated with optimal level of energy savings through DSM identified by the IRP. Table 2 provides a comparison of first-year energy savings between the optimal Mid-Level of DSM from the 2014 IRP, and the amounts approved by the Board.

Table 2: Comparison of mid-level and Board-approved levels of DSM energy savings

Year	First-Year Energy Savings (GWh)		Variance - GWh	Variance %
	Mid-Level DSM	Board Approved		
2015	164.0	121.2	42.8	26%
2016	171.0	133.1	37.9	22%
2017	177.7	136.5	41.2	23%
2018	170.0	136.3	33.7	20%
2019	167.4	127.2	40.2	24%
Five-year average	**170.0**	**130.9**	**39.1**	**23%**

For each year that DSM investment falls short of the Mid-Level DSM, Nova Scotia ratepayers are left with lost energy saving opportunities, and it becomes less and less likely they will ever realize the full benefits of Mid-Level DSM as set out in the IRP.

EfficiencyOne would have to achieve 181 GWh/year in energy savings for each year from now until 2040, in order for ratepayers to fully achieve the Mid-Level DSM benefits. Now is the time for Nova Scotia to get on a path towards the IRP levels before additional energy savings benefits are lost to Nova Scotians. Unless the energy savings targets in the next 3-year DSM Plan begin to move toward the 2014 IRP levels, there

is little opportunity for Nova Scotians to achieve the full benefits.

4.3 Industry Trends

4.3.1 What Industry Trends aided in the development of the Preferred Plan energy savings and why?

EfficiencyOne considered two important industry trends:

- diversification beyond lighting savings; and
- energy savings as a percentage of electricity generation.

4.3.1.1 Diversification Beyond Lighting Savings

Historically, DSM portfolios across North America have relied heavily upon savings claimed from lighting.[23] This has led to high saturation in this end use of savings[24], and a projected decline in future claimed lighting savings across the industry.[25] Nova Scotia has experienced this decline in savings opportunities in its Residential DSM programs. The Preferred Plan addresses this decline by diversifying its portfolio away from lighting savings and into more robust energy savings measures; this strategy is consistent with industry trends.[26] This diversification necessarily increases the unit cost of delivering DSM activities; this increase in cost is also consistent with industry trends.[27]

4.3.1.2 Energy Savings as a Percentage of Electricity Generation

The American Council for an Energy Efficient Economy ("ACEEE") Annual State

[23] David Hill Direct Evidence February 27, 2019, page 17, lines 3-5.
[24] David Hill Direct Evidence February 27, 2019, page 25, lines 22-25.
[25] David Hill Direct Evidence February 27, 2019, page 8, lines 19- 21.
[26] *supra*
[27] *supra*

Scorecard[28] showed that the leading jurisdictions' investment in energy savings is increasing as a percentage of electricity sales. Their 2018 Scorecard revealed that, on average, the top 10 jurisdictions are achieving annual DSM energy savings at a rate of 2 percent of total annual electricity sales, which is reporting energy at the meter. EfficiencyOne reports achieved energy savings at the generator and therefore presents this as a percentage of electricity generation. However, whether considering energy savings at the meter compared to electricity sales, or energy savings at the generator compared to electricity generation, the ratio is the same.

Despite significant progress and leadership in the area of energy conservation, Nova Scotia's approved annual DSM energy savings levels as a percentage of total electricity generation have been trending downward (now at 1.2 percent); Nova Scotians are being denied "a reasonable opportunity to achieve the overall long-term cost savings identified in the IRP."[29] Table 3 shows the levels of Board-approved DSM energy savings as a percentage of electricity generation.

Table 3: Board-approved first-year energy savings as a percentage of electricity generation

Year	Board Approved (GWh)	% of Electricity Generation
2015	121.2	1.1
2016	133.1	1.2
2017	136.5	1.3
2018	136.3	1.2
2019	127.2	1.1
Five-year average	**130.9**	**1.2**

The Preferred Plan makes a correction to this trend with a modest move from 1.2 percent to 1.3 percent of total annual electricity generation, over the three-year plan period. This effectively resets DSM targets to be, at minimum, directionally moving

[28] https://database.aceee.org/
[29] M06733, Board Decision

toward the IRP's Preferred Resource Plan level. This is a reasonable, and responsible step in the right direction.

This modest increase in proposed energy savings levels recognizes the need to ensure affordability to electricity ratepayers. For this reason, EfficiencyOne is not proposing an immediate "jump" to, what would otherwise be, the IRP driven optimal levels of energy savings over this three-year planning period. By shifting the energy savings trendline toward IRP levels however, Nova Scotians will begin to move closer to achieving this optimal level of energy savings from their DSM investment.

4.4 Other Considerations

In addition to the above factors, EfficiencyOne considered DSM supply sector capacity and NS Power's 2018 Load Forecast in determining the appropriate level of energy savings.

4.4.1 DSM Supply Sector Capacity

Determining the appropriate level of energy savings necessitates a consideration of how much DSM capacity is available in Nova Scotia.

Nova Scotians have benefited from a robust development of the DSM supplier sector. EfficiencyOne is confident that Nova Scotia's energy efficiency sector currently has the capacity to address the responsible increase in DSM from 1.2 percent to 1.3 percent of electricity generation. Therefore, the appropriate level of energy savings can be achieved considering Nova Scotia's current capacity. Any reduction in the level of investment will risk negatively impacting the DSM supply community and potentially resulting in permanent reduced capacity. The DSM supply community operates on a mid to long term planning horizon – it is not a resource that can be turned on or off on a short-term basis.

4.4.2 2018 Load Forecast

NS Power's 2018 load forecast provided an outlook on the energy and peak demand requirements of in-province customers for the 2019 through 2028 period. [30] The load forecast forms the basis for fuel supply planning, investment planning, and overall operating activities of NS Power. It is not intended to inform the appropriate level of DSM.

NS Power relied on IRP Base-Level DSM in its 2018 Load Forecast, which is below the optimal Mid-Level DSM. In developing the Preferred Plan, EfficiencyOne considered this to be the minimal level of energy savings through DSM that NS Power would require in the forecast period to meet its load requirements. This minimum level of 130.5 GWh annually (averaged over the 2020-2022 period) in energy savings is less than the Mid-Level DSM.

[30] M08670, April 20, 2018, Nova Scotia Power Load Forecast Report, Exhibit N-1

5. BALANCED PLAN APPROACH

After determining that 141 GWh/year for 2020 to 2022 provided the best value to Nova Scotians, EfficiencyOne considered how to deliver this level of energy savings in a manner that would best meet the needs of Nova Scotia ratepayers. Consistent with the direction of the Standardized Filing Framework, EfficiencyOne developed a Preferred Plan that followed a balanced portfolio design.

DSM portfolios must be responsive to evolving customer needs, technologies, market conditions and regulatory requirements. Portfolio design is critical to effectively, responsively, equitably and affordably delivering the energy and demand savings identified in the Preferred Plan.

EfficiencyOne has undertaken a balanced portfolio design, aligning with the principles of the "Balanced Plan Approach" outlined in the Standardized Filing Framework. This Balanced Plan Approach directs EfficiencyOne to "produce DSM resource plans that balance multiple aspects of DSM for the benefit of customers".[31] These aspects are:

- short-term and long-term energy avoidance;
- program delivery costs;
- avoided energy and capacity investments;
- non-electric and non-energy benefits;
- diversity of program delivery;
- business relationships and maintenance of market presence;
- access to programs by all market sectors and rate classes by addressing barriers to participation; and
- rate impacts.

[31] M06733, June 20, 2016 Settlement agreement, s. 4.3.1

The application of these principles has resulted in some particularly focused initiatives which are prominent in the Preferred Plan including:

- diversifying beyond savings from lighting;
- improving and providing accessibility for all market sectors and rate classes;
- maintaining business relationships and market presence;
- avoiding capacity investments;
- developing pilots to inform further program offerings in the future;
- balancing higher cost measures through cost management strategies;
- managing Rate and Bill impacts; and
- investing in Enabling Strategies.

5.1 Diversifying Savings Beyond Lighting

5.1.1 How has the lighting transition impacted energy savings in Nova Scotia?

The energy market in Nova Scotia has evolved since initial DSM efforts began in the Province. Efficient lighting initiatives in the Residential sector have been met with great success. Technology has made efficient lighting more readily available and accessible, and EfficiencyOne must plan for more rapid adoption of these technologies which, together with the success of past programs, are transforming Nova Scotia's lighting market.

As a result of this evolution, the market for attributable savings resulting from lighting has declined. This market transformation has been demonstrated in recent program evaluation reports and Nova Scotia residential socket studies. In particular, the Nova Scotia market socket study found that 66 percent of sockets had efficient lighting in 2016, an increase from 50 percent in 2011.[32] Further, claimable energy savings

[32] December 2016. *2016 Socket Study Final Report.* Prepared for Efficiency Nova Scotia.

resulting from the installation of LED lamps in the Residential Efficient Product Rebates program have decreased by approximately 60 percent based on evaluation results since 2016. Accordingly, beginning in 2019, the instant savings program discontinued rebates on all A-series lamps.

This evolution is consistent with industry trends projecting a decline in future attributable lighting savings.[33] While North American DSM portfolios have historically relied upon savings from lighting measures,[34] the volume of savings from lighting will decrease moving forward.[35] For example, energy savings resulting from lighting measures averaged 68 percent of the Efficiency Vermont DSM portfolio from 2010 to 2018 but are anticipated to decrease to 20 percent of the portfolio by 2028[36]. Table 4 presents the percentages of energy savings from lighting measures by program component over the 2015-2017 period.

Table 4: Historical percentages of lighting energy savings within each ENS program component (2015-2017)

Percent of Savings from Lighting				
Program	**Program Component**	**2015**	**2016**	**2017**
BNI	Business Energy Rebates	84%	84%	86%
	Small Business Energy Solutions	87%	73%	80%
	Custom	20%	9%	14%
	Energy Management Information Systems	0%	0%	0%
	Strategic Energy Management	0%	0%	0%
Residential	Appliance Retirement	0%	0%	0%
	Instant Savings	82%	95%	92%
	Efficient Products Installation	65%	64%	69%
	Home Energy Assessment	0%	0%	0%
	Green Heat	0%	0%	0%
	New Home Construction	0%	0%	0%

[33] David Hill Direct Evidence February 27, 2019, page 8, lines 19-21, page 16 lines 4-7, page 28 lines 8-11.
[34] David Hill Direct Evidence February 27, 2019, page 17, lines 3-5.
[35] David Hill Direct Evidence February 27, 2019, page 25, lines 15-16.
[36] David Hill Direct Evidence February 27, 2019, page 16, lines 8-9.

5.1.2 How does the Preferred Plan respond to the decline in savings from lighting?

The Preferred Plan responds to this projected decline in savings by diversifying its program delivery to energy saving measures beyond lighting. In other words, the Preferred Plan reduces its reliance on savings from lighting, a strategy consistent with industry trends.[37]

To achieve this targeted diversification, the Preferred Plan increases funding and support for comprehensive, non-lighting upgrades that achieve deeper[38] energy savings. In particular, the key objective of the Home Energy Assessment program component is to increase energy savings through long-lasting measures such as increasing energy efficient space and water heating systems and increasing insulation. Further, the removal of several lighting products from the Business, Non-Profit and Institutional (BNI) Efficiency Rebates Program in 2019 has allowed this program to place a greater focus on other energy efficient technologies in areas such as heating, compressed air, and agriculture. The Preferred Plan builds on these measures by adopting various products and services in the areas of domestic water heating and space heating equipment (e.g. First Nations Home Energy Efficiency, Residential Efficient Product Installation, Green Heat), and building envelope (e.g. Home Energy Assessments, and drain water heat recovery).

5.1.3 Does diversifying away from lighting increase first-year unit cost?

Yes.

The overall unit cost of the Preferred Plan has increased from an estimated first-year

[37] David Hill Direct Evidence February 27, 2019, page 8, lines 19-21.
[38] Deeper energy savings is defined as providing ENS support to enable customers to complete a wide range of energy efficiency upgrades / efforts, in order to help them maximize cost-effective energy savings per building / facility. In many cases, these efforts will take place over several years

unit cost of $0.23/kWh during the 2016-2018 period, to an approved first-year unit cost of $0.27/kWh in 2019 to the Preferred Plan first-year unit cost of $0.31/kWh for 2020-2022.

Notably, on a year-over-year comparison, adjusting the 2016 – 2018 unit costs for the removal of the lighting measures, which no longer exist in the proposed Preferred Plan, results in an adjusted unit cost for 2016 – 2018 of approximately $0.27/kWh. Table 5 illustrates this effect.

Table 5: Theoretical change in 2016-2018 unit costs after removal of lighting measures not included in 2020-2022 Plan

2016-2018 (2018 not finalized)	First Year Energy Savings (GWh)	First Year Energy Savings (GWh) Lighting Removed	Fully Allocated Spend ($M)	Fully Allocated Spend ($M) Lighting Removed	Fully Allocated Unit Cost ($/kWh)	Fully Allocated Unit Cost ($/kWh) Lighting Removed
Residential	174.4	132.7	40.5	35.4	0.23	0.27
BNI	247.5	180.9	45.6	39.3	0.18	0.22
Enabling Strategies	-	-	9.1	9.1	-	
Total	**421.9**	**313.6**	**95.1**	**83.7**	**0.23**	**0.27**

This increase in unit cost is consistent with the lighting transformation experienced across the industry. Implementing lighting measures is relatively inexpensive. Accordingly, as lighting measures decrease as a percentage of the DSM portfolio, a higher investment is required to achieve the same level of savings.[39] Further, the non-lighting measures are more complex and in order to stimulate the market for these measures, it is expected that higher levels of customer engagement and information sharing will be required.[40] This increased reliance on non-lighting measures for future claimed savings necessitates an increased unit cost, consistent with industry trends.[41]

[39] David Hill Direct Evidence February 27, 2019, page 28, lines 22-23.
[40] David Hill Direct Evidence February 27, 2019, page 28, lines 17-19.
[41] David Hill Direct Evidence February 27, 2019, page 8, lines 19-21.

5.1.4 Is there still room for energy savings from lighting in Nova Scotia?

Yes.

While it will not be possible to sustain the same levels of claimed savings from lighting in the Residential sector, there are still opportunities that remain. Residential socket studies completed in Nova Scotia indicate that there has been a relatively rapid transition to efficient residential lighting, from 50 percent penetration in 2011 to 66 percent in 2016. Reports from other jurisdictions suggest that there is much more potential for additional lighting savings in the commercial and industrial sectors.

The Preferred Plan does not altogether eliminate funding of lighting initiatives. Lighting measures remain in the Residential sector through the Instant Savings and the Efficient Product Installation program components, albeit at reduced levels. Lighting continues to be an important part of the energy savings in the BNI sector where there remain significant opportunities for lighting savings.[42]

The Preferred Plan achieves lighting savings through the following programs:

- Efficient Product Installation (Residential) – free installation of energy efficient lighting measures;
- Efficient Product Rebates – through retailers, distributors and mail-in applications;
- Custom Incentives – in specialized cases; and
- Direct Installation (Small Business Energy Solutions) – rebates on energy efficient lighting upgrades.

[42] David Hill Direct Evidence February 27, 2019, page 17, lines 3-6 and 9-10.

5.2 Improving and Providing Accessibility to all Market Sectors and Rate Classes

5.2.1 What barriers to accessibility are addressed by the Preferred Plan and how?

EfficiencyOne has identified underserved markets and barriers to accessing DSM activities in both the Residential and BNI sectors. The Preferred Plan addresses shortcomings by establishing initiatives and enhancing program design to reach previously underserved markets and remove barriers to improve access to DSM programs.

5.2.1.1 Residential

For residential customers, the Preferred Plan focuses on the barriers of affordability and up-front costs, lack of information and awareness of energy efficient technologies and benefits, lack of time and resources to implement upgrades, lack of trust in free services, competing interests, and split incentives between landlord costs and those of the tenant. The way in which these barriers to participation are addressed by each of the Residential Programs and their individual components are summarized in Table 6 below.

Table 6: Residential barriers to participation and mitigating strategies

Program	Program Component	Brief Description of Program Component	Target Market Segment	Barriers Addressed in Preferred Plan and How
EFFICIENT PRODUCT REBATES	Appliance Retirement	Removal and responsible recycling of old, inefficient appliances and replacement with energy efficient appliances	Residential (renters, homeowners, landlords)	Affordability: financial incentive to customers for each retired appliance, replacement and installation at no cost to qualified low income participants in the HomeWarming Program Awareness & Lack of Information: available across Nova Scotia, marketing through various platforms Short Decision Period: delivery agent manages all aspects of appointment booking, pick-ups, transportation and delivery/decommissioning of appliances Lack of Trust: appliance replacement package provided at a cost to participants
	Instant Savings	Rebate on energy efficient products through participating retail stores	Residential (renters, homeowners)	Affordability & Lack of Trust: rebates provide reduced price Awareness & Lack of Information: available across Nova Scotia; in store ambassadors demonstrate products, educate customers on benefits of energy efficiency; marketing so customers can easily recognize eligible products in-stores; ENS website updates; marketing through various platforms Short Decision Period: delivery agent encourages, and recruits retailors to participate and provides training to retailers on energy efficient products and additional ENS services
EXISTING RESIDENTIAL	Affordable Multi-Family Housing and Non-Profit Organizations Project	Project management support and technical and financial assistance to help building owners implement energy efficiency upgrades	Residential (landlords)	Affordability: focus on helping low income renters and non-profits who provide shelter to reduce utility bills and stabilize rents; financial assistance provided; rebates on implemented upgrades Awareness & Resources: project management support and energy auditors Split Incentive: benefits for landlord and tenants
	Efficient Product Installation	Provision and installation of low-cost energy efficient upgrades at no cost	Residential (renters, homeowners, landlords)	Affordability: no cost to participants Awareness & Resources: qualified installers engage directly with customers during home visit, demonstrating energy efficient products and promoting benefits of energy efficiency and value of more comprehensive upgrades and assessments Split Incentive: benefits for landlord and tenants
	First Nations Home Energy Efficiency	Initial energy assessment of home to identify energy efficient upgrades; implementation of upgrades, including removal and responsible recycling of inefficient appliances and replacement with energy efficient appliances; Final energy assessment	Residential (band-owned homes)	Affordability: no cost to participants Awareness: assessments performed by Natural Resource Canada Registered Energy Advisor who educate and inform customers on upgrades Resources: delivery agent provides complete project management Split Incentive: benefit for landlords and tenants

Program	Program Component	Brief Description of Program Component	Target Market Segment	Barriers Addressed in Preferred Plan and How
	Green Heat	Mail-in rebates (after purchase) and instant rebates (at time of purchase) on heat pumps, biomass space heating equipment, solar thermal products and electric thermal storage (ETS) units	Residential (renters, homeowners, landlords)	Affordability: mail-in and instant rebates provide reduced price; increased financial support for heat pump water heaters and drain water heat recovery Awareness: working directly with residential heating distributors to promote and market Resources: instant rebates in place of mail-in rebates (for some products) Split Incentive: demand reduction measures; benefit for landlords and tenants
	Home Energy Assessment	Customized assessments provide tailored recommendations for energy efficient upgrades	Residential (homeowners, landlords)	Affordability: rebates provide reduced price with instant rebates for qualifying heat pump products; low interest financing; increased financial support for heat pump water heaters and drain water heat recovery Awareness & Resources: assessments performed by Natural Resource Canada Registered Energy Advisor who educate and inform customers on upgrades; instant rebates in place of mail-in rebates (for some products); ENS will work directly with residential heating distributors to promote and market; project management support to participants completing significant upgrades (answering detailed questions, connecting participant to ETN contractors); new EnerGuide Rating System conveys home's performance to participants in meaningful way Split Incentive: benefit for landlords and tenants
NEW RESIDENTIAL	New Home Construction	For those building a new home: access to technical expertise and financial incentives for installing energy efficient upgrades during design and early construction phases	Residential (homeowners, builders)	Upfront Costs: financial incentives based on pre and post construction modelling and the performance of implemented upgrades Lack of Information & Competing Interests: Natural Resource Canada Registered Energy Advisor works with participants to provide tailored upgrade recommendations and educate on cost-effective energy efficient options; new EnerGuide Rating System conveys home's performance to participants in meaningful way; incentives are tiered and increase with increased energy savings

Examples of key improvements and enhancements to increase access to residential energy efficiency programs and services offered by the Preferred Plan include:

- Establishing a new First Nations program component, which was first introduced in 2018 as a pilot, to deliver comprehensive electrical energy savings to homes in First Nation communities.
- Establishing a new Affordable Multi-Family Housing program component, which was first introduced as a Pilot in 2016, to provide energy audits and energy-efficient upgrades for low-income housing units. This program component has been designed to help low income renters realize the benefits of energy efficiency. Historically, this market has had low participation levels.
- Additional project management support (via an Energy Advocate) for participants in the Home Energy Assessment (HEA) program component.

The Preferred Plan enhances programs that provide both financial and technical assistance to ratepayers. This increased focus on overcoming barriers of accessibility, forms part of the balanced portfolio approach. These services come at a higher unit cost as a result of the design approach to overcome barriers (e.g. facilitated support for Affordable Multi-family Housing) which increases the overall unit cost of the portfolio.

5.2.1.2 BNI

For business, non-profit and institutional customers, the Preferred Plan focuses on the barriers of affordability and upfront costs, internal competition for capital, short payback periods, lack of resources and lack of information and awareness of energy efficient technologies and benefits. The Preferred Plan addresses these barriers in the manner set out in Table 7, below.

Table 7: BNI barriers to participation and mitigating strategies

Program	Program Component	Brief Description of Program Component	Target Market Segment	Barriers Addressed in Preferred Plan and How
CUSTOM INCENTIVES	Custom	Customized incentives for retrofits and new construction opportunities based on case specific energy and demand savings	Existing and new construction BNI facilities	Upfront Costs, Internal Competition for Capital & Payback Periods: • financial incentives for: o initial scoping and feasibility studies to evaluate energy savings opportunities; and o energy modelling of new building designs. • Rebates and financing for implementing cost-effective efficient projects; and • Greater support for demand reduction-focused projects Time & Capacity Constraints: EfficiencyOne staff, partners and third parties identify, define, assess, and implement energy saving opportunities Lack of Participant Internal Commitment and Technical Expertise: financial and/or technical assistance for improvements to compressed air systems, to optimize building performance, and to assess and implement energy management opportunities
	Energy Management Information Systems	Customized incentives for energy management information systems based on case specifics.	Industrial, institutional	Upfront Costs, Internal Competition for Capital & Payback Periods: • financial incentives for: o initial audit, energy management information system implementation plan and installation Lack of Information & Internal Capacity: support provided by EfficiencyOne staff and service providers
	Strategic Energy Management	Technical and financial support for the implementation of energy management policies and processes.	Industrial	Upfront Costs, Internal Competition for Capital & Payback Periods: • subsidized participation costs Lack of Information & Internal Capacity: EfficiencyOne staff and the Service Provider help participants identify energy management opportunities and establish continuous improvement policies and processes
DIRECT INSTALLATION	Small Business Energy Solutions	Technical and financial support and incentives to small businesses for installation of energy efficient and demand reduction equipment	Small businesses	Affordability: free energy assessments to assess upgrade opportunities; prescriptive rebates through self-serve path Awareness & Resources: support provided to customers by Small Business Energy Auditor, including energy assessment to identify upgrade opportunities, and customized measure incentives
EFFICIENT PRODUCT REBATES	Business Energy Rebates	Financial incentives for installation of a variety of high efficiency equipment and demand reduction equipment (instant and mail-in rebates)	Existing and new construction BNI facilities	Upfront Costs & Competing Priorities: rebates provide reduced price Lack of Information & Lack of Internal Capacity: electrical and pumping distributors/partners promote rebates and assist customers in through product expertise and completing mail-in rebate applications

Some of the key improvements and enhancements to increase access to BNI energy efficiency programs and services offered by the Preferred Plan include:

- The Small New Construction service will offer financial and technical assistance to small commercial buildings to improve the energy performance of their new construction projects. These customers have been historically underserved by ENS new construction offerings.
- Helping more small businesses participate in the Small Business Energy Solutions ("SBES") program through the facilitated path rather than the self-directed path; program results show that participants who follow the facilitated path save more energy and achieve greater electricity bill reductions than participants who follow the self-directed path.
- Investing in research and development of pilots leading to future program components that will continue to meet the needs of customers primarily focused on overcoming barriers to participation.

5.3 Maintaining Business Relationships and Maintenance of Market Presence

Maintaining the business relationships and market presence that EfficiencyOne has developed over the years is critical to the continued success of DSM in Nova Scotia. This maintenance ensures that ratepayers obtain the best value for their investment by creating consistent and stable market conditions and encouraging healthy market competition.

The Preferred Plan achieves this important goal by balancing maintenance of existing programs and launching new initiatives.

By maintaining the existing portfolio of programs, the Preferred Plan continues EfficiencyOne's consistent market presence and builds on relationships with, among others, distributors, retailers, contractors, and developers. In particular, the Residential and BNI Program components have quality assurance frameworks that include site

visits and customer satisfaction surveys, which will further develop the relationship with partners. EfficiencyOne also partners with national retail chains and independent retailers to deliver rebates through the Residential Efficient Product Rebates Program. The education and training of contractors and delivery agents is furthered through the Existing Residential Program. The success of the BNI Efficient Products Rebate program depends upon important relationships with electrical and pumping distributors within Nova Scotia to promote instant rebates. The Preferred Plan also maintains the Efficiency Trade Network, which builds industry relationships and provides training and marketing support to industry partners.

The Preferred Plan maintains and furthers EfficiencyOne's market presence by including strong marketing initiatives for both Residential and BNI portfolios. These initiatives include collaborating with retailers to provide in-store demonstrations of energy efficient products by trained energy ambassadors to increase customer engagement (Residential Efficient Product Rebates Program), engaging delivery agents to recruit new retailers and manage relationships with participating retailers (Residential Efficient Product Rebates Program) and engaging with builder and permit offices through outreach, home shows and case studies (New Residential Program).

The Preferred Plan maintains current relationships through existing programs while increasing its market presence through new initiatives, striking the appropriate balance for the benefit of ratepayers.

5.4 Avoided Capacity Investments

2019 is the first year in which avoided cost of capacity from the 2014 IRP is greater than zero. There is now an opportunity to derive value from investing in capacity avoidance. The Preferred Plan addresses this new opportunity by investing in demand reduction initiatives.

Demand reduction activities have a primary objective of reducing system coincident demand through the installation of passive measures (proactive). These measures do not rely on ongoing communication with the electricity utility. This differs from demand response activities which have the primary objective of reducing system coincident peak demand via utility signals to customers and/or associated equipment (reactive).

The Preferred Plan includes demand reduction rather than demand response activities to build experience in demand-focused DSM. EfficiencyOne expects that there could be future potential to build on these early efforts and expand into demand response initiatives.

Demand reduction initiatives help customers reduce their electricity demand, which can in turn reduce NS Power's peak demand. By decreasing NS Power's peak demand, investments in capacity are deferred or avoided. As firm demand continues to grow in Nova Scotia, it becomes increasingly important to invest in demand reduction initiatives that will mitigate associated long-term rate impacts for ratepayers resulting from investments in capacity. These investments in demand reduction also benefit customers directly either by decreasing facility peak demand charges (BNI customers) or providing access to time-of-use rates (residential customers).

The Preferred Plan recognizes the long-term benefits that demand reduction will provide to ratepayers. To be clear, there are no direct energy savings associated with demand reduction, and an increased investment in demand reduction results in a higher first-year energy savings unit cost of the Preferred Plan. However, this investment avoids mid and long-term capacity issues, mitigating long-term rate impacts, which is a real benefit to ratepayers.

The Preferred Plan appropriately balances the dual priorities of achieving energy savings and demand savings by increasing investment in demand reduction initiatives from $1 million in the 2019 pilot to $3.3 million per year over the term of the Preferred

Plan. This investment is expected to reduce demand by 20.7 MW over the term of the 2020-2022 DSM Plan.

The demand reduction savings included in the Preferred Plan build on the 2019 Pilot, which was combined with a locational DSM pilot for the purpose of reducing demand in a specific location. The Preferred Plan increases the growth of demand reduction in both the Existing Residential Program and multiple BNI programs.

Residential

Demand reduction in the Residential sector focuses on installing electric thermal storage (ETS) units and electric storage domestic water heater timers in the Green Heat and Home Energy Assessment program components.

Electric thermal storage systems and domestic water heater timers were selected for demand reduction measures within the Residential sector on the basis of three major considerations. The first consideration relates to the fact that amongst electrically-heated households in Nova Scotia, space and water heating are the two largest electricity end-uses and are typically active loads during system peak in Nova Scotia. This fact allows for the provision of relatively large peak demand savings from these end-uses on a per home basis. Secondly these two measures either capture storage capabilities already present in the home (domestic hot water timers) or add storage capability (ETS) to the home. Demand reduction using technologies that allow for energy storage allows for the provision of demand reduction during system peak periods, without customer inconvenience or discomfort. ETS and DHW timers also allow for a passive demand reduction approach, which does not require ongoing communication with the electricity utility. Further, ETS systems allow residential customers to gain access to Time-of-Use rates, which can provide electricity bill savings.

BNI

Demand reduction initiatives in the BNI sector include rebates for a wide range of electric thermal storage (ETS) units suitable to business customers in the Efficient Product Rebates and Direct Installation programs and incentives for projects that focus exclusively on system peak demand savings in the Custom Incentives program (through direct financial incentives and financing options as well as in the form of support for scoping and feasibility studies).

As with the Residential sector, ETS systems were selected on the basis of their ability to provide passive demand reduction without ongoing communication with the electricity utility, the prominence of space heating as a large end-use of electricity for many BNI customers (and its temperature-dependent load, which generally is high during system peak periods), and its ability to add energy storage to BNI customer premises so that demand reduction can be provided without inconvenience or discomfort with respect to the energy services provided. Within most BNI rate-classes, Customer demand charges may provide additional incentive (beyond ENS incentives) for the installation of these systems.

Accordingly, the Preferred Plan achieves the principle of short term and long-term energy and capacity avoidance by increasing investment for demand reduction initiatives, which will result in a demand reduction of 120.1 MW over the term of the 2020-2022 DSM plan.

5.4.1 Why does the Preferred Plan invest in Enabling Strategies?

Enabling Strategies improve DSM programs and services through innovation, increase education and awareness about DSM programs and services that increase participation and market transformation, and provide the tools to inform energy and cost savings to Nova Scotians. Therefore, each DSM Plan must include investment in enabling

strategies in order for Nova Scotians to meet energy and demand savings targets now and in the future. The Enabling Strategies set out in the Preferred Plan focus on:

- Education and Outreach;
- Development and Research; and
- Other Enabling Strategies (Efficiency Trade Network, Codes and Standards and Regulatory Affairs).

The approach taken with Enabling Strategies builds on the historical focus on this area. It is considered to be a key component of proper DSM program design.

5.4.2 Developing Pilots to Inform Future Program Offerings

EfficiencyOne will undertake new initiatives to test appropriate ways to meet changing market conditions, reach under-served segments of customers, and take advantage of new information and technology. These initiatives include:

- Researching and testing service delivery approaches to encourage dynamic energy management and control at commercial building sites.
- Exploring opportunities to help businesses manage and reduce demand costs – for example, using interval data for large businesses to identify demand reduction opportunities, and promoting building optimization software.
- Exploring net-zero (or near net-zero) options for existing residential.
- Exploring new service delivery approaches for homes and business (e.g., a whole-home/business approach as opposed to a 'program-by-program' approach).
- Researching and testing the use of Advanced Metering Infrastructure (AMI) data and associated technology, in combination with advanced analytics (e.g., machine-learning and artificial intelligence) to:
  - Develop more customized offerings and information to customers based on electricity usage patterns and estimated load shape.
  - Determine potential for costs reduction (e.g., test effectiveness of remote

energy audits; more reliance on usage data for measurement and verification where appropriate).

5.4.3 Balancing Higher Cost Measures through Cost Management Strategies

EfficiencyOne is committed to controlling costs on an ongoing basis, while at the same time meeting Performance Targets. EfficiencyOne has implemented a number of cost management strategies including:

- *Benchmarking* - Ensuring its costs are aligned with other similar industries and organizations and confirms this through market research and market comparisons prepared by third parties.
- *Competitive Procurement* - Following rigorous procurement practices to achieve best value by acquiring goods and services through a competitive approach.
- *Independent Reviews* - Conducting third-party; independent audits and reviews to ensure that the organization's key controls are operating effectively and that the reporting of financial and energy savings results are accurate.
- *Process Improvement* - Taking a strategic approach to process improvement with the implementation of an industry leading methodology to maximize cost effectiveness.

EfficiencyOne is vigilant about cost containment and control. It is keenly aware that it has been entrusted with electricity customers' money. At all points of DSM program development, design and implementation, the issue of cost control is a critical component.

5.4.4 How will the Preferred Plan Impact Rates?

Near term rate impacts are an important consideration in DSM planning. The Rate and

Bill Impact Analysis from the Preferred Plan indicates an average rate impact between 0.8 to 1.7 percent by customer rate class over the study period (2020-2035) of the Preferred Plan.[43] This analysis compares a no DSM scenario (no investment) to the investment level in the Preferred Plan ($129.1 million). This is a relatively minor impact when considered against non-DSM factors, such as fuel cost escalation which is estimated to increase rates by 2.7 percent per year (2020-2035).

While DSM investment is one factor among many that impact NS Power's costs and rates, DSM investment is the only expenditure by NS Power that directly allows customers reduce their power bills. DSM is an investment – not a cost. For each $1.00 invested in DSM, electricity customers receive $4.80 in lifetime benefits. Over the 2020-2022 plan period, the Preferred Plan will deliver $622.7 million in lifetime customer benefits.

The Preferred Plan will offset just under 6,000 GWh of energy production over the lifetime of installed measures, and produce over 120 MW of incremental, system-peak demand reductions.[44] This will reduce the average participant bills by up to 11 percent while producing minimal bill impacts for non-participants[45](0.5 – 1.1 percent). It will also save NS Power's customers over $475 million on their electricity bills.[46]

The Preferred Plan requires NS Power to increase its investment in DSM funding from an average of 2.6 percent in the period of 2015-2018 to within 3 percent of its total annual revenue from ratepayers. This increase of less than one percentage point should not alone be used as justification for a rate increase.

Table 8, below, shows the DSM investments as compared to NS Power's electricity

[43] 2020-2022 Preferred DSM Plan at page 6.
[44] 2020-2022 Preferred DSM Plan at page 6.
[45] 2020-2022 Preferred DSM Plan at page 6.
[46] 2020-2022 Preferred DSM Plan at page 11,

sales or collections from customers from 2015 to 2018.

Table 8: DSM investment as a percentage of annual electric revenues

DSM Investment as a Percentage of Annual Electric Revenues		
Total Electric Revenues (NS Power Audited Financial Statements)		$ million
2015	$	1,389
2016		1,327
2017		1,309
2018		1,412
Total	**$**	**5,437**
Approved DSM Investment		
2015	$	39
2016		33
2017		34
2018		35
Total	**$**	**141**
Approved DSM Spending as Percentage of Annual Revenues (2015 to 2018)		**2.6%**
Estimated Annual Electric Revenues for 2020-2022 - Based on 2018 sales level	$	1,412
DSM Investment level - 2020-2022 Preferred Plan -Average per Year	$	43
2020-2022 DSM Investment as Percentage of Estimated Electric Revenues		**3.0%**

The negligible impact of the Preferred Plan on residential rates is demonstrated in Table 9, below.

Table 9: Impact of $43 million vs. $35 million on a residential customer

Impact of $43 million vs. $35 million on a Residential Customer			
2018 Residential Rate per kWh	$	0.15331	
		Amount	**% of total**
Amount of DSM included in 2018 - $35 million - per kWh	$	0.00383	2.5%[a]
If DSM level was $43 million - per kWh	$	0.00460	3.0%
Impact of $8 million increase from 2018 to Residential Customers - per kWh	**$**	**0.00077**	**0.5%**

[a] Refer to Figure 2: NS Power 2018 operating costs as a percentage of annual electric revenues

Accordingly, while an increase in DSM investment may lead to increased rate pressure, its effect must be considered in the context of all other, and significantly more material, factors which drive rates.

6. APPROPRIATE INVESTMENT LEVEL

The Preferred Plan requires an investment of $43 million per year. In determining this investment level, EfficiencyOne considered the following factors:

- affordability;
- alignment with the IRP;
- alignment with past expenditures;
- balanced participation among rate classes;
- other considerations, including:
  - other NS Power expenditures; and
  - balancing long and short-term affordability.

6.1 Is the Preferred Plan Affordable?

Affordability is recognized as a key factor in DSM planning. In its decision on the 2016-2018 DSM Plan, the Board stated it is "specifically directed by the 2014 amendments to the PUA to address the issue of affordability".[47] The legislation does not define affordability or the parameters for the Board's consideration; determining whether a DSM Plan is affordable is left to the discretion of the Board in its inquiry and assessment of the evidence presented to it.

In arriving at its determination on the issue of affordability, EfficiencyOne was guided by the 2016-2018 DSM Plan decision[48], as it was this Board's first opportunity to consider "affordability" in the context of Nova Scotia's electricity efficiency regime. The Board concluded that a "focus exclusively on short-term affordability would be detrimental to ratepayers since long-term costs would never be considered, which

[47] M06733 NSUARB Decision dated August 12, 2015, at paragraph 76.
[48] M06733, *Application for Approval of a Supply Agreement for electricity efficiency and conservation activities between EfficiencyOne and Nova Scotia Power Incorporated, the establishment of a final agreement between the parties, and approval of a 2016-2018 Demand Side Management Resource Plan,* 2015 NSUARB 204

would not be in the best interests of ratepayers."[49]

The Board's findings are instructive to EfficiencyOne in establishing the basis for the Preferred Plan's affordability:

> [82] The Board finds that the inclusion of Section 79L(9) of the PUA directs the Board to take into account an increased focus on short term rate impacts. Having said that, the Board notes that there will be a review of the DSM program every three years. There will always be rate pressures to be taken into account in both determining rates and in determining the DSM program. A focus exclusively on short term affordability means that the Board would never get to consider long term costs. That would be to the detriment of ratepayers. The Board does not believe that ratepayers are well-served, or that it is in their best interests to focus only on short term costs and thereby deny customers the real long term cost savings that are possible from a balanced and properly implemented DSM program. Accordingly, while the Board finds that there has been a change in focus mandated by the Legislature, and an increased emphasis on short term rate impacts, the overarching consideration continues to be "the best interests of Nova Scotia Power Incorporated's customers" as stated in Section 79L(8) of the PUA. [Emphasis added].[50]

The Preferred Plan is affordable based upon the guidance provided by this Board. The Preferred Plan strikes an appropriate balance between short and long-term considerations that promote affordability.

6.1.1 Does the Preferred Plan align with the IRP?

The 2014 Integrated Resource Plan ("IRP") is the most recently available Preferred Resource Plan and has been rigorously scrutinized and validated through the regulatory process.[51] The Preferred Resource Plan identifies the level of energy and capacity

[49] M06733, para. 143
[50] M06733, Decision at para. 82.
[51] M05522, NS Power 2014 IRP Update

savings that result in the lowest revenue requirement for customers.[52] The 2020– 2022 Preferred DSM Plan seeks to maximize the IRP benefits to customers.

EfficiencyOne, NS Power and various stakeholders have agreed that the IRP would inform the development of the DSM Plan:

> The Preferred Resource Plan identified in the IRP will inform the development of a preferred DSM Resource Plan by EfficiencyOne, including analysis of alternate scenarios of DSM activity, in accordance with the Standardized Filing Framework.[53]

In the 2014 IRP, the mid-DSM scenario in the Preferred Resource Plan for the period ranging from 2020-2022 was an average investment of $82.5 million annually. This scenario results in the lowest revenue requirement over the 25-year planning period, rendering it the most cost-effective and therefore affordable scenario for Nova Scotians over the long-term. The Proposed Plan of $43 million per year is 48 percent below the 2014 IRP mid-DSM scenario for this same period.

The 2020-2022 Preferred DSM Plan investment will lead to energy savings more consistent with the IRP, as noted above. It is a Plan which reasonably balances short-term and long-term affordability in the ultimate best interest of Nova Scotia electricity ratepayers.

6.1.2 Does the Preferred Plan align with past DSM expenditures?

The DSM investment in the Preferred Plan is $43 million per year, an increase of approximately $3 million from an average of approximately $40 million over the last 9 years of approved investment levels. This proposed investment level is materially consistent with the average of approved investment levels.

[52] 2020-2022 Preferred DSM Plan at page 4.
[53] Section 4.3 of Appendix 1 to the Consensus Agreement dated June 30, 2016

DSM investment must be increased as a result of the evolution and maturity of energy efficiency in Nova Scotia over the last number of years. The opportunities to generate energy savings from lower unit cost measures, such as lighting, are diminishing. For example, the Residential Efficient Product Rebates program began by offering rebates on CFLs, and as the result of a gradual market evolution, shifted towards rebates on LEDs.[54] However, since the beginning of 2019, this program no longer offers rebates on any A-series lamps because of continued market evolution.[55] With respect to the BNI sector, there was an increase in market penetration in the lighting area between 2016 and 2018.[56] Accordingly, the Preferred Plan includes a transition away from reliance on lighting savings.[57] As the remaining opportunities exist in areas that are more complex and expensive, it is increasingly challenging to sustain the achievement of lower unit cost energy savings. While implementing more comprehensive upgrades includes increased cost, it also promotes deeper energy savings to customers.

Since 2015, the level of DSM investment in Nova Scotia has been lower than that identified in the IRP. This has resulted in lost benefits year-over-year to Nova Scotia ratepayers. If the trend of accumulating lost benefits continues there will come a point in time when it will be too late to close the gap and avoid supply side investments. This could result in an uneconomical decision due to lost opportunity to avoid costs. Since 2015 the gap in first year energy savings is approximately 166 GWh and the value of these lost lifetime benefits is estimated to be $200 million

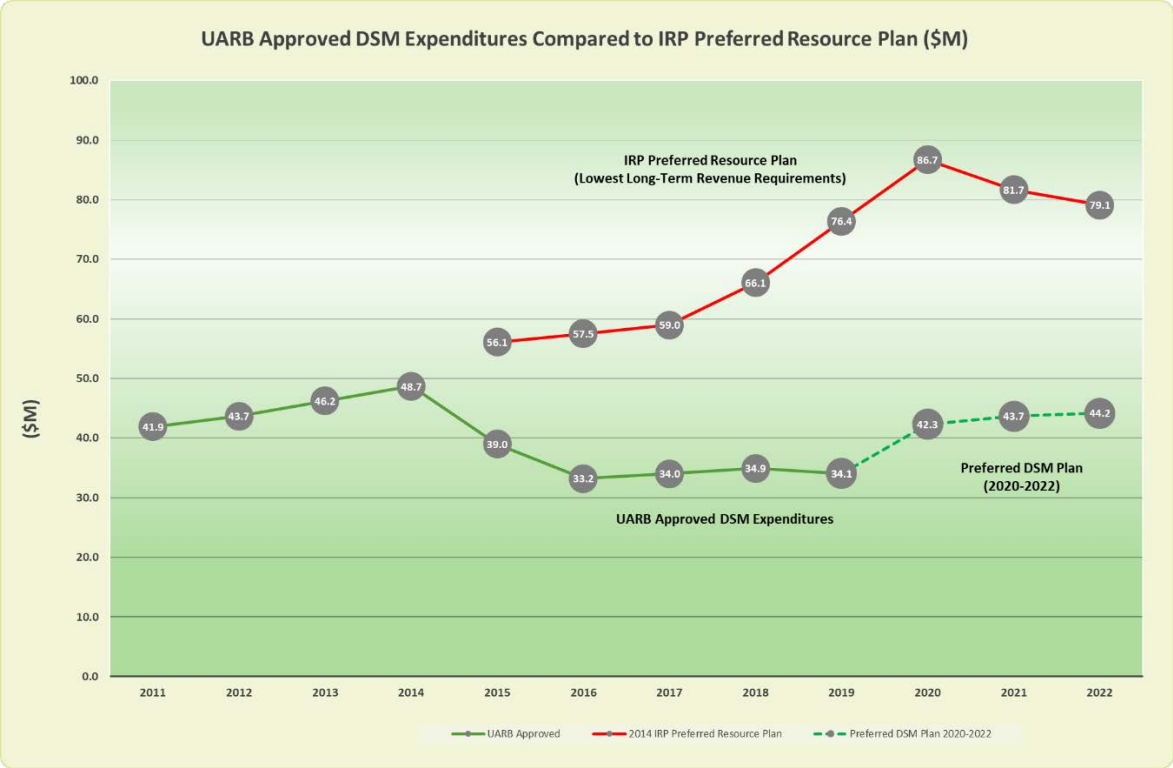
Beginning in 2020, NS Power ratepayers will need to achieve an annual average energy savings of 181 GWh until 2040 in order to meet the optimal level of savings which is in the best interests of ratepayers. The DSM investment levels set out in the Preferred

[54] 2020-2022 Preferred DSM Plan, Page 21
[55] 2020-2022 Preferred DSM Plan, Page 21
[56] 2020-2022 Preferred DSM Plan, Page 21.
[57] 2020-2022 Preferred DSM Plan, Page 48.

Plan move towards the levels set out in the IRP, but still do not achieve the optimal level.

Accordingly, the gap between customer benefits contemplated by the IRP and benefits provided to customers as a result of approved DSM plans, continues to widen. An investment below the Preferred Plan will further widen this gap – a gap which is not in the best interest of ratepayers. A chart detailing the levels of investment required to meet the IRP is illustrated in Figure 1, below:

Figure 1: UARB-approved DSM expenditures compared to IRP Preferred Resource Plan



Spending on energy efficiency must not be left to the end, once all other costs are considered. The amount of funding available for DSM cannot simply be the difference between NS Power's costs and the room in rates that can absorb DSM without a rate

increase.[58]

Further, the Preferred Plan's increase in unit cost compared to historical performance as a result of diversification away from lighting is consistent with industry trends;[59] therefore, this should not be used as a basis to determine the Preferred Plan is not cost-effective or that the level of DSM investment should be reduced.[60]

Accordingly, while the Preferred Plan has an increased level of investment as compared to approved expenditures from 2015-2019, this increase is necessitated by the evolving DSM market and is consistent with approved expenditures levels from 2011 to 2014.

6.2 Is there an opportunity to subsidize DSM investment through HST Savings?

Yes.

On August 13, 2018, ENS Transition Corporation entered into Minutes of Settlement with respect to its appeal of the Minister of National Revenue's decision to deny certain HST credits relating to the operation of Efficiency Nova Scotia (subsequently, ENS Transition Corporation) for the period May 2010 through January 2015. The refund of these credits totalled $14,123,701.10, and together with accrued interest of $895,164.50, resulted in a total refund amount of $15,018,371.60.

Applying the HST rebate to the Preferred Plan is in the best interest of ratepayers as it provides the best alignment with source of funds and rate class allocation, is easily understood by ratepayers, and results in the best value option for ratepayers given that it provides a return on investment to ratepayers of approximately 480 percent.

[58] M06733 NSUARB Decision dated August 12, 2015, at paragraph 84.
[59] David Hill Direct Evidence February 27, 2019, page 8, lines 19-21.
[60] David Hill Direct Evidence February 27, 2019, page 9, lines 1-3.

Further particulars with respect to the proposed disposition of these funds is set out in Section 9.

6.3 Other relevant considerations affecting the affordability of the proposed DSM Plan

6.3.1.1 How does the level of DSM investment in the Preferred Plan compare to other expenditures by NS Power?

The proposed level of DSM investment in the Preferred Plan equates to only 3 percent of NS Power's total revenue, yet its investment yields significant return for ratepayers. Notably between 2015 and 2018, NS Power collected $5 billion from its ratepayers[61], while investing on average only 2.6 percent of that amount in DSM programs as presented in Table 8. Figure 2 presents expenditures for 2018.

Figure 2: NS Power 2018 operating costs as a percentage of annual electric revenues

NS Power - 2018 Operating Costs as % of Annual Electric Revenues	$ Million	% of Total
Annual Electric Revenues	$ 1,412	
Fuel	593	42.0%
Operating, Maintenance & General	252	17.8%
DSM	35	2.5%
Provincial Grants & Taxes	40	2.8%
Depreciation & Amortization	219	15.5%

As has been noted by this Board in previous decisions, DSM expenditure levels are given an exceptional level of regulatory scrutiny.

> EfficiencyOne's regulated budget of approximately $35 million annually has become the most regulated $35 million the Board oversees. The regulatory burden should not outweigh the potential benefit.[62]

[61] NS Power Audited Financial Statements
[62] M07390 UARB Decision on EfficiencyOne's Code of Conduct August 2017 at page 6, Item 16

However, notwithstanding this degree of focus, it is appropriate that they be considered in the context of the revenue base of the electric utility. With a demonstrated return to ratepayers of nearly 5 times the investment – DSM must not be left to receive what is left over after considering all other costs in a rate setting context.

6.3.1.2 How does the Preferred Plan balance short term and long-term affordability?

A balanced and properly implemented DSM Plan resulting in real, long term cost savings must be weighed against the rate impact of the plan in the short term. While the impact on short term rates is a factor to be taken into consideration in assessing affordability, it is not the sole determinant of affordability. One of the objectives of the Preferred Plan is to reduce the long-term cost of electricity to ratepayers.[63]

On May 30, 2014, ICF submitted a report titled "*Market Trends for the Supply & Demand of Electricity in Nova Scotia"* to the Nova Scotia Department of Energy. The report demonstrates energy efficiency is the lowest cost fuel.[64]

Energy efficiency is available at a lower cost compared to other fuels and should be the first choice for ratepayers. The cost of energy efficiency is demonstrably lower than the cost of fuel to NS Power. The lifetime unit cost of the Preferred Plan is $0.022 per kWh, while NS Power's fuel costs in 2018 alone, were $0.048 per kWh[65]; nearly double the lifetime unit cost of DSM. Furthermore, DSM reduces the amount of fuel required to meet system demand, lowering fuel costs and applying downward pressure on the fuel adjustment mechanism (FAM), which is applied to every kWh consumed. All ratepayers experience the direct benefit of this downward pressure with a reduced FAM.

[63] 2020-2022 Preferred DSM Plan at page 10.
[64] ICF International, 30 May, 2014, *Market Trends for the Supply & Demand of Electricity in Nova Scotia*
[65] NS Power Financial Statements MDA Page 9 Fuel Generation and Purchased Power

7. PERFORMANCE TARGETS

Performance Targets are the criteria upon which the success of EfficiencyOne in implementing the approved DSM Plan is evaluated.

EfficiencyOne's progress in implementing the approved DSM Plan is measured and monitored continuously, through quarterly and annual reports. EfficiencyOne's progress and reported results are subject to an independent review by a third-party Evaluation Consultant. These evaluated results are then further reviewed by the Board-appointed Verification Consultant.

The process ensures performance targets and thresholds are current throughout the term of the DSM Plan and supports mid-course adjustments in a timely and responsive manner where necessary.

7.1 Established Performance Targets

The Standardized Filing Framework establishes the performance targets and thresholds that EfficiencyOne is to meet in executing the approved DSM Plan. These Established Performance Targets are:

i. Cumulative annual energy savings; and

ii. Cumulative annual peak demand savings.

Performance Targets are applied and evaluated during the period of the Board-approved Supply Agreement, rather than annually, and EfficiencyOne is deemed to be in substantial compliance with Performance Targets if 90 percent or greater achievement is reached on each of the Performance Targets.

7.2 Proposed Lifetime Energy Savings Target

In this application, EfficiencyOne proposes and requests approval to add a third

Performance Target: Lifetime Energy Savings.

7.2.1 The Benefit of a Lifetime Energy Savings Target

The impact of a DSM Plan on ratepayers should be clear. Lifetime Energy Savings, as a Performance Target, provides a direct link to the long-term ratepayer benefits ultimately achieved by a DSM Plan. While annual energy and demand savings are important measures, the cost-effectiveness and benefits of a DSM Plan are best demonstrated through Lifetime Energy Savings.

EfficiencyOne is asking that Lifetime Energy Savings be added as a Performance Target for the 2020-2022 DSM Plan, in order to more comprehensively measure the Plan's direct impact on ratepayers. Further, the addition of this Performance Target will allow this impact to be presented in a manner meaningful to ratepayers.

While annual energy and demand savings provide useful information on the annual level of DSM resources acquired (e.g. energy and capacity savings), Lifetime Energy Savings provides additional useful information which is more closely correlated to Lifetime Ratepayer Benefits.[66] Table 10 highlights how two measures with the same annual energy savings, but with different measure lifetimes, will have very different lifetime energy savings (and hence, Lifetime Ratepayer Benefits).

[66] Lifetime energy savings is not a perfect proxy to Lifetime Ratepayer Benefits, as it does not account for time-varying and non-linear avoided cost profiles, or capacity-related effects directly. Lifetime energy savings, does, however, provide a more direct link to the total ratepayer value of DSM activities, as compared to First-Year Energy and Demand Performance Targets.

Table 10: Effect of measure lives on nominal lifetime benefits

Year	Annual Energy Savings (kWh)		Example Annual Avoided Cost of Energy ($/kWh)
	Measure 1	Measure 2	
2020	100	100	20
2021	100	100	20
2022	100	100	20
2023	100	100	20
2024	100	100	20
2025	0	100	20
2026	0	100	20
2027	0	100	20
2028	0	100	20
2029	0	100	20
2030	0	100	20
Lifetime Energy Savings (kWh)	**500**	**1,100**	**-**
Lifetime Benefits ($)	**10,000**	**22,000**	**-**

Table 11 summarizes the associated performance metrics for these two measures.

Table 11: Summary of performance metrics for measure life example

Metric	Measure 1	Measure 2
First-Year Energy Savings (kWh/year)	100	100
Lifetime Energy Savings (kWh)	500	1100
Lifetime Benefits ($)	$10,000	$22,000

First-year energy savings for these two example measures are identical; however, the Lifetime Energy Savings and Lifetime Benefits for these two measures are markedly different. Therefore, the First-year energy savings is not a complete indicator of overall energy savings and benefits for any particular measure. Lifetime Energy Savings account for the lifetime of individual measures, and track more closely to Lifetime Benefits, when compared to first-year energy savings.

7.2.2 Threshold

EfficiencyOne proposes the Lifetime Energy Savings performance target be established with a threshold of 75 percent, as opposed to the 90 percent threshold established for shorter term cumulative annual energy and peak demand savings.

The 2017 Evaluation process represented the first independent third-party evaluation of EfficiencyOne's internal tracking methods associated with Lifetime Energy Savings. The evaluation findings provided a Lifetime Energy Savings value of 1620.8 GWh. Major findings from the evaluation included limited changes to Effective Useful Life (EUL) values, on the basis of newer or more comprehensive information being available to the Evaluator, as well as the Evaluator's treatment of LED lighting measures. For LED measures, the Evaluator introduced a multi-baseline approach, recognizing the in-situ baselines encountered by EfficiencyOne, current regulatory requirements for lighting minimum efficiency, as well as future expectations for regulatory changes (notably, the anticipation of Amendment 17 to Canada's Energy Efficiency Regulations). These changes resulted in approximately a 25 percent decrease for Lifetime Energy Savings, when comparing tracked to evaluated values, with LED lighting methodological changes driving the bulk of the difference.

The reason for lower threshold is that as a performance metric, lifetime energy savings may still be subject to volatility not encountered in more established targets. As the process matures, refined methodologies and improvements in evaluating these savings may make this measure of savings a "moving target".

8. ALTERNATE SCENARIO

EfficiencyOne has been directed by the Board to provide one or more alternate scenarios of DSM budgets for the Board to consider. NS Power has been directed to provide rate impact analysis on those scenarios.

The intent of the alternate scenario is to provide a lower cost plan option which EfficiencyOne as the DSM administrator can deliver for the Board to consider.

8.1 Alternate Scenario Development

The development of the Alternate scenario follows the same key considerations used in the Preferred Plan:

- energy savings (customer value);
- balanced portfolio approach (customer need); and
- investment level (customer affordability).

8.2 Alternate Scenario Energy Savings

The Alternate scenario will deliver approximately 125 GWh of incremental energy savings for each year of the three-year plan period, for an average annual investment of approximately $37 million, as demonstrated in Table 12 below.

Table 12: Alternate Scenario performance metrics

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Weighted-Average Measure Life (years)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	36.1	171.2	124.4	1,744.4	14.0	33.4	1.9	4.7
2021	37.3	182.1	125.4	1,786.1	14.2	34.5	1.9	4.9
2022	37.6	189.9	124.4	1,785.5	14.4	34.9	2.0	5.0
Total	**111.0**	**543.3**	**374.2**	**5,316.0**	**14.2**	**102.7**	**2.0**	**4.9**

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding. Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and

distribution were provided by NS Power in 2018.

[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using the utility WACC.

[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

Energy savings in EfficiencyOne's Alternate scenario align with the level of energy savings approved in the 2019 DSM Resource Plan, but do not align with the 2014 IRP or with trends seen in leading jurisdictions. The energy savings are below NS Power's 2018 load forecast, which maintains the trend of moving away from the optimal level of DSM in the 2014 IRP.

8.3 Balanced Plan Approach

The balanced approach taken in developing the Alternate scenario applied the same principles and areas of focus as the Preferred Plan:

- diversifying beyond lighting;
- improving and providing accessibility for all market sectors and rate classes;
- maintaining business relationships and market presence;
- avoided capacity investments;
- balancing higher cost measures through cost management strategies; and
- rate and bill impacts.

EfficiencyOne considered the same key considerations in both the development of the 2020-2022 Preferred DSM Resource Plan and Alternate scenario. The significant difference between it and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels.

Appendix C provides details on the energy savings and program investments for each year of the term.

9. HST

ENS Transition Corporation ("ENS") was successful in its appeal of an Excise Tax Act assessment by the Minister of National Revenue for investment tax credits (ITC's) for the period May 1, 2010 to January 31, 2015. This successful appeal resulted in ENS recovering $14,123,207.10 in harmonized sales tax ("HST") together with accrued interest of $895,164.50 for a total refund amount of $15,018,371.60 ("HST Refund"). This amount was received on September 12, 2018.

These funds have been invested in a short-term GIC bearing annual interest of 2.65 percent.

In accordance with the Electricity Efficiency and Conservation Restructuring (2014) Act. 2014, c.5, s.1, HST refund forms and asset of ENS, which accrues to the benefit of Nova Scotia Power ratepayers.

Assets acquired on or after Implementation Date

8. Any assets of the Corporation acquired on or after the Implementation Date must be transferred to Nova Scotia Power Incorporated for the benefit of the customers of Nova Scotia Power Incorporated as directed by the [Review] Board. 2014, c.5, s.8

The HST refund represented the monies collected by NS Power through the rate rider mechanism and provided to Efficiency Nova Scotia Corporation (as it then was), for delivery of DSM activities.

EfficiencyOne and NS Power had entered into a co-funding arrangement with respect to the cost of the Excise Tax Act (Canada) appeal, which *inter alia*, provided that the parties would attempt to reach agreement on the proposed disposition of the funds, and to jointly recommend this approach for approval with the Board. Despite a series of discussions on the various approaches, the parties were not able to reach agreement on a single recommendation to this Board.

EfficiencyOne proposes that the HST refund be applied, on an equal basis, across each year of the 2020 – 2022 DSM Plan, to reduce the required investment amount. In this way, the incremental cost of the Preferred Plan would be reduced by approximately $5 million over each of the 3 years; thus reducing the average annual investment to be recovered from ratepayers, from $43 million to $38 million.

EfficiencyOne considers this to be the preferred approach for a number of reasons including:

1. alignment with original use of funds;
2. maximum benefit to electricity customers;
3. allows for amounts to be precisely allocated to rate class; and
4. enhances affordability of 2020 – 2022 DSM plan.

Figure 3 details the proportion of the HST refund allocable to each rate class.

Figure 3: Proposed allocation of HST refund to rate classes

	Total HST By Rate Class		Present Value of Reinvestment of HST in 2020-2022 DSM Resource Plan[1]		Net Present Benefit of Reinvestment	
	($)	Relative Share	($)	Relative Share	($)	Relative Share
Rate Class						
Residential Total	$7,598,541	53.8%	$36,641,684	53.8%	$29,043,143	53.8%
Small General	$1,127,675	8.0%	$5,437,874	8.0%	$4,310,199	8.0%
General Demand	$3,790,082	26.8%	$18,276,535	26.8%	$14,486,452	26.8%
Large General	$289,120	2.0%	$1,394,196	2.0%	$1,105,076	2.0%
Small Industrial	$350,313	2.5%	$1,689,279	2.5%	$1,338,966	2.5%
Medium Industrial	$238,213	1.7%	$1,148,713	1.7%	$910,499	1.7%
Large Industrial	$364,898	2.6%	$1,759,611	2.6%	$1,394,713	2.6%
Municipal	$274,916	1.9%	$1,325,702	1.9%	$1,050,785	1.9%
Unmetered	$82,379	0.6%	$397,249	0.6%	$314,870	0.6%
I Part-RTP	$216	0.0%	$1,043	0.0%	$827	0.0%
Gen. Repl. / Load Foll.	$6,851	0.0%	$33,037	0.0%	$26,186	0.0%
Shore Power	$1	0.0%	$6	0.0%	$5	0.0%
Total	**$14,123,207**	**100.0%**	**$68,104,929**	**100.0%**	**$53,981,722**	**100.0%**

Numbers may not add due to rounding

1 The value of reinvestment is calculated by multiplying each rate class's Total HST Owing amount by the ratio of of present-value lifetime benefits to ratepayer investment found in Efficiency Nova Scotia's Preferred 2020-2022 DSM Resource Plan.

9.1 Methodology Used to Allocate HST Refund by Rate Class

To enable the appropriate rate class allocation of funds associated with HST amounts paid by ratepayers from 2010 through 2014, EfficiencyOne has developed a cost allocation model specifically for this purpose, included as Appendix F.

This cost allocation model predominantly[67] relies on the identical methodologies in which the allocated costs for a given year were finalized (i.e. the 2010-2014 Balance Adjustments). HST amounts by Program Component and by year were arrived at from Efficiency Nova Scotia Corporation's financial reporting system. These amounts were then inserted into the original Balance Adjustment sections that detailed final allocated costs by rate class for a given year, in lieu of original investment amounts. The original system allocators were preserved, as were the original Program Component allocators, which are used in the calculation of system and participant benefit, respectively.

For the years 2010 and 2011, two rate classes that no longer exist contributed to HST costs (Extra-Large Industrial Two Part Real Time Pricing and Bowater Mersey (Additional Energy Only). In 2012, Bowater Mersey (Additional Energy Only) was the only rate class that fell into this category. These cases were all treated in a similar manner. The HST amount allocated to any discontinued rate class in a given year was allocated to the other rate classes in proportion to their HST amount in that particular year.

EfficiencyOne is confident the methodology used in the allocation of HST amounts by Rate Class properly reflects its purpose; it accurately calculates HST amounts by rate class as they were originally paid by the various rate classes.

In effort to demonstrate the relative value of reinvestment of the HST refund in the

[67] For the year 2010, Efficiency Nova Scotia Corporation relied on the original Program-level allocators for the participant portion of the HST refund calculation.

2020-2022 Preferred DSM Plan, as compared to their immediate return, EfficiencyOne estimated the Present Value of Benefits provided through reinvestment of these HST Refund. This estimation used the ratio of Present Value Lifetime Benefits to Investment within EfficiencyOne's Preferred Plan to estimate the Present Value Benefits of reinvestment of the HST Refund. From this, the Net Present Value Difference between the reinvestment and immediate return scenarios was calculated.

10. ADDITIONAL CONSIDERATIONS IN PLANNING AND DEVELOPMENT

10.1 Improve the Accuracy of the Avoided GHG Estimates

In approving the 2019 DSM Plan[68], EfficiencyOne was directed to improve the accuracy of the avoided GHG estimates by better accounting for the timing of DSM savings.

EfficiencyOne recognizes two primary options to improve avoided GHG estimates. One option is short-term and the other long-term:

Short term: Until detailed energy efficiency load shapes are developed, use average emissions rates from marginal power plants

Long term: Developing load shapes for energy efficiency measures and combining them with time-based emissions factors for Nova Scotia Power's generation fleet

EfficiencyOne and Nova Scotia Power have begun discussions on this topic and will continue to work collaboratively in 2019 to refine the avoided GHG estimation methodology used by E1.

10.2 Incorporate the Value of Avoiding C02 Emissions in its DSM Cost Effectiveness

In its Reply Submissions, filed in support of the 2019 Demand Side Management (DSM) Resource Plan, EfficiencyOne agreed to study opportunities to incorporate the value of avoided C02 emissions in is cost effectiveness screening. Given the nature and complexity of the matter, EfficiencyOne is not in a position to bring forward definitive recommendation at this time. EfficiencyOne proposes, in conjunction with

[68] M08064 EfficiencyOne 2019 DSM Plan and Supply Agreement, Board Order

the DSMAG, to undertake further review of methodologies and approaches that would best incorporate this benefit into future screening processes.

10.3 Address the Transparency Concerns with Respect to EfficiencyOne's eTRM

In approving the 2019 DSM Plan[69], EfficiencyOne was directed to address the transparency concerns with respect to its electronic Technical Reference Manual (eTRM).

EfficiencyOne's eTRM is an operationalized system, i.e. it performs a functional role and is integrated with day-to-day program administration functions. This integration reduces opportunity for user error and provides a central location for energy and demand savings algorithms. This contrasts with a traditional TRM, which is a written document that cannot directly affect a data management system.

Because the eTRM is a functional system of software tools that are integrated with EfficiencyOne's IT infrastructure, it cannot be printed or shared in the same way as a traditional TRM. To address this, EfficiencyOne provided stakeholders with a detailed overview of the eTRM at the October 24, 2018 DSMAG meeting. This presentation included:

- comparison to traditional print TRMs;
- review of the components that comprise the eTRM and their functional roles within the eTRM:
  - the calculation engine, Energy Savings Platform (ESP);
  - E1's database and CRM, Dynamic DSM (DDSM); and
  - program evaluation reports;
- complete walkthrough of each step in the savings calculation process; and
- live demonstration of Energy Savings Platform.

[69] M08604 EfficiencyOne 2019 DSM Plan and Supply Agreement, Board Order

Appendix H includes the full presentation.

10.4 Develop an Improved Rate and Bill Impact Analysis

As agreed in the (Non-Quantum) Settlement Agreement to the 2016-2018 DSM Plan, EfficiencyOne worked with the DSMAG through 2016 to incorporate a means to account for the reallocation of fixed cost recovery due to DSM.

As part of the 2020-2022 DSM Resource Plan, EfficiencyOne is filing a forward-looking Rate and Bill analysis on both the Preferred Plan and Alternate scenario. The analysis shows that expected rate and bill effects attributable to the proposed 2020-2022 DSM activities are in line with previously approved DSM from 2011-2019.

Detail on the rate and bill impacts are included in Appendix B.

10.5 The Use of Avoided Costs from the 2014 IRP in the Development of the 2020-2022 DSM Resource Plan

EfficiencyOne's 2020-2022 DSM Resource Plan, and more specifically, EfficiencyOne's 2020-2022 DSM Plan model, relies on avoided utility costs for the calculation of cost-effectiveness test results and lifetime benefit calculations. As part of the 2020-2022 DSM Resource Plan development process, EfficiencyOne requested that NS Power confirm the appropriate avoided costs for use in the 2020-2022 DSM Resource Plan modelling effort. On October 16, 2018, NS Power provided confirmation that the 2014 Integrated Resource Plan avoided costs represent the appropriate avoided cost streams for use.

Given that the 2014 Integrated Resource Plan represents the most recent full long-term planning exercise in Nova Scotia, EfficiencyOne agrees with the use of the 2014 Avoided Costs for the 2020-2022 DSM Resource Plan.

EfficiencyOne has also included an estimate of the Avoided Costs of Transmission and Distribution within the 2020-2022 DSM Resource Plan model. The costs included are consistent with information presented to DSMAG members by NS Power within a presentation dated October 24, 2018. EfficiencyOne believes these supplied costs to be conservative, and justified for inclusion, given the specific exclusion of Transmission and Distribution avoided costs from the 2014 IRP Avoided Cost methodology.

Finally, EfficiencyOne has included other resource costs and benefits where appropriate. These other resource costs and benefits are limited to natural gas and water impacts, and are based on utility rates, as opposed to true avoided costs, as such information is not, to EfficiencyOne's knowledge, in existence.

11. CONCLUSION

EfficiencyOne submits that the Preferred Plan is the DSM plan which best serves the interests of Nova Scotians. The Preferred Plan has been built around three primary considerations affecting customers: (1) need; (2) value and (3) affordability.

Need

The 2014 IRP is the appropriate evidence-based utility planning tool to identify the level of DSM that is in the best interest of Nova Scotians. The Preferred Resource Plan establishes the optimal level of DSM that results in the lowest long-term revenue requirement from electricity ratepayers. EfficiencyOne's 2020-2022 Preferred DSM Resource Plan corrects the trend in Nova Scotia of moving away from this optimal level of DSM. The move from 1.2 percent to 1.3 percent of total annual electricity generation is a responsible step in the right direction that will help Nova Scotians move closer to achieving the optimal level of DSM.

Value

Consistent with the Standardized Filing Framework, the Preferred Plan adopts a Balanced Plan Approach which incorporates multiple factors of DSM for the benefit of customers. The application of these principles has resulted in focused initiatives which are prominent in the Preferred Plan including:

- diversifying beyond savings from lighting;
- improving and providing accessibility for all market sectors and rate classes;
- maintaining business relationships and market presence;
- avoiding capacity investments;
- developing pilots to inform further program offerings in the future;
- balancing higher cost measures through cost management strategies;
- managing Rate and Bill impacts; and
- investing in Enabling Strategies.

The result is a Plan which is carefully designed to yield access to all sectors and rate

classes, providing maximum value to Nova Scotians.

Affordability

The affordability of DSM to Nova Scotians is given special consideration in the Public Utilities Act; as it was in the development of the Preferred Plan. It is neither an entirely long-term consideration nor a short-term consideration. The Preferred Plan avoids this "either/or" approach. It has been designed to directionally, and modestly, begin to move Nova Scotians toward optimal (2014 IRP) energy saving levels.

Appendix A

2020-2022 DSM Resource Plan

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1. INTRODUCTION

EfficiencyOne developed the 2020-2022 Preferred Demand Side Management (DSM) Resource Plan (Preferred Plan) to acquire cost-effective energy efficiency and system coincidence peak demand reduction resources that provide maximum benefits to ratepayers.

This document outlines new initiatives and enhanced service offerings to achieve significant energy and system-peak demand savings over the next three years and builds on the historic success of the energy efficiency programs delivered by Efficiency Nova Scotia since 2010. This document will reference EfficiencyOne with regard to development of the Preferred Plan and Efficiency Nova Scotia (ENS) with regard to administering DSM activities in Nova Scotia over the 2020-2022 period and all previous years.

The 2020-2022 DSM Resource Plan has been developed based on ENS's experience and history in delivering successful DSM programs and services to Nova Scotians. The success of energy efficiency programs in Nova Scotia has resulted from strong partnerships, stakeholder engagement and Nova Scotians' system-peak demand for assistance to make energy efficiency choices. Today, residents and businesses are collectively saving $188 million in annual electricity costs and over 800,000 tonnes of greenhouse gas emissions through a variety of programs and services.[1]

In the Preferred Plan, EfficiencyOne is proposing an investment of $129.1 million – an investment that saves customers money, reduces greenhouse gas emissions and

[1] M08946, EfficiencyOne *2018 Rate and Bill Impact Analysis* (31 October 2018), Electronically filed model version, Microsoft Excel file).

supports a robust energy efficiency industry in Nova Scotia.

Over the past decade demand side management in Nova Scotia has provided benefits (avoided cost to ratepayers) that far outweigh the total utility investment by a magnitude of 4 to 1 on average. The same is true of the Preferred Plan which will deliver lifetime benefits of $622.7 million to Nova Scotians.

The Preferred Plan addresses the continued maturation of Nova Scotia's electricity efficiency market. Since 2010, the energy efficiency landscape has evolved for both EfficiencyOne and Nova Scotians. Success in DSM program delivery has driven accelerated market penetration for some energy efficiency products, particularly in the residential lighting market. As high lighting market penetration continues to diminish some of these opportunities and EfficiencyOne evolves the DSM portfolio to increase focus on more complex markets and projects, the historically low unit costs of DSM cannot be maintained. Despite the resulting increasing unit costs, the 2020-2022 Preferred DSM Resource Plan remains cost effective and energy efficiency continues to be a smart investment that helps customers lower their energy bills, with a Total Resource Cost ratio of 2.1 and a Program Administrator Cost ratio of 4.8.

Consistent with previous DSM Resource Plans, EfficiencyOne has taken a balanced approach in the design of its program portfolio. The Preferred Plan focuses on program enhancements that improve the customer experience, increase accessibility of programs for underserved markets, remove barriers to participation, and achieve deeper[2] savings from non-lighting measures.

[2] Deeper energy savings is defined as providing ENS support to enable customers to complete a wide range of energy efficiency upgrades / efforts, in order to help them maximize cost-effective energy savings per building / facility. In many cases, these efforts will take place over several years

The Preferred Plan outlines EfficiencyOne's proposed programs and strategies for achieving energy and system-peak demand saving targets for 2020-2022. The purpose of the Preferred Plan is to:

- outline DSM targets, objectives, performance metrics, strategies, and budgets for 2020-2022;
- provide a detailed description to stakeholders, customers, partners and industries in the marketplace of the direction that EfficiencyOne is taking electricity efficiency programs for the next three years; and
- form the basis of a DSM Supply Agreement made pursuant to S79 of the *Public Utilities Act*.[3]

[3] *Public Utilities Act*, RSNS 1989, c 380, s.79.

2. DEVELOPMENT APPROACH AND DETAILS

The Preferred Plan was developed for the purpose of delivering cost-effective energy and system-peak demand savings to Nova Scotia electricity ratepayers for the three-year plan period. EfficiencyOne used a multi-stage development process to establish the following: proposed performance targets, a cost-effective portfolio structure, and a program design to achieve them. The development process is illustrated in Figure 1.

Figure 1: Development Process for the 2020-2022 DSM Resource Plan

The Preferred Plan was developed with an emphasis on producing achievable cost-effective results that balance long-term requirements for energy and system-peak demand savings within a balanced approach to portfolio design.

2.1 Key Considerations

An evidence-based approach was used to develop the Preferred Plan and was informed by the following three key considerations:

- Customer Value: determine the appropriate level of energy savings;
- Customer Need: design a portfolio that is responsive to the diverse and changing needs of customers; and
- Customer Affordability: consider the affordability of the proposed plan to achieve an appropriate balance of short-term cost and long-term value for ratepayers.

The evidence used to inform the development of the key considerations relied on several sources including but not limited to:

- results of Nova Scotia Power Inc.'s (NS Power) 2014 Integrated Resource Planning (IRP) Process;
- past Nova Scotia Utility and Review Board (NSUARB) decisions;
- historical results and approved DSM Resource Plans;
- previous evaluation and verification results and their recommendations;
- expert consultation for strategic and modelling support;
- the Standardized Filing Framework's DSM Standards;
- stakeholder comments;
- market conditions and jurisdictional trends;
- industry research; and
- operational data.

The Preferred Plan seeks to decrease overall utility capacity and energy costs for the benefit for customers. NS Power's 2014 Integrated Resource Plan identified the candidate resource plan (the Preferred Resource Plan) that results in the lowest revenue requirement from customers. The level of DSM investment and savings in the Preferred Resource Plan is the mid-level of DSM from Navigant's DSM Potential Study.[4] This level of energy and capacity savings informed the development of the Preferred Plan.

EfficiencyOne's Preferred Plan proposes to move directionally toward, rather than continuing to move away from, the achievement of annual savings in the IRP's Preferred Resource Plan. These annual savings represent the greatest long-term benefits to Nova Scotians and the Preferred Plan is helping provide customers a reasonable opportunity of realizing these benefits in the future by taking a responsible step in the

[4] Navigant (2014). *Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study*.

right direction.

Determination of a reasonable pace for the acquisition of these resources required consideration of several factors including historical levels of energy savings, industry capacity to increase energy efficiency efforts, and rate and bill impacts from program activity.

Appropriate portfolio design is critical to effectively, responsibly and equitably deliver cost-effective electricity savings levels established in EfficiencyOne's Preferred Plan. DSM portfolios must be responsive to evolving customer needs, technologies, market conditions and regulatory requirements. EfficiencyOne has considered the following areas of focus in the development of the 2020-2022 Preferred Plan:

- increasing the diversity of energy savings, to further help customers achieve cost-effective energy solutions;
- providing accessibility for a wider variety of market sectors and customer segments; and
- increasing the level of system-peak demand reduction benefits.

EfficiencyOne also considered affordability in the development of the 2020-2022 Preferred Plan. An analysis of the Preferred Plan's rate and bill impacts, which compares a "no-DSM" scenario ($0 investment in 2020-2022 DSM) to the Preferred Plan's level of DSM ($43 million annual investment), shows minor average rate increases (between 0.8 to 1.7 percent) by customer rate class over the study period (2020-2035). Average participants in each class will reduce their annual bills by between 1 and 11 percent. Relative to 2019, the necessary increase in DSM cost recovery to support the Preferred Plan is 0.1 cents/kWh.

DSM delivered under the 2020-2022 Preferred Plan will offset just under 6,000 GWh

of energy production over the lifetime of installed measures and reduce annual system-peak demand by 120 MW, providing lifetime benefits of over $600 million.

2.2 Modelling

The "Model" is a DSM portfolio design tool used to inform EfficiencyOne's DSM Resource Plans. EfficiencyOne engaged Navigant Consulting to provide its ProCESS short-term DSM planning tool for these purposes.

Navigant's ProCESS model is developed on the Analytica® software platform. The use of this software platform is an improvement on EfficiencyOne's previous use of Navigant's Microsoft Excel®-based Electricity Resource Assessment Model (ELRAM). The use of Analytica® as a platform provides benefits including increased ease of model inspection, a more powerful and reliable modelling structure, and more support for the rapid provision of model outputs.

The ProCESS model possesses a few key differences to the ELRAM. The ProCESS model is specifically designed for short-term planning exercises whereas the ELRAM is designed to provide support for both short-term (e.g. DSM Plans) and long-term DSM modelling (e.g. DSM Potential Studies). The ProCESS model does not predict measure uptake by modelling customer behaviour, a feature that has limited usefulness in short-term planning exercises. In addition, the ProCESS model features a portfolio optimization engine, a feature that was absent from the ELRAM. These differences make ProCESS a more specific and better-suited tool for modelling short-term DSM Plans.

At the outset of the modelling process, EfficiencyOne and Navigant developed a set of input data to serve as the basis for all subsequent modelling steps associated with the 2020-2022 Preferred Plan. Input data included line loss factors, customer rate

information, avoided costs, applicable discount rates, and all measure technical information (e.g. measure life, annual energy and system-peak demand savings, incremental costs, incentives). Measure data were initially developed from current EfficiencyOne data, and subsequently modified to reflect differences in characterization expected across the 2020-2022 period.

Following the development and inputting of data into the model, Navigant prepared the model to reach an operational state and initial test runs were performed.

After test runs were completed, different portfolio options (e.g. different mixes of measures) were explored using the ProCESS model's optimization tool. This tool allows various combinations of measures to be explored using optimization processes. This optimization tool allows the introduction of a desired goal (e.g. the maximization of lifetime energy savings), and the introduction of constraint parameters that must be considered when striving for that goal (e.g. maximum percentage of savings from the lighting end use).

EfficiencyOne identified the objective function and constraint parameters for the 2020-2022 Preferred Plan as model inputs. The model then generated a model result that best satisfied the desired goal with its constraint parameters.

2.3 Model Constraints

As mentioned above, the model contains an optimization tool that assists in building a DSM Resource Plan. The optimization tool requires an objective function and can be bound by defined constraint parameters. EfficiencyOne's goal for these early stages of the Preferred Plan modelling process was to maximize utility and ratepayer benefits for each year of the Plan. An example of a constraint parameter used in this stage of the

2020-2022 Preferred Plan modelling process was to ensure that no program has a Total Resource Cost (TRC) less than 1.0.

2.4 Cost-Effectiveness

To assess the cost-effectiveness of the 2020-2022 Preferred Plan, EfficiencyOne used two industry standard screening tests: the TRC test and the Program Administrator Cost (PAC) test. The TRC was used as the primary test of EfficiencyOne's DSM investments per the NSUARB decision[5] that all programs included in the DSM Plan must have a TRC of 1 or greater.

EfficiencyOne has presented PAC test results on an information-only basis. The PAC test provides information relating to the ratepayer and utility costs and benefits associated with the 2020-2022 DSM Resource Plan, and notably excludes voluntary participant contributions which are included in the TRC. EfficiencyOne believes the PAC test provides another valuable cost-effectiveness perspective. Cost effectiveness results for each sector by program are provided in Table 1.

[5] M03669, NSUARB Order, *In the Matter of the Efficiency Nova Scotia Corporation Act and In the Matter of an Application by Efficiency Nova Scotia Corporation for Approval of its Electricity Demand Side Management Plan for 2012 (30 June, 2011*) and M03669, NSUARB Decision, *In the Matter of the Efficiency Nova Scotia Corporation Act and In the Matter of an Application by Efficiency Nova Scotia Corporation for Approval of its Electricity Demand Side Management Plan for 2012*, (30 June, 2011), at para 82.

Table 1: 2020-2022 Preferred DSM Resource Plan Cost Effectiveness Results by Program

2020-2022	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]
Residential DSM Programs		
Efficient Product Rebates	1.1	2.2
Existing Residential	1.9	6.1
New Residential	1.5	4.6
Business, Not-for-profit and Institutional Programs		
Efficient Product Rebates	2.3	7.4
Custom Incentives	2.1	5.2
Direct Installation	2.2	3.0
Enabling Strategies		
Education and Outreach		
Development and Research		
Other Enabling Strategies		
Total	**2.0**	**4.8**

Portfolio total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

The 2020-2022 Preferred Plan programs are cost-effective for both the Residential and Business, Non-profit and Institutional sectors with passing benefit/cost ratios across all programs. This information is presented above in Table 1.

2.5 Vetting Process

The final stage of model design is the vetting process. This step is crucial, as it allows

for the alignment of EfficiencyOne's qualitative and quantitative design efforts. The vetting process involves analysis of the model outputs. This analysis was informed by a variety of internal teams (data analytics, service delivery, marketing, technical teams) and external support to assess the validity of achieving results. The review includes an examination of energy savings at the program component and measure level to consider the reasonableness of the model output. For example, in one instance the model output resulted in an existing program component dropping to energy savings of 0 GWh in 2020 and then ramping up again in 2021 and growing further in 2022. EfficiencyOne questioned the impact this would have on delivery costs, industry capacity and market presence. Refinements to the model were performed in response to this analysis and updated model runs were completed. This was an iterative process and several cycles occurred.

3. 2020-2022 PREFERRED PLAN

The 2020-2022 Preferred Plan represents a comprehensive suite of programs and service offerings for Nova Scotia electricity customers. The main goal of each program is to help reduce electricity costs for consumers. Further objectives include:

- reduce the long-term cost of electricity to ratepayers;
- increase consumer awareness of cost-effective options for reducing electricity consumption and/or consumption at peak periods; and
- create favorable market conditions for the increased adoption of energy efficient and system-peak demand reduction equipment and upgrades.

Highlights of the 2020-2022 Preferred Plan include:

- Incremental Annual Energy savings = 1.3 percent of electricity generation;
- Cumulative net lifetime CO_2 reductions = 3,180 MT.[6]
- Lifetime cost of saved energy = $0.022/kWh;
- Weighted average measure life = 14.2 years;
- Net system benefits = $493.6 million[7]; and
- Percentage of non-lighting energy savings over historical levels (i.e. 2016-2019) = +55 percent

3.1 2020-2022 Preferred Plan Savings and Investment

In 2020-2022, EfficiencyOne will invest $129.1 million (in nominal dollars) to achieve 421.7 GWh of incremental cumulative net energy savings, 120.1 MW of cumulative system-peak demand savings, and 5,996.3 GWh of cumulative net lifetime energy

[6] Estimates are based on current electricity emissions intensity and reductions in emissions intensity in accordance with Nova Scotia Greenhouse Gas Emissions Regulations emissions caps, §4 (1)
[7] $622.7 million of lifetime benefits - $129.1 million of DSM investment = $493.6 million of net benefit

savings at the generator.

Table 2 presents program investment budgets and targets for the planned 2020-2022 portfolio.

Table 2: 2020-2022 Preferred DSM Resource Plan Investment and Savings

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Weighted-Average Measure Life (years)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	41.9	195.6	140.2	1,967.9	14.0	38.7	1.9	4.7
2021	43.3	208.7	141.3	2,014.5	14.3	40.3	1.9	4.8
2022	43.9	218.4	140.2	2,013.9	14.4	41.1	2.0	5.0
Total	**129.1**	**622.7**	**421.7**	**5,996.3**	**14.2**	**120.1**	**2.0**	**4.8**

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.
Portfolio total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

EfficiencyOne estimates that the 2020-2022 Preferred Plan will produce annual incremental CO_2 reductions of 86 MT and cumulative net lifetime CO_2 reductions of 3,180 MT.[8]

Tables 3, 4, and 5 provide the program investment budgets and targets for 2020, 2021 and 2022, respectively.

[8] Estimates are based on current electricity emissions intensity and reductions in emissions intensity in accordance with Nova Scotia Greenhouse Gas Emissions Regulations emissions caps, §4 (1)

Table 3: 2020 Preferred DSM Resource Plan Investment and Savings

2020	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.7	8.7	15.8	113.0	1.7	1.3	2.4
Existing Residential	11.2	66.4	35.6	523.6	16.2	1.9	5.9
New Residential	2.8	12.8	5.5	165.8	1.6	1.5	4.5
Low Income Participation[d]	*4.1*		*8.9*	*88.9*	*1.3*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	7.3	50.9	40.6	580.3	8.0	2.2	7.0
Custom Incentives	9.0	44.4	33.2	457.5	8.8	2.0	4.9
Direct Installation	4.4	12.4	9.5	127.7	2.3	2.1	2.8
Low Income Participation[d]	*0.6*		*5.4*	*77.7*	*1.3*		
Enabling Strategies							
Education and Outreach	0.9						
Development and Research	0.9						
Other Enabling Strategies	1.8						
Total	**41.9**	**195.6**	**140.2**	**1,967.9**	**38.7**	**1.9**	**4.7**

Currency is expressed in 2020 dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[d] Reflects EfficiencyOne's planned participation by low-income customers. Numbers are a subset of Residential Efficient Products Rebates, Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

Table 4: 2021 Preferred DSM Resource Plan Investment and Savings

2021	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.5	7.5	13.8	93.5	1.5	1.1	2.1
Existing Residential	11.5	70.3	35.5	537.2	16.7	1.9	6.1
New Residential	3.0	13.6	5.7	171.6	1.6	1.5	4.5
Low Income Participation[d]	*3.9*		*8.4*	*85.9*	*1.3*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	7.5	55.7	42.0	604.9	8.8	2.3	7.5
Custom Incentives	9.3	47.6	34.2	472.4	9.1	2.1	5.1
Direct Installation	4.6	14.0	10.1	134.9	2.7	2.2	3.0
Low Income Participation[d]	*0.6*		*5.6*	*80.7*	*1.4*		
Enabling Strategies							
Education and Outreach	1.0						
Development and Research	1.0						
Other Enabling Strategies	2.0						
Total	**43.3**	**208.7**	**141.3**	**2,014.5**	**40.3**	**1.9**	**4.8**

Currency is expressed in 2021 dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.
[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[d] Reflects EfficiencyOne's planned participation by low-income customers. Numbers are a subset of Residential Efficient Products Rebates, Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

Table 5: 2022 Preferred DSM Resource Plan Investment and Savings

2022	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.3	6.7	11.8	81.5	1.2	1.0	2.0
Existing Residential	11.2	70.0	33.6	503.5	16.6	2.0	6.3
New Residential	3.2	14.5	5.9	177.3	1.7	1.6	4.6
Low Income Participation[d]	*3.8*		*7.9*	*78.8*	*1.2*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	7.8	60.2	43.1	621.9	9.3	2.4	7.7
Custom Incentives	9.5	51.2	35.2	487.4	9.4	2.2	5.4
Direct Installation	4.9	15.8	10.6	142.3	3.0	2.2	3.2
Low Income Participation[d]	*0.7*		*5.7*	*83.1*	*1.4*		
Enabling Strategies							
Education and Outreach	1.0						
Development and Research	1.0						
Other Enabling Strategies	2.0						
Total	**43.9**	**218.4**	**140.2**	**2,013.9**	**41.1**	**2.0**	**5.0**

Currency is expressed in 2022 dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.
[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[d] Reflects EfficiencyOne's planned participation by low-income customers. Numbers are a subset of Residential Efficient Products Rebates, Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

As with prior DSM Plans, this Preferred Plan has been developed for planning and cost-effectiveness testing purposes and is not an implementation Plan. EfficiencyOne is committed to adapting the activities and services outlined in the Preferred Plan as needed to respond to changing technological and market conditions, and to ensure Performance Targets are met cost-effectively and within the approved investment amount.

4. RESIDENTIAL PROGRAMS AND SERVICES

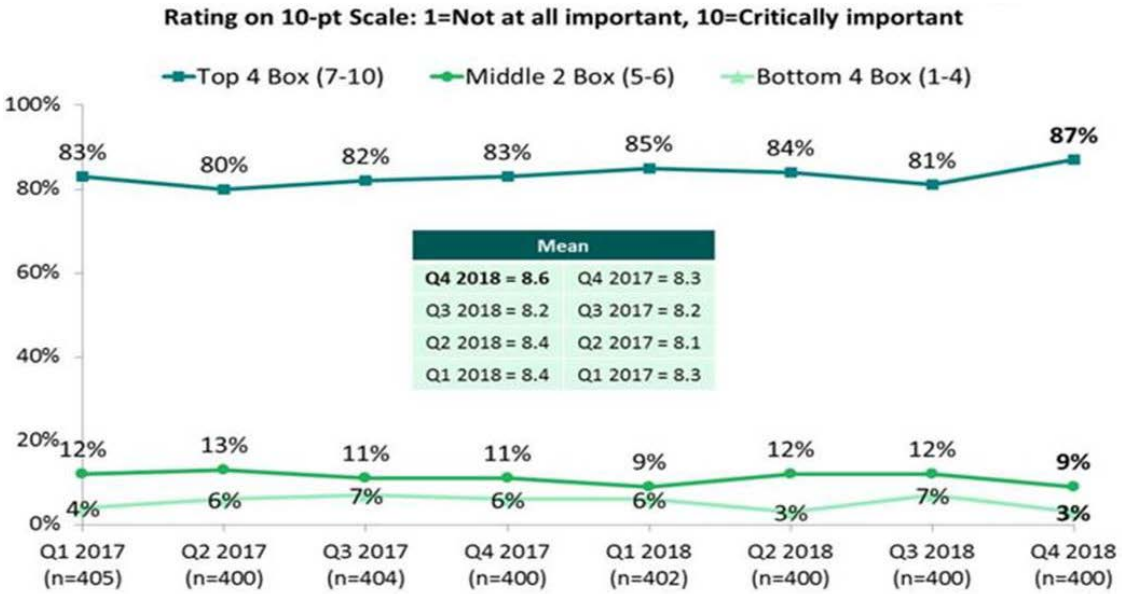
The Preferred Plan will allow EfficiencyOne to continue delivering cost-effective energy savings benefits for Nova Scotia's residential customers. The Preferred Plan pursues enhanced approaches to the delivery of programs and activities to better help customers navigate the complex upgrade choices available in today's energy market.

Over the past three years, EfficiencyOne has further refined its focus on understanding customers, their values, and how best to work with them to support the adoption of energy efficient measures in their homes.

In Nova Scotia, household perception of the importance of reducing energy use is at an all-time high. In the fourth quarter of 2018, 87 percent of Nova Scotians placed a high level of importance on reducing household energy use.[9] This is an indication of the desire to reduce energy use at home, as shown in Figure 2.

[9] Corporate Research Associates. *Autumn 2018 Atlantic Quarterly*

Figure 2: Household Perception of Importance of Reducing Energy Use



As the Nova Scotia electricity efficiency market continues to mature, some opportunities become increasingly saturated. EfficiencyOne will evolve program and service offerings by taking advantage of new technologies and customer data to achieve energy savings from larger, more complex projects that are often more expensive to implement but produce high energy savings.

This evolution is reflected in the Preferred Plan, which supports the adoption of a variety of energy efficient products and services in areas such as the building envelope, space heating equipment and domestic water heating. The Preferred Plan demonstrates an increased shift towards non-lighting measures and builds on steps being taken in 2019. Enhancements for the Residential sector in the Preferred Plan, described in the next section, focus on the following key areas:

- decreasing reliance on energy savings from lighting;
- increasing accessibility to programs and services; and
- increasing types of benefits delivered by DSM (i.e. including system-peak

demand reduction).

The Preferred Plan offers three Residential sector programs and eight program components, as presented in Table 6 below.

Table 6: Preferred Plan: Residential Sector Offerings

Program	Program Component	Target Market Segment	Delivery Approach	Enhancements in 2020-2022 Plan
Residential Efficient Product Rebates	Appliance Retirement	Residential (renters, homeowners, landlords)	Turn-key service	• New Appliance Replacement service
	Instant Savings	Residential (renters, homeowners)	Point of sale discounts	• New clothes dryer measures
Existing Residential	Efficient Product Installation	Residential (renters, homeowners, landlords)	Turn-key service	• Continued support
	First Nations Home Energy Efficiency	Residential (band-owned homes)	Turn-key service	• This is a new program component
	Green Heat	Residential (renters, homeowners, landlords)	After purchase mail-in rebates & mid-stream incentives	• New domestic water heating measures • New mid-stream delivery approach for heat pumps • New system-

Program	Program Component	Target Market Segment	Delivery Approach	Enhancements in 2020-2022 Plan
				peak demand reduction measures
	Home Energy Assessment	Residential (homeowners, landlords)	Facilitated* and financial incentives	• New project management support service • Adjustments to incentives to encourage deeper energy savings • New system-peak demand reduction measures
	Affordable Multifamily Housing and Non-profit Organizations	Residential (landlords)	Facilitated and financial incentives	• This is a new program component
New Residential	New Home Construction	Residential (homeowners, builders)	Facilitated and financial incentives	• Continued support

** Facilitated is defined as providing customers with assistance in identifying energy efficiency opportunities and guidance on implementation to satisfy program requirements.*

4.1 Residential Efficient Product Rebates: Program Description

4.1.1 Overview

The Residential Efficient Product Rebates program provides residential customers

access to financial incentives for consumer products through retail channels and to retire and/or replace old inefficient appliances. The Residential Efficient Product Rebates program is comprised of two program components:

- Appliance Retirement; and
- Instant Savings.

The Appliance Retirement program component helps residential customers retire old, inefficient appliances through a turn-key service approach. This service will pick up and responsibly recycle working, but less-efficient, home appliances such as refrigerators, freezers, and air conditioners from customers across the province. Customers receive a financial incentive for each retired appliance. Appliance Retirement also currently includes a free replacement service for low-income qualified customers participating in the HomeWarming program. As part of the replacement service, the older appliance is removed and retired, and a new energy efficient appliance is delivered and installed.

The Instant Savings program component focuses on purchases made through participating retail stores across Nova Scotia by offering customers point-of-sale rebates on eligible energy efficient products. Products typically include Light Emitting Diode (LED) lighting products, thermostats, appliances, controls and other consumer goods. EfficiencyOne partners with national and independent retailers to deliver rebates. Historically, incentives have been made available to approximately 200 retail locations throughout Nova Scotia. In addition to point-of-sale rebates, Instant Savings also collaborates with retailers to increase customer engagement with in-store events where trained energy ambassadors demonstrate products, educate consumers on their use and talk about the benefits of energy efficiency.

4.1.2 Enhancements in 2020-2022

Two enhancements to the Residential Efficient Product Rebate program are being introduced in the Preferred Plan to help Nova Scotians make energy efficient choices about large residential appliances.

Appliance Replacements

Appliance Retirement will place an increased focus on appliance replacements by offering a new turn-key service. Currently, Appliance Retirement replaces fridges, freezers and dehumidifiers for low-income qualified Nova Scotians participating in the HomeWarming program. In addition to the appliances listed above, the First Nations Home Energy Efficiency program component will also offer replacements for clothes washers and clothes dryers. Enhancements for the Preferred Plan will include ENS offering an appliance replacement package to Nova Scotians at a cost to participants. The full service will provide removal and recycling of old, inefficient appliances, and the installation of new efficient replacement appliances.

Efficient Clothes Dryers

Instant Savings will offer a point-of-sale rebate on energy efficient clothes dryers. This proposed enhancement aligns with other jurisdictions that have recently introduced incentives for efficient dryers including BC Hydro, Fortis BC, Efficiency Vermont, and MassSave.

4.1.3 Objectives

Objectives of the Residential Efficient Product Rebates program include:

- make energy-efficient products more accessible to Nova Scotians across all income levels and geographic locations;
- increase customer and retailer awareness of energy efficiency opportunities;

- increase system-peak demand for energy efficient products;
- increase the availability of energy-efficient products at retailers;
- increase customer and retailer awareness of the benefits of energy efficient products, particularly the lesser known non-lighting products;
- remove old, inefficient appliances from the Nova Scotia electricity system; and
- help customers achieve energy savings and power bill reductions.

4.1.4 Opportunity

Target Market

The target market for the Efficient Products Rebates program is comprised of residential customers including low-income and renter customer groups.

Market Barriers

Barriers to participating in the Efficient Product Rebates program includes:

- Affordability: The cost difference between efficient products and less efficient products can create a participation barrier.
- Awareness: Some potential participants may not be aware of the benefits of energy-efficient products.
- Short decision period: Replacement of failing equipment can occur quickly resulting in lost opportunities if the efficient product is not purchased.
- Lack of trust: Some potential participants do not trust a free service.
- Lack of information: Lack of familiarity with energy efficient products and appliances.

Program History

Residential Efficient Product Rebates is a well-established program in Nova Scotia and

has been operating as part of the ENS portfolio since 2010. Instant Savings on energy-efficient products has been operating since 2009[10] and Appliance Retirement has been operating since 2010.

Instant Savings was previously known by the following names: Efficient Lighting Products (2009), Power Down (2010), Plug into Savings (2011), and Retail Markdown (2012). Since 2012, the program has been known as Instant Savings.

The Instant Savings program component offers instant rebates on efficient products in retail stores across Nova Scotia and the program has maintained a consistent delivery model since inception. Eligible products under Instant Savings have shifted as a result of gradual market evolution. For example, the program component began with a strong focus on Compact Fluorescent Lamps (CFLs), and then shifted toward LEDs with their introduction in 2011. Complete removal of the CFL product from Instant Savings occurred in 2014. Beginning in 2019, the program component is discontinuing rebates on all A-series lamps.

Since 2011, Instant Savings rebates have primarily been offered during two annual campaigns: spring and fall. Beginning in 2014, the program component offered year-round rebates on eligible refrigerators and clothes washers, and in 2018, year-round rebates were expanded to include other products such as smart thermostats and dehumidifiers. EfficiencyOne continues to monitor the market and pilot new products to ensure its instant rebates pro-actively drive energy efficiency purchases.

Appliance Retirement has been operating since 2010 and is available throughout Nova

[10] In 2009, NS Power offered a DSM program offering instant rebates program on energy efficient products. The responsibility and accountability for DSM administration transferred to Efficiency Nova Scotia effective October 1, 2010.

Scotia. Initially only available in Halifax Regional Municipality and Cape Breton Regional Municipality in 2010, it expanded to the entire province in 2011. The program offers rebates to all Nova Scotians wanting to retire their old less-efficient refrigerators and freezers.

Starting in 2012, Appliance Retirement operated a pilot project to offer incentives for large scale appliance replacements. The pilot project offered participants custom incentives for replacing old appliances with new ENERGY STAR® qualified appliances. The service included the purchase and delivery of the new appliances along with the removal, decommissioning and recycling of the old appliances.

EfficiencyOne integrated appliance replacements for HomeWarming participants into its operations beginning in 2015. Appliance Retirement has been, and continues to be, responsible for the pick-up of eligible full-sized refrigerators, freezers and dehumidifiers from clients referred by HomeWarming and replaces these units with comparably sized, new, energy-efficient models. The removed appliances are responsibly recycled as part of the standard appliance retirement process.

Since the inception of Appliance Retirement, the program component removed incentives for dehumidifiers and later introduced incentives for room air conditioner units, small refrigerators, and small freezers as add-on appliances that can be retired with a primary appliance. The rebate structure has remained relatively consistent, temporarily offering participants the option of Air Miles rewards instead of cash rebates from 2012-2014.

4.1.5 Program Design

Measures Promoted

Assistance will be provided to retire the following old, inefficient products:

- refrigerators;
- freezers; and
- window air conditioning.

Assistance will be provided to replace the following old, inefficient products:

- refrigerators;
- freezers;
- dehumidifiers;
- clothes washers;
- clothes dryers;
- dishwashers; and
- stoves / ranges.

Assistance is planned to be provided to purchase the following high efficiency consumer products:

- non-A-Series LED lighting;
- LED recessed downlight fixtures;
- LED integrated fixtures – with and without motion sensors;
- dimmer switches;
- indoor and outdoor motion sensors;
- programmable thermostats;
- smart power bars;
- power bars with built in timers;
- outdoor heavy-duty timer;

- clotheslines;
- room air purifier;
- clothes washers;
- clothes dryers;
- refrigerators;
- smart thermostats for electric heating;
- dehumidifiers;
- energy efficient showerheads;
- variable speed pool pumps; and
- air source heat pump hot water heaters.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan Measure Level Technical Tables) for additional detail.

4.1.6 Implementation Strategy

Program Delivery

The Residential Efficient Product Rebates program uses both a self-serve and turn-key delivery approach to help residential customers make smart energy choices through the retirement and/or replacement of inefficient appliances and the purchase of high-efficiency consumer goods.

The Appliance Retirement program component uses a delivery agent approach for service delivery. The service to customers provided by the delivery agent includes the management of all aspects of appointment booking, pick-ups, transportation and delivery/decommissioning of the appliances.

The Instant Savings program component engages a delivery agent for encouraging and recruiting retailers to participate, managing relationships with participating retailers, delivering in-store customer engagement events and providing retailer training on energy-efficient products and additional ENS services.

Marketing Strategy

The marketing strategy for Appliance Retirement will focus on enhancing a customer's quality of life through non-energy benefits (convenient, hassle-free pick up and recycling) with the rebate promoted as a secondary message (through online targeted advertising). The objective to increase the number of appliances retired is achieved through integrated marketing campaigns including digital and social media, out-of-home (billboard, truck wraps), radio, and direct mail. To increase program participation across Nova Scotia, the marketing strategy is to reach out to potential participants through various platforms to encourage appliance retirement and upgrading to a more energy-efficient model via a new appliance replacement option.

The marketing strategy for Instant Savings is to increase awareness and drive customers to retail locations to realize the benefits of energy efficient products. The marketing plan is designed to encourage customers to purchase a range of energy efficient products during campaign periods (which may be all-year for some products) to make their homes more efficient and comfortable; to incent customers to purchase energy efficient products by removing the price barrier; and to ensure customers can easily recognize eligible products in-stores. It includes the following tactics: development of point-of-purchase materials and in-store signage; customer engagement events and materials; training for efficiency ambassadors; and ENS website updates. Media promotion may include radio remotes, radio and television commercials, digital advertising; electronic billboard advertising; cross promotion with other ENS programs (e.g. postcards delivered to customers in Appliance Retirement & Efficient Products Installation service); and social media.

Quality Assurance

The Residential Efficient Product Rebates program has a quality assurance framework which includes retailer site visits (during both campaign and non-campaign periods), random customer record review, appliance metering, appliance internal temperature testing and customer satisfaction surveys.

4.1.7 Performance Indicators

Performance indicators for the Residential Efficient Product Rebates program are provided in Table 7 below.

Table 7: 2020-2022 Residential Efficient Product Rebates Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
2020	3.7	15.8	113.0	1.7	1.3	2.4	275,517	$ 0.040	$ 0.033
2021	3.5	13.8	93.5	1.5	1.1	2.1	221,345	$ 0.045	$ 0.037
2022	3.3	11.8	81.5	1.2	1.0	2.0	157,986	$ 0.049	$ 0.041
Total	10.5	41.5	288.0	4.3	1.1	2.2	654,848	$ 0.044	$ 0.036

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Appliance Retirement and Instant Savings.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

4.1.8 Low-Income Performance Indicators

Low-Income performance indicators for the Residential Efficient Product Rebates program are provided in Table 8 below.

Table 8: 2020-2022 Residential Efficient Product Rebates Low-Income Performance Indicators

Year	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Participation (units)[a]
2020	0.4	2.7	0.04	1,996
2021	0.4	2.3	0.03	1,603
2022	0.3	2.0	0.03	1,144
Total	1.1	7.0	0.10	4,743

[a] The number of individual products rebated through Instant Savings and appliance retirement

4.1.9 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and alternate scenario. The significant difference between the Alternate scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and keys. Table 9 below presents this difference for the Residential Efficient Product Rebates program.

Table 9: 2020-2022 Residential Efficient Product Rebates Performance Indicators – Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
Preferred	2020	3.7	15.8	113.0	1.7	1.3	2.4	275,517	$ 0.040	$ 0.033
	2021	3.5	13.8	93.5	1.5	1.1	2.1	221,345	$ 0.045	$ 0.037
	2022	3.3	11.8	81.5	1.2	1.0	2.0	157,986	$ 0.049	$ 0.041
	Total	10.5	41.5	288.0	4.3	1.1	2.2	654,848	$ 0.044	$ 0.036
Alternate	2020	3.3	14.1	100.9	1.5	1.3	2.4	246,135	$ 0.040	$ 0.033
	2021	3.1	12.4	83.5	1.3	1.1	2.1	197,740	$ 0.045	$ 0.037
	2022	3.0	10.6	72.8	1.0	1.0	2.0	141,138	$ 0.049	$ 0.041
	Total	9.4	37.1	257.3	3.9	1.1	2.2	585,013	$ 0.044	$ 0.036
Variance from Preferred	2020	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	2021	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	2022	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	Total	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Appliance Retirement and Instant Savings.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

4.2 Existing Residential: Program Description

4.2.1 Overview

The Existing Residential program provides residential customers with access to technical and financial assistance to identify, assess and implement energy efficiency and system-peak demand reduction upgrades. The Existing Residential program is comprised of the following five components:

- Affordable Multi-Family Housing and Non-Profit Organizations;
- Efficient Product Installation;
- First Nations Home Energy Efficiency;
- Green Heat; and
- Home Energy Assessment.

The Affordable Multi-Family Housing and Non-Profit Organizations program component was developed specifically to help low-income renters and non-profits that provide shelter, access the benefits of energy efficiency through reduced utility bills and stable rents. This program component offers project management support to participants combined with technical and financial assistance to help building owners make energy efficient upgrades.

The Efficient Product Installation program component offers low-cost energy efficient upgrades to homeowners and renters at no cost to participants. During a home visit, qualified installers provide free installation of energy efficient products such as lighting, domestic hot water measures, and other electricity-saving equipment. Efficient Product Installation offers the opportunity to engage directly with customers during the home visit. Installers demonstrate the energy efficient products, talk about their benefits and promote the value of more comprehensive assessments and upgrades for the dwelling.

The First Nations Home Energy Efficiency program component is a whole home service offered to customers at no cost. An initial energy assessment is conducted on the home by a Natural Resources Canada (NRCan) Registered Energy Advisor to identify energy efficiency upgrade recommendations specific to that residence. Following the implementation of upgrades, a final energy assessment is performed. Complete project management is provided by the Delivery Agent and, where possible, EfficiencyOne's delivery agent hires qualified First Nation-preferred contractors to complete the work. Upgrades delivered through this program component include draft proofing, insulation, and energy efficient space heating and water heating equipment.

Green Heat currently provides incentives through an after-purchase mail-in rebate offer delivery approach. In the Preferred Plan a mid-stream delivery approach for heat pumps

is being introduced. Rebates will be offered on products such as heat pumps, biomass space heating equipment, solar thermal products for space and water heating, and electric thermal storage (ETS) units.

Home Energy Assessment was developed specifically to help homeowners make energy efficient upgrade choices and implement deep savings measures such as building envelope improvements and the installation of efficient heating systems, which can deliver significant energy savings to customers. The home energy evaluation, coupled with the interaction with a NRCan Registered Energy Advisor and prioritized, tailored recommendations, help to educate and inform homeowners who otherwise may not be aware of their home's upgrade potential. Financial incentives in the form of rebates or low interest financing are offered to help homeowners overcome the financial barrier to implementing otherwise costly retrofits.

4.2.2 Enhancements in 2020-2022

Several new initiatives are introduced in 2020-2022 to enhance the Existing Residential Program. These are detailed in the following section.

Domestic Hot Water Support

In Nova Scotia, energy used to heat potable water accounts for approximately 16 percent of household energy use.[11] EfficiencyOne estimates that of the approximately 400,000 households in Nova Scotia, 55 percent use electricity for domestic water heating (DWH). Historically, EfficiencyOne's portfolio has achieved 8 percent to 10 percent of its residential energy savings from measures that target water heating.

[11] Natural Resources Canada National Energy Use Database, 2016. *Residential Sector, Nova Scotia, Table 2: Secondary Energy Use and GHG Emissions by End-Use*

Reducing electricity used for water heating is achieved by using less hot water, reducing thermal losses and/or heating the water more efficiently. Several enhancements to the Existing Residential program in the Preferred Plan focus on helping customers reduce the amount of electricity used for domestic water heating.

Additional Measures

Green Heat will expand its measure mix to include drain water heat recovery (DWHR) systems and domestic water heater timers.

Additional Support

Increased financial support will be provided for heat pump water heaters and DWHR in both the Green Heat and Home Energy Assessment program components. Additional engagement with plumbers and plumbing contractors will be leveraged to support the implementation of these upgrades in the residential sector.

Mid-stream[12] Delivery Approach for Cold Climate Ductless Heat Pumps

Currently, incentives for ductless heat pumps are delivered through a downstream mail-in rebate via Green Heat or as part of whole home upgrades in Home Energy Assessment. Enhancements for the Preferred Plan include transitioning the delivery approach to the provision of instant rebates for qualifying heat pump products. This enhancement is expected to drive participation by helping overcome barriers relating to: perceived administrative burden of mail-in applications, understanding the benefits of the equipment, and the upfront costs of purchasing the equipment.

EfficiencyOne will work directly with participating residential home heating

[12] Mid-stream delivery approach refers here to the supply distribution chain where incentives are reimbursed back to the distributor (or retailer) with the net after-rebate price made available to the contractor or end-use customer at time of purchase.

distributors to help promote and market the offer to customers.

Deeper Energy Savings Support for Home Energy Assessment Participants

Home upgrades such as increasing insulation and, energy efficient space and water heating systems are an important part of the residential sector portfolio. Achieving deeper energy savings that are long lasting is a key objective of the Home Energy Assessment program component. It is estimated that at the end of 2018, the market penetration for Home Energy Assessment was 17 percent, indicating there is room to grow the Home Energy Assessment program component. Two enhancements will support increased participation in Home Energy Assessment.

Project Management Support

Existing Residential will begin offering project management support to participants who wish to complete significant home upgrades in Home Energy Assessment. This project management support will build on assistance already offered in Home Energy Assessment, and will likely include increased efforts to:

- answer more detailed questions about the Home Energy Assessment report;
- facilitate participation;
- connect the homeowner with Efficiency Trade Network (ETN) contractors to complete the recommended upgrades; and
- facilitate participation in other ENS programs relevant to the customer.

Additional Support

Increased financial support will be provided to encourage Home Energy Assessment participants to implement deeper energy savings projects. Coupled with program management support, it is anticipated that more Home Energy Assessment customers will implement upgrades recommended through the program, and a subset of those customers will be encouraged to achieve more significant energy savings than they

would have without these additional support elements. The intention of this effort is to further increase the level of efficiency upgrades occurring in homes, helping customers get their homes closer to net-zero energy use.

Demand Reduction Measures

Demand reduction initiatives are being introduced as part of the broader DSM portfolio in the Preferred Plan. These initiatives are meant to build on the demand reduction pilot beginning in 2019. Demand reduction focused measures (ETS units and electric storage hot water heater timers) are included in the Green Heat and Home Energy Assessment program components.

First Nations Home Energy Efficiency

This program component will continue the efforts of the pilot initiatives in both 2018 and 2019. Additional upgrades in First Nation homes will occur under the Existing Residential Program in the Preferred Plan.

Affordable Multi-Family Housing & Non-Profit Organizations

This is a new program component being introduced under the Existing Residential Program in the Preferred Plan. This effort will build on ENS experience delivering a similar program funded by the Province of Nova Scotia (to reduce non-electrical energy use), and through past ENS efforts to improve the energy efficiency in affordable rental units.

4.2.3 Objectives

Objectives of the Existing Residential program include:

- increase customer awareness of cost-effective energy efficient options;
- improve the energy performance of residential dwellings within Nova Scotia;

- improve homeowners understanding of energy efficiency in their home and how their house functions as a system;
- improve energy efficiency in affordable housing to help reduce energy poverty and maintain affordable housing in Nova Scotia;
- significantly reduce energy use in homes across all 13 First Nations communities in Nova Scotia;
- achieve long lasting energy and system-peak demand savings;
- provide customer engagement to support the broader transition to wide-scale adoption of energy efficiency products and behaviours across Nova Scotia; and
- encourage the adoption of equipment that reduces utility peak demand.

4.2.4 Opportunity

Target Market

The Existing Residential program serves all types of residential dwellings in Nova Scotia. These include single detached homes, semi-detached homes/duplexes, townhouses, mobile/mini homes, rental housing, and other multi-family residences such as apartments and condominiums.

Market Barriers

Barriers to participating in the Existing Residential program include:

- Affordability – lack of financial resources to cover upfront costs (product/equipment, installation, energy assessments).
- Awareness – lack of information/knowledge about energy efficient technologies, upgrades, energy savings and benefits.
- Resources – lack of time/human resources for project management, contractor management, upgrade implementation.

- Split incentive – when landlords are not paying for utilities (specifically heating), they are often not motivated to implement energy efficiency upgrades to the building and/or equipment.

Program History

The Existing Residential program has been operating in various forms since Efficiency Nova Scotia Corporation became Nova Scotia's DSM Administrator. The oldest component, Home Energy Assessment, was inherited from Conserve Nova Scotia and NS Power (acting as interim DSM Administrator). Prior to this, HEA incentives were offered by the federal government in the early 2000's. The other components, Green Heat, Efficient Product Installation, First Nations Home Energy Efficiency, and Affordable Multi-family Housing and Non-Profit Organizations have each evolved from pilots.

DSM funds have consistently incentivized homeowners to make energy efficient choices through its Home Energy Assessment program component with additional support from the federal and provincial governments at various times over the last ten years. The component underwent a significant change in 2012 where its name was updated to Home Energy Assessment (from "EnerGuide for Existing Houses") and its eligible measures were scaled back to focus solely on building envelope upgrades. A financing option was added in 2013, giving participants the choice of low-interest financing instead of rebates to support their home upgrades. The program component underwent additional revisions in October 2015 where it reduced the cost to participants for energy assessments, began offering rebates for heating systems and water heating equipment, and re-structured its rebates to encourage participants to achieve deeper energy savings (e.g. higher rebates for bundled upgrades). The rebate structure was again re-structured in July 2018 in response to customer feedback that the previous design was confusing and difficult to navigate. In September 2017, Home Energy

Assessment began using a new EnerGuide Rating System to convey a home's performance to participants; rather than assigning a rating of 0-100, the new system calculates a rating in gigajoules that reflects the modelled consumption of a home where 0 gigajoules is the best a home can achieve.

Green Heat was initially launched as a Fuel Substitution pilot in 2011 and was established as a full program component the following year. While it initially included incentives for switching to natural gas heating systems, the program component was modified in 2013 to focus on switching to fuel derived from renewable sources. At that time, the program component was re-launched under the name Green Heat. In 2015, it incorporated solar thermal rebates that were formerly offered under a separate program component and began rebating ductless mini-split heat pumps, which significantly increased program participation. The most recent set of notable changes took place in 2017, when Green Heat revised its delivery model to reflect an after-purchase mail-in rebate program to remove barriers to participation.

Efficient Product Installation was piloted in 2011 as an extra service under several other program components. Because of its success and potential for energy savings, it launched as a stand-alone program component in 2012. Initially focusing on communities with a high percentage of low-income residents and participants in other ENS programs, the service became available to all Nova Scotians in 2014. At its outset, the service replaced incandescent bulbs with CFL bulbs, and by 2014, it was primarily replacing incandescent bulbs with LEDs. In 2017, the program component merged with the former "Rental Properties and Condominiums" program component to offer a complete, consistent service to residents living in all sizes of homes or buildings. The program component continues to monitor the efficient product market and test new equipment and approaches in order to respond to changes in the market. Recent promotions tested in 2018 have included LED holiday lights (exchanged with

incandescent lights), thermostatic shower valves, and clotheslines.

In 2018, EfficiencyOne launched the First Nations Home Energy Efficiency pilot with funding from both the Province of Nova Scotia and DSM, supporting non-electric and electric upgrades, respectively. The first phase of the pilot is scheduled to end in the spring of 2019 and reach a total of 100 participants across all 13 First Nations communities in Nova Scotia. It is also anticipated that a second phase of this pilot will continue for the remainder of 2019.

4.2.5 Program Design

Measures Promoted

The Existing Residential program offers financial and technical assistance in the following areas:

- installation of low-cost energy efficiency products at no cost to customer;
- direct engagement and education;
- home energy assessments to identify energy efficiency upgrade recommendations tailored to the home;
- energy audits for affordable multi-family housing buildings and non-profit organizations who provide shelter;
- financial incentives in the form of rebates and financing for major upgrades such building envelope, space heating equipment, domestic water heating equipment and system-peak demand reduction measures (i.e. ETS units and electric storage hot water heater timers); and
- project management.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan

Measure Level Technical Tables) for additional detail.

4.2.6 Implementation Strategy

Program Delivery

The Existing Residential Program leverages a variety of delivery approaches to help customers implement energy efficiency improvements in their home. These strategies include:

- turn-key direct installation service;
- after purchase mail-in rebates;
- mid-stream instant rebates;
- project management support; and
- whole building energy modelling and upgrade incentives.

The Affordable Multi-Family Housing and Non-Profit Organizations program component is delivered in partnership with contracted energy auditors. An energy audit is performed on the building to identify energy efficiency opportunities specific to the building. Following the completion of upgrades, which could include increased insulation, energy efficient space and water heating equipment, appliances and lighting, participants receive rebates based on the implemented upgrades.

Efficient Product Installation is delivered in partnership with external delivery agents who are responsible for booking installation appointments with customers, installing the energy efficient products, demonstrating the products to participants, engaging with customers about energy efficiency, installer training and education, reporting and data collection, and marketing efforts.

The First Nations Home Energy Efficiency program component is delivered in partnership with Nova Scotia First Nations Communities and a delivery agent. Housing Managers in each community select their participants based on need. Where possible, EfficiencyOne's delivery agent hires qualified First Nation-preferred contractors to complete the work. EfficiencyOne's delivery agent is responsible for:

- conducting the initial home energy assessment;
- proposing upgrades that are reviewed and approved by both EfficiencyOne and the Housing Managers;
- hiring and managing contractors to implement the approved upgrades;
- conducting quality assurance site visits on all completed upgrades;
- conducting final home energy assessment; and
- providing documentation to EfficiencyOne.

Green Heat will be delivered through an after-purchase mail-in rebate approach and will expand to offer a mid-stream instant rebate path for heat pumps. Customers can choose to receive rebates at the time of purchase from any participating distributors/retailers, or to submit a mail-in rebate at their convenience after installation of the equipment is complete. This will provide flexibility for customers, and also offer an opportunity for EfficiencyOne to engage more directly with equipment providers to supply further information/training on relevant rebates.

The Home Energy Assessment program component is delivered with the support of NRCan licensed Service Organizations. Registered Energy Advisors complete an initial home energy assessment and provide the homeowner with a report containing tailored upgrade recommendations. Homeowners select and complete energy efficient upgrades. Participants who wish to implement significant upgrades can choose to help implement upgrades through additional project management support. After completing upgrades, the Energy Advisor performs a final home energy assessment. Received

rebates are based on the implemented upgrades.

Marketing Strategy

The Existing Residential program marketing strategy will use integrated marketing campaigns by program component, focus on cross promotion between program components and have key messages focusing on non-energy benefits to enhance customer's lifestyles while making their homes more comfortable and energy efficient. EfficiencyOne will collaborate closely with its design agency, the Efficiency Trade Network and its program delivery agents to reach markets and deliver effective messaging. Specific tactics will include:

- contractor education and training;
- Delivery Agent education and training;
- industry event promotion;
- integrated media plan;
- engagement with permit offices;
- in-store promotion;
- leveraging strategic partnerships; and
- community outreach.

Quality Assurance

The Existing Residential program has an established quality assurance framework inclusive of random and targeted site visits, energy model file reviews and rebuilds, documentation review, and customer surveys.

4.2.7 Performance Indicators

Performance indicators for the Existing Residential program are provided in Table 10

below.

Table 10: 2020-2022 Existing Residential Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Participation (homes)[d]	Participation (projects)[e]	Levelized Cost of Saved Energy ($/kWh)[f]	Nominal cost of saved energy ($/kWh)[g]
2020	11.2	35.6	523.6	16.2	1.9	5.9	251,764	1,003	34	0.032	$ 0.021
2021	11.5	35.5	537.2	16.7	1.9	6.1	225,962	1,112	34	0.033	$ 0.021
2022	11.2	33.6	503.5	16.6	2.0	6.3	207,571	1,002	34	0.034	$ 0.022
Total	34.0	104.7	1,564.3	49.6	1.9	6.1	685,297	3,117	102	0.033	$ 0.022

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Efficient Product Installation, Green Heat, Home Energy Assessment, and First Nations Home Retrofits.
[d] The number of households completing upgrades through Home Energy Assessment and First Nations Home Retrofits.
[e] The number of projects completing upgrades through the Affordable Multifamily Renter Program component.
[f] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[g] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

4.2.8 Low-Income Performance Indicators

Low-income performance indicators for the Existing Residential program are provided in Table 11 below.

Table 11: 2020-2022 Existing Residential Low-Income Performance Indicators

Year	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Participation (products)[a]	Participation (homes)[b]	Participation (projects)[c]
2020	8.5	86.1	1.26	103,672	112	34
2021	8.0	83.6	1.22	92,668	112	34
2022	7.5	76.9	1.13	84,806	112	34
Total	24.1	246.6	3.61	281,146	336	102

[a] The number of individual products rebated through Efficient Product Installation and First Nations Home Retrofits.
[b] The number of households completing upgrades through First Nations Home Retrofits.
[c] The number of projects completing upgrades through the Affordable Multifamily Renter Program component.

4.2.9 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and alternate scenario. The significant difference between the Alternate scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels. Table 12 below presents this difference for the Existing Residential program.

Table 12: Existing Residential Performance Indicators - Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Participation (homes)[d]	Participation (projects)[e]	Levelized Cost of Saved Energy ($/kWh)[f]	Nominal cost of saved energy ($/kWh)[g]
Preferred	2020	11.2	35.6	523.6	16.2	1.9	5.9	251,764	1,003	34	$ 0.032	$ 0.021
	2021	11.5	35.5	537.2	16.7	1.9	6.1	225,962	1,112	34	$ 0.033	$ 0.021
	2022	11.2	33.6	503.5	16.6	2.0	6.3	207,571	1,002	34	$ 0.034	$ 0.022
	Total	34.0	104.7	1,564.3	49.6	1.9	6.1	685,297	3,117	102	$ 0.033	$ 0.022
Alternate	2020	9.1	31.0	454.2	14.0	1.9	6.3	224,711	871	17	$ 0.030	$ 0.020
	2021	9.3	30.9	466.3	14.3	1.9	6.5	201,600	968	17	$ 0.030	$ 0.020
	2022	8.9	29.1	436.2	14.0	2.0	6.7	185,110	869	17	$ 0.031	$ 0.020
	Total	27.2	91.0	1,356.6	42.2	1.9	6.5	611,421	2,708	51	$ 0.031	$ 0.020
Variance from Preferred	2020	-19%	-13%	-13%	-14%	0%	7%	-11%	-13%	-50%	-7%	-7%
	2021	-20%	-13%	-13%	-15%	0%	7%	-11%	-13%	-50%	-8%	-8%
	2022	-21%	-13%	-13%	-16%	0%	8%	-11%	-13%	-50%	-9%	-9%
	Total	-20%	-13%	-13%	-15%	0%	7%	-11%	-13%	-50%	-8%	-8%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Efficient Product Installation, Green Heat, Home Energy Assessment, and First Nations Home Retrofits.
[d] The number of households completing upgrades through Home Energy Assessment and First Nations Home Retrofits.
[e] The number of projects completing upgrades through the Affordable Multifamily Renter Program component
[f] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[g] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

4.3 New Residential: Program Description

4.3.1 Overview

The New Residential program, marketed as New Home Construction, provides customers who are building a new home access to technical expertise and financial

incentives for the installation of energy efficiency upgrades during the design and early construction phases.

Working with a NRCan Registered Energy Advisor, participants have their house plans modelled to estimate the energy consumption of the initial design. Based on the results, tailored upgrade recommendations are provided to help customers make informed decisions and achieve energy efficiency targets for their home. Upon completion the home is modelled to estimate energy consumption as-built and receives its home rating label.

4.3.2 Objectives

Objectives of the New Residential program include:

- deliver significant and long-lasting energy savings for homeowners;
- increase homeowner and builder awareness of cost-effective options for improving the energy efficiency of new homes;
- reduce lost opportunities for energy savings;
- introduce best practices and improvements upon current home design, construction techniques, and systems commissioning; and
- improve the energy efficiency of new Nova Scotia housing stock comprising single detached, semi-detached, and row homes.

4.3.3 Opportunity

Target Market

The target market is comprised of Nova Scotia residents and builders who are building a new home in Nova Scotia.

Market Barriers

Barriers to participation in the New Residential program include:

- Upfront costs: for both modelling and energy efficient upgrades.
- Lack of information: lack of familiarity with energy efficient upgrades and equipment.
- Competing interests: builders who are building on specifications may not prioritize energy efficiency in trying to keep purchase costs low for prospective buyers.

Program History

DSM funds began supporting the New Residential program in 2009, two years before Efficiency Nova Scotia Corporation began administering the program. Marketed as "Performance Plus" beginning in late 2010, and then re-launched as "New Home Construction" in 2014, the program has maintained a simple incentive structure with slight modifications over the years to reflect available funding and a continuously evolving market. In 2017, New Home Construction and Home Energy Assessment simultaneously adopted the new EnerGuide Rating System.

With the aim of continuing to push the new residential building market toward highly energy efficient homes, New Home Construction initiated a Passive House pilot in 2016 which provided incentives for homes reaching Passive House requirements. Building on the pilot experience a top tier incentive was added to the New Residential program in December 2018 to encourage builders and homeowners to build top performance homes such as Passive Homes, net zero ready homes, and net zero homes.

4.3.4 Program Design

Measures Promoted

The New Residential program provides financial incentives to participants based on whole home modelling. Typical energy efficiency upgrades recommended and implemented by program participants are: increased insulation levels; energy efficient space heating and water heating equipment; and, efficient ventilation systems.

Incentives are provided to both reduce the upfront costs of pre- and post- construction modelling, as well as for the implementation of comprehensive energy efficiency upgrades. Upgrade incentives are performance based (corresponding to the size of the home) and are aligned with the achievement of consumption targets as compared to a home built to the Nova Scotia building code. Incentives are tiered and increase with increased energy savings to encourage homeowners and builders to build top performance homes such as Passive Homes, net-zero ready and net zero homes.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan Measure Level Technical Tables) for additional detail.

4.3.5 Implementation Strategy

Program Delivery

The New Residential program is delivered in partnership with contracted Service Organizations who are licensed by NRCan.

Customers work directly with ENS and NRCan Registered Energy Advisors for detailed home design advice and program guidance. The customer works with the Energy Advisor to model their new home before it is built using building code and

house plan inputs to assess the projected energy consumption of the home under different scenarios of energy efficiency upgrades. The Energy Advisor provides tailored recommendations for a variety of upgrade options, helping the customer assess how to achieve high efficiency targets.

Upon completion of the new home, a final onsite evaluation is completed by the Energy Advisor and the home (as built) is modelled. The modelled results provide an energy rating for the completed new home.

Marketing Strategy

The marketing strategy for the New Residential program will continue to focus on building strong relationships and value for both homebuilders and contractors and communicating long-term benefits of the program. This will be achieved by raising awareness of program benefits with key audiences. The marketing strategy for New Residential will focus on builder and permit office engagement through outreach, home shows and events, sponsorships, educational outreach, inbound marketing, digital marketing, content strategy, marketing communications (e.g. case studies) and training opportunities. Media tactics may include radio, out of home (e.g. billboard), print, digital, and potentially earned media.

Quality Assurance

The New Residential program has an established quality assurance framework, which includes random and targeted site visits, model file review and rebuild, and customer surveys.

4.3.6 Performance Indicators

Performance indicators for the New Residential program are provided in Table 13 below.

Table 13: 2020-2022 New Residential Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (homes)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
2020	2.8	5.5	165.8	1.6	1.5	4.5	785	$ 0.038	$ 0.017
2021	3.0	5.7	171.6	1.6	1.5	4.5	808	$ 0.039	$ 0.017
2022	3.2	5.9	177.3	1.7	1.6	4.6	830	$ 0.040	$ 0.018
Total	9.0	17.0	514.7	4.8	1.5	4.6	2,423	$ 0.039	$ 0.017

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of households completing upgrades through New Home Construction.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

4.3.7 Low-Income Performance Indicators

Low-income participation in the New Residential program is assumed to be zero.

4.3.8 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and alternate scenario. The significant difference between the Alternate scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels. Table 14 below presents this difference for the New Residential program.

Table 14: New Residential Performance Indicators - Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (homes)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
Preferred	2020	2.8	5.5	165.8	1.6	1.5	4.5	785	$ 0.038	$ 0.017
	2021	3.0	5.7	171.6	1.6	1.5	4.5	808	$ 0.039	$ 0.017
	2022	3.2	5.9	177.3	1.7	1.6	4.6	830	$ 0.040	$ 0.018
	Total	9.0	17.0	514.7	4.8	1.5	4.6	2,423	$ 0.039	$ 0.017
Alternate	2020	2.5	4.9	148.1	1.4	1.5	4.5	701	$ 0.038	$ 0.017
	2021	2.7	5.1	153.3	1.4	1.5	4.5	722	$ 0.039	$ 0.017
	2022	2.8	5.2	158.4	1.5	1.6	4.6	742	$ 0.040	$ 0.018
	Total	8.0	15.2	459.8	4.3	1.5	4.6	2,165	$ 0.039	$ 0.017
Variance from Preferred	2020	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	2021	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	2022	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%
	Total	-11%	-11%	-11%	-11%	0%	0%	-11%	0%	0%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of households completing upgrades through New Home Construction.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5. BUSINESS, NON-PROFIT AND INSTITUTIONAL PROGRAMS AND SERVICES

The Preferred Plan maintains a focus on delivering energy savings benefits to Nova Scotia business customers through a variety of effective programs. Over the 2016-2018 period, market penetration in the commercial sector, particularly in the lighting market increased. This was accomplished in part through strong distributor engagement that EfficiencyOne plans to leverage in 2020-2022 as part of a transition towards increasing the proportion of savings from non-lighting upgrades. Implementing more comprehensive upgrades comes with barriers, such as increased cost, complexity and required expertise. The Preferred Plan will help more business customers overcome these barriers by making it easier for them to participate in programs, connecting them with expertise specific to their needs, and building on efforts to further reach business customers.

The Preferred Plan supports the adoption of a variety of energy-efficient products and services in areas such as capital retrofit projects, process-focused energy management and new building construction. The Preferred Plan demonstrates an increased shift towards helping customers achieve savings that are more challenging and builds on related steps taken in 2019 that have eliminated incentives for some lighting measures. Enhancements for this plan period, described in the next section, focus on the following key areas:

- decreasing reliance on energy savings from lighting;
- increasing accessibility to programs; and
- increasing the types of benefits delivered by DSM (i.e. including system-peak demand reduction).

The Preferred Plan offers three Business, Non-Profit and Institutional (BNI) sector

programs comprised of five program components, as presented in Table 15 below.

Table 15: Preferred Plan: BNI Sector Offerings

Program	Program Component	Target Market Segment	Delivery Approach	Enhancements in 2020-2022
Custom Incentives	Custom	Existing and new construction BNI facilities	Facilitated* and financial incentives	• New system-peak demand reduction support • New small new construction incentives
	Energy Management Information Systems	Industrial, institutional	Facilitated and financial incentives	
	Strategic Energy Management	Industrial	Facilitated and financial incentives	
Direct Installation	Small Business Energy Solutions	Small businesses	Facilitated and financial incentives	• New system-peak demand reduction measure (ETS)
BNI Efficient Product Rebates	Business Energy Rebates	Existing and new construction BNI facilities	Point of sale rebates and mail in rebates	• New system-peak demand reduction measure (ETS)

**Facilitated is defined as providing customers with assistance in identifying energy efficiency opportunities and guidance on implementation to satisfy program requirements.*

5.1 Efficient Product Rebates: Program Description

5.1.1 Overview

The Efficient Product Rebates program provides BNI customers with financial incentives for the installation of energy efficient and system-peak demand-reducing

equipment. The program focuses primarily on equipment that has applicability across a variety of commercial, industrial and institutional customers and equipment that has predictable energy and system-peak demand savings. The program offers customers two participation pathways, instant rebates and mail-in rebates:

- Instant rebates: customers have access to prescriptive rebates on a variety of energy efficiency equipment through point-of-purchase discounts through a province-wide network of distribution partners; and
- Mail-in rebates: customers have access to prescriptive rebates on a variety of energy efficiency equipment through mail-in applications. Through the mail-in pathway customers can have their rebate adjusted in some cases to reflect the energy savings resulting from the specific conditions of the project.

5.1.2 Enhancements in 2020-2022

Demand Reduction

Demand reduction initiatives are being introduced as part of the broader DSM portfolio in the Preferred Plan. These initiatives are meant to build on the 2019 demand reduction pilot. Demand reduction focused measures are included in the BNI Efficient Product Rebates program, in the form of the availability of rebates for a wide range of ETS options suitable to a wide range of business customers.

5.1.3 Objectives

Objectives of the BNI Efficient Product Rebates program include:

- encourage the use of efficient products in a variety of facilities;
- increase the market penetration of the supported technologies; and
- promote the adoption of high-efficiency equipment.

5.1.4 Opportunity

Target Market

The target market includes all Nova Scotia business, non-profit and institutional facilities, including multi-unit residential buildings.

Market Barriers

Barriers to the BNI Efficient Product Rebates program include:

- Upfront costs: the higher priced energy efficient equipment is a barrier for many customers.
- Project Return: Competing priorities for capital investments.
- Lack of knowledge and technical expertise means many customers are not familiar with high efficiency options.
- Lack of internal capacity to include energy efficiency considerations (e.g. identify, evaluate) during purchase decisions.

Program History

The BNI Efficient Product Rebates program launched in 2010 and was initially modelled closely after successful prescriptive programs offered in other markets, specifically Vermont. Since the core program was developed, new measure categories have been added and/or removed, as determined by market need and technological evolution.

The success of the program has led to an increase in the adoption of LED products in existing buildings and new construction projects throughout Nova Scotia. Along with ENS incentives, decreasing prices and widespread availability have removed some of the barriers for businesses to be able to access and incorporate some of these LED products. In response to these changes in the market, EfficiencyOne removed several

lighting products from its Efficient Product Rebates program in 2019 and adjusted the available rebates on others. This has allowed the program to place greater focus on other areas of energy efficient technology.

5.1.5 Program Design

Measures Promoted

All measures listed under the BNI Efficient Product Rebates program are prescriptive. As the program develops and expands in scope, the list of eligible measures will change as required.

- agriculture;
- compressed Air;
- heating;
- IT & datacenters;
- kitchen;
- laundry;
- lighting;
- refrigeration;
- solar thermal;
- pool equipment;
- pumping;
- variable frequency drives; and
- water heating.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan Measure Level Technical Tables) for additional detail.

5.1.6 Implementation Strategy

Program Delivery

BNI Efficient Product Rebates uses a self-directed approach for both the instant savings and mail-in incentive pathway. Through instant savings, point-of-purchase discounts are available on a variety of high efficiency equipment. The mail-in path provides an avenue for pre-approval and after purchase incentives.

Program partners are crucial to the success of the BNI Efficient Product Rebates program. In particular, electrical and pumping distributors within the province play a key role in promoting instant rebates through the program. These distributors also provide assistance to customers in the form of product expertise, as well as assistance in completing mail-in applications. Electrical distributors involved with the BNI Efficient Product Rebates program are active participants in the ETN, which provides marketing support and training to distributors.

Marketing Strategy

The strategic marketing focus is to enhance relationships with the distributor network. The marketing strategy will be aligned by customer segment or vertical. Key messages will focus on non-energy benefits as well as ways to enhance business operations through rebates. EfficiencyOne will collaborate closely with its partners, business development team and the ETN to reach markets and deliver messaging effectively. Specific tactics used will include:

- business development engagement;
- presentations to relevant industry associations;
- preparation of marketing materials for specific verticals;
- marketing materials placed in distributor branches;

- attendance at trade shows;
- inclusion of articles in trade association newsletters;
- province wide mail-outs and e-blasts to businesses targeting customers and leveraging program participation through data analytics;
- distributor training and instore promotion; and
- partner recognition.

Quality Assurance

The BNI Efficient Product Rebates program has an established quality assurance framework that includes random and targeted site visits, documentation review, and customer surveys.

5.1.7 Performance Indicators

Performance indicators for the BNI Efficient Product Rebate program are provided in Table 16 below.

Table 16: 2020-2022 BNI Efficient Product Rebates Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
2020	7.3	40.6	580.3	8.0	2.2	7.0	380,309	$ 0.019	$ 0.013
2021	7.5	42.0	604.9	8.8	2.3	7.5	368,216	$ 0.018	$ 0.012
2022	7.8	43.1	621.9	9.3	2.4	7.7	353,546	$ 0.019	$ 0.013
Total	22.6	125.7	1,807.1	26.2	2.3	7.4	1,102,071	$ 0.019	$ 0.012

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through the Mail-In and Instant Rebates elements of Business Energy Rebates.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5.1.8 Low-Income Performance Indicators

Low-income performance indicators for the BNI Efficient Product Rebate program are provided in Table 17 below.

Table 17: 2020-2022 BNI Efficient Product Rebates Low-Income Performance Indicators

Year	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Participation (products)[a]
2020	3.3	47.8	1.10	31,262
2021	3.5	49.8	1.20	30,268
2022	3.5	51.2	1.28	29,062
Total	10.3	148.8	3.59	90,592

[a] The number of individual products rebated through Business Energy Rebates.

5.1.9 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and alternate scenario. The significant difference between the Alternative scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels. Table 18 below presents this difference for the BNI Efficient Product Rebates program.

Table 18: Efficient Product Rebates (BNI) Performance Indicators - Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
Preferred	2020	7.3	40.6	580.3	8.0	2.2	7.0	380,309	$ 0.019	$ 0.013
	2021	7.5	42.0	604.9	8.8	2.3	7.5	368,216	$ 0.018	$ 0.012
	2022	7.8	43.1	621.9	9.3	2.4	7.7	353,546	$ 0.019	$ 0.013
	Total	22.6	125.7	1,807.1	26.2	2.3	7.4	1,102,071	$ 0.019	$ 0.012
Alternate	2020	6.4	36.2	518.4	6.8	2.2	7.0	339,699	$ 0.018	$ 0.012
	2021	6.5	37.6	540.4	7.4	2.3	7.5	328,879	$ 0.018	$ 0.012
	2022	6.8	38.5	555.5	7.8	2.4	7.7	315,755	$ 0.018	$ 0.012
	Total	19.7	112.3	1,614.4	21.9	2.3	7.4	984,333	$ 0.018	$ 0.012
Variance from Preferred	2020	-12%	-11%	-11%	-15%	-1%	0%	-11%	-2%	-2%
	2021	-13%	-11%	-11%	-16%	-1%	0%	-11%	-2%	-2%
	2022	-13%	-11%	-11%	-17%	-1%	0%	-11%	-3%	-3%
	Total	-13%	-11%	-11%	-16%	-1%	0%	-11%	-2%	-2%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through the Mail-In and Instant Rebates elements of Business Energy Rebates
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5.2 Custom Incentives: Program Description

5.2.1 Overview

The Custom Incentives program provides financial incentives and technical assistance to help non-profit, institutional, commercial and industrial customers reduce their electrical energy consumption and system-peak demand. Support is customized based upon consideration of project-specific energy and system-peak demand savings.

The program is designed to accommodate a wide range of customer project types and works directly with customers to identify and implement energy efficiency and system-peak demand reduction projects that are not supported by other ENS programs.

The Custom Incentives program is comprised of the following three program

components:

- Custom;
- Energy Management Information Systems (EMIS); and
- Strategic Energy Management (SEM).

5.2.2 Enhancements in 2020-2022

Demand Reduction

Demand reduction initiatives are being introduced as part of the broader DSM portfolio in the Preferred Plan. These initiatives are meant to build on the demand reduction pilot beginning in 2019. Support for demand reduction measures within the Custom Program is expected to maintain the broader proposed implementation structure of the Program but allow for incentives for projects that focus exclusively on system-peak demand savings. As with the broader program, these incentives are expected to be offered in the form of support for scoping and feasibility studies, as well as direct financial incentives and financing options.

Small New Construction Service

The Small New Construction service will offer financial and technical assistance to small commercial buildings. Historically these buildings have been underserved by ENS new construction offerings. This service will offer both a prescriptive and performance path to help small commercial customers improve the energy performance of their new construction projects.

5.2.3 Objectives

Objectives of the Custom Incentives program include:

- influence electrical energy efficiency and system-peak demand reduction

projects within Nova Scotia;

- build awareness around the benefits of energy efficiency to program participants;
- increase awareness of cost-effective energy efficiency options for BNI customers;
- help BNI customers overcome the barriers to implementing complex, custom energy efficiency projects;
- increase developer and builder awareness of cost-effective options for improving the energy efficiency of new buildings;
- increase the number of new buildings adopting high efficiency design techniques;
- provide customers with the knowledge and tools required to enable energy management;
- promote long term relationships with customers to achieve energy sustainability, and cost reduction objectives; and
- further diversify the program offerings of ENS by developing new programs from technologies and methods successfully trialed in the Custom Incentives program.

5.2.4 Opportunity

Target Market

The Custom Incentives program is open to all Nova Scotia business, non-profit, institutional and industrial customers. Despite its broad customer eligibility criteria, the program typically targets larger energy users.

Market Barriers

Barriers to participation in the Custom Incentives program include:

- Financial constraints resulting from internal competition for capital.
- Upfront cost requirement for feasibility studies and audits before energy savings

potential is known can be challenging for businesses to justify.

- Payback periods: businesses often require short paybacks on investments making it challenging for custom energy efficiency projects to compete against other capital investments.
- Time and internal capacity constraints.
- Lack of internal commitment to energy management.
- Lack of technical expertise can mean that in-house staff are unfamiliar with new efficient technologies or processes.

Program History

The Custom Incentives program began with a single component, Custom Retrofit, in May 2008. When Efficiency Nova Scotia began administering the program in 2010, it added a New Construction program component to help streamline services offered to large BNI participants. The Custom program component includes incentives for retrofits and new construction opportunities and continues to be a cornerstone of EfficiencyOne's portfolio.

The implementation of pilots and additional services since 2010 has broadened the Custom Incentives offering, providing opportunities for a wider range of BNI participants to carry out energy efficiency projects with assistance from Efficiency Nova Scotia. For example, the program initiated a compressed air optimization offering in 2013. The Building Optimization service within the Custom program component, formerly known as "Existing Building Commissioning", was introduced in 2014 and then re-vamped in 2016 to encourage higher participation with a revised structure and delivery process. Most recently, in 2018, a New Construction Commissioning Pilot was introduced to encourage participants to fully commission their building at the end of the construction process. EMIS, which began as a pilot in 2013, is now a stand-alone component. SEM began in 2014 and has since evolved from a cohort delivery approach

to a continuous uptake approach to better accommodate individual customer timelines.

5.2.5 Program Design

Measures Promoted

A variety of technical and financial assistance is available through the program, which is designed to consider projects individually. This approach allows support to be customized based on case specific energy and system-peak demand savings. Some key areas of support provided through the program include:

- financial incentives for initial scoping and feasibility studies to evaluate energy and system-peak demand savings opportunities;
- financial incentives for energy modelling of new building designs to identify and evaluate energy efficiency upgrades;
- financial incentives (rebates and financing) for implementing cost-effective electrical energy efficiency and system-peak demand reduction projects;
- financial and/or technical assistance for improvements to compressed air systems;
- financial and/or technical assistance to optimize building performance; and
- financial and technical support for customers to assess and implement energy management opportunities, specifically in the areas of operations, maintenance and behavioural savings.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan Measure Level Technical Tables) for additional detail.

5.2.6 Implementation Strategy

Program Delivery

The Custom Incentives program structure is designed to overcome customer barriers associated with large upfront costs, lack of in-house capacity and business case requirements. The program is delivered through a combination of EfficiencyOne staff, contracted partners and third-parties to identify, define, assess, and implement energy saving opportunities. Involved external resources are often consulting engineering firms, efficiency contractors and service providers, and heating, ventilation and air conditioning automation companies.

Marketing Strategy

The marketing strategy for Custom Incentives is to segment, profile, and launch integrated marketing campaigns (e.g. mass media, print, direct mail, digital and social media, events, outreach) by vertical (e.g., large commercial, industrial, municipal, distributors). The marketing strategy for the BNI sector will continue to be aligned by customer vertical and key messages will focus on ways to improve operational efficiency and also promote non-energy benefits. EfficiencyOne will collaborate closely with our design agency, business development team and Efficiency Trade Network to reach markets and deliver messaging effectively. Specific tactics used will include:

- business development engagement;
- presentations to relevant industry associations;
- preparation of marketing materials and campaigns for specific verticals;
- case studies;
- attendance at trade shows;
- inclusion of articles in trade association newsletters;

- leverage strategic relationships with developers, architects, mechanical and electrical designers;
- service provider and contractor training; and
- partner recognition.

Quality Assurance

The Custom Incentives program has an established framework for quality assurance. Quality control of projects includes pre and post measurement of energy consumption (e.g. direct, modelled, expert review), random and targeted site visits, documentation review and customer surveys.

5.2.7 Performance Indicators

Performance indicators for the Custom Incentives program are provided in Table 19 below.

Table 19: 2020-2022 Custom Incentives Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (projects)[c]	Participation (participants)[d]	Levelized Cost of Saved Energy ($/kWh)[e]	Nominal cost of saved energy ($/kWh)[f]
2020	9.0	33.2	457.5	8.8	2.0	4.9	112	13	0.029	$ 0.020
2021	9.3	34.2	472.4	9.1	2.1	5.1	116	13	0.029	$ 0.020
2022	9.5	35.2	487.4	9.4	2.2	5.4	120	13	0.029	$ 0.020
Total	27.8	102.6	1,417.3	27.2	2.1	5.2	348	39	0.029	$ 0.020

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of projects supported through the Custom program component (includes Custom Retrofit, BNI New Construction, and Building Optimization).
[d] The number of companies participating in EMIS and SEM.
[e] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[f] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5.2.8 Low-Income Performance Indicators

Low-Income performance indicators for the Custom Incentives program are provided in Table 19 below.

Table 20: 2020-2022 Custom Incentives Low-Income Performance Indicators

Year	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Participation (projects)[a]
2020	2.1	29.8	0.15	16
2021	2.1	30.8	0.16	16
2022	2.2	31.8	0.16	17
Total	6.4	92.4	0.48	49

[a] The number of projects completing upgrades through Custom.

5.2.9 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and alternate scenario. The significant difference between the Alternate scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels. Table 21 below presents this difference for the Custom Incentives program.

Table 21: Custom Incentives Performance Indicators - Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (projects)[c]	Participation (participants)[d]	Levelized Cost of Saved Energy ($/kWh)[e]	Nominal cost of saved energy ($/kWh)[f]
Preferred	2020	9.0	33.2	457.5	8.8	2.0	4.9	112	13	$ 0.029	$ 0.020
	2021	9.3	34.2	472.4	9.1	2.1	5.1	116	13	$ 0.029	$ 0.020
	2022	9.5	35.2	487.4	9.4	2.2	5.4	120	13	$ 0.029	$ 0.020
	Total	27.8	102.6	1,417.3	27.2	2.1	5.2	348	39	$ 0.029	$ 0.020
Alternate	2020	8.0	29.7	408.7	7.9	2.0	4.9	100	12	$ 0.029	$ 0.020
	2021	8.3	30.6	422.0	8.1	2.1	5.1	103	12	$ 0.029	$ 0.020
	2022	8.5	31.5	435.4	8.4	2.2	5.4	107	12	$ 0.029	$ 0.020
	Total	24.8	91.7	1,266.1	24.3	2.1	5.2	310	36	$ 0.029	$ 0.020
Variance from Preferred	2020	-11%	-11%	-11%	-11%	0%	0%	-11%	-11%	0%	0%
	2021	-11%	-11%	-11%	-11%	0%	0%	-11%	-11%	0%	0%
	2022	-11%	-11%	-11%	-11%	0%	0%	-11%	-11%	0%	0%
	Total	-11%	-11%	-11%	-11%	0%	0%	-11%	-11%	0%	0%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of projects supported through the Custom program component (includes Custom Retrofit, BNI New Construction, and Building Optimization).
[d] The number of companies participating in EMIS and SEM.
[e] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[f] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5.3 Direct Installation: Program Description

5.3.1 Overview

The Direct Installation program (marketed as Small Business Energy Solutions 'SBES') provides small business customers access to technical assistance and financial incentives for the installation of energy efficient and system-peak demand reduction equipment. There are two pathways available for customers: self-directed and facilitated. These pathways are described as follows:

- Self-directed: this pathway allows customers who have already identified and selected those energy efficiency opportunities they plan to pursue to select a contractor of their choosing to complete the upgrades, or EfficiencyOne can direct them to seek out contractors using the Efficiency Trade Network.

- Facilitated: this pathway provides customers with assistance in identifying energy efficiency opportunities with an energy audit performed by a Small Business Energy Auditor. The customer then selects the opportunities they plan to pursue and select a contractor themselves or by using the Efficiency Trade Network.

Financial assistance is provided for a variety of prescriptive energy efficiency products; however, customized incentives are an option for customers when energy savings are identified and estimated by a Small Business Energy Auditor.

5.3.2 Enhancements in 2020-2022

Demand Reduction

Demand reduction initiatives are being introduced as part of the broader DSM portfolio in the Preferred Plan. These initiatives are meant to build on the demand reduction pilot beginning in 2019. Demand reduction focused measures are included in the Direct Installation program through incentive support for a range of ETS units suitable for small to medium sized businesses.

5.3.3 Objectives

Objectives of the Direct Installation program include:

- increase customer awareness of cost-effective energy efficiency and system-peak demand reduction options;
- help small business make smart energy upgrades;
- help small business be more profitable and more comfortable; and
- remove/eliminate barriers for the adoption of energy efficient and system-peak demand reduction products by Nova Scotia's small businesses.

5.3.4 Opportunity

Target Market

The target market is primarily small commercial businesses, and can also include not-for-profits, multi-unit residential buildings and small industrials. The program is targeted to those small businesses with annual electrical energy consumption of 350,000 kWh or less.

Market Barriers

Barriers to participation in the Direct Installation program include:

- Affordability: the cost of equipment/upgrades and lack of access to affordable capital can be a barrier to program participation.
- Awareness: some potential participants may not understand the costs, benefits, and appropriateness of various projects for their business.
- Resources: some participants may not have the resources, such as time, human capital for project management, and capacity to hire contractors to implement upgrades.

Program History

The Direct Installation program began in 2008 in Dartmouth and Pictou County with incentives available for energy efficient lighting upgrades. A recycling component was incorporated into this program in 2009. In 2010, Efficiency Nova Scotia Corporation expanded the Direct Installation program to include small businesses across the entire province. Since its inception, the program's offering has broadened to include non-lighting measures and encourage installation of a wider range of energy efficiency products. In 2015, the program underwent its most significant change to increase industry participation. EfficiencyOne modified the program from a delivery agent model (responsible for all aspects of program delivery including marketing,

administration, ordering, delivery, and installation) to a program design that allows participants to select their own contractors and install approved energy efficiency products. This change coincided with the development of the Efficiency Trade Network, where participants could find qualified contractors for their projects. No-cost energy audits were made available for certain qualifying small businesses where a Small Business Energy Auditor would perform a complete energy audit and develop a list of energy efficiency opportunities for the participant. EfficiencyOne has implemented several changes to improve the participant experience since its re-launch in 2015 and plans to continue delivering the program under this general program design into 2020. This includes an increased focus on growing awareness and participation in the energy audit path where the participant receives additional support from the Small Business Energy Auditor.

The Affordable Multi-Family Housing pilot launched in 2016 using a similar framework as SBES. Eligible measures were similar to those offered in SBES; however, the pilot specifically targeted landlords renting affordable housing units. Initial efforts did not generate strong participation results and few upgrades were implemented. In 2017, the Province of Nova Scotia provided support to build on the DSM pilot to help overcome barriers in this target market. Initial feedback suggested a need for higher incentives, more time to complete projects, and additional project management support were needed to help participants. In the Preferred Plan a new program component has been included in the Existing Residential program which aims to help low-income renters and non-profit organizations providing shelter specifically.

5.3.5 Program Design

Measures Promoted

The Direct Installation Program provides financial and technical support to small business customers through both a self-directed and facilitated pathway. This support includes:

- no-cost energy audits to assess upgrade opportunities;
- customized measure incentives through the energy audit path; and
- prescriptive rebates through the self-serve path for energy efficient upgrades in the areas of lighting and heating, ventilation and air conditioning primarily and system-peak demand reduction upgrades, specifically through ETS units.

Please refer to **Attachment 1** of this report (2020-2022 Preferred DSM Resource Plan Measure Level Technical Tables) for additional detail.

5.3.6 Implementation Strategy

Program Delivery

The Direct Installation program is designed to overcome barriers faced by small Nova Scotia businesses, including lack of capital for implementing energy efficient upgrades, lack of time and expertise to identify and assess efficiency opportunities.

The self-directed path approach is designed for those business that already know what energy options they wish to pursue. The facilitated pathway is delivered in partnership with contracted Small Business Energy Auditors. The Energy Auditors provide technical support to small business customers. They conduct an energy audit of the business to identify energy upgrade opportunities, provide recommendations to the

customer and help them understand the options that have been assessed. Financial incentives are provided for both the cost of the energy audit as well as the implementation of energy efficiency upgrades.

Marketing Strategy

The marketing strategy is to segment, profile, and launch integrated marketing campaigns (e.g. media, print, direct mail, digital and social media, events, outreach) to effectively reach small businesses. This will involve leveraging brand messaging specifically for the small business vertical, refining messaging around non-energy benefits, and collaborating closely with the Efficiency Trade Network to reach markets and deliver messaging effectively. Specific tactics used may include:

- targeted marketing campaigns and messaging to drive program participation;
- presentations to relevant industry and economic development associations;
- preparation of marketing materials to highlight customer success stories;
- attendance at trade shows;
- inclusion of articles in trade association newsletters;
- targeted mail-outs and e-blasts to small businesses to leverage program participation; and
- contractor training.

Quality Assurance

Direct Installation has an established quality assurance framework, which includes random and targeted site inspections, documentation review, and customer surveys.

5.3.7 Performance Indicators

Performance indicators for the Direct Installation program are provided in Table 22 below.

Table 22: 2020-2022 Direct Installation Performance Indicators

Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
2020	4.4	9.5	127.7	2.3	2.1	2.8	132,255	$ 0.050	$ 0.034
2021	4.6	10.1	134.9	2.7	2.2	3.0	138,284	$ 0.050	$ 0.034
2022	4.9	10.6	142.3	3.0	2.2	3.2	144,686	$ 0.050	$ 0.034
Total	13.9	30.2	404.9	8.0	2.2	3.0	415,225	$ 0.050	$ 0.034

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Small Business Energy Solutions.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

5.3.8 Low-Income Performance Indicators

Low-income performance indicators for the Direct Installation program are provided in Table 23 below.

Table 23: 2020-2022 Direct Installation Low-Income Performance Indicators

Year	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Participation (products)[a]
2020	0.01	0.1	0.00	296
2021	0.01	0.1	0.00	307
2022	0.01	0.1	0.00	320
Total	0.02	0.3	0.00	923

[a] The number of individual products rebated through Small Business Energy Solutions.

5.3.9 Program Alternatives

EfficiencyOne considered the same key principles in both the development of the 2020-2022 Preferred DSM Resource Plan and Alternate scenario. The significant difference between the Alternate scenario and EfficiencyOne's Preferred Plan is that participation levels are reduced due to lower energy savings and investment levels. Table 24 below presents this difference for the Direct Installation program.

Table 24: Direct Installation Performance Indicators - Comparison of Preferred and Alternate Plans

Scenario	Year	Investment ($ million)	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[a]	Program Administrator Cost Test (PAC)[b]	Participation (products)[c]	Levelized Cost of Saved Energy ($/kWh)[d]	Nominal cost of saved energy ($/kWh)[e]
Preferred	2020	4.4	9.5	127.7	2.3	2.1	2.8	132,255	$ 0.050	$ 0.034
	2021	4.6	10.1	134.9	2.7	2.2	3.0	138,284	$ 0.050	$ 0.034
	2022	4.9	10.6	142.3	3.0	2.2	3.2	144,686	$ 0.050	$ 0.034
	Total	13.9	30.2	404.9	8.0	2.2	3.0	415,225	$ 0.050	$ 0.034
Alternate	2020	3.8	8.5	114.1	1.8	2.0	2.7	118,217	$ 0.049	$ 0.033
	2021	4.0	9.0	120.6	2.0	2.1	3.0	123,585	$ 0.048	$ 0.033
	2022	4.2	9.5	127.1	2.2	2.1	3.1	129,286	$ 0.048	$ 0.033
	Total	11.9	27.0	361.8	6.0	2.1	2.9	371,088	$ 0.048	$ 0.033
Variance from Preferred	2020	-13%	-11%	-11%	-22%	-4%	-3%	-11%	-3%	-3%
	2021	-14%	-11%	-11%	-24%	-4%	-3%	-11%	-4%	-4%
	2022	-15%	-11%	-11%	-26%	-5%	-3%	-11%	-5%	-5%
	Total	-14%	-11%	-11%	-24%	-4%	-3%	-11%	-4%	-4%

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding.
Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM.
Avoided costs of transmission and distribution were provided by NS Power in 2018.
Total cost-effectiveness tests are calculated using the sum of each year's present value of benefits and costs
[a] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[b] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.
[c] The number of individual products rebated through Small Business Energy Solutions.
[d] The levelized cost of saved energy represents the cost of lifetime energy savings, with savings discounted using Nova Scotia Power's weighted average cost of capital (WACC).
[e] The nominal cost of saved energy is the quotient of lifetime energy savings and investment.

6. ENABLING STRATEGIES

Enabling Strategies are an essential component of this DSM Plan and are required for EfficiencyOne to meet energy and system-peak demand savings targets now and in the future. As in previous plans, EfficiencyOne will continue to use Enabling Strategies to invest in research and development, among other strategies, that provide information and tools to help inform energy and cost savings to Nova Scotians.

EfficiencyOne's 2020-2022 Enabling Strategies will include:

- Education and Outreach;
- Development and Research; and
- Other Enabling Strategies (Efficiency Trade Network, Codes and Standards and Regulatory Affairs).

Enabling Strategies have the following objectives:

- increase awareness of, and education about, DSM programs and services, driving long term participation;
- evolve DSM programs and services through innovation and improving delivery of these services; and
- drive market transformation.

6.1 Education and Outreach

The objective of Education and Outreach activities is to increase program participation by effectively communicating what energy efficiency is and how it positively affects the lives of Nova Scotians. Education and Outreach activities also help, over time, to establish energy efficiency as a cultural norm in Nova Scotia.

A high proportion of Nova Scotians express a high level of agreement that adopting a

more energy efficient lifestyle adds to their quality of life (71 percent in Q3 2018)[13], which suggests that Enabling Strategies activities have positively influenced public perception of energy efficiency over time. However, the influence EfficiencyOne has on leading households to reduce their energy consumption (30 percent in Q3 2018) [14] demonstrates that opportunities remain to help more Nova Scotians turn this perception into action.

Education and Outreach strategies in 2020 through 2022 will build on EfficiencyOne's activities and experience to date and take into account the ongoing feedback collected from Nova Scotians through surveys, interviews, and one-on-one interactions.

[13] Corporate Research Associates. *Autumn 2018 Atlantic Quarterly*
[14] *Ibid*

Areas of focus will include:

- continuing to inspire Nova Scotians to adopt an energy efficient lifestyle with a branding platform that creates a strong emotional connection with customers, and with ENS partners and contractors, by demonstrating the value and benefits of participating in DSM programs (i.e. “Enjoy the good things efficiency brings.”);
- improving the ENS digital experience for customers;
- continuing to evolve and optimize ENS content to ensure it is designed around customer needs and delivered at the right point along the customer decision journey;
- removing barriers that affect customer experience and hinder the customer’s ability to find the information, support and programs they need;
- engaging students, teachers and other stakeholders in the education sector to build a culture of energy efficiency in Nova Scotia and foster the next generation of energy efficiency leaders; and
- continuing to build strategic partnerships in relevant sectors to share energy efficiency information and support with more Nova Scotians.

The following components support this strategy:

- advertising to increase awareness and understanding of how energy efficiency, and participating in DSM programs, connects positively to the lives of Nova Scotians;
- engaging Nova Scotians on the ENS website, and through various social media channels, electronic newsletters and stories in the media, to promote participation in DSM programs and build a culture of energy efficiency through education;
- continuing a vertical marketing approach to ensure businesses understand the value of incorporating energy efficiency into their specific industry;
- gaining a better understanding of residential customer segments through research and profiling to increase engagement and grow participation in our residential

programs;

- continuing to enhance the Green Schools program to engage and educate teachers, students and other key stakeholders in the education sector;
- working with post-secondary education institutions to promote and integrate energy efficiency into the curriculum;
- developing strategic partnerships with identified organizations in relevant sectors to reach more Nova Scotians;
- organizing events and presentations on energy efficiency; and
- additional activities as opportunities arise.

6.2 Development and Research

EfficiencyOne uses an evidence-based approach to achieve cost-effective incremental net energy and system-peak demand savings for its customers. Continuing to invest in research and development will ensure that programs evolve with changing technology and the market landscape. These activities will:

- support the evolution of DSM programs and future DSM Resource Plans via research and development initiatives; and
- improve customer service and engagement through customer relationship management via development activities.

6.2.1 Research

EfficiencyOne recognizes that the key to delivering cost-effective energy savings is to keep the customer front and center when making business decisions around program design and delivery. Reducing barriers to enrollment and offering compelling services and delivery approaches is critical. Specific development and research activities will focus on:

- Understanding customers and market conditions:
  - motivations and barriers research;
  - trends and preferences in consumer behaviour and energy consumption behavior; and
  - incentive-level research.

- Developing customer-centric approaches to engagement and service delivery:
  - testing alternative marketing approaches;
  - using predictive analytics to segment and target customers;
  - piloting new technologies and approaches to make delivery of savings easier for customers, and to improve customer engagement and interactions; and
  - examining and piloting new use cases using customer energy usage data.

- Evolving programs and developing future DSM Resource Plans:
  - researching opportunities from other jurisdictions and partnering with other DSM experts; and
  - researching and piloting new measures and new approaches to service delivery.

6.2.2 Development: New initiatives

EfficiencyOne will undertake new initiatives to test appropriate ways to meet changing market conditions, reach under-served segments of customers, and take advantage of new information and technology. These initiatives include:

- researching and testing service delivery approaches to encourage dynamic energy management and control at commercial building sites;
- exploring opportunities to help businesses manage and reduce demand costs –

for example, using interval data for large businesses to identify system-peak demand reduction opportunities, and promoting building optimization software;

- exploring net-zero (or near net-zero) options for existing residential;
- exploring new service delivery approaches for homes and business (e.g., a whole-home/business approach as opposed to a 'program-by-program' approach); and
- researching and testing the use of Advanced Metering Infrastructure data and associated technology, in combination with advanced analytics (e.g., machine-learning and artificial intelligence) to:
- develop more customized offerings and information to customers based on electricity usage patterns and load shape; and
- determine potential for costs reduction (e.g., test effectiveness of remote energy audits; more reliance on usage data for measurement and verification where appropriate).
- EfficiencyOne intends to continue to support the 2019 Locational-DSM Pilot until its planned conclusion in 2020.

6.3 Other Enabling Strategies

The Other Enabling Strategies for 2020-2022 include the following:

- Efficiency Trade Network;
- Codes and Standards; and
- Regulatory Affairs.

6.3.1 Efficiency Trade Network

EfficiencyOne has recruited over 200 members to the ETN since 2016 in locations across Nova Scotia. The ETN structure allows EfficiencyOne to effectively engage

trade allies to build industry capacity in Nova Scotia and meet DSM savings targets. The ETN connects businesses and homeowners with trusted professionals including contractors, insulation installers, heating system installers, electricians, and more to complete their efficiency projects.

In 2020, and through 2022, EfficiencyOne will continue to enhance the ETN. Areas of focus will include:

- adding new members with specific expertise in under-represented markets;
- continuing to raise awareness and showcase all the benefits of ETN membership to existing and potential members;
- continuing to provide ETN members with marketing materials and support to help sell DSM programs to customers;
- continuing to offer training opportunities to ETN members;
- supporting events or industry conferences where customers, current ETN members, and potential members can network and build relationships; and
- exploring the development of a system to recognize and/or reward ETN members to motivate them to bring more projects to DSM programs.

The following components will support this strategy:

- developing and distributing success stories through a variety of internal channels (e.g. the ETN newsletter, training sessions, ETN meetings) and external targeted channels (e.g. trade publications, conferences, professional meetings);
- advertising ENS sponsored events and training through email, ENS's website, newsletters, and word-of-mouth;
- coordinating with other industry associations to disseminate training opportunity information;
- sponsoring training that enables contractors to take on new types of projects or grow their businesses; and

- hosting Bright Business Conferences and other networking events to support the development of new relationships within the industry and work referrals.

6.3.2 Codes & Standards

In 2020-2022, EfficiencyOne will continue to work with government colleagues to promote and advance the development of evidence-based and meaningful changes to energy efficiency related codes and standards in collaboration with the provincial and federal government, as well as other stakeholders. In addition, EfficiencyOne will continue to advocate for and support the adoption of energy-efficiency standards within provincial and federal regulations.

EfficiencyOne anticipates continued participation in the Canadian Standards Association's Steering Committee on Performance, Energy Efficiency and Renewables and associated Strategic Resource Task Force, as well as other related committee participation as opportunities arise. In addition, EfficiencyOne will provide increased technical and policy support to both provincial and federal governments relating to strategic electrification, demand response, energy storage, and other forms of DSM.

6.3.3 Regulatory Affairs

Regulatory Affairs activities include NSUARB processes, DSM Advisory Group initiatives and stakeholder consultation work, industry research, and legal work related to regulatory initiatives.

In 2020-2022, Regulatory Affairs initiatives will include:

- developing the 2023-2025 DSM Resource Plan;
- negotiating the 2023-2025 DSM Resource Plan with NS Power and gaining

stakeholder and NSUARB-approval of the same;

- developing and/or filing regular report updates with the NSUARB on topics including:
  - 2020, 2021, 2022 Quarterly Reports;
  - 2019, 2020, 2021 Evaluation Reports;
  - 2019, 2020, 2021 Annual Progress Reports;
  - 2019, 2020, 2021 Audited Financial Statements;
  - 2020, 2021, 2022 Historical-looking Rate and Bill Impact Analysis;
  - 2019, 2020, 2021 Code of Conduct Compliance Report;
  - evaluation and verification recommendation updates; and
  - other studies, reports and updates, as appropriate.

Throughout 2020-2022, EfficiencyOne will continue to host DSM Advisory Group meetings and engage closely with stakeholders to discuss ongoing activities, as appropriate. Other initiatives will include working with the Evaluation and Verification Consultants to facilitate their efforts and pursuing commitments arising from the 2020-2022 DSM Resource Plan regulatory process.

7. EVALUATION

EfficiencyOne proposes to take a similar approach to evaluation in 2020-2022 as in 2016-2019, where evaluation activities are conducted to ensure accurate determination of net electrical energy and net system-peak demand savings. Evaluation activities will be condensed where appropriate, in recognition of the maturity level that some Efficiency Nova Scotia program components have reached. Evaluation activities will include an annual impact evaluation for each program in each of the three years, with some modification to the evaluation reporting structure. In all cases, evaluation activities will be undertaken to ensure the accurate determination of net electrical energy and net system-peak demand savings, to maximize the value of the evaluation process, and to provide opportunities for continuous improvement.

7.1 Impact Evaluations

Annual impact evaluations will provide EfficiencyOne, stakeholders, and the NSUARB with up-to-date impacts on net electrical energy and net system-peak demand savings as progress indicators towards the overall approved 2020-2022 DSM Resource Plan energy and system-peak demand savings targets. EfficiencyOne will work with the Evaluator to determine if a program component requires a full impact evaluation or a condensed impact evaluation. Condensed impact evaluation reports are expected to consist of energy (annual and lifetime) and system-peak demand savings results and distortion effects. Methodology and related calculations would be referenced to prior evaluation reports. The condensed reports would also include any changes or updates to programs and measures that occurred following the filing of the 2019 evaluation reports. This means that for stable, mature program components, the Evaluator may use the previous year's unitary savings values, realization rates, and/or installation rates. Full impact evaluation reports are expected for newer program components and

those with recent changes or more variable savings parameters. The Evaluator will design and conduct a full scope of evaluation activities for program components that require a full impact evaluation.

7.2 Process and Market Evaluations

Program process and market evaluations will remain consistent with what has occurred in the 2016-2018 DSM Resource Plan. EfficiencyOne will work with the Evaluator to determine what program components should be evaluated based on the following criteria:

- newly created program components that have not yet been evaluated;
- program components that have incurred major changes;
- program components that received many recommendations from the evaluator;
- program components that have a variance of energy savings larger than 25 percent of plan year target; and
- program components that have not received a process evaluation in the past two years.

8. REPORTING

EfficiencyOne proposes to report on the implementation of the 2020-2022 DSM Resource Plan through Quarterly Reports and Annual Progress Reports (APR) and other reporting requirements as outlined in the Standardized Filing Framework.[15]

8.1 Annual Progress Reports

In the first quarter of each calendar year, EfficiencyOne will file an APR with the NSUARB, which will include the following information:

- a summary of the context, activities and milestones achieved in the prior year, including the status of the annual performance indicators;
- a management discussion and analysis of any major discrepancies (25 percent or greater variance) relative to the original plan's intent and forecasts;
- a summary of expenditures, energy, and system-peak demand savings for each program or target market area. If the total reported results fall below 75 percent of the original plan's forecast cumulative annual net incremental energy savings up to that point, EfficiencyOne will also file a Corrective Action Plan designed to achieve the total approved energy savings target, within the NSUARB-approved multi-year budget.

In the event EfficiencyOne proposes significant changes to elements within an approved plan, advance notice will be provided to the NSUARB and Stakeholders within the APR. Significant changes include:

- adding a new Program;

[15] In accordance with the Consensus Agreement to the 2016-2018 DSM Resource Plan, Parties agreed to establish a Standardized Filing Framework for future applications to approve a DSM Supply Agreement. The Standardized Filing Framework was approved by the NSUARB September 13, 2016 (M07543).

- terminating an existing Program;
- increasing the 3-year plan budget for the total Residential sector by more than 25 percent;
- decreasing the 3-year plan budget for the total Residential sector by more than 25 percent;
- increasing the 3-year plan budget for the total BNI sector by more than 25 percent;
- decreasing the 3-year plan budget for the total BNI sector by more than 25 percent;
- increasing the 3-year plan savings target for the total Residential sector by more than 25 percent;
- decreasing the 3-year plan savings target for the total Residential sector by more than 25 percent;
- increasing the 3-year plan savings target for the total BNI sector by more than 25 percent; and
- decreasing the 3-year plan savings target for the total BNI sector by more than 25 percent.

8.2 Quarterly Reports

EfficiencyOne will file quarterly reports with the NSUARB for quarters one through three of each year. The reports will provide quarterly status updates and service highlights, as well as communicate course adjustments within the current approved DSM Resource Plan.

In accordance with the NSUARB's Revised Filing Dates letter, issued January 9, 2018, EfficiencyOne will file its 2020-2022 DSM Resource Plan Quarterly Reports no later than:

- Q1 – May 25th
- Q2 – August 25th
- Q3 – November 25th

EfficiencyOne proposes to continue reporting quarterly to the NSUARB and stakeholders on the following metrics, including:

- quarterly and year-to-date (YTD) highlights (comparison of targets, mid-course adjustments, and results by program);
- YTD investment by rate class (compared to approved forecast);
- sector highlights (results, participation, and items of interest by program, as well as low-income results);
- other activities (organized by Enabling Strategies categories); and
- advance notice of significant changes if relevant.[16]

8.3 Mid-Course Adjustments and Flexibility

EfficiencyOne often makes limited adjustments to an approved DSM Resource Plan to reflect changes in market conditions and updated insights from program and organizational evaluations unknown at the time of DSM Resource Plan development. When setting 2020-2022 Mid-Course Adjustments (MCAs), EfficiencyOne will follow the same approach as was taken for the 2019 DSM Resource Plan and 2016-2018 DSM Resource Plan MCAs. This approach includes the following:

- EfficiencyOne will provide explanations of substantial changes, defined as variance in energy savings or investment of 25 percent or more at a program level.

[16] Significant changes are defined as a variance in energy savings or investment of 25 percent or more at a program level.

- Dependent on approved cost allocation methodology, EfficiencyOne will undertake reasonable efforts to avoid program changes that will result in substantial changes to any customer rate class on an annual basis.
- EfficiencyOne will provide written advance notice of its intent to implement mid-course adjustments by program and their customer rate class impacts. The written advance notice of intent to file Mid-Course Adjustments will be included in the APRs for the 2020-2022 DSM Resource Plan period and the MCAs for the 2020-2022 DSM Resource Plan will be filed with the Quarterly Report in Q1. It is EfficiencyOne's position that it is not able to provide advance notice of mid-course adjustments resulting from third-party evaluation reports, as these adjustments are made immediately after receipt of these reports.

8.4 Audited Financial Statements

EfficiencyOne will retain the services of an external financial auditor to prepare audited annual financial statements. These will be filed with the NSUARB in the second quarter of the following year, no later than April 28 in accordance with the NSUARB's Revised Filing Dates letter issued January 9, 2018.

8.5 Rate and Bill Impact Analyses

EfficiencyOne will file its historical Rate and Bill Impact Analysis (RBIA) by October 31st of each year. The historical RBIA estimates the high-level, long-term impact to rates and bills of all DSM activities up to and including those of the previous calendar year, as well as any future DSM investments that have been approved by the NSUARB. EfficiencyOne will file a forward-looking RBIA as part of each DSM Resource Plan. The forward-looking RBIA estimates the high-level, long-term impact to rates and bills of all DSM activities conducted as part of the proposed DSM Resource Plan.

8.6 Demand Side Management Advisory Group

The DSM Advisory Group is a forum to provide strategic or directional advice and stakeholder perspectives on current or emerging DSM issues including, but not limited to, issues identified in NSUARB Orders pertaining to Demand Side Management.

8.7 Performance Metrics

EfficiencyOne proposes the following definitions and requirements for Performance Targets and Thresholds as consistent with requirements outlined in the Standardized Filing Framework.[17]

8.7.1 Definitions

To provide clarity, the following definitions are used:

Performance Metric: A quantifiable measure that is used to track and assess the status of a specific achievement.

Performance Indicators: A set of particular performance metrics used to indicate or monitor progress toward performance targets. Performance Indicators are management tools that provide information to allow an organization to take action to help it deliver on performance targets.

Performance Target: A performance metric expressed as a specific quantified goal

[17] In accordance with the Consensus Agreement to the 2016-2018 DSM Resource Plan, Parties agreed to establish a Standardized Filing Framework for future applications to approve a DSM Supply Agreement. The Standardized Filing Framework was approved by the NSUARB September 13, 2016 (M07543).

that identifies the desired outcome of an activity at a specific point in time. In this Application Performance Targets refer to NSUARB-approved targets.

Performance Threshold: A predefined quantity, percentage, or range which identifies the allowable deviation from a Performance Target within which the actual outcome is considered to have achieved success. In this Application, Performance Thresholds refer to NSUARB-approved thresholds.

8.8 Performance Targets and Thresholds

i. Performance Targets apply to the period of the NSUARB-approved Supply Agreement with NS Power, rather than annually;

ii. EfficiencyOne is deemed to be in substantial compliance with the NSUARB-approved Plan Performance Targets if 90 percent or greater achievement is reached on each of the cumulative annual energy savings and cumulative annual system-peak demand savings Performance Targets, and if 75 percent or greater achievement is reached on the cumulative lifetime energy savings Performance Target. If less than 90 percent of either cumulative annual energy savings or cumulative annual system-peak demand savings Performance Targets, or of less than 75 percent of the cumulative lifetime energy savings Performance Target, EfficiencyOne understands that the NSUARB would use its discretion to determine appropriate action.

Performance Targets consist of:

i. Cumulative annual energy savings;

ii. Cumulative annual system-peak demand savings; and

iii. Cumulative lifetime energy savings.

Performance Indicators consist of:

i. Annual incremental energy savings (reported by program and rate class);

ii. Cumulative annual energy savings (reported by program and rate class);

iii. Annual lifetime energy savings (reported by program and rate class);

iv. Annual incremental system-peak demand savings (reported by program and rate class);

v. Cumulative annual system-peak demand savings (reported by program and rate class);

vi. Total ratepayer benefits;

vii. Total spending (reported by program and rate class);

viii. Customer satisfaction;

ix. An analysis of the impact on rates through the implementation of the programs will be included as part of EfficiencyOne's historical-looking rate and bill impact analysis, filed by October 31st of each year; and

x. Reporting on low-income program participation, expenditures, and savings through a variety of methods, including estimation based on geographic census information.

Filed Electronically

Appendix A - Attachment 1:

2020-2022 Preferred DSM Resource Plan

Measure Level Technical Tables

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Appendix B

Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Resource Plan

The electronic version of this filing includes model versions (Microsoft Excel files.)

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Attachment 4: 2020-2022 Plan Rate and Bill Impact Analysis Equations

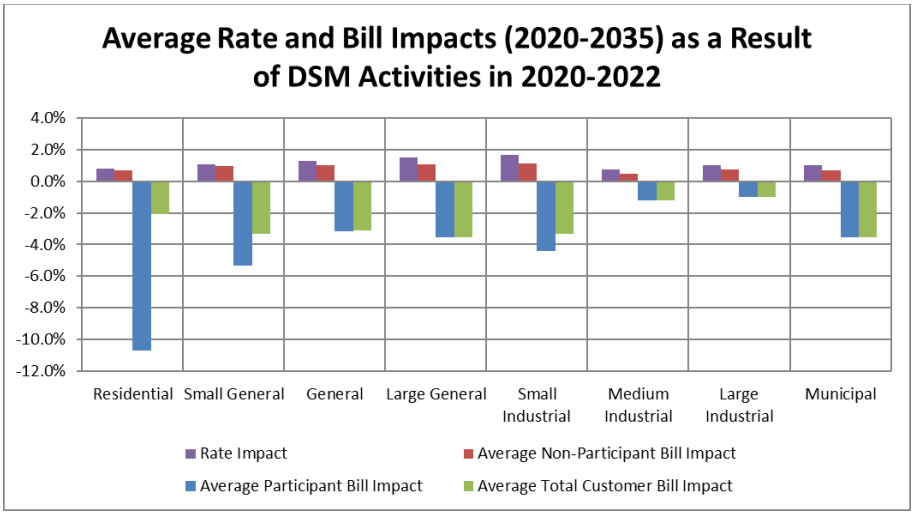
The electronic version of this filing includes model versions (Microsoft Excel files).

EXECUTIVE SUMMARY

EfficiencyOne's 2020-2022 Demand-Side Management (DSM) Resource Plan Rate and Bill Impact Analysis provides a broad trend-based picture of the rate and bill impacts of proposed DSM activities to be carried out during the 2020-2022 period, looking forward until 2035, when the modelled impacts of 2022 measures expire. Two plans have been modelled within this analysis – EfficiencyOne's Preferred 2020-2022 DSM Resource Plan (the Preferred Plan) and its Alternate scenario – each with different levels of DSM investment and savings. For each of these plans, the differences between two scenarios are compared – a no-DSM scenario that does not include 2020-2022 DSM impacts, and a DSM scenario that allocates program investments, avoided costs, and recovery of lost revenues arising from 2020-2022 DSM activities to each participating rate class, excluding Unmetered. The analysis examines DSM effects in isolation of utility effects such as the specific timing of infrastructure upgrades or general rate applications, or the creation of rate stability periods; as such it provides insight into the average effect of DSM on rates and bills over the long term, as opposed to forecasting Nova Scotia Power (NS Power) rates with a high degree of specificity in any given year.

Figure 1 presents the average rate and bill impacts over the study period (2020-2035) as a result of DSM activities in 2020-2022, in comparison with the no-DSM scenario; please note that as a result, the impacts are not the incremental impacts over the current level of DSM.

Figure 1: Average Rate and Bill Impacts (2020-2035) as a Result of DSM Activities in 2020-2022 (Preferred Plan)



The results in Figure 1 show that over the 16 years of the study period, rates will be approximately 0.8 percent to 1.7 percent higher with 2020-2022 DSM than without it. To put these impacts in context with other rate impacts, rates are assumed to rise at 2.7 percent *per year* due to non-DSM factors, to a total of 49 percent over the same 16-year period (based on an assumption used in the 2014 Integrated Resource Plan (IRP), and also the current rate of inflation).[1] The analysis shows that avoided costs and the reallocation of fixed costs roughly cancel each other out in every class, leaving DSM program cost recovery as the primary driver of rate impacts.

The Preferred Plan will offset 5.9 GWh of energy production over the lifetime of installed measures and produce 120 MW of incremental system-peak demand reductions, reducing average DSM program participant bills by 11 percent in the Residential class, while producing minimal bill impacts for non-participants. In total

[1] Bank of Canada Consumer Price Index Inflation rate for 2018-Q3.

the Preferred Plan will save NS Power customers over $475 million on their electricity bills.[2]

The model used for this analysis has evolved with input from the DSM Advisory Group (DSMAG) since its first use in 2013; following the 2016-2018 DSM Plan application, EfficiencyOne worked with the DSMAG to incorporate a means to account for fixed cost recovery. Key improvements since the most recent analysis (the 2018 Historical RBIA filed on 31 Oct. 2018) include a switch from levelized to annual avoided fuel costs and application of line loss factors to differentiate savings at the generator versus savings at the meter.

It is important to recognize that this analysis is not a comprehensive evaluation of total DSM impacts in that it ignores benefits that do not directly impact rates or bills, such as the reduction of greenhouse gas emissions, the reduction of energy poverty, investment in local businesses that deliver efficiency services instead of in foreign fuel suppliers, increased productivity in businesses, increased occupant comfort in homes and businesses, and increased room in operating budgets of public agencies, among others.

[2] 2020 net present value of bill savings incurred between 2020 and 2035; assumes an average consumer discount rate of 3 percent.

1. INTRODUCTION

This rate and bill impact analysis (RBIA) provides a high-level estimate of the impact of DSM activities proposed within EfficiencyOne's 2020-2022 DSM Resource Plan ("the Plan") on customer rates and bills, within each participating rate class, excluding Unmetered. The analysis estimates these impacts in each year from 2020 to 2035, when measures installed in 2022 expire. A full analysis was performed for both the Preferred Plan and Alternate scenario for 2020-2022.

The analysis explores the impacts of DSM on both rates and bills, as all customers experience rate impacts associated with DSM investments, and some customers participate in DSM programs, reducing their energy and peak demand use. This analysis forecasts the impacts so they can be assessed by the Nova Scotia Utility and Review Board (NSUARB) and stakeholders and considered in the decision on DSM investment over the 2020-2022 period.

The RBIA model, initially filed on November 14, 2013 along with a detailed methodology report, is designed to show the average, long-term effect of DSM on rates and bills. The model was developed by Efficiency Nova Scotia Corporation and Elenchus Research Associates and built on a sample framework provided by the NSUARB's consultant on this matter, Synapse Energy Economics. Prior to the 2013 filing, it was reviewed several times by Synapse and subsequently revised to ensure it served its required purposes. It has been revised several times since then, based on feedback from past filings and discussions with the DSMAG; the most notable enhancement to the model since its use for the 2016-2018 DSM Plan is the ability to account for the reallocation of fixed costs due to DSM amongst the remaining energy and demand sales base. Additionally, the model includes several enhancements made to the version used most recently for the 2018 RBIA, which EfficiencyOne introduced in materials circulated to the DSMAG in January 2019 and which are also described in Section 2.

Section 3 provides an overview of the model framework and discusses key assumptions. Results for the Preferred Plan are discussed in Section 4, with overall trends followed by individual rate class impacts. Section 5 compares differences between results of the Preferred Plan and Alternate scenario. Future considerations are discussed in Section 6, and concluding remarks are made in Section 7.

Attachments 1 and 2 provide outputs from the model for each rate class analyzed, for the Preferred Plan and Alternate scenario, respectively. A list of assumptions and their derivations are included as Attachment 3. Attachment 4 includes a list of equations to describe the lost revenue and avoided cost calculations. Both versions of the model, Microsoft Excel files, have been included in the electronic version of this filing.

2. UPDATE ON MODEL EVOLUTION

Several enhancements were made to the model since the 2018 RBIA, as described below.

Use of annual avoided energy costs

EfficiencyOne adopted a recommendation to use annual avoided energy costs instead of levelized avoided energy costs. The annual avoided costs in this model are from the 2014 IRP and are the same figures that were used to produce the levelized avoided costs that were used previously.

Timeframe for levelization of avoided capacity costs

EfficiencyOne adopted a recommendation to levelize the annual avoided capacity costs from the 2014 IRP over the RBIA study period, instead of using the levelized value from the 2014 IRP, which had been levelized over the IRP study period. This resulted in a levelized avoided capacity cost value of $195,990/MW instead of $195,355/MW.

Escalation of avoided transmission and distribution costs

In 2018 NS Power provided estimates of avoided transmission and distribution costs based on ACE Plan data for 2017. Since these are annual, not levelized values, EfficiencyOne applied these values to 2018 and assumed a conservative escalation rate of 2.0 percent per year thereafter.

Weighted-average bill impact graphs

EfficiencyOne adopted a recommendation to change the averaging method used to generate average bill impacts in Figure 1 and Figure 6 from an arithmetic average to a weighted average.

Line losses

EfficiencyOne adopted a recommendation to include line losses in the analysis. The model now uses savings "at meter" to calculate lost revenues and bill impacts, and savings "at generator" to calculate avoided system costs.

Addition of "Rates with and without DSM" graph in Attachments 1 and 2

This analysis previously included a graph for each class showing year-over-year percentage changes in rates with and without DSM (the bottom-left graph of odd-numbered pages in Attachments 1 and 2). Since rates do not actually change every year these graphs focused on estimated impacts that are more erratic than would be experienced in reality. They have been replaced with a new graph that shows full projected rates over the study period for both the DSM and no-DSM scenarios, to provide context to the magnitude of DSM impacts in comparison to total rates.

3. METHODOLOGY AND ASSUMPTIONS

This section describes the overall modelling approach and key assumptions.

3.1 PREFERRED AND ALTERNATE 2020-2022 DSM RESOURCE PLANS

The 2020-2022 DSM Plan includes both a Preferred Plan and an Alternate scenario, which contain different investment levels and savings over the three years of DSM delivery. A full RBIA was performed for both, using separate Excel models which have both been filed electronically. The model for both Plans is identical; the only differences are the DSM costs, savings, and participation estimates for the 2020-2022 period.

3.2 SCENARIOS

The models each compare two scenarios: a DSM scenario and a no-DSM scenario. The DSM scenario includes the estimated administrative costs and resulting energy and system-peak demand reductions of DSM programs that are proposed to operate in 2020 through 2022 (which are different for the Preferred and Alternate plans). The no-DSM scenario does not include any DSM costs for, or benefits resulting from DSM in 2020-2022. The rate and bill impacts calculated in each model are mainly presented as differences between the DSM and no-DSM scenarios, thereby isolating the effects of 2020-2022 DSM. Section 4 presents detailed results of the Preferred Plan, and Section 5 compares key results of both the Preferred and Alternate Plans for 2020-2022.

3.3 CUSTOMER CLASSES

The models present results, by rate class, for the following NS Power customer classes:

- Residential (rate codes 2, 3, 4, 5, 6, 9 and 16);
- Small General (rate code 10);

- General (rate code 11);
- Large General (rate code 12);
- Small Industrial (rate code 21);
- Medium Industrial (rate code 22;)
- Large Industrial (rate codes 23 and 25, and customers under the 'One part high voltage real time pricing' tariff); and
- Municipal (rate code 24).

The six municipal electric utilities (MEUs) are treated as the only six customers in NS Power's Municipal rate class, and each MEU is considered to be a participant in Efficiency Nova Scotia (ENS) programs when any customer within their distribution system participates in an ENS program. Participation of individual customers connected to MEU distribution systems is not modelled.

3.4 TIME PERIOD DEFINITIONS

In this analysis,

- The DSM delivery period is the timeframe over which DSM programs are delivered. The DSM delivery period is 2020-2022.
- The cost recovery period is the timeframe over which DSM program costs are recovered. Program costs for 2020-2022 are assumed to be completely recovered within each of those years, so the cost recovery period is also 2020-2022.
- The avoided costs period is the timeframe over which the benefits of DSM are realized. In this analysis, measures installed in 2022 (the last year of the DSM delivery period) have an average measure life of approximately 14 years at the portfolio level, so the avoided costs period is 2020-2035.
- The lost revenues period is the timeframe over which DSM affects the revenues collected by NS Power, relative to the no-DSM scenario. Weighted-average measure lives at the portfolio level are used for the calculation of

avoided costs but are averaged at the class level for calculation of lost revenues (this difference in modelling is due to the fact that a small amount of savings occur outside of the modelled classes but still contribute to avoided costs). In this analysis, measures installed in 2022 for the Residential class have an average measure life of approximately 14 years (the longest of all classes), so the lost revenues period is also 2020-2035.

- The study period is the full timeframe over which impacts are modelled, and by which temporal average impacts are calculated. The study period is 2020-2035.

3.5 AVOIDED COSTS

Avoided cost values used for this analysis are presented in Table 1. The avoided costs of energy and capacity were developed via a difference in revenue requirements approach through the 2014 IRP, while the avoided costs of transmission and distribution (T&D) were calculated by NS Power and shared with the DSMAG. There remains considerable uncertainty regarding the avoided T&D cost estimates; it has been suggested that the actual avoided T&D values may be in the range of thirty to one hundred times the values provided by NS Power.

Table 1: Avoided Cost values used for this analysis

Avoided Cost Category	Unit	Value	Source
Capacity	$/MW	195,990	2014 IRP, Base DSM scenario (levelized over 2020-2035)
Transmission	$/MW	Starts at 10,521 in 2018	Provided by NS Power in 2018; assumed to escalate at 2% per year
Distribution	$/MW	Starts at 4,358 in 2018	Provided by NS Power in 2018; assumed to escalate at 2% per year
Energy	$/MWh	Varies by year	2014 IRP, Base DSM scenario (annual)

3.6 PROGRAMS

Since the entire portfolio of electricity DSM programs impacts future rates and bills, the analysis includes all proposed DSM programs that will be funded by NS Power and for which costs will be recovered from electricity system ratepayers.

3.7 CALCULATING RATE IMPACTS

This section describes key elements of the rate impact calculations. The model does not forecast the timing of general rate applications, or the occurrence of any future rate adjustments; it instead assumes that rates change every year. By presenting results as differences between the DSM and no-DSM scenarios, the effects of DSM are isolated from all other utility effects impacting rates, and the rate effects presented here should be interpreted as the annual 'rate pressure' from DSM.

3.7.1 NO-DSM SCENARIO RATES

The model uses a set of forecast rates without DSM, on top of which calculated DSM impacts are added. The last year for which actual (i.e. with-DSM) rates are known is 2019. An approximate Program Cost Recovery amount was calculated for 2019, by class, and subtracted from 2019 rates (both block 1 and block 2, where applicable), to produce theoretical 2019 no-DSM rates. These rates were then escalated by the assumed energy and demand rate escalation factor of 2.7 percent to produce estimated 2020 no-DSM rates, the starting point for the analysis. These 2020 no-DSM rates are then escalated by 2.7 percent per year thereafter to produce a full set of no-DSM rates for the rest of the study period.

These no-DSM rates are used to calculate the total class revenue from energy sales (block 1, block 2, and Fuel Adjustment Mechanism (FAM) charges), which is then redistributed amongst the total kWh sales for the class, producing a single average no-DSM energy rate for each class that accounts for block 1, block 2, and FAM charges.

3.7.2 DSM SCENARIO RATES

The DSM rates are calculated by taking the average no-DSM rates, adding a program cost recovery component (upward rate pressure), adding a lost revenue component (upward rate pressure), and subtracting an avoided costs component (downward rate pressure), for each year of the study period. Two key assumptions are that a) all lost revenues must be recovered (including lost energy revenues) and b) all avoided costs must not be recovered (including avoided energy costs). Together, these two assumptions model the reallocation of fixed costs from lost sales due to DSM into an upward rate pressure.

Program cost recovery

EfficiencyOne tracks costs by rate class within each year. For each year of the 2020-2022 DSM Plan, which was originally modelled by Navigant at the program level (not by rate class), the planned investments within each program component were allocated to rate classes according to the distribution of actual 2017 expenditures by rate class. These costs are converted to a $/kWh program cost recovery component by dividing annual DSM costs by annual with-DSM scenario kWh sales within each rate class.

Avoided costs

This analysis uses annual avoided energy costs ($/MWh), levelized avoided capacity costs ($/MW), and annual avoided transmission and distribution costs ($/MW). Avoided costs are calculated at the portfolio level by multiplying total annual energy and system-peak demand savings by these rates, for each year of the avoided costs period.

Lost revenues

Similar to the development of DSM costs by rate class, EfficiencyOne allocated the 2020-2022 energy and system-peak demand savings modelled by Navigant at the program component level to rate classes according to the distribution of actual 2017 energy and system-peak demand savings within each program component.

Lost NS Power revenues are calculated at the rate class level by multiplying total DSM energy and system-peak demand savings in each year by no-DSM energy and system-peak demand rates and are then summed to the portfolio level.

Class allocation of avoided costs and lost revenues

The annual avoided costs and lost revenues at the portfolio level are then reallocated back to rate classes based on class shares of the total revenue requirement. For classes without demand charges, avoided costs and lost revenues are each divided by kWh sales within the class to form $/kWh impacts to energy rates. For rate classes with demand charges, it is assumed that energy and demand rates would change in proportion to one another, and so avoided costs and lost revenues for these classes are each split into a $/kWh energy rate impact and a $/kW demand rate impact.

3.8 CALCULATING BILL IMPACTS

This section describes key elements of the bill impact calculations.

No-DSM consumption

In the no-DSM scenario, for each rate class, in each year, the estimate of total class energy consumption is divided by the number of customers to produce an estimate of the average customer's consumption. This average consumption, along with no-DSM scenario rates, are used to calculate average bills for the no-DSM scenario. Beyond 2019, the ratio of block 1 energy consumption to total energy consumption within each class is assumed to remain constant.

Non-participant consumption and bill impacts

In the DSM scenario, non-participants in DSM programs are assumed to use the same amount of energy as they do in the no-DSM scenario. Their bill impacts are therefore driven only by changes in rates. Although non-participant bill impacts are only driven by changes in rates, the percentage bill impacts are often different than the percentage rate impacts; this is due to fixed customer charges on bills, which are unaffected by DSM.

Participant consumption and bill impacts

For the DSM scenario, within each rate class, in each year, total annual savings (i.e. current-year savings plus persistent savings from past years) are divided equally amongst the number of cumulative participants within the study period. The model does not estimate impacts for multiple 'depths of participation', i.e. all participants in each class are assumed to save the same amount of energy and system-peak demand. In reality, some participants would save more, and others would save less.

Total customer consumption and bill impacts

The output graphs include a third category of participants, called Total Customers. Impacts for this category are determined by allocating DSM savings for the class equally among all customers in the class. It provides an estimate of bills for the class without differentiating between participants and non-participants.

3.9 CALCULATING PARTICIPATION IMPACTS

For illustrative purposes, participation graphs provided in Attachments 1 and 2 include historical participation in 2011-2019 DSM programs. These participation figures are identical to those used in EfficiencyOne's historical 2018 RBIA.

Forecasted 2020-2022 participation

For the current analysis, which looks only at DSM delivered over 2020-2022, estimates of both annual and new participants are required for each program, within each rate class, for each year of the Plan. The required participant figures are counts of unique NS Power accounts, which is not the same as the participation values developed by Navigant for the 2020-2022 Plan model, which for most programs represent the number of products rebated.

EfficiencyOne has estimated 2020-2022 participation figures based on actual participation records from 2017 (the most recent year for which EfficiencyOne has integrated participant records with previous years). For each year of the 2020-2022 Plan, each 2017 participation figure was scaled by two factors: one to account for differences in overall program magnitude, and one to account for differences in the program measure mix relative to 2017. The first factor is the ratio of program component-level energy savings between each year of the Plan and 2017; the application of this factor relies on the assumption that the number of participating NS Power accounts will vary in proportion with the program energy savings. The second factor is the ratio of the number of rebated products per GWh of energy savings

between each year of the Plan and 2017; the application of this factor relies on the assumption that the number of participating NS Power accounts will also vary in proportion with the number of products rebated. There are two exceptions to this method – participant values for New Home Construction could be taken directly from Navigant's ProCESS model, as each measure in that program represents exactly one unique NS Power customer. For Custom Incentives, the measure-mix factor was not required as the program does not contain 'measures' in the same sense as other programs within the Navigant model, and so differences in the measure mix for Custom Incentives between 2017 and the Plan years could not be quantified (nor are they expected to vary significantly).

The method described above was applied to both annual participants as well as new participants (i.e. unique NS Power accounts), the latter of which is used to calculate cumulative participation since 2011 for presentation in Attachments 1 and 2.

In order to properly calculate participant bill savings resulting from the Plan, it was necessary to also estimate the number of cumulative participants (i.e. unique NS Power accounts) *within the three-year DSM delivery period*. The number of annual participants in the first year of the Plan are all considered 'new' in this context. Estimates were then developed for the number of participants in each of the second and third years of the Plan that would not have already participated within this three-year period. The model already contains estimates of new participants in these years, using the method described in the preceding paragraphs, however these new participants are incremental to all past years, starting in 2011. In order to estimate new participants relative to 2020, the ratio of new to annual participants in 2011-2013 was calculated for each class, which approximates an exponential decay curve, and accounts for the fact that delivering the same programs for the same customer base over several years will result in fewer and fewer new, unique NS Power accounts that participate, even if annual participation rates remain the same. It was assumed that, within each class, the decay rate of new participants over 2020-2022 would reflect

that which occurred over 2011-2013, and so the ratio of new to annual participants in the 2011-2013 period was applied to 2020-2022 annual participants. A cumulative sum of these figures within each class, starting in 2020, is considered the number of cumulative DSM participants within the three years of the Plan. Total annual energy and system-peak demand savings in each year are divided by these participation figures to determine the average DSM participant consumption, which is used to calculate participant bill savings. The calculation of rates and therefore non-participant bills is not affected by these participation estimates.

4. 2020-2022 PREFERRED PLAN ANALYSIS RESULTS

The results in this section are for the Preferred Plan. All impacts are calculated relative to a scenario where no DSM is conducted in 2020-2022. Summary sheets for rate, bill, and participation impacts for each applicable rate class are included in Attachment 1 for the Preferred Plan and Attachment 2 for the Alternate scenario. The graphs presented on the summary sheets have been selected based on representative outputs from the model.

4.1 OVERALL RATE IMPACTS

The general trend in rates, visible in all classes, is that the avoided costs and lost revenues are approximately in balance throughout the life of DSM measures; this means that DSM program cost recovery is the predominant driver of rate impacts. In years where DSM program costs are recovered (2020-2022), there is a net upward pressure on rates. The net result for most classes is a small (<1.7%) increase in rates when averaged over the study period. Figure 2 presents the rate impacts averaged over the study period.

Figure 2: Average Rate Impacts (2020-2035) as a Result of DSM Activities in 2020-2022 (Preferred Plan)

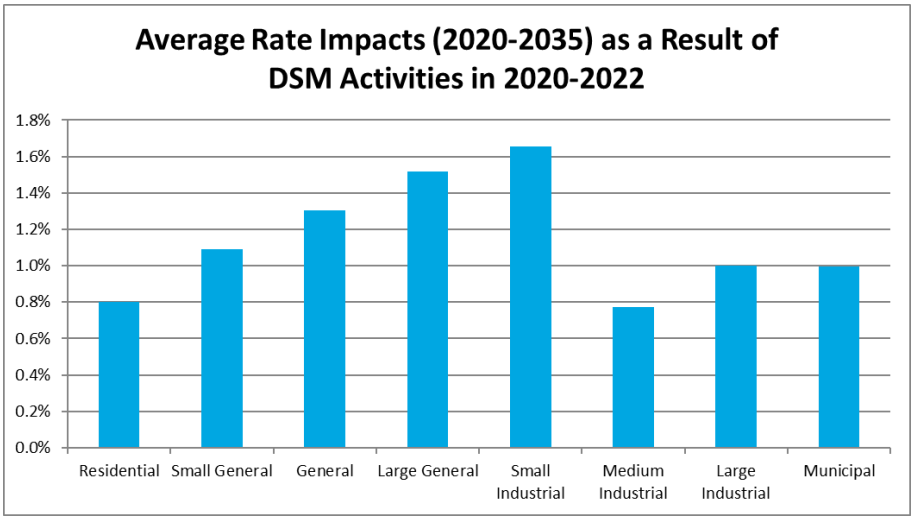
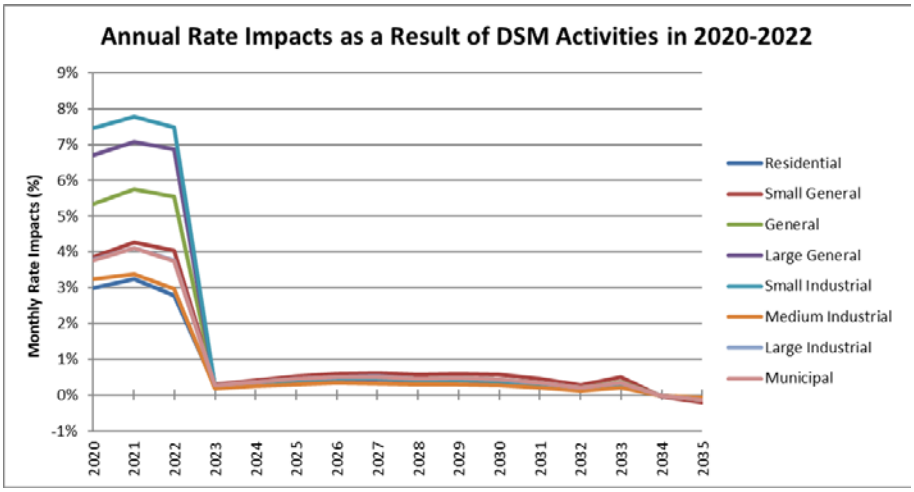


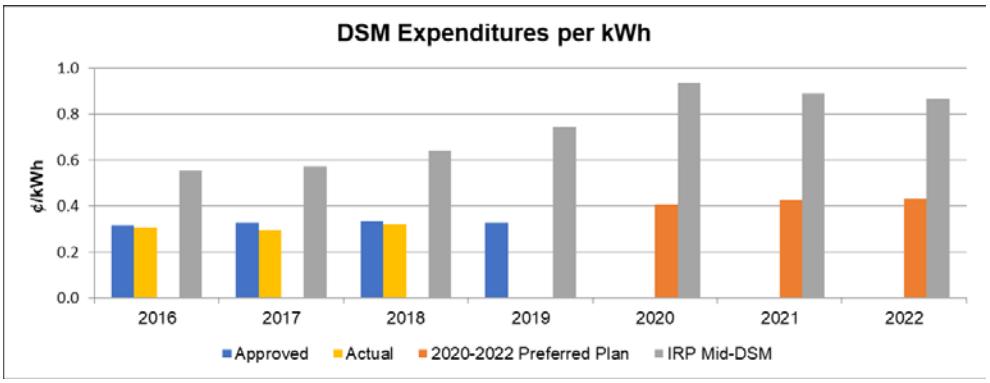
Figure 3 illustrates the annual rate effects, assuming that rates change every year. This pattern shows that program cost recovery in 2020-2022 is by far the largest contributor to rate impacts; after 2022 the rate impacts are close to zero. Effects in the last few years of the analysis are due to measures expiring in different years between each rate class and the total portfolio average. Note that these 2020-2022 impacts, in the range of three to seven percent, are calculated relative to a scenario where there are no DSM costs; these impacts are not additional to 2019 rates which include DSM costs.

Figure 3: Annual Rate Impacts as a Result of DSM Activities in 2020-2022 (Preferred Plan)



Considering that current rates already contain some DSM cost recovery, Figure 4 shows approximate overall DSM expenditures per kWh of total sales for 2016-2019 approved amounts, 2016-2018 actuals, the 2020-2022 Preferred Plan, as well as the necessary investment to support the mid-DSM scenario modelled in the 2014 IRP (part of the candidate resource plan with the lowest total revenue requirement). The increase from 2016-2019 approved amounts, which are currently in rates, to the 2020-2022 Preferred Plan average is approximately 0.1 cents per kWh. Note these figures are based on a 100 percent participant benefit allocation.

Figure 4: DSM Expenditures and Investments per kWh



Note: 2016 and 2017 energy savings use evaluated results while 2018 are estimated.

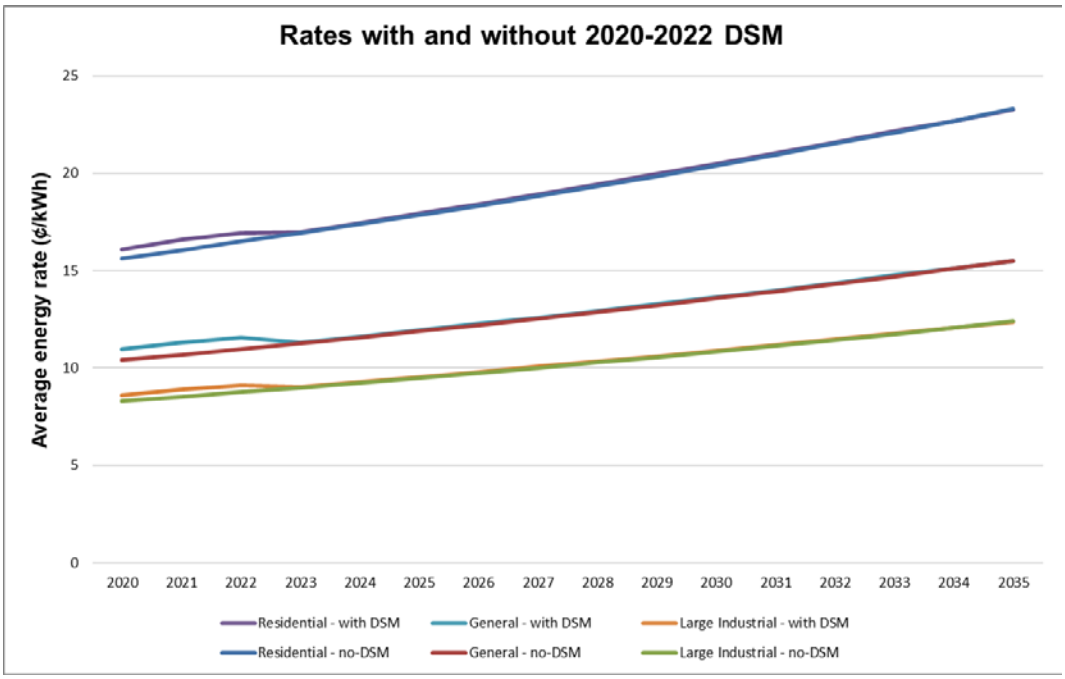
Table 2 presents the average rate impacts over the study period (the same values as in Figure 2) compared to the rate impacts from the historical 2018 RBIA. Note that the current analysis looks at three years of DSM with impacts averaged over 2020-2035 (16 years), while the 2018 RBIA looked at nine years of DSM (2011-2019) with impacts averaged over 2011-2031 (21 years). The current analysis also uses annual avoided energy costs and line losses, while the 2018 analysis used levelized avoided energy costs and did not account for differences between savings at the meter and savings at the generator.

Table 2: Average Rate Impact compared to No-DSM Scenario, 2018 Historical to 2020-2022 Preferred Plan Results Comparison

	2018 Historical RBIA Result (Average Impact over 2011-2032)		2020-2022 Preferred Plan RBIA Result (Average Impact over 2020-2035)	
Rate Class	**(cents/kWh)**	**(%)**	**(cents/kWh)**	**(%)**
Residential	+0.044	+0.36%	+0.136	+0.80%
Small General	+0.137	+1.09%	+0.175	+1.09%
General	+0.073	+0.81%	+0.145	+1.31%
Large General	+0.068	+0.89%	+0.152	+1.52%
Small Industrial	+0.080	+0.91%	+0.174	+1.66%
Medium Industrial	+0.020	+0.31%	+0.066	+0.77%
Large Industrial	+0.005	+0.09%	+0.090	+1.00%
Municipal	+0.005	+0.11%	+0.090	+1.00%

Figure 5 puts rate impacts from 2020-2022 DSM in context with other assumed rate impacts over the study period. Using the assumption that rates escalate by 2.7 percent per year, rates will rise by 49 percent over the study period due to factors other than DSM. Both the DSM and no-DSM rates are shown in Figure 5 for three representative classes: Residential, General and Large Industrial. The pattern is similar for the other classes. The only material rate impacts are in the first three years when DSM program costs are being recovered.

Figure 5: Rates with and without 2020-2022 DSM for three classes (Preferred Plan)



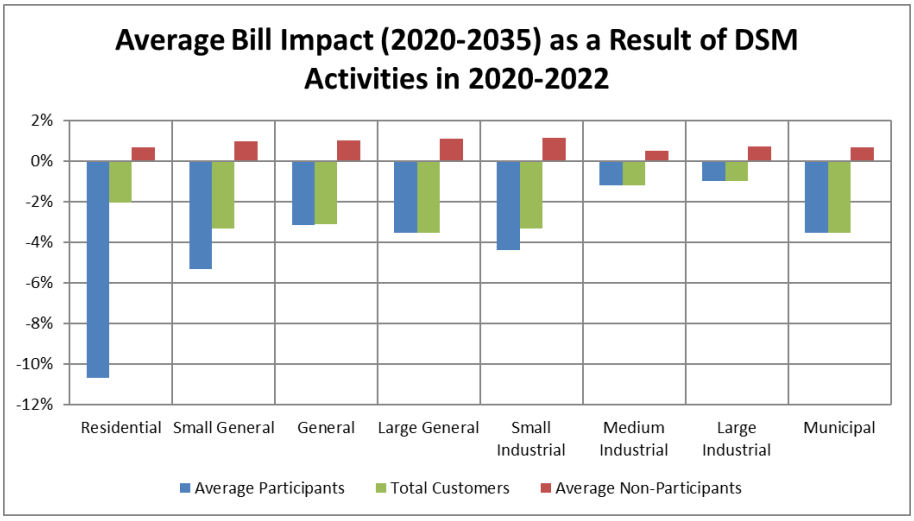
4.2 OVERALL BILL IMPACTS

The analysis shows that between 2020 and 2035, participants in 2020-2022 DSM programs under the Preferred Plan will see average bill reductions between 1 percent (Medium and Large Industrial) and 11 percent (Residential). The average bill impact for non-participants over this period is an increase of 0.5 percent (Medium Industrial) to 1.1 percent (Large General and Small Industrial). Over the study period, NS Power

customers will see bill savings over $475 million as a result of 2020-2022 DSM programming.[3]

Average bill impacts for participants, non-participants and total customers are presented in Figure 6, by class. Variations in average participant savings between classes reflect the ability of a typical energy efficiency project (i.e. a project with a statistically average level of savings) to impact a customer's total bill. Generally, participants in lower-consumption classes can lower their bills by a significant amount through installation of relatively simple lighting, heating and hot water measures. Implementing these same simple measures for participants in higher-consumption classes, particularly medium and large industrial, save a much lower portion of their bill, as a significant portion of their electricity consumption is tied to industrial processes that are relatively more difficult to reach through DSM programs.

Figure 6: Average Bill Impact (2020-2035) as a Result of DSM Activities in 2020-2022 (Preferred Plan)



When examining non-participant bill impacts, it is important to note the broad reach of EfficiencyOne's point-of-sale rebate program components, Instant Savings and the

[3] *Ibid.*

Instant Rebates portion of Business Energy Rebates (BER-IR). These offerings provide discounts on products that can be installed in every home and business; in larger classes it is assumed that each customer does participate every year, either directly or indirectly through contractors that perform work in their facilities. The result is that there are likely very few true non-participants in the General, Large General, Medium Industrial, Large Industrial and Municipal classes.

4.3 OVERALL PARTICIPATION IMPACTS

Figures 4 through 7 present actual participation for 2011-2017 and estimates for 2018 through 2022. The 2011-2019 figures are presented here to provide context for the 2020-2022 estimates. The estimates for 2018 and 2019 are the same as used in the 2018 RBIA. Two types of participation figures are presented – tracked and untracked. Tracked participants are those for which EfficiencyOne has had direct contact with the customer and has collected personally identifying information such as address and NS Power account number. Untracked participants are those for which EfficiencyOne had not collected such identifying information, who participate in point-of-sale programs such as Instant Savings and BER-IR.

Cumulative participation is presented in Figure 7 (tracked participants only) and Figure 8 (tracked plus untracked participants), including estimates of participation for 2018-2022.

Figure 7: Cumulative Participation Rates by Rate Class (tracked only) (Preferred Plan)

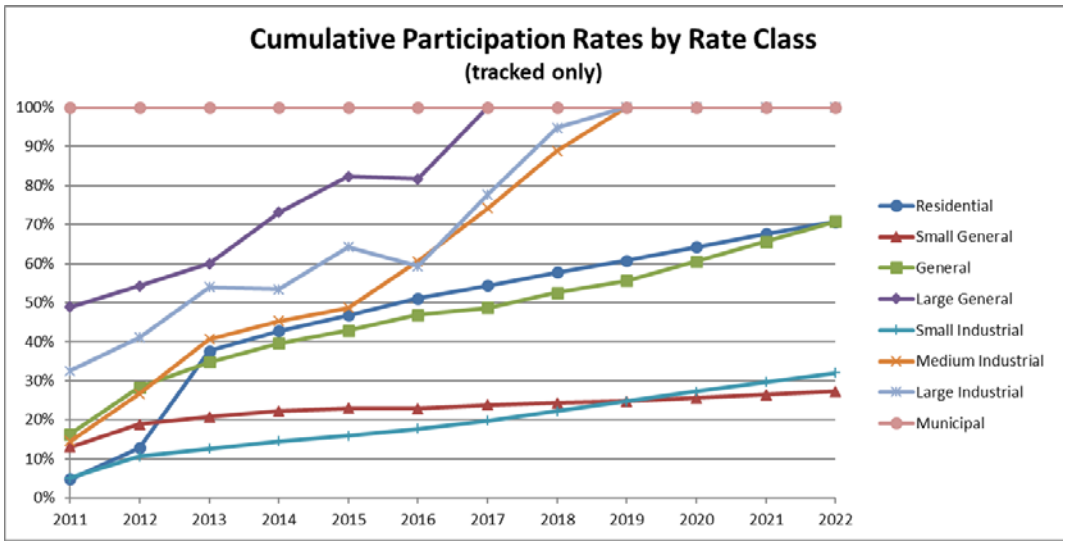
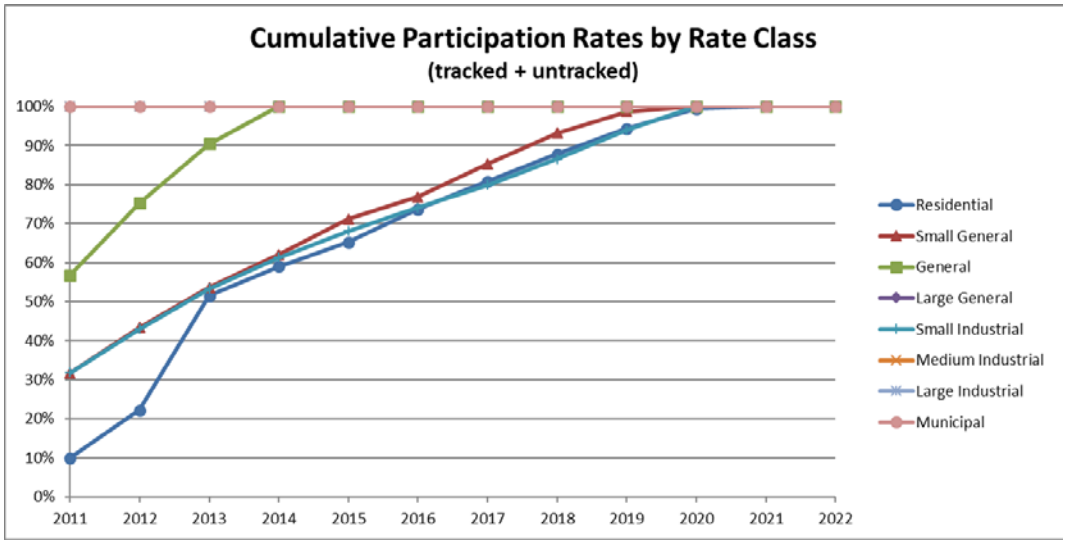


Figure 8: Cumulative Participation Rates by Rate Class (tracked + untracked) (Preferred Plan)



EfficiencyOne employs the assumption that all customers in the Large General, Medium Industrial, Large Industrial and Municipal classes participate in BER-IR each year, so these classes show 100 percent participation in Figure 8 for all years. The other, smaller-customer-consumption classes show that cumulative participation rates have been steadily climbing since 2011. Figure 9 and Figure 10 present annual participation impacts.

Figure 9: Annual Participation Rates by Rate Class (tracked only) (Preferred Plan)

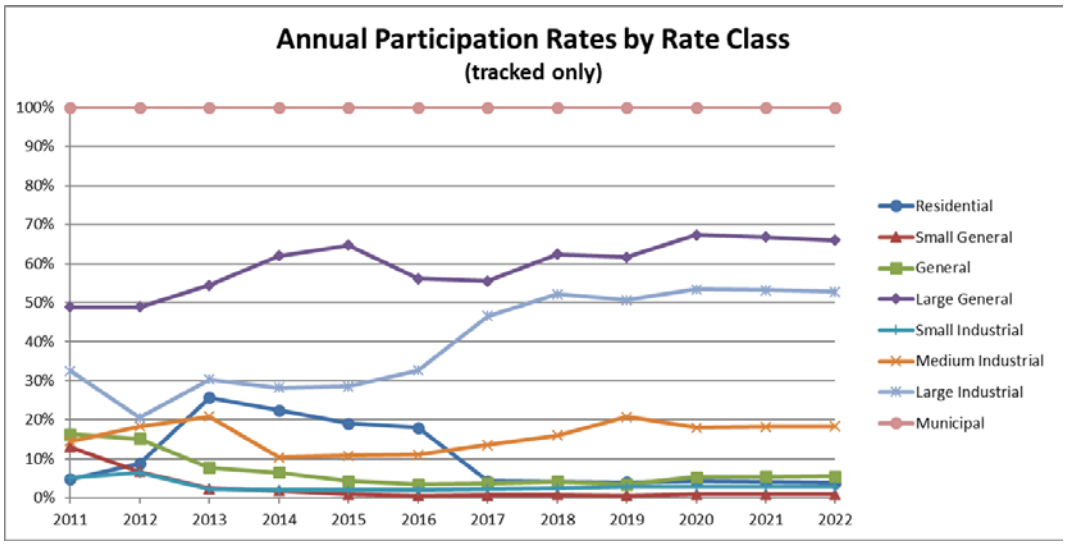
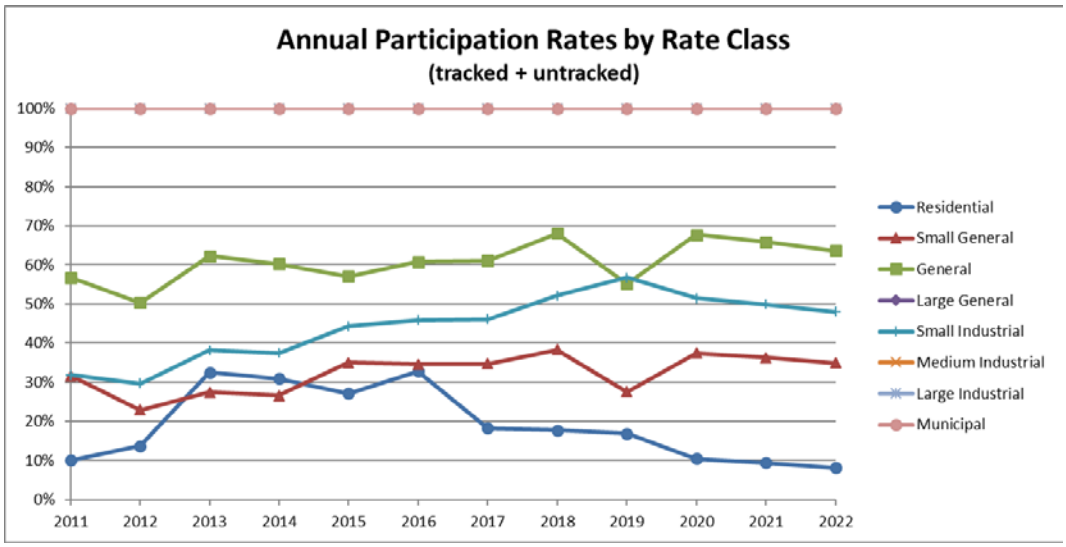


Figure 10: Annual Participation Rates by Rate Class (tracked + untracked) (Preferred Plan)



4.4 RESULTS BY RATE CLASS

This section highlights results in more detail, by individual rate class for the Preferred Plan.

4.4.1 RESIDENTIAL

Residential

↑ **0.8%** Rates

↓ **10.7%** Avg. Participant bills

↓ **2.1%** Avg. Total Cust. bills

- As modelled, the Residential class includes Rate Codes 2, 3, 6, 9 and 16 (Domestic), as well as 4 and 5 (Charitable).
- Participants in the Residential class see an average bill decrease of 10.7 percent over the study period.
- Non-Participants see an average bill increase of 0.7 percent over the study period.
- The class overall sees an average bill decrease of 2.1 percent over the study period.
- The average rate impact over the study period is an increase of 0.8 percent, or 0.1 cents/kWh.

4.4.2 SMALL GENERAL

Small General

↑ **1.1%** Rates

↓ **5.3%** Avg. Participant bills

↓ **3.3%** Avg. Total Cust. bills

- As modelled, the Small General class includes Rate Code 10 only.
- Participants in the Small General class see an average bill decrease of 5.3 percent over the study period.
- Non-Participants see an average bill increase of 1.0 percent over the study period.
- The class overall sees an average bill decrease of 3.3 percent over the study period.
- The average rate impact over the study period is an increase of 1.1 percent, or 0.2 cents/kWh.

4.4.3 GENERAL

General

↑ **1.3%** Rates

↓ **3.2%** Avg. Participant bills

↓ **3.1%** Avg. Total Cust. bills

- As modelled, the General class includes Rate Code 11 only.
- Participants in the General class see an average bill decrease of 3.2 percent over the study period.
- Non-Participants see an average bill increase of 1.0 percent over the study period.
- The class overall sees an average bill decrease of 3.1 percent over the study period.
- The average rate impact over the study period is an increase of 1.3 percent, or 0.1 cents/kWh.

4.4.4 LARGE GENERAL

Large General

↑ **1.5%** Rates

↓ **3.5%** Avg. Participant bills

↓ **3.5%** Avg. Total Cust. bills

- As modelled, the Large General class includes Rate Code 12 only.
- Participants in the Large General class see an average bill decrease of 3.5 percent over the study period.
- Non-Participants see an average bill increase of 1.1 percent over the study period.
- The class overall sees an average bill decrease of 3.5 percent over the study period.
- The average rate impact over the study period is an increase of 1.5 percent, or 0.2 cents/kWh.

4.4.5 SMALL INDUSTRIAL

Small Industrial

↑ **1.7%** Rates

↓ **4.4%** Avg. Participant bills

↓ **3.3%** Avg. Total Cust. bills

- As modelled, the Small Industrial class includes Rate Code 21 only.
- Participants in the Small Industrial class see an average bill decrease of 4.4 percent over the study period.
- Non-Participants see an average bill increase of 1.1 percent over the study period.
- The class overall sees an average bill decrease of 3.3 percent over the study period.
- The average rate impact over the study period is an increase of 1.7 percent, or 0.2 cents/kWh.

4.4.6 MEDIUM INDUSTRIAL

Medium Industrial

↑ **0.8%** Rates

↓ **1.2%** Avg. Participant bills

↓ **1.2%** Avg. Total Cust. bills

- As modelled, the Medium Industrial class includes Rate Code 22 only.
- Participants in the Medium Industrial class see an average bill decrease of 1.2 percent over the study period.
- Non-Participants see an average bill increase of 0.5 percent over the study period.
- The class overall sees an average bill decrease of 1.2 percent over the study period.
- The average rate impact over the study period is an increase of 0.8 percent, or 0.1 cents/kWh.
- In this rate class, cumulative participation reaches the rate class maximum of 100 percent participation in 2011. For this reason, the bill effects for the participant group reflect the bill effects for total customers. The non-participant line is still shown, even though no non-participants may exist in the rate class. This non-participant line is useful when considering a

participant with very little energy and demand savings (e.g., small point-of-sale purchase only).

4.4.7 LARGE INDUSTRIAL

Large Industrial

↑ **1.0%** Rates

↓ **1.0%** Avg. Participant bills

↓ **1.0%** Avg. Total Cust. bills

- As modelled, the Large Industrial class includes Rate Code 23 (Large Industrial), Rate Code 25 (Large Industrial, interruptible service), and the one-part high voltage real time pricing tariff.
- Participants in the Large Industrial class see an average bill decrease of 1.0 percent over the study period.
- Non-Participants see an average bill increase of 0.7 percent over the study period.
- The average rate impact over the study period is an increase of 1.0 percent, or 0.1 cents/kWh.
- In this rate class, cumulative participation reaches the rate class maximum of 100 percent participation in 2011. For this reason, the bill effects for the participant group reflect the bill effects for total customers. The non-participant line is still shown, even though no non-participants may exist in the rate class. This non-participant line is useful when considering a participant with very little energy and demand savings (e.g., small point-of-sale purchase only).

4.4.8 MUNICIPAL

Municipal

↑ **1.0%** Rates

↓ **3.6%** Average bills

- As modelled, the Municipal class includes Rate Code 24 only.
- Municipal utilities see an average bill decrease of 3.6 percent over the study period.

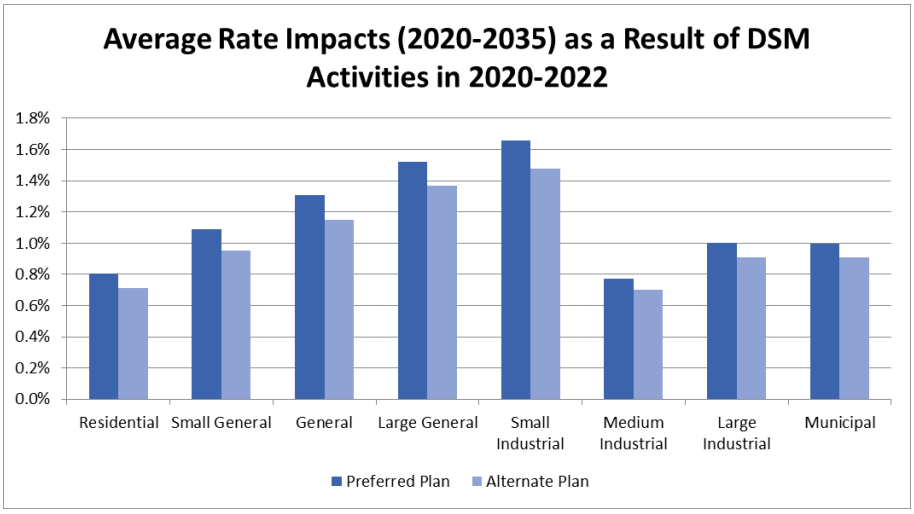
- The average rate impact over the study period is an increase of 1.0 percent, or 0.1 cents/kWh.
- Since there was participation in ENS programs from all six Municipal Electric Utilities in each year of the DSM delivery period, the bill impacts for participants match those for total customers exactly. This is a simplification of the rate and bill effects for individual MEU customers, as their individual participation is not modelled in the analysis.

5. COMPARISON OF PREFERRED AND ALTERNATE PLANS

Full results by class for both the Preferred Plan and Alternate scenario for 2020-2022 are provided in Attachments 1 and 2. This section compares key outputs between the two Plans.

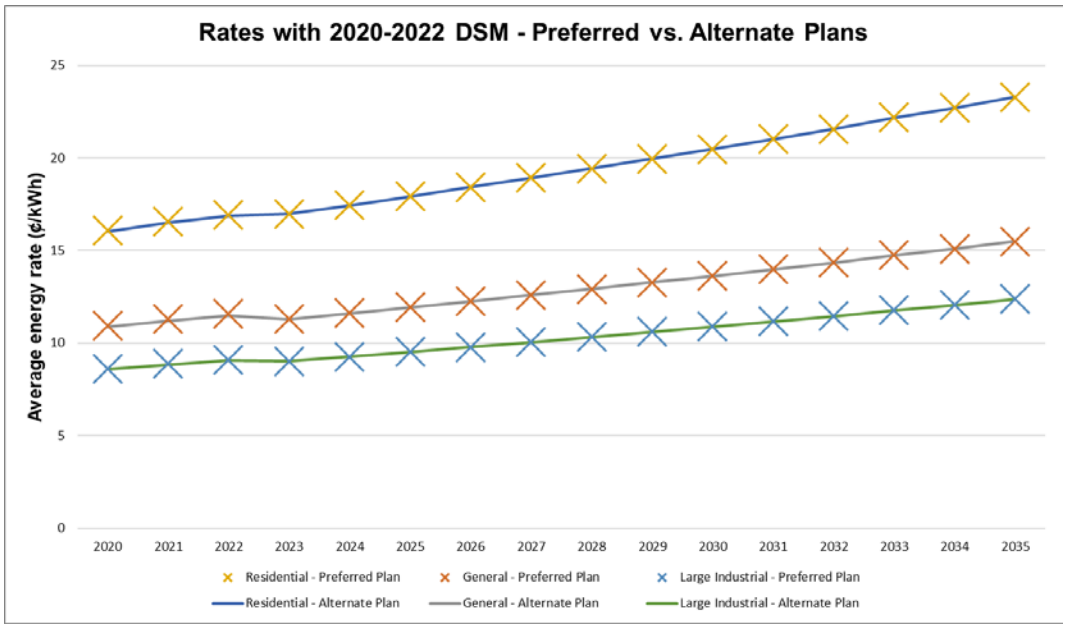
Rate impacts for both Plans are similar. On average across classes, the Preferred Plan produces average (2020-2035) rate impacts that are 0.1 percent higher than the Alternate scenario, as shown in Figure 11. Since avoided costs and lost revenues are approximately in balance for each class in both Plans, this difference in rate impacts is primarily driven by the difference in DSM program costs.

Figure 11: Average Rate Impacts (2020-2035) as a Result of DSM Activities in 2020-2022 (Preferred Plan vs. Alternate Scenario)



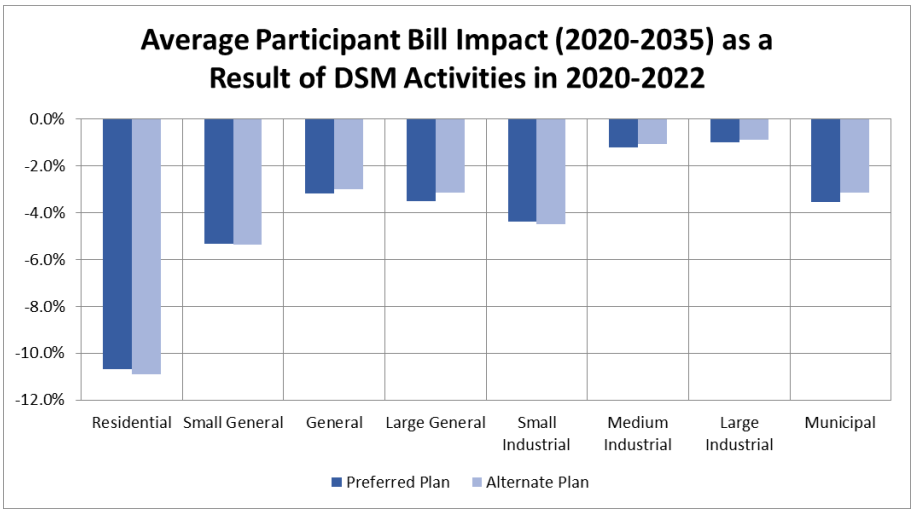
Full rates with DSM impacts are presented for three representative classes in Figure 12, for both the Preferred Plan and Alternate scenario. The Preferred and Alternate figures in this graph lay almost exactly on top of each other, as the rate impacts do not differ significantly between the two Plans.

Figure 12: Rates with 2020-2022 DSM – Preferred vs. Alternate Plans



Average participant bill impacts are presented in Figure 13 for both the Preferred Plan and Alternate scenario. Since program components were not all scaled down in proportion to one another to produce the Alternate Plan, there are minor differences in the average savings per participant.

Figure 13: Average Participant Bill Impact (2020-2035) as a Result of DSM Activities in 2020-2022



As shown in the previous figures, the rate and participant bill impacts for the Preferred Plan and Alternate scenario are similar; the main difference is that under the Preferred Plan, a greater number of customers would have the opportunity to participate.

6. FUTURE CONSIDERATIONS

Through collaboration with the DSMAG, EfficiencyOne's RBIA has evolved considerably since the last application for a three-year DSM Resource Plan; between that application and the current one, it has been filed with the NSUARB and reviewed by stakeholders five times. The most notable change since the last three-year Plan application is that the rate impacts of fixed cost recovery due to DSM have been modelled using an approach suggested by Synapse, the Consumer Advocate and the Industrial Group. While these improvements have resulted in a more robust analysis, which the NSUARB and stakeholders can rely on in their review of the 2020-2022 DSM Plan, EfficiencyOne will continue to make improvements to the model in the future. Of greatest importance as a design principle is general agreement as to the purpose of the model each time it is used, so the assumptions can be tailored to provide the types of outputs that are desired by the NSUARB and stakeholders.

In January 2019 EfficiencyOne circulated a memo to the DSMAG that summarized the issues that had been raised by stakeholders over the past two years, and included some new issues identified by EfficiencyOne, with a proposed path forward for each. As described in Section 2, EfficiencyOne implemented model changes resulting from a number of these issues. Several topics warrant further discussion with NS Power and the DSMAG, which could result in additional refinements to the model that will be used in future analyses. These include, most notably:

- Developing more robust estimates of avoided costs of transmission and distribution, possibly through the 2019 IRP;
- Developing estimates of avoided costs of environmental compliance, possibly through the 2019 IRP;
- Further exploring NS Power's proposed means of breaking down lost revenues and avoided costs into those arising from fuel and fixed rate components;
- Further exploring NS Power's proposed means of allocating lost revenues and avoided costs to rate classes;

- Discussing which avoided cost estimates to use when avoided cost estimates change (EfficiencyOne indicated its intended approach in the January 2019 memo; however, no change was required for the current analysis as it uses a single set of avoided cost estimates); and
- Modelling the expiry of participants and the desired amount of historical data to be used for each historical RBIA.

The next application of the RBIA model will be for the historical 2019 RBIA, filed in October 2019. EfficiencyOne looks forward to working with stakeholders in advance of that filing.

7. CONCLUSION

This analysis captures the impacts of 2020-2022 DSM programs to customer rates and bills throughout the full lifetime of the DSM impacts. Over the lifetime of measures installed in 2020-2022, NS Power customers will save over $475 million on electricity bills.[4]

DSM investments benefit customers over the long term, as evidenced by a Total Resource Cost ratio of 2.0 and Program Administrator Cost ratio of 4.8 for the 2020-2022 Preferred DSM Plan. These investments impact rates in three main ways: recovery of program costs, reallocation of fixed costs from sales avoided due to DSM, and the ability of DSM to avoid future system costs. The resulting rate increases affect all customers in each class equally; however, the main impacts of DSM programs, the reduction of energy and system-peak demand consumption, are only incurred by participants in DSM programs. Their reductions in consumption drive bill decreases that far outweigh the increases caused by higher rates.

Rate impacts are mainly driven by DSM cost recovery, as avoided costs and lost revenue recovery roughly cancel out. For the Preferred Plan, rate increases, averaged over the life of measures, are 0.8 percent to 1.7 percent, average bill savings for total customers are 1 percent to 4 percent, with average Participants saving up to 11 percent. Considering the uncertainty around avoided T&D costs, which could in reality be much higher than the assumptions used, the results of this analysis are likely conservative.

It is important to recognize that this analysis is not a comprehensive evaluation of total DSM impacts in that it ignores benefits that do not directly impact rates or bills, such as the reduction of greenhouse gas emissions, reduction of energy poverty,

[4] *Supra* note 2.

investment in local businesses that deliver efficiency services instead of investment in foreign fuel suppliers, increased productivity in businesses, increased occupant comfort in homes and businesses, and increased room in operating budgets of public agencies, among others.

EfficiencyOne will continue to work with NS Power and the DSMAG to adapt its model to produce the most useful results in future analyses and welcomes feedback on the model structure and assumptions. For transparency, the full Excel models, one for each of the Preferred Plan and Alternate scenario, have been filed publicly.

Appendix B – Attachment 1:

Results by Rate Class (Preferred Plan)

Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

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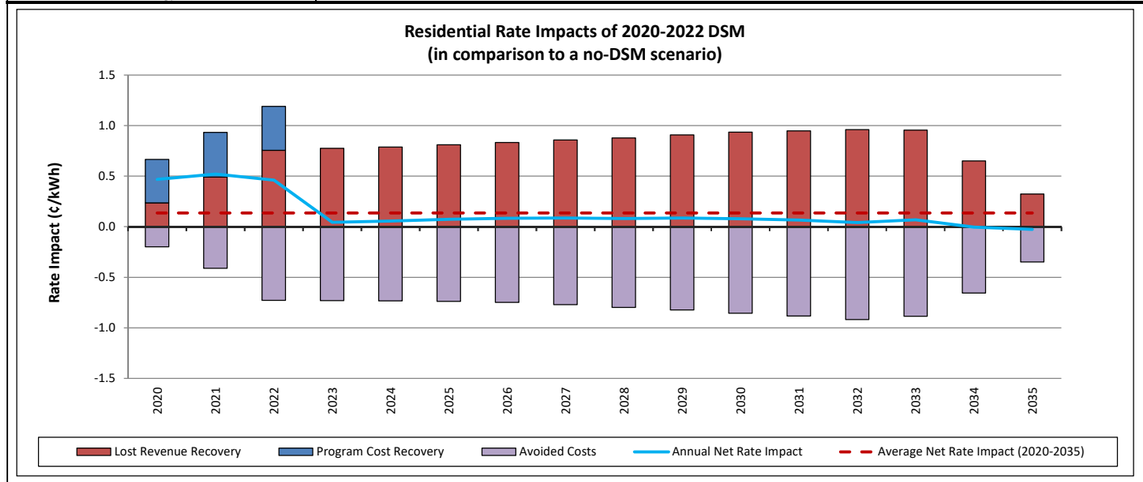
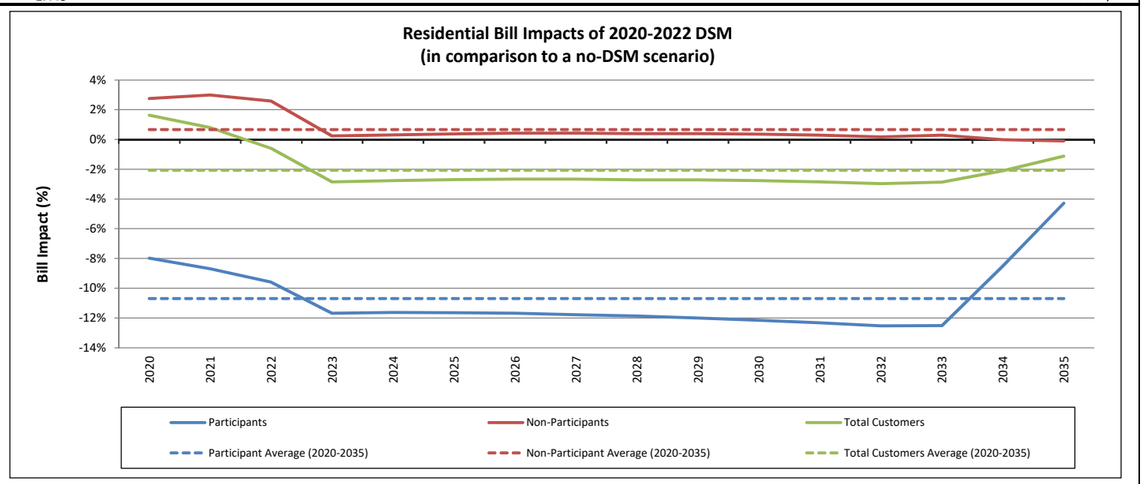
Rate and Bill Impacts of DSM on the Residential Class - PREFERRED PLAN

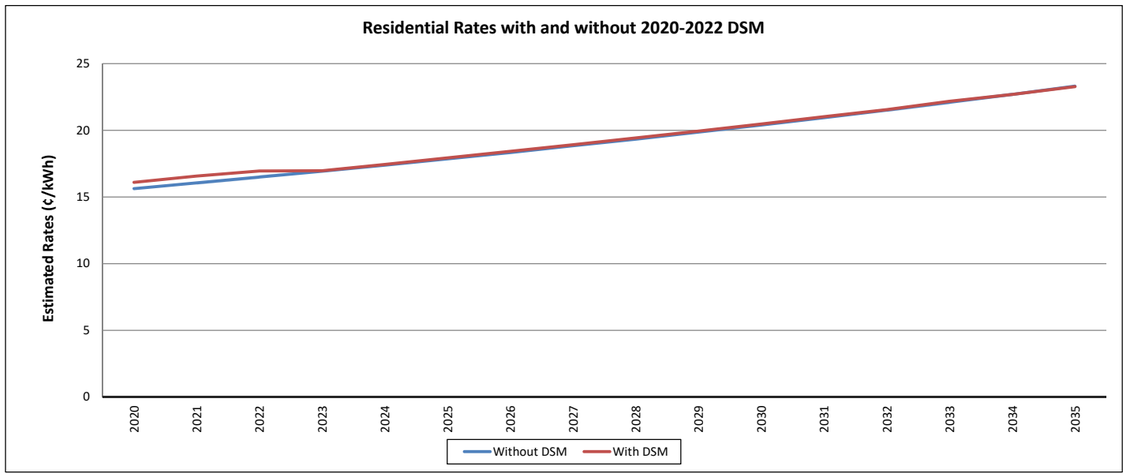
Line#	Impacts of DSM on the Residential Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.6	57.0	53.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.6	115.6	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	110.4	53.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	19,135,778	19,652,278	19,321,141	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	49,547	89,771	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	1,076	1,171	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	803	389	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	49,547	44,918	38,972	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	1,076	1,153	1,246	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.323	2.378	2.448														cents/kWh



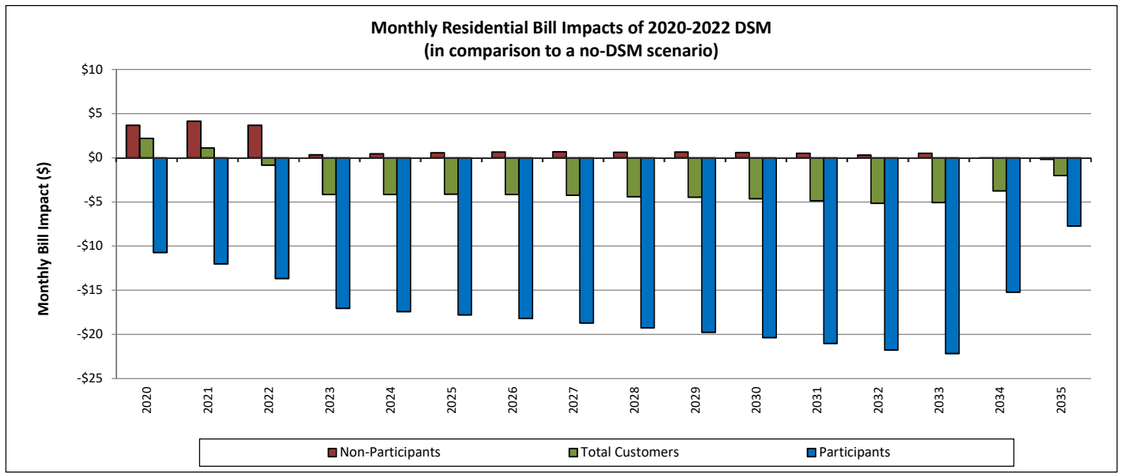
This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants.



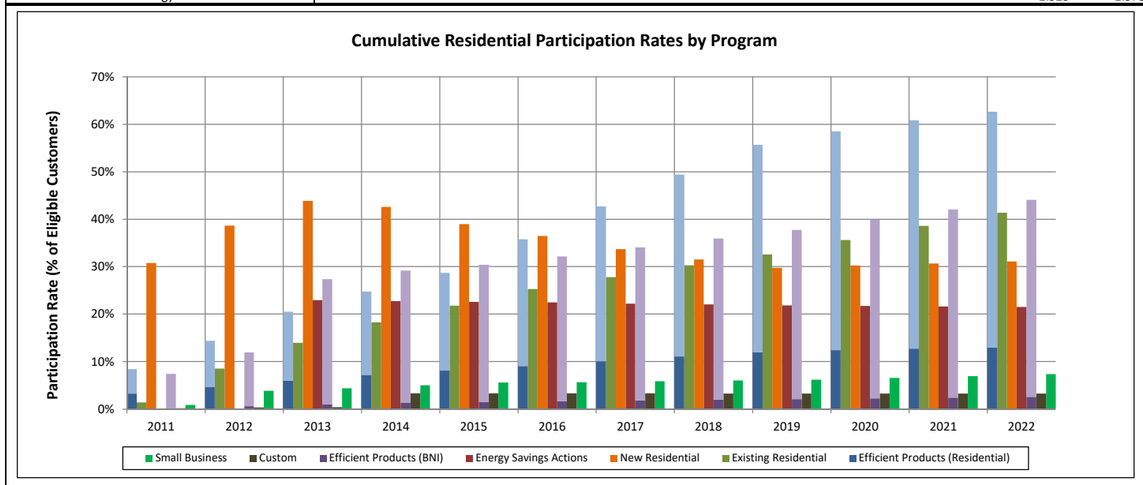
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.



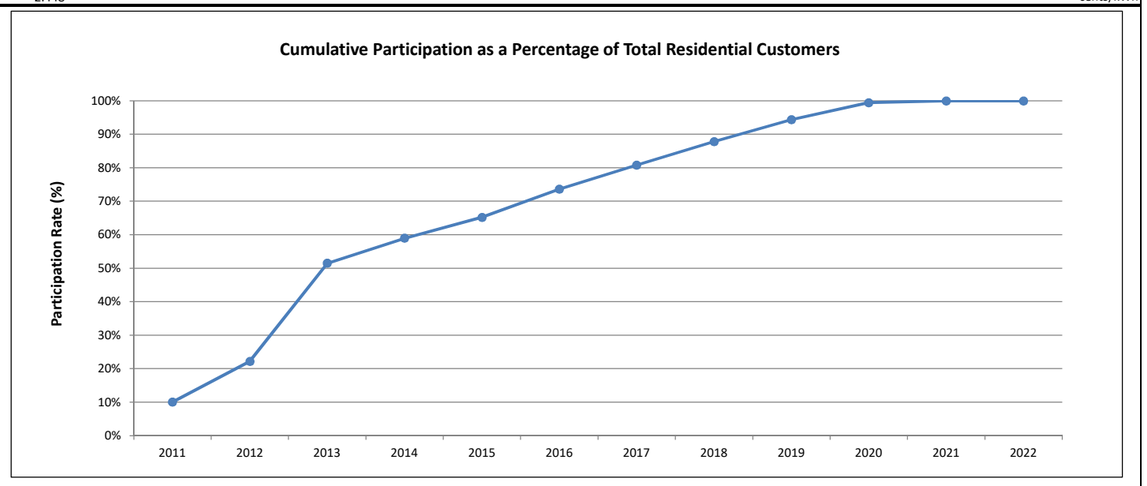
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Residential Class - PREFERRED PLAN

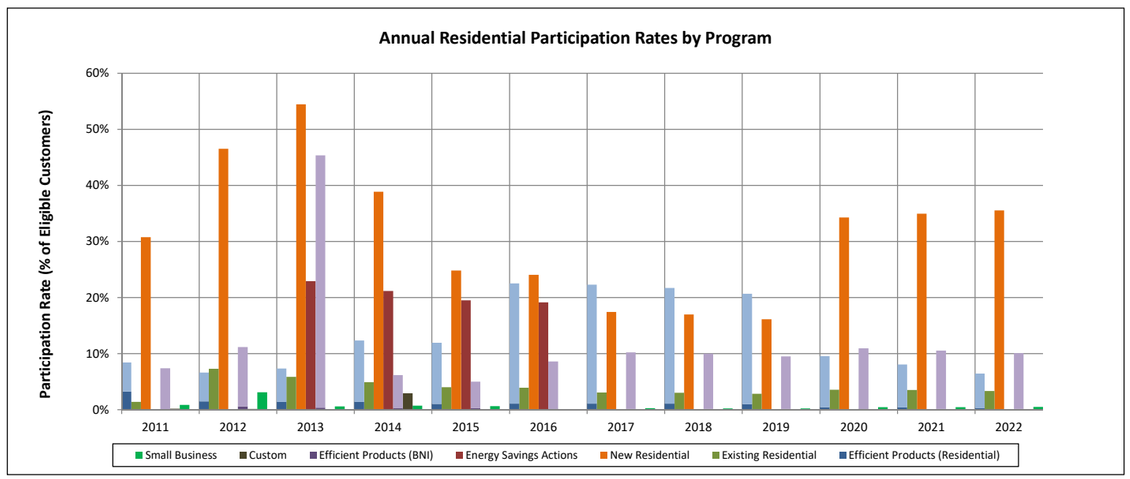
Line#	Impacts of DSM on the Residential Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.6	57.0	53.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.6	115.6	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	169.0	110.4	53.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	19,135,778	19,652,278	19,321,141	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	49,547	89,771	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	124,983	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	1,076	1,171	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	803	389	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	49,547	44,918	38,972	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	1,076	1,153	1,246	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.323	2.378	2.448														cents/kWh



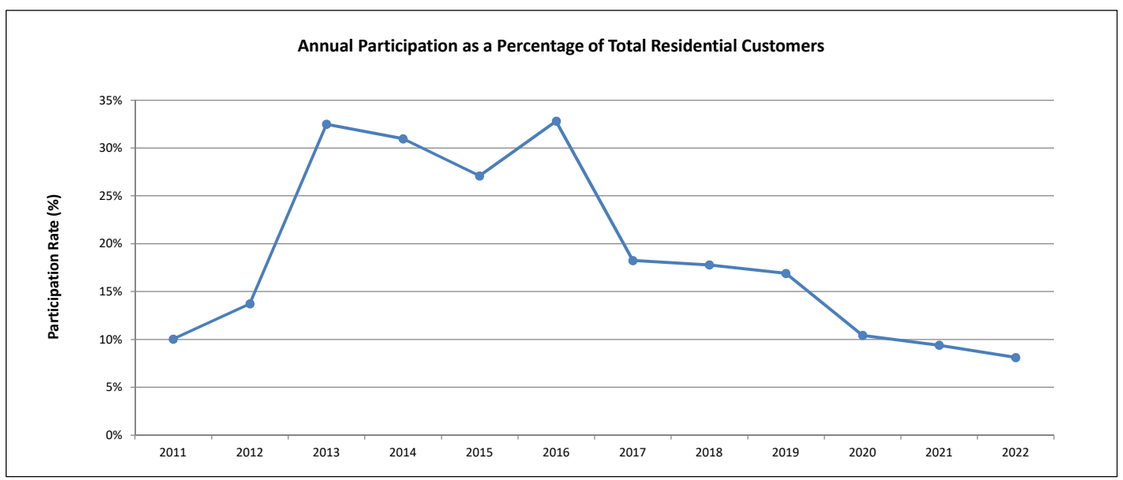
This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



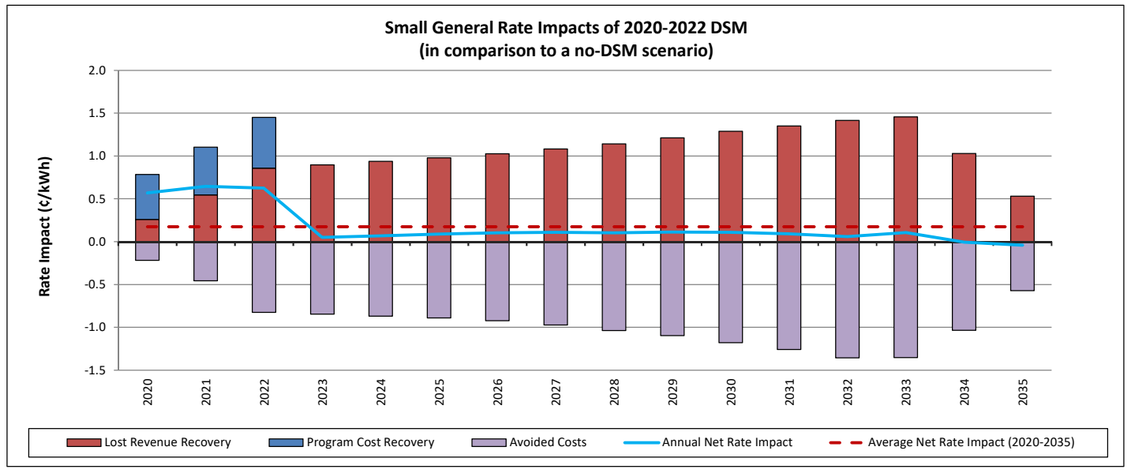
This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).

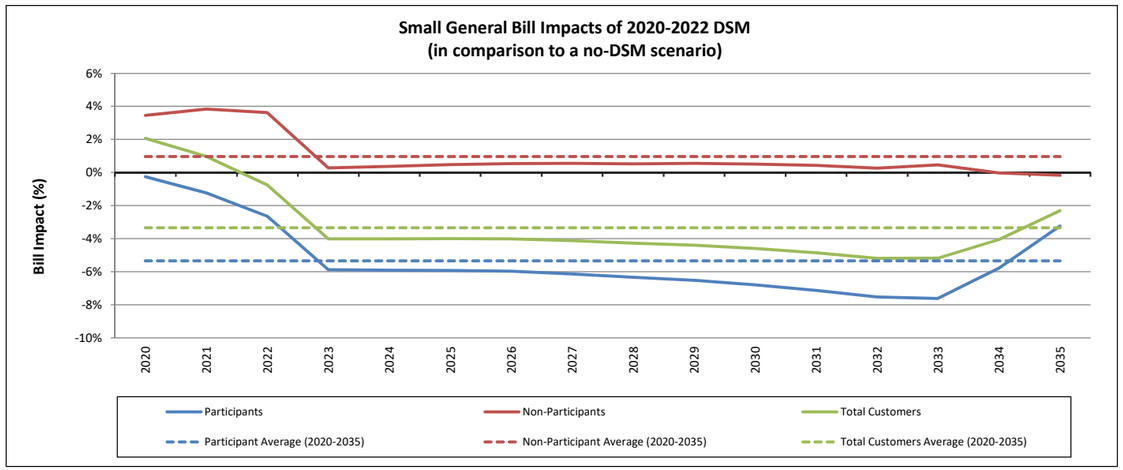


This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Small General Class - PREFERRED PLAN

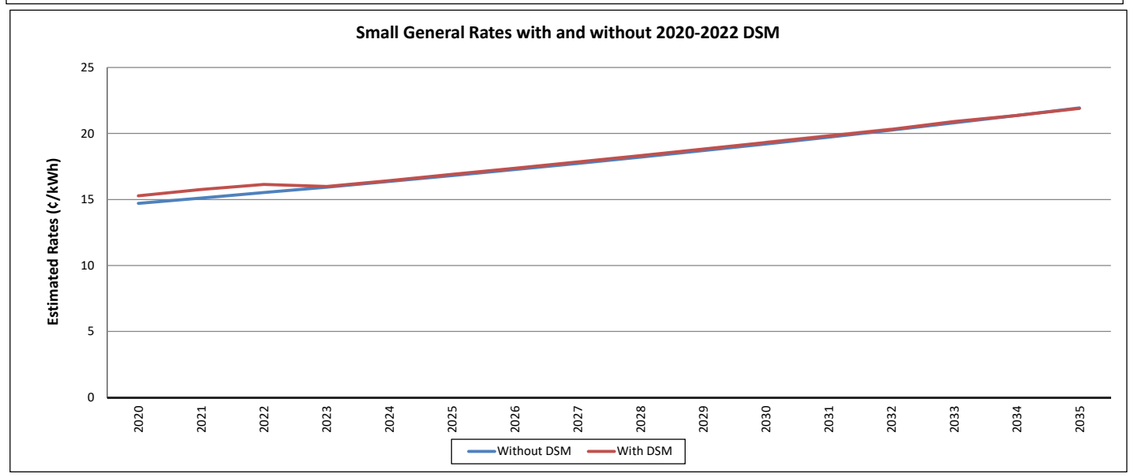
Line#	Impacts of DSM on the Small General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.8	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	7.4	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	7.6	3.9	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,143,893	1,192,283	1,248,295	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	9,287	13,987	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	356	482	594	594	594	594	594	594	594	594	594	594	594	594	403	205	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	9,287	9,000	8,651	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	356	382	410	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.246	2.243	2.273														cents/kWh

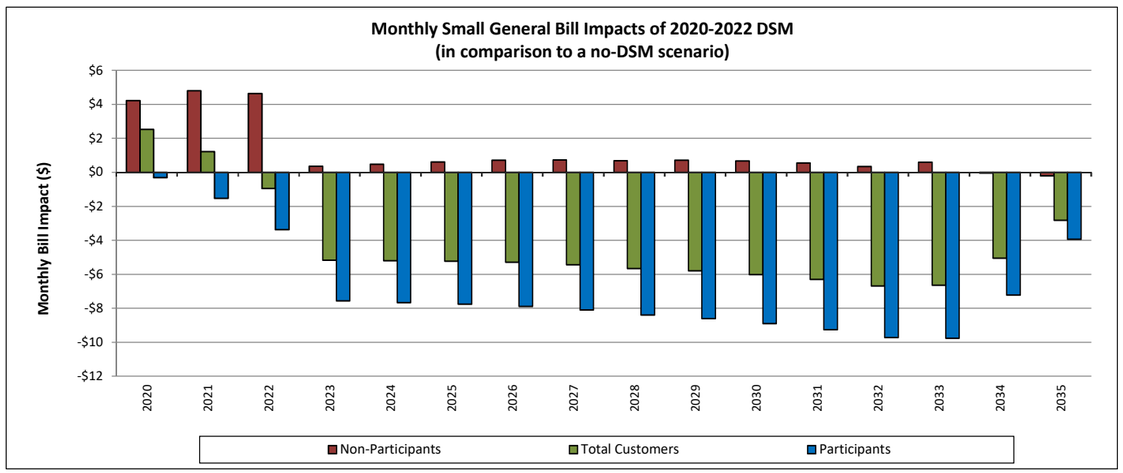




This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.

This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants.



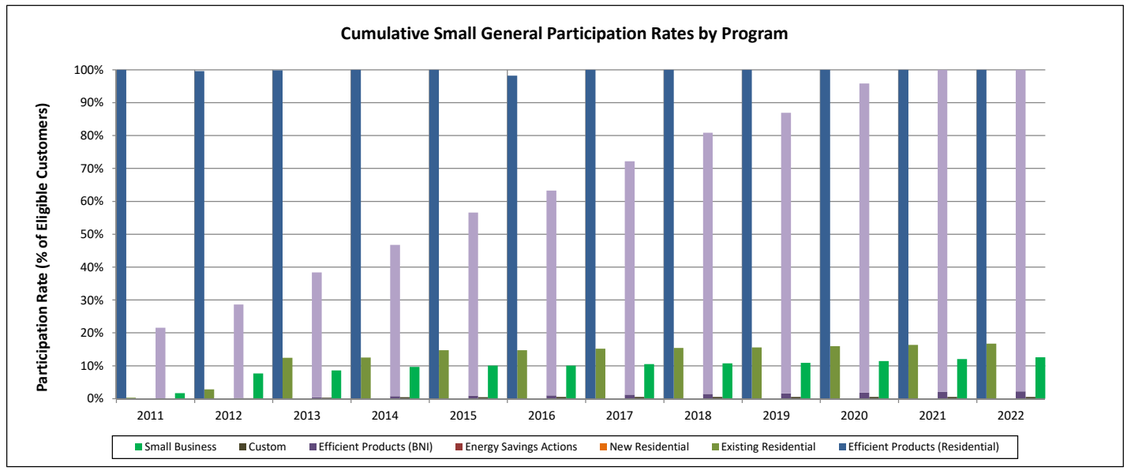


This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.

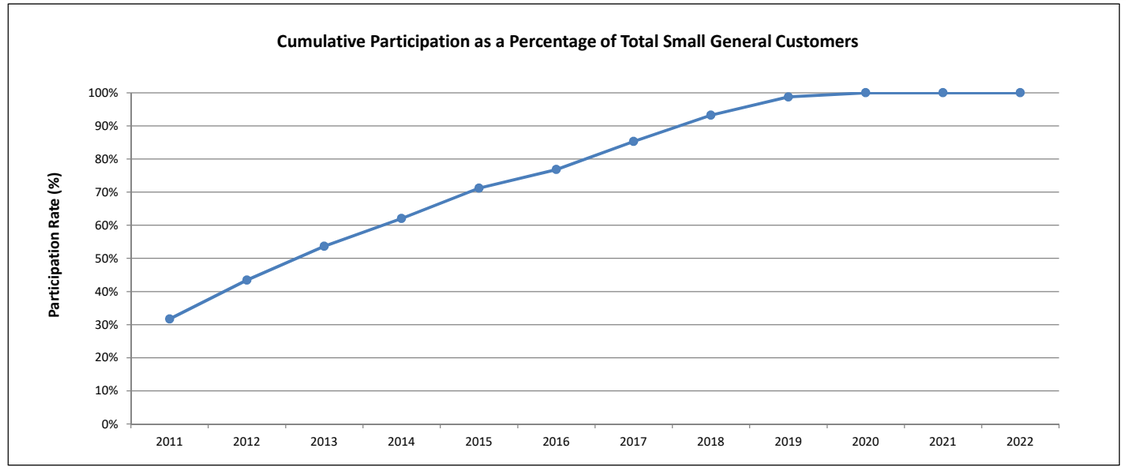
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Small General Class - PREFERRED PLAN

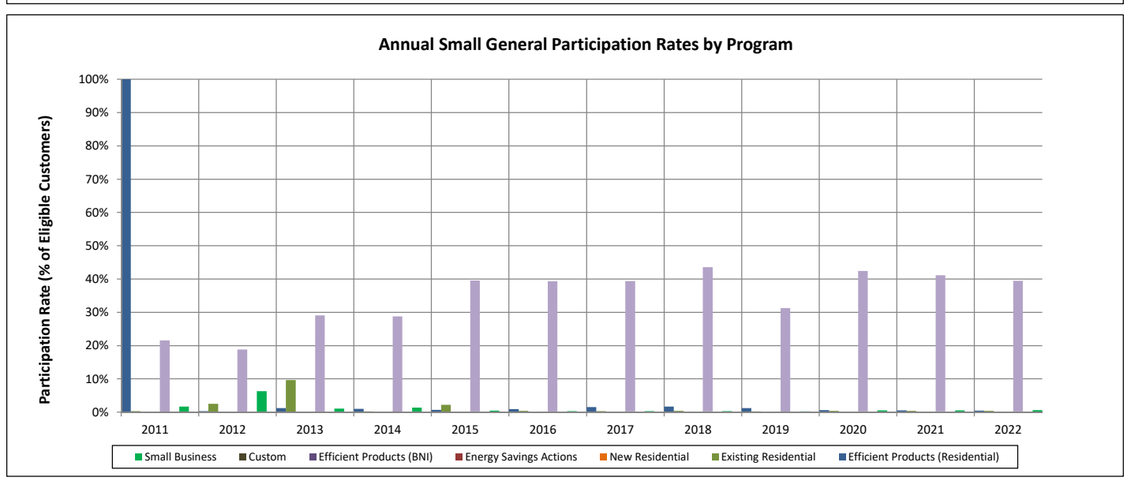
Line#	Impacts of DSM on the Small General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.8	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	7.4	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	7.6	3.9	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,143,893	1,192,283	1,248,295	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	9,287	13,987	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	17,305	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	356	482	594	594	594	594	594	594	594	594	594	594	594	594	403	205	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	9,287	9,000	8,651	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	356	382	410	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.246	2.243	2.273														cents/kWh



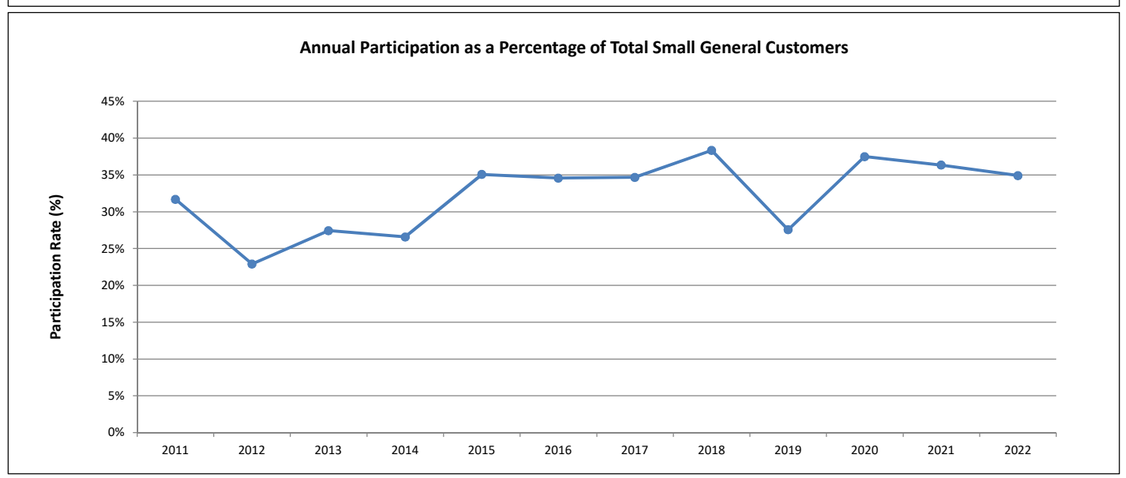
This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



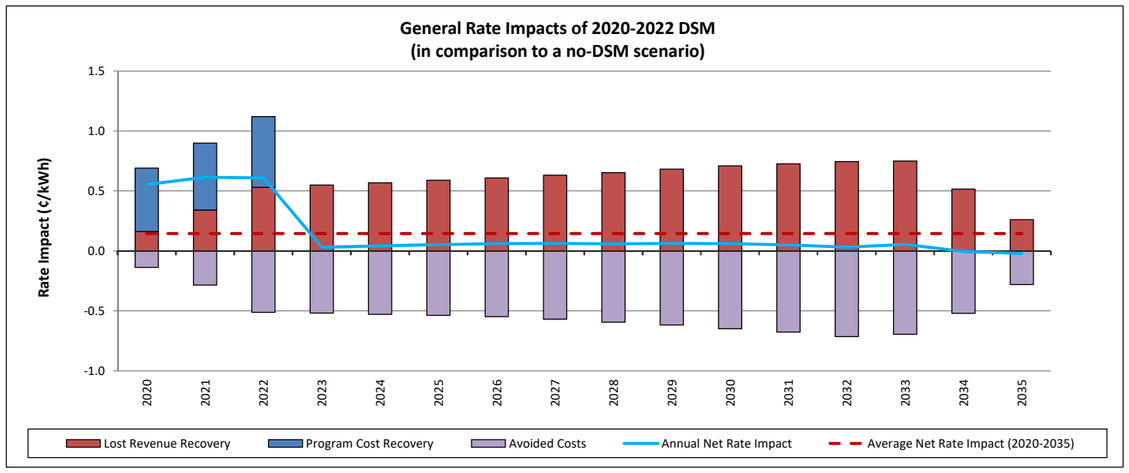
This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



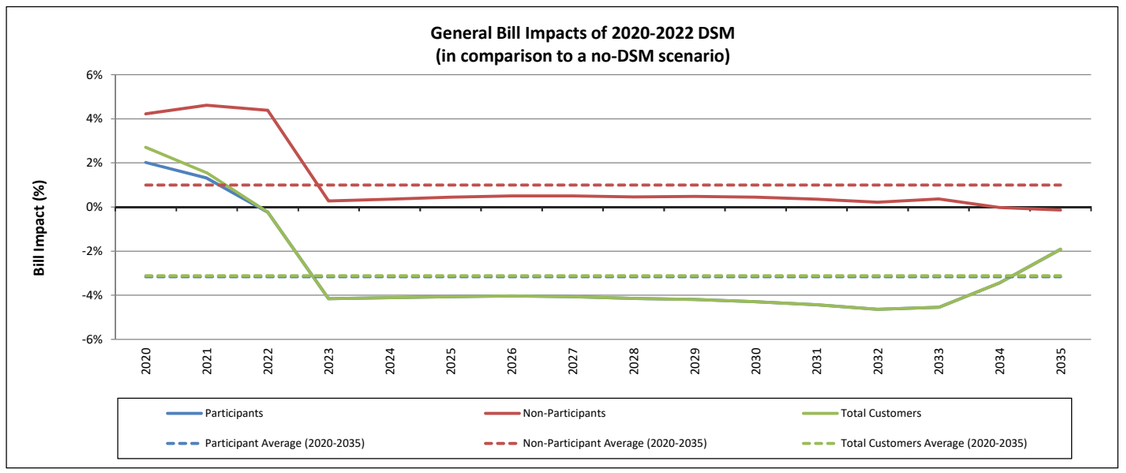
This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the General Class - PREFERRED PLAN

Line#	Impacts of DSM on the General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.9	46.6	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.9	91.5	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	94.7	48.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	12,512,140	13,033,888	13,585,095	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	7,861	10,713	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,371	8,031	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	7,667	3,891	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	7,861	7,644	7,378	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,371	5,731	6,120	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.942	1.944	1.963														cents/kWh



This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



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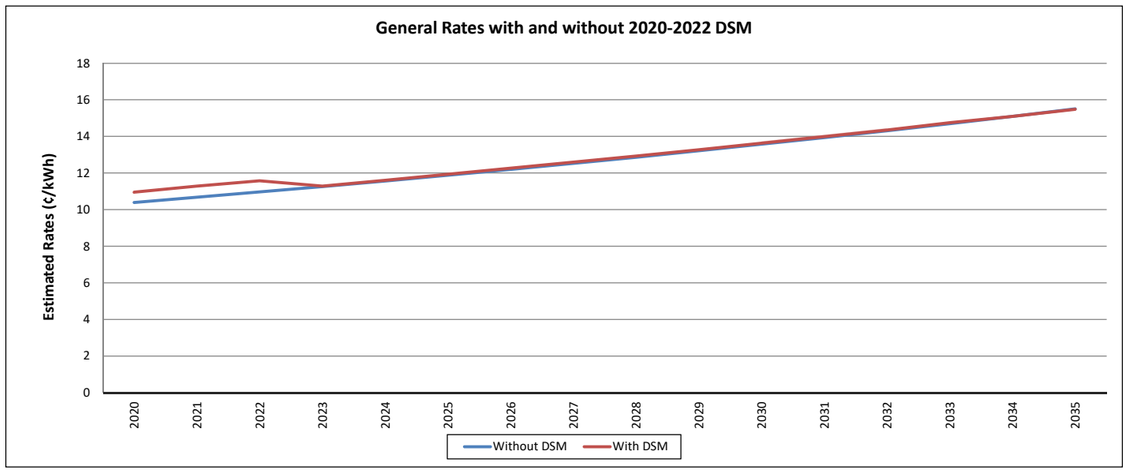

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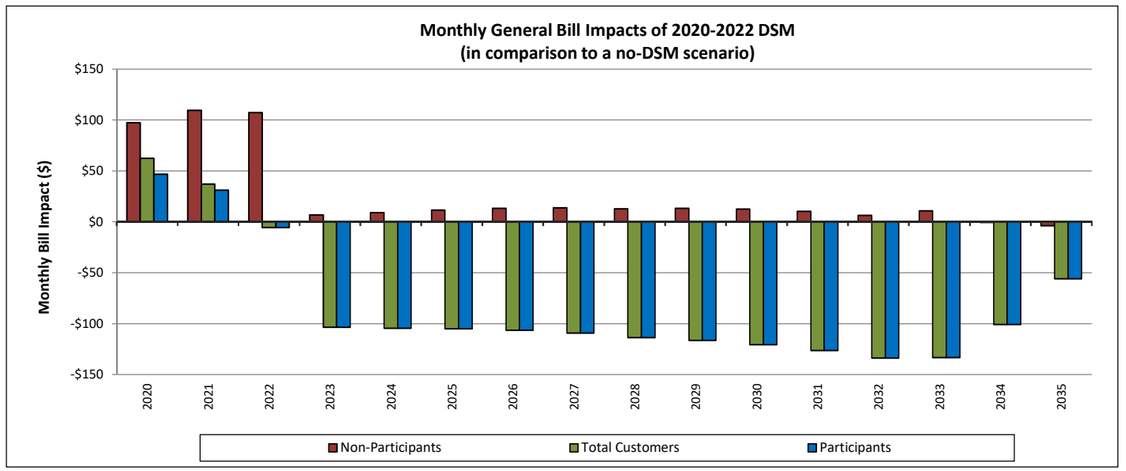
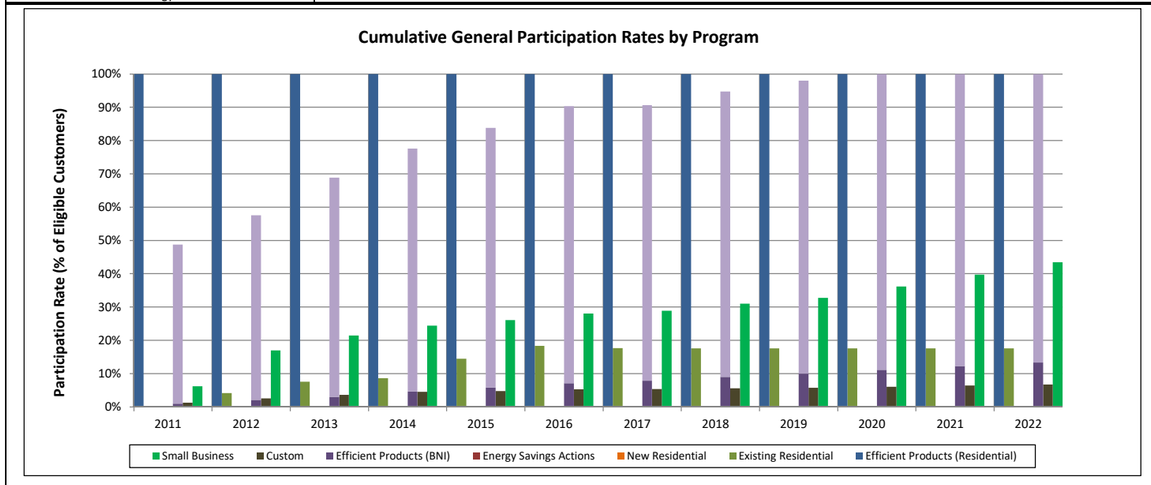


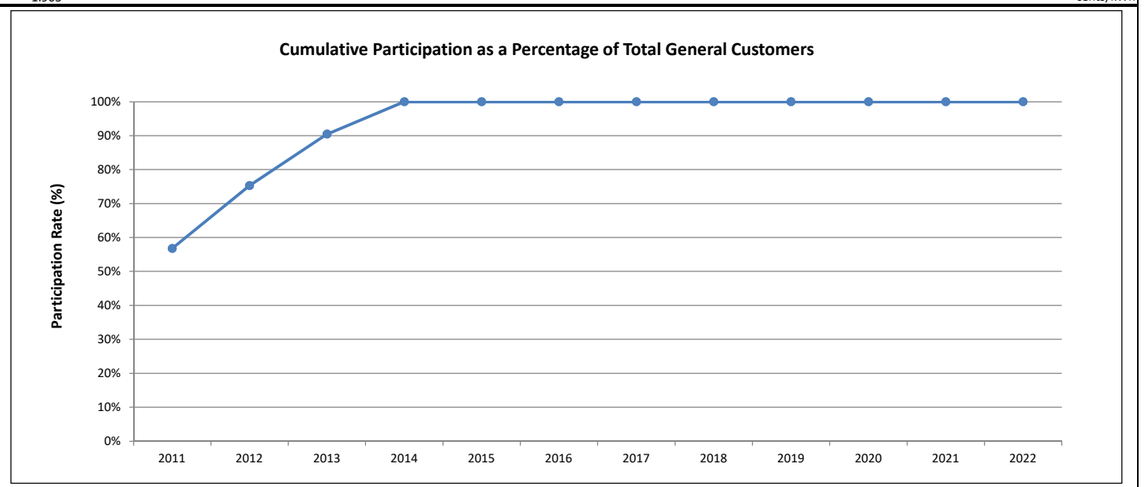
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the General Class - PREFERRED PLAN

Line#	Impacts of DSM on the General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.9	46.6	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.9	91.5	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	94.7	48.0	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	12,512,140	13,033,888	13,585,095	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	7,861	10,713	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	11,603	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,371	8,031	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	11,306	7,667	3,891	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	7,861	7,644	7,378	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,371	5,731	6,120	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										1.942	1.944	1.963														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



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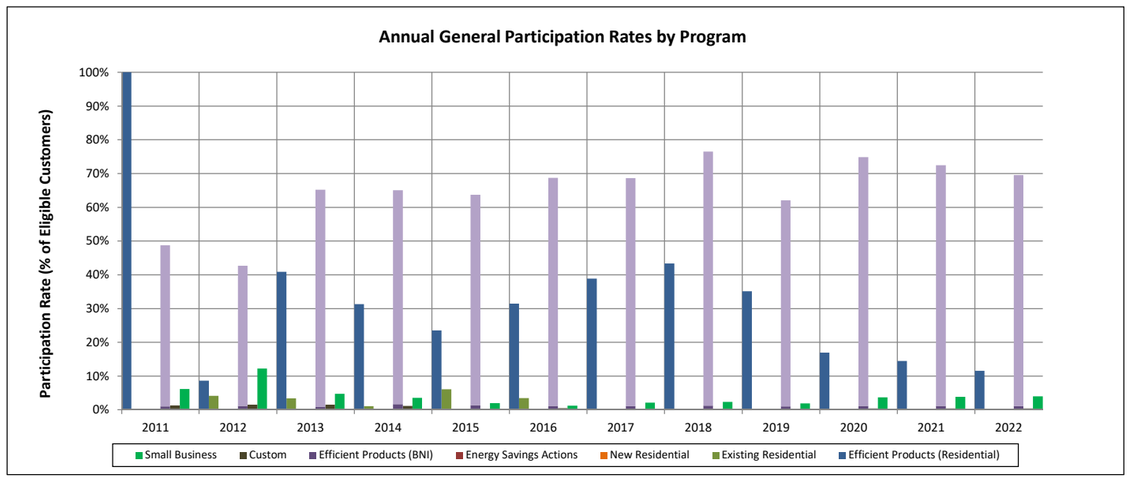

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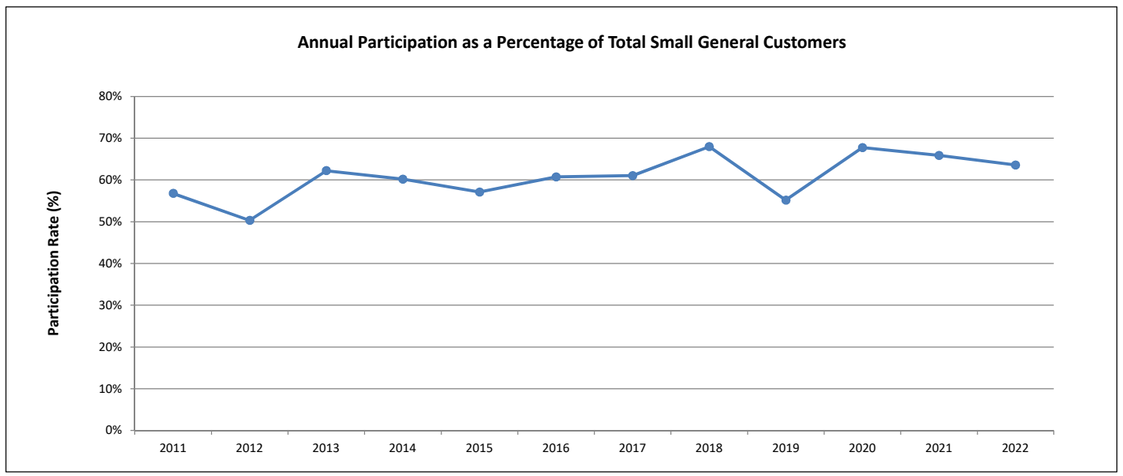
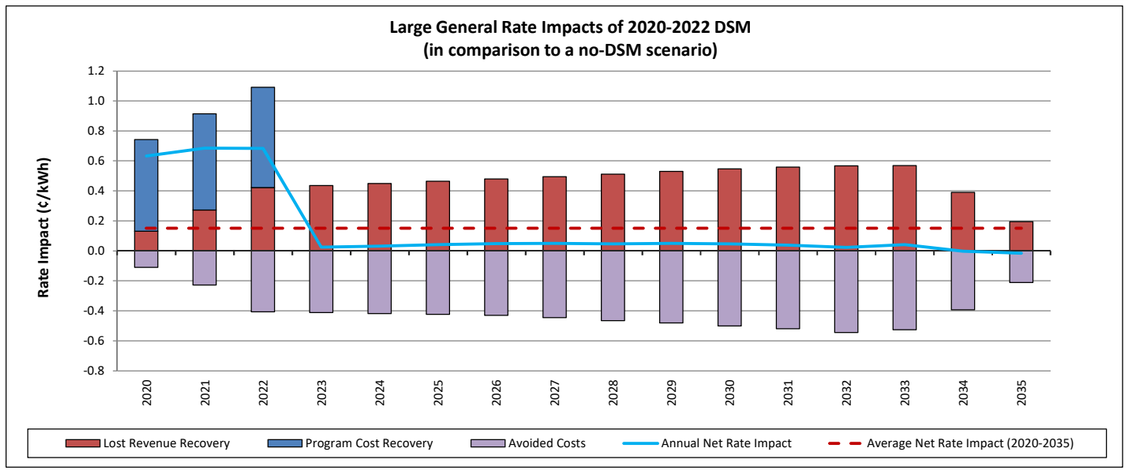


This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Large General Class - PREFERRED PLAN

Impacts of DSM on the Large General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	8.7	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	17.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	17.6	9.0	GWh@gen
DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	2,379,245	2,478,746	2,564,045	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	NSPI acct.'s
Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	440,532	896,161	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	924,843	469,214	kWh@meter
Annual Number of Participants	0	0	0	0	0	0	0	0	0	32	31	30	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	249,371	263,960	280,055	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
Levelized Cost of Saved Energy										1.928	1.939	1.945														cents/kWh



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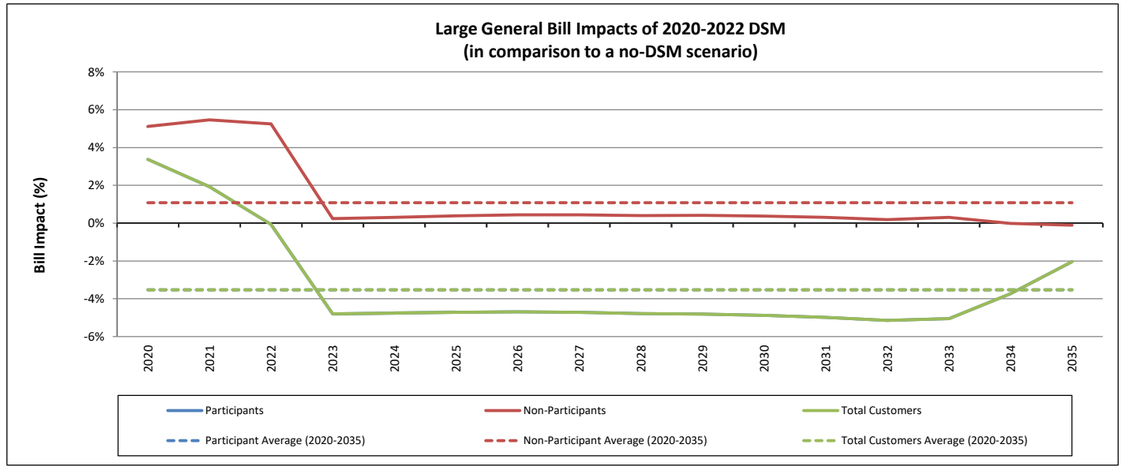
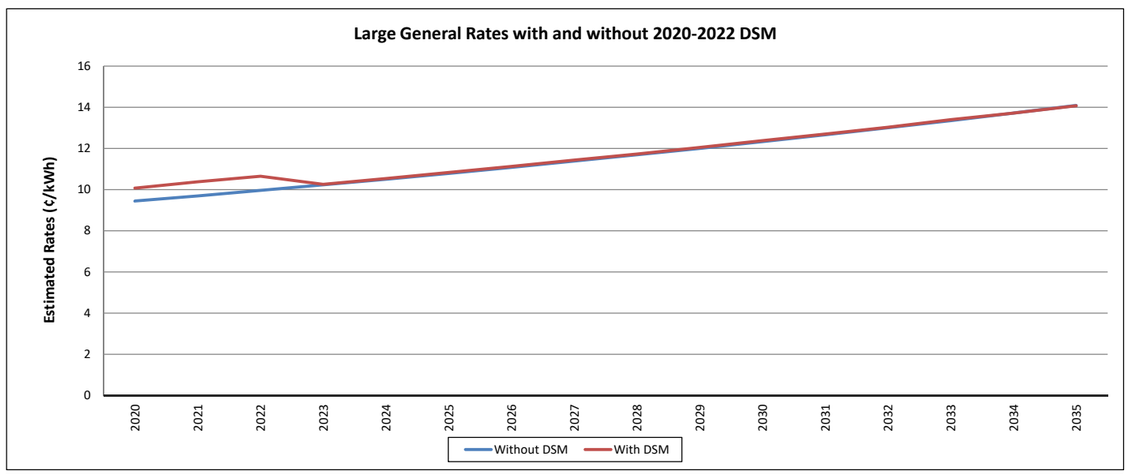


This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants. In this class, all customers are assumed to have participated, so the Participants line matches the Total Customers line (i.e., there are likely no customers whose impacts follow the Non-Participant line).



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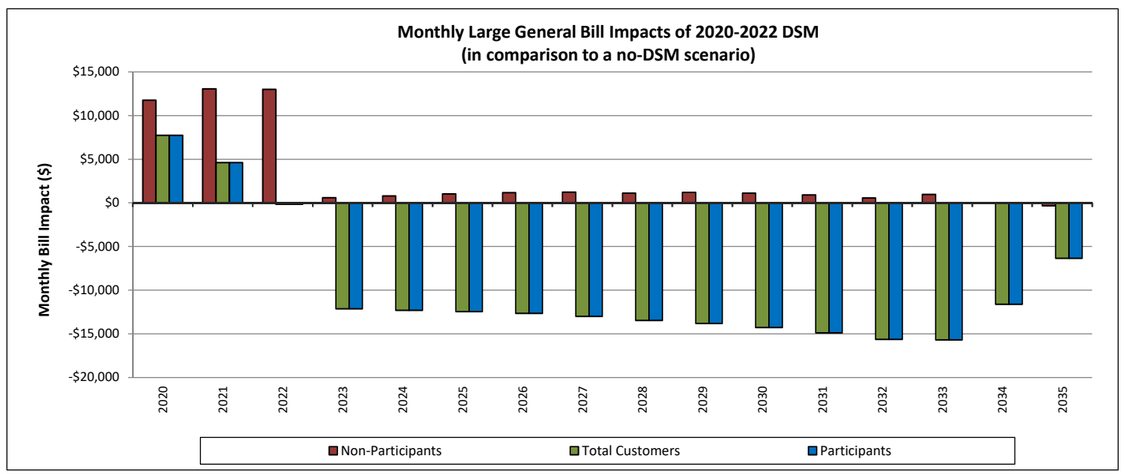
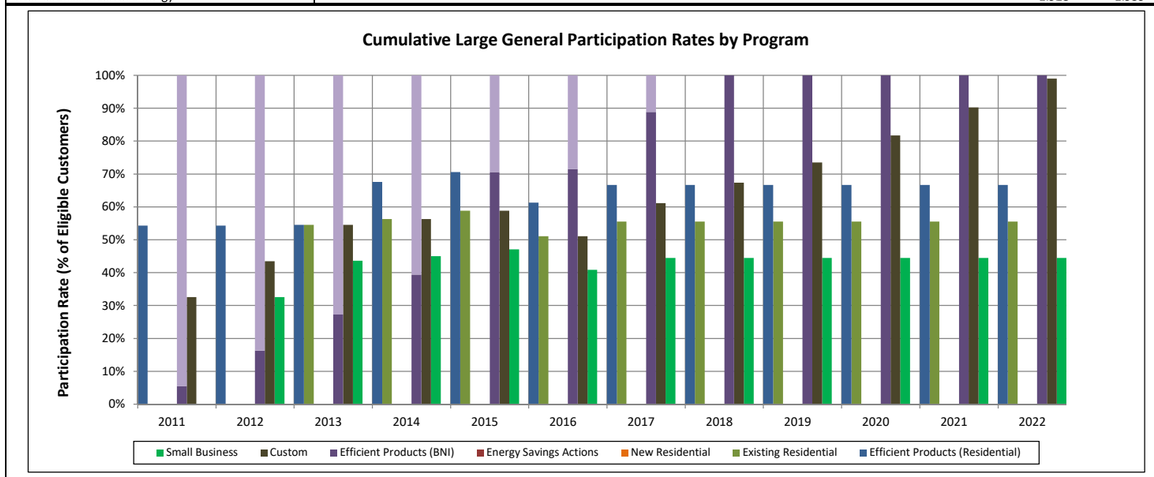


This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Large General Class - PREFERRED PLAN

Line#	Impacts of DSM on the Large General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	8.7	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	17.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	17.6	9.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	2,379,245	2,478,746	2,564,045	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	440,532	896,161	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	1,365,375	924,843	469,214	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	32	31	30	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	249,371	263,960	280,055	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.928	1.939	1.945														cents/kWh



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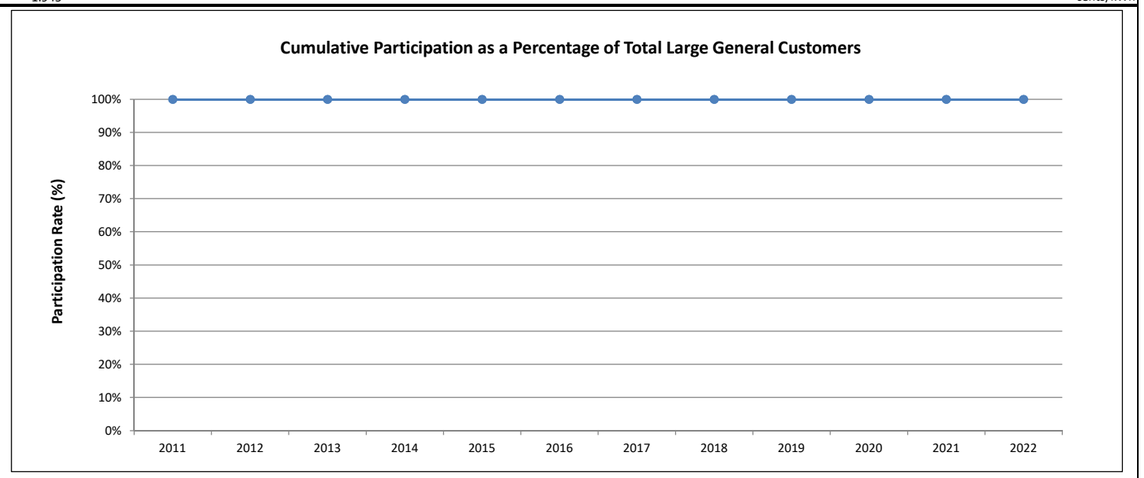
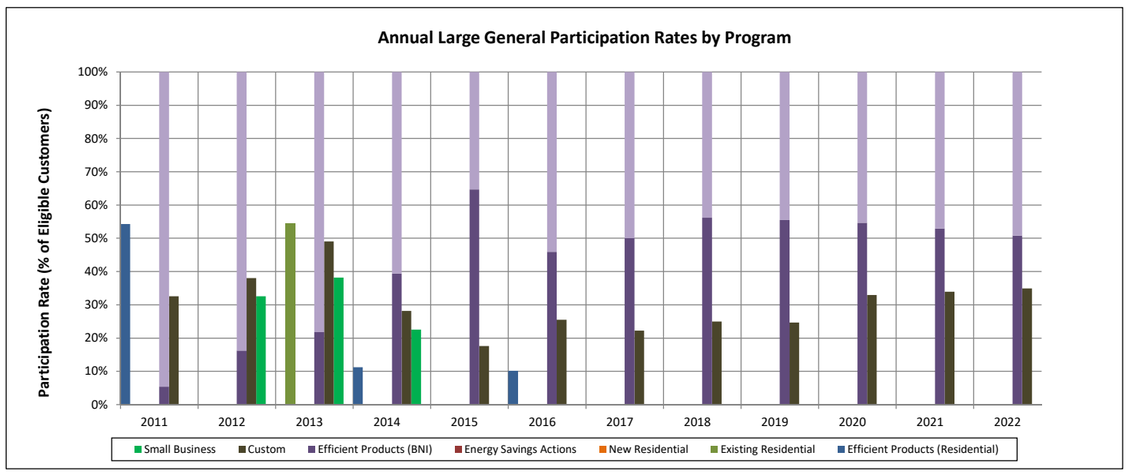
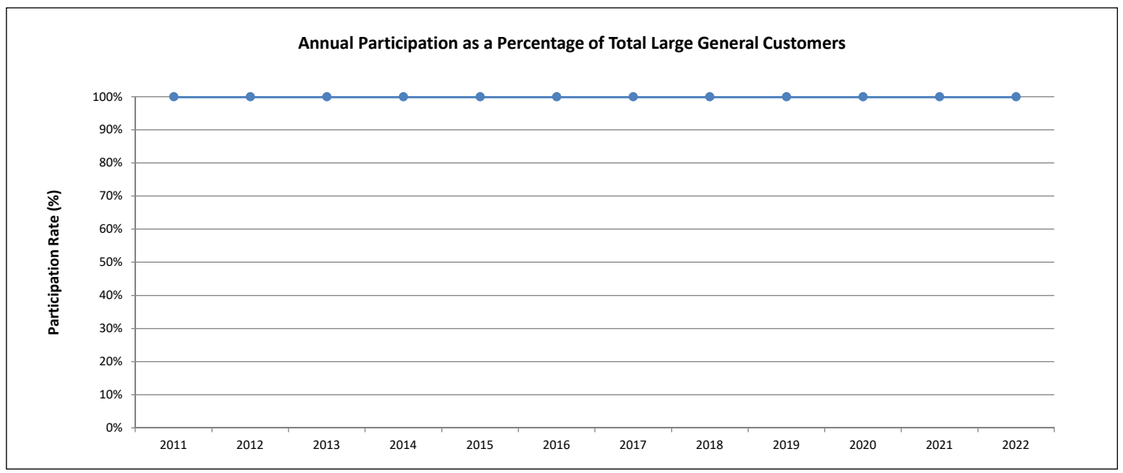


This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



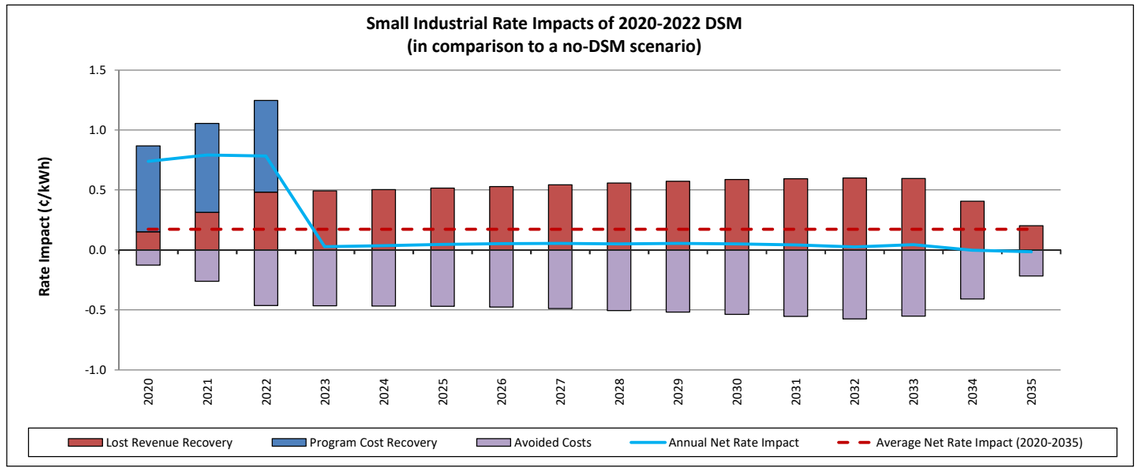
This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



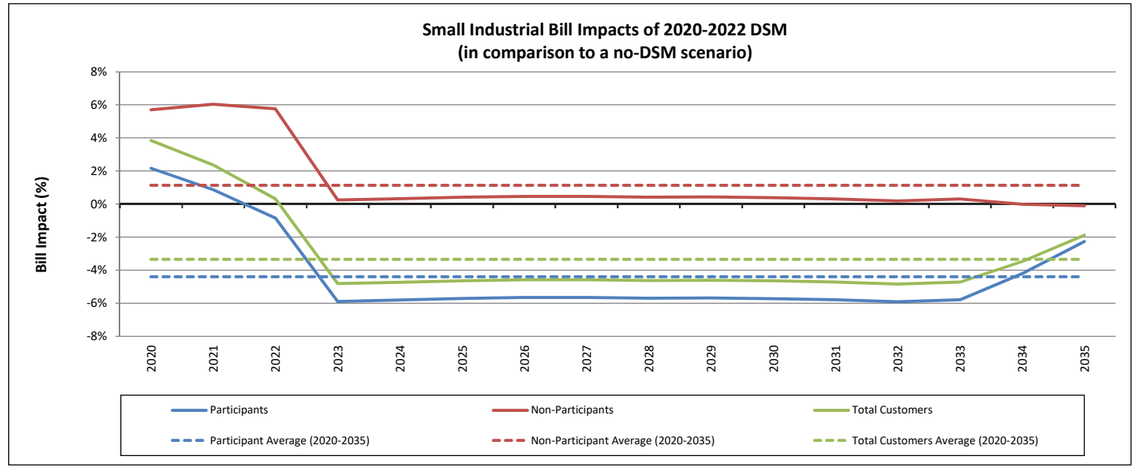
This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Small Industrial Class - PREFERRED PLAN

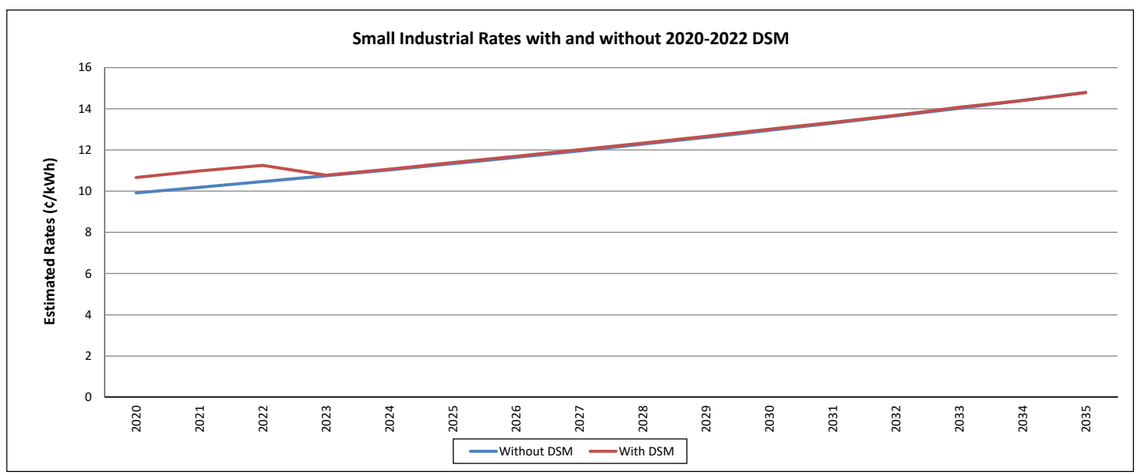
Line#	Impacts of DSM on the Small Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.2	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	12.2	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	12.6	6.4	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,805,285	1,880,678	1,951,271	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	1,086	1,486	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,197	7,735	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	6,859	3,482	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	1,086	1,054	1,014	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,197	5,552	5,948	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.082	2.089	2.100														cents/kWh



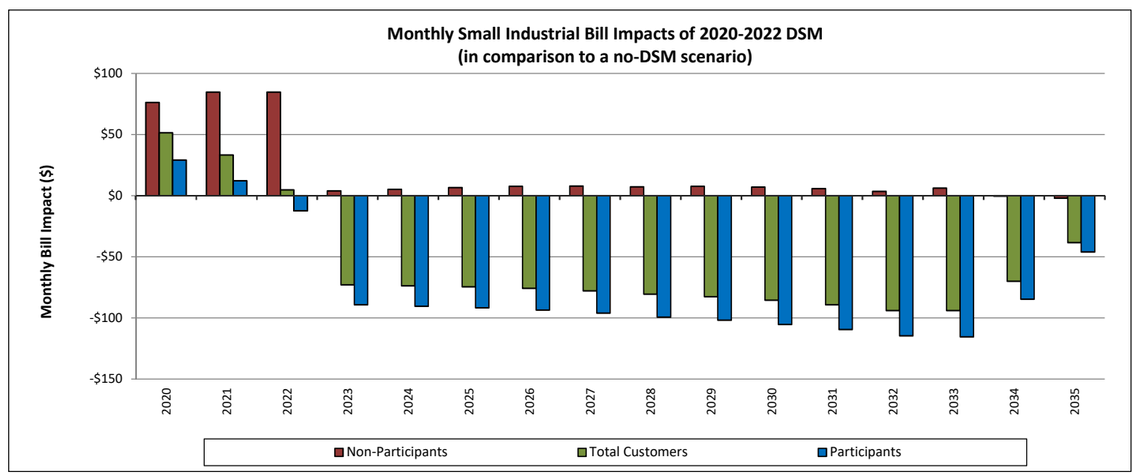
This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants.



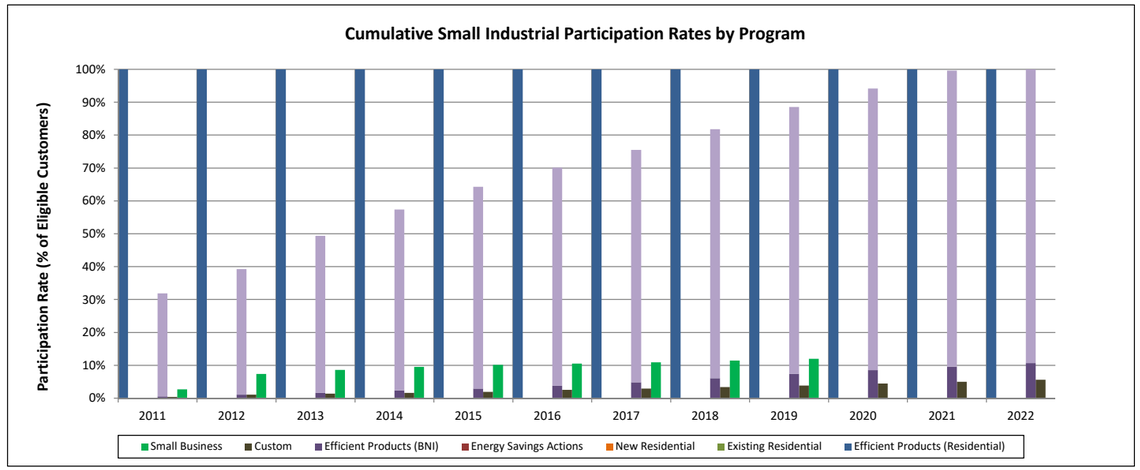
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.



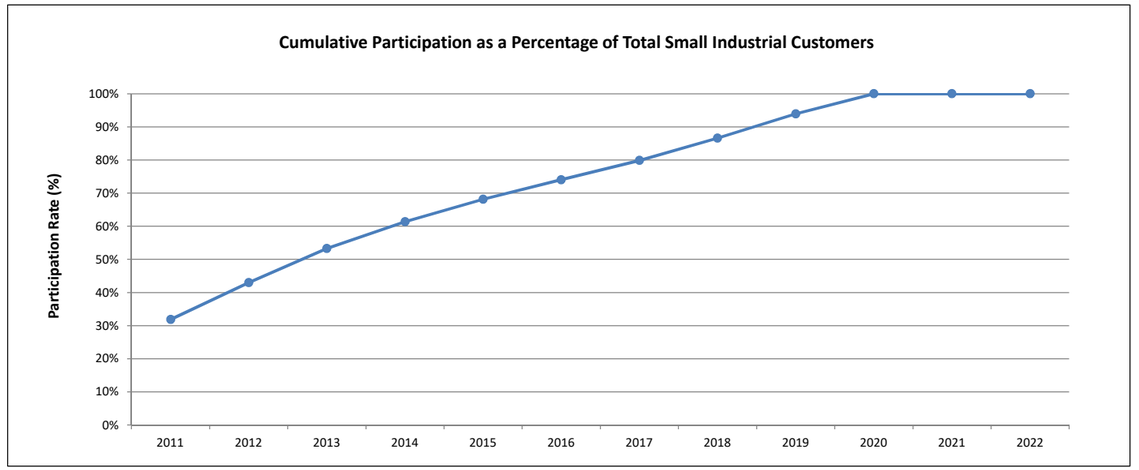
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Small Industrial Class - PREFERRED PLAN

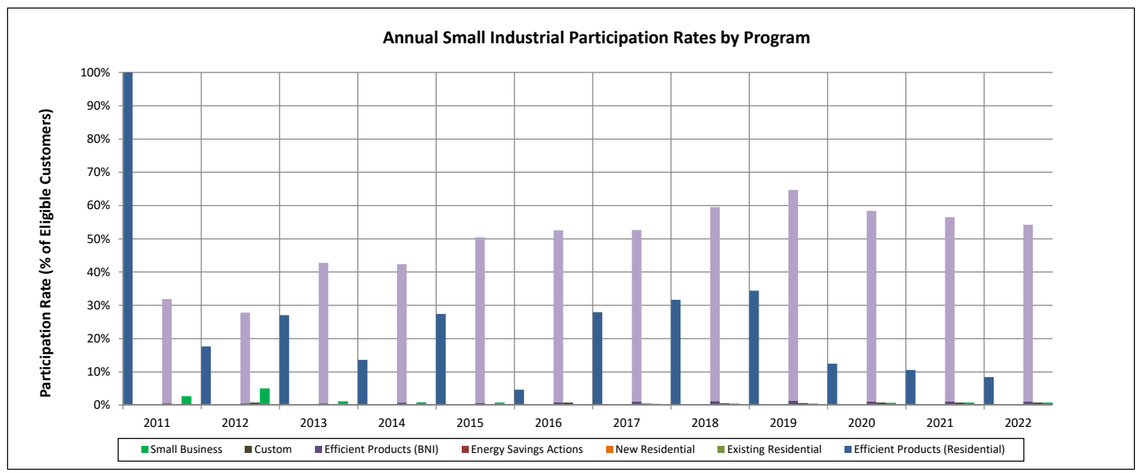
Line#	Impacts of DSM on the Small Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.2	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	12.2	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	12.6	6.4	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,805,285	1,880,678	1,951,271	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	1,086	1,486	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	1,732	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,197	7,735	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	6,859	3,482	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	1,086	1,054	1,014	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,197	5,552	5,948	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.082	2.089	2.100														cents/kWh



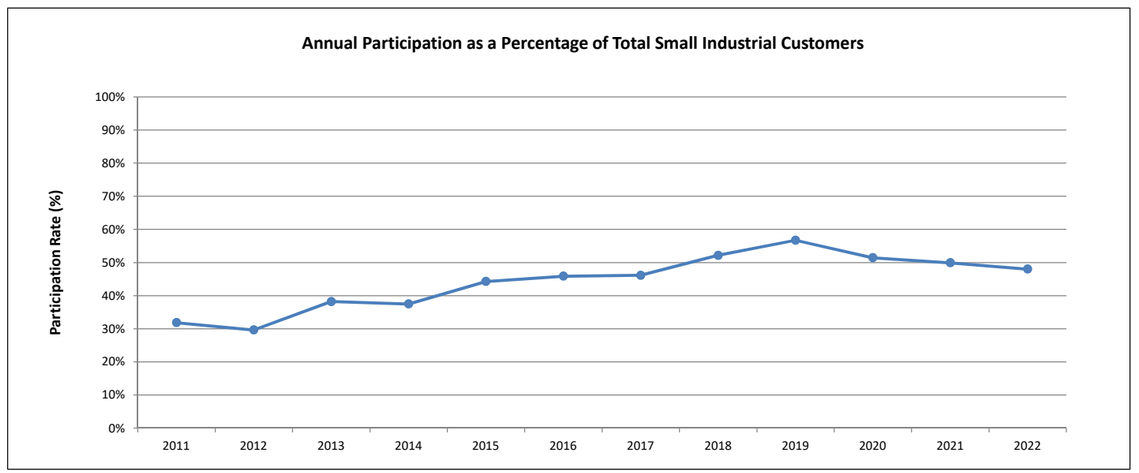
This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



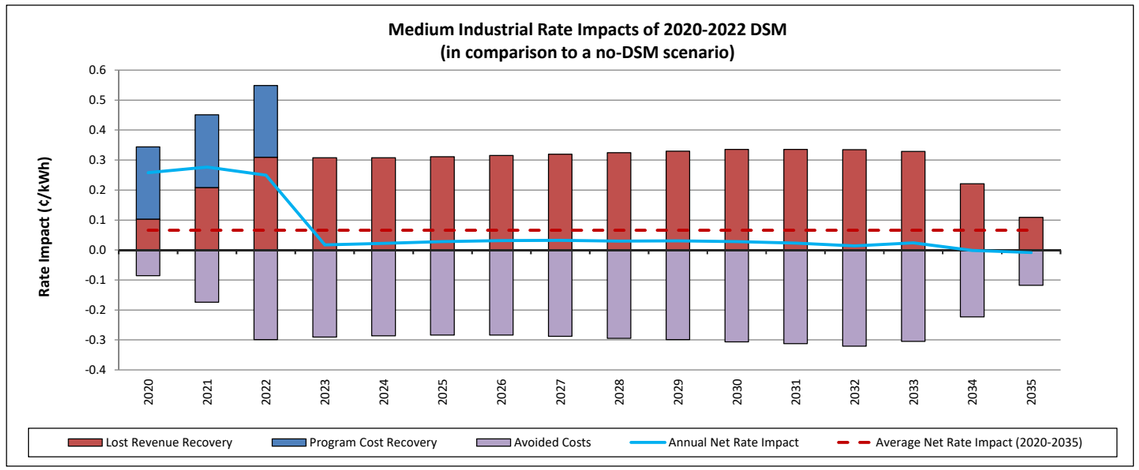
This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



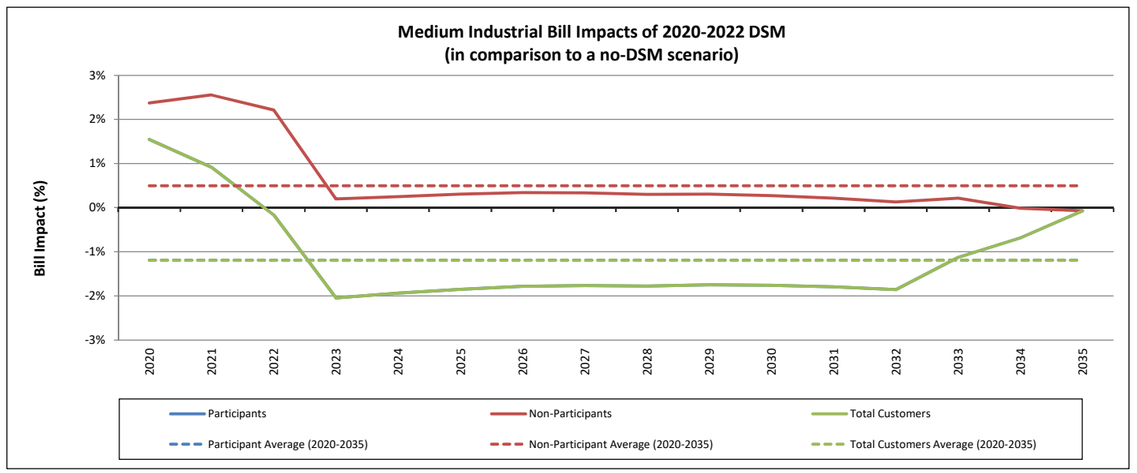
This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Medium Industrial Class - PREFERRED PLAN

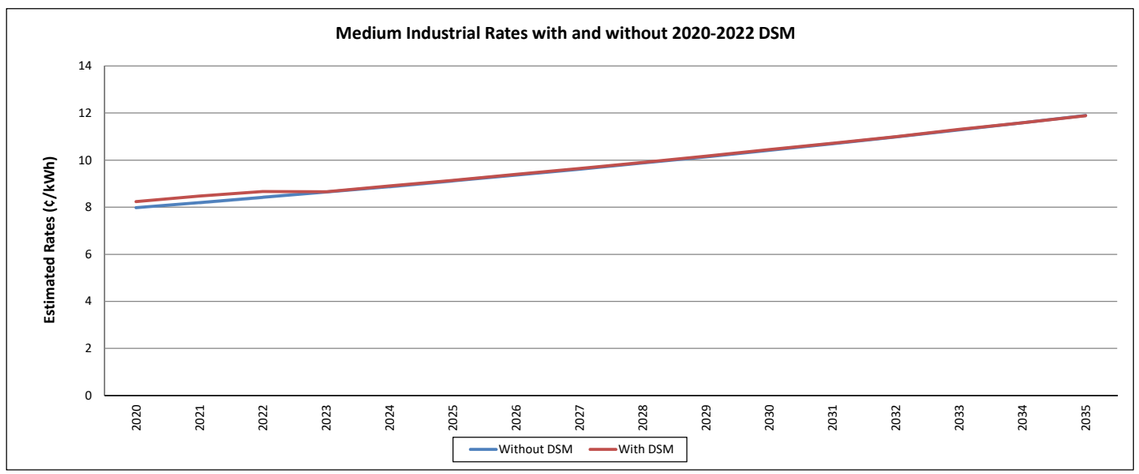
Impacts of DSM on the Medium Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.9	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	13.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	14.0	7.1	0.0	GWh@gen
DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,438,535	1,492,352	1,538,400	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	NSPI acct.'s
Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	42,486	86,270	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	88,739	44,955	0	kWh@meter
Annual Number of Participants	0	0	0	0	0	0	0	0	0	204	198	192	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	31,115	32,938	34,993	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
Levelized Cost of Saved Energy										1.604	1.608	1.609														cents/kWh



This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants. In this class, all customers are assumed to have participated, so the Participants line matches the Total Customers line (i.e., there are likely no customers whose impacts follow the Non-Participant line).



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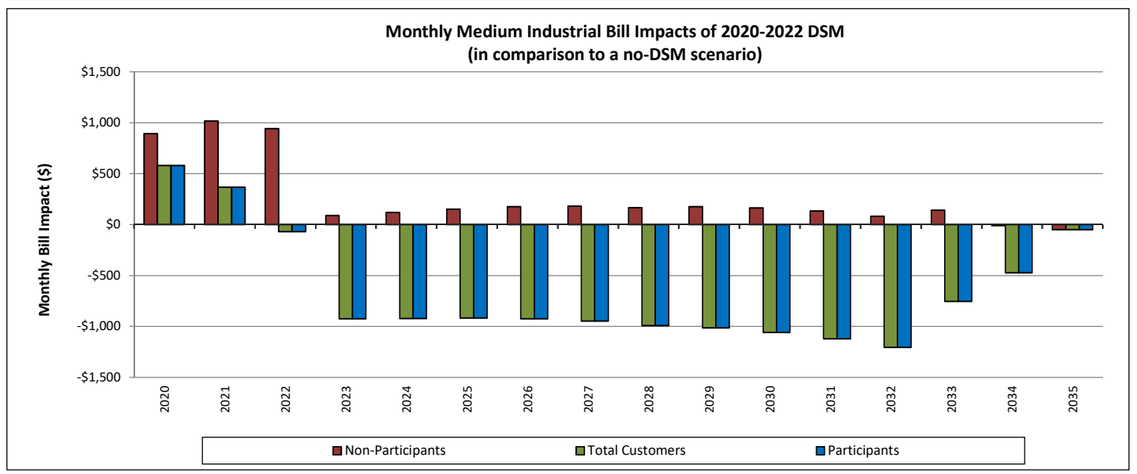
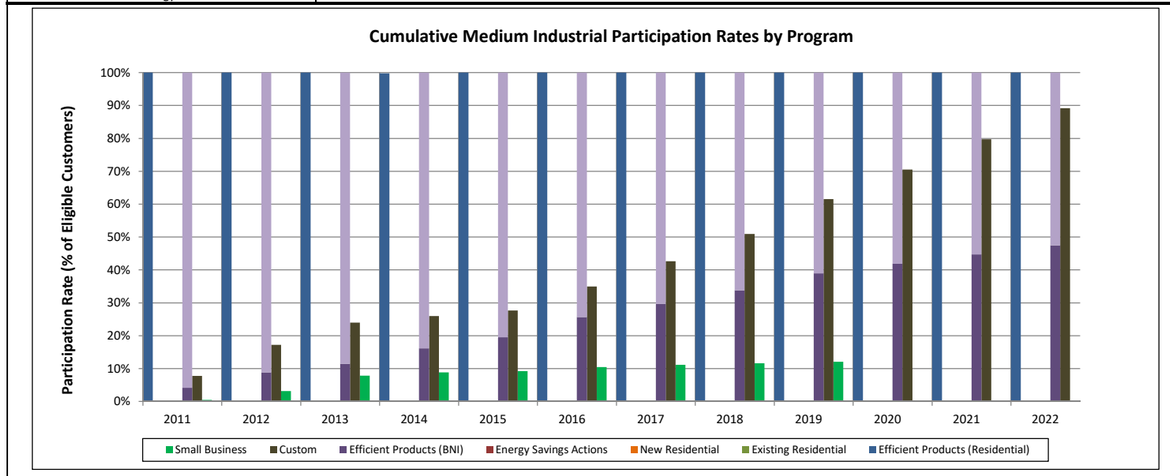


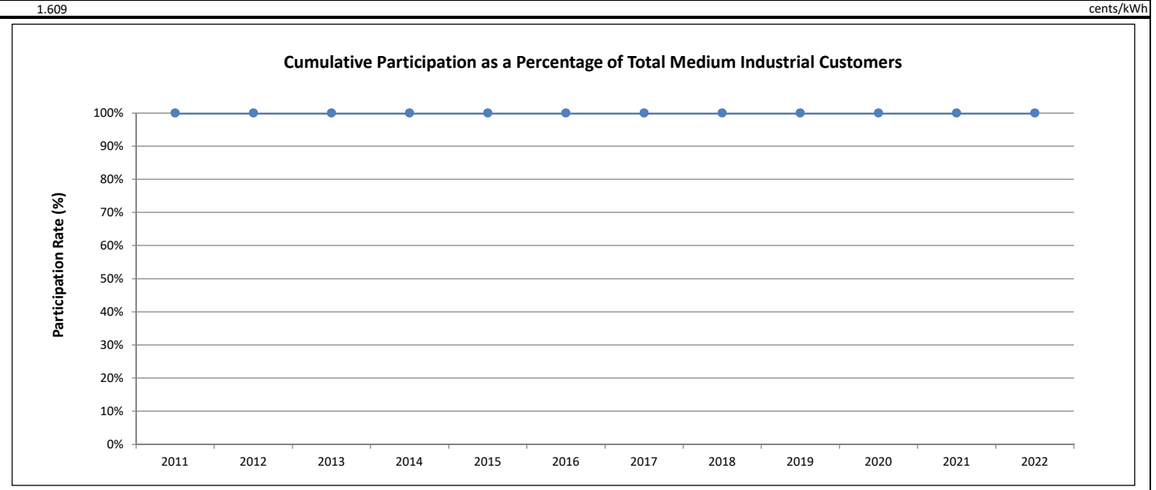
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Medium Industrial Class - PREFERRED PLAN

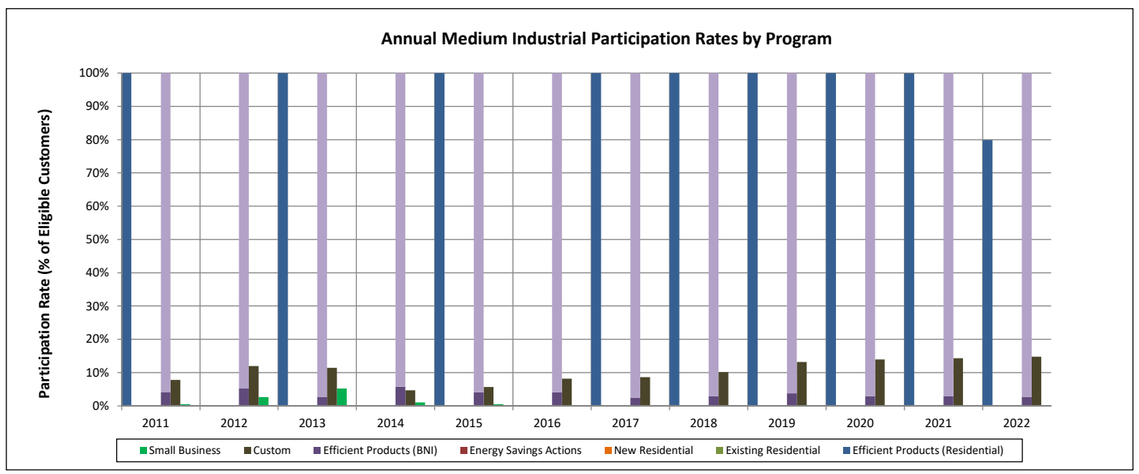
Line#	Impacts of DSM on the Medium Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.9	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	13.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	14.0	7.1	0.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,438,535	1,492,352	1,538,400	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	42,486	86,270	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	131,225	88,739	44,955	0	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	204	198	192	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	31,115	32,938	34,993	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.604	1.608	1.609														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



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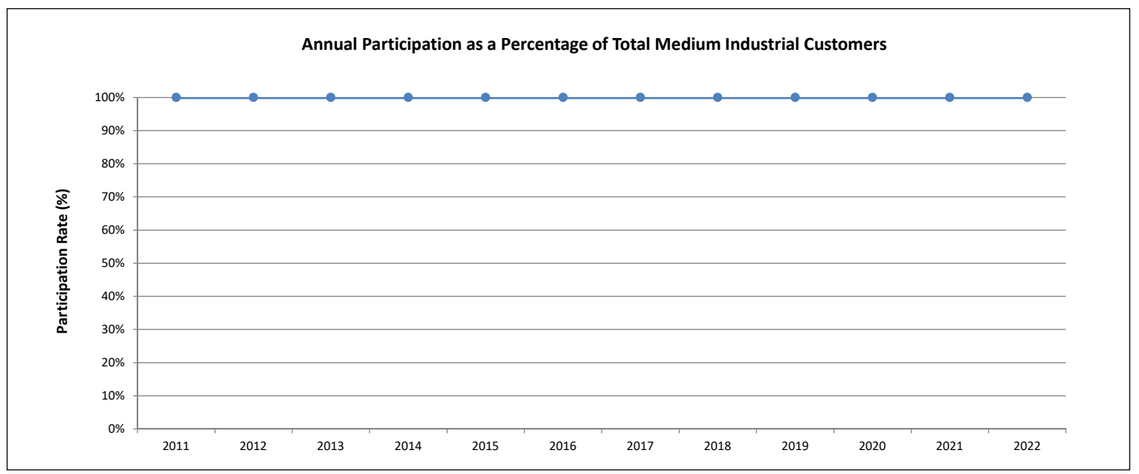
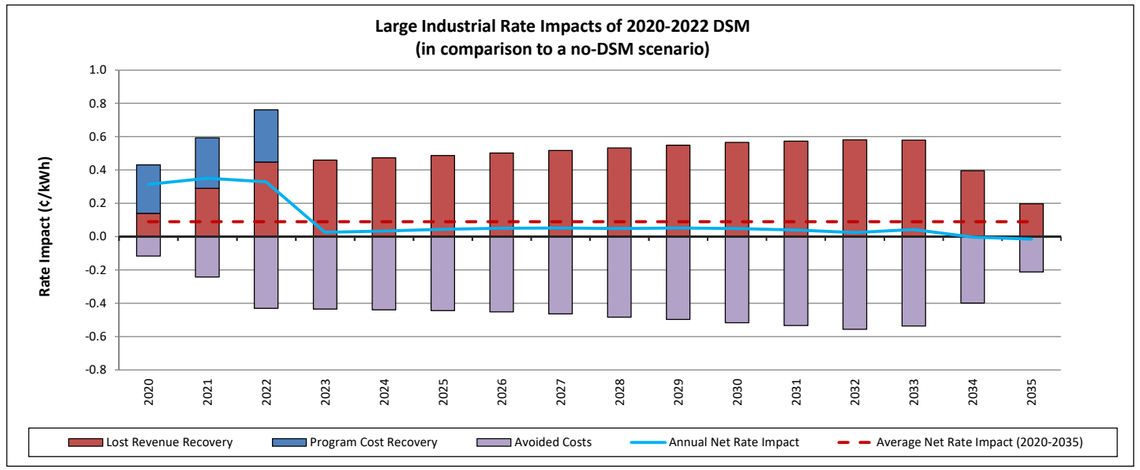


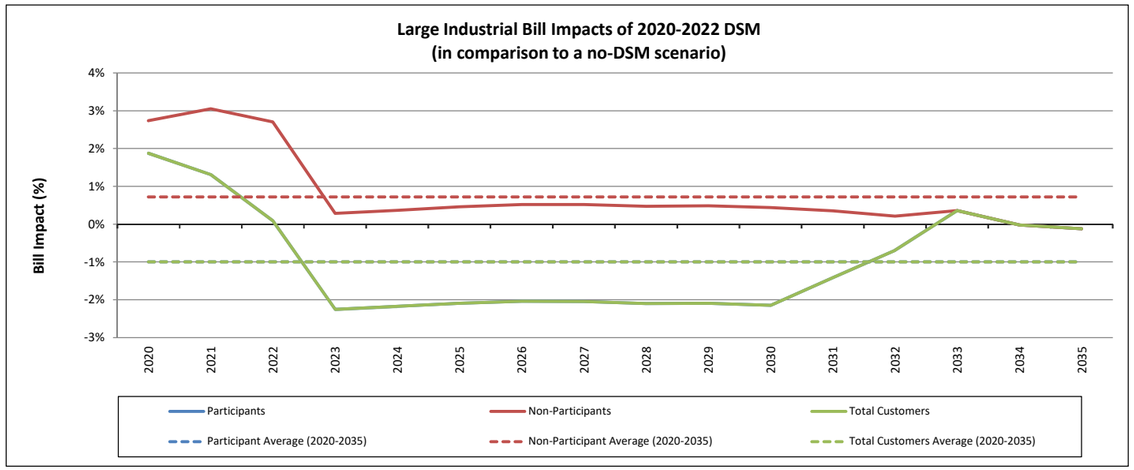
This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Large Industrial Class - PREFERRED PLAN

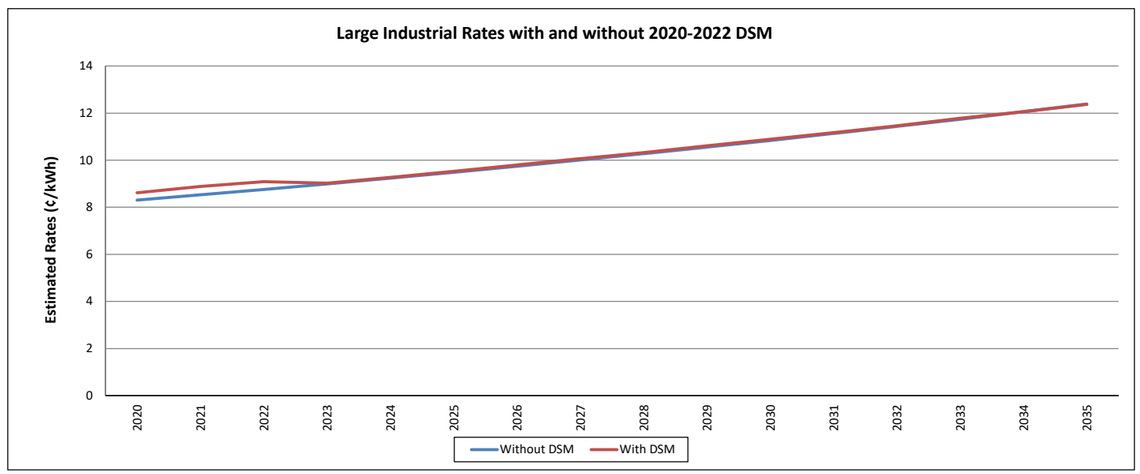
Line#	Impacts of DSM on the Large Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	8.2	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	16.2	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	16.6	8.4	0.0	0.0	0.0	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,935,664	2,007,106	2,068,172	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	235,839	477,659	724,766	724,766	724,766	724,766	724,766	724,766	724,766	724,766	724,766	488,927	247,107	0	0	0	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	53	51	50	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	145,826	152,976	160,993	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.093	2.098	2.102														cents/kWh



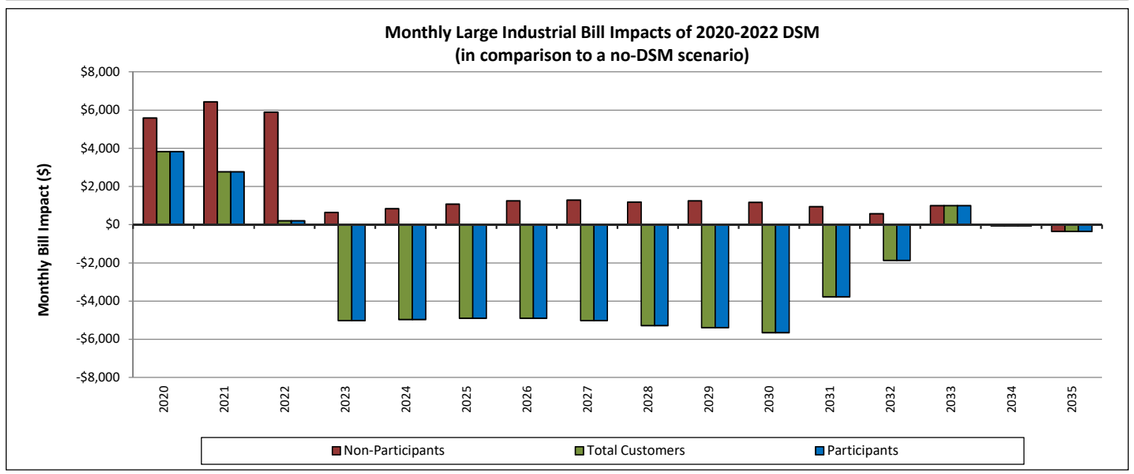
This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants. In this class, all customers are assumed to have participated, so the Participants line matches the Total Customers line (i.e., there are likely no customers whose impacts follow the Non-Participant line).



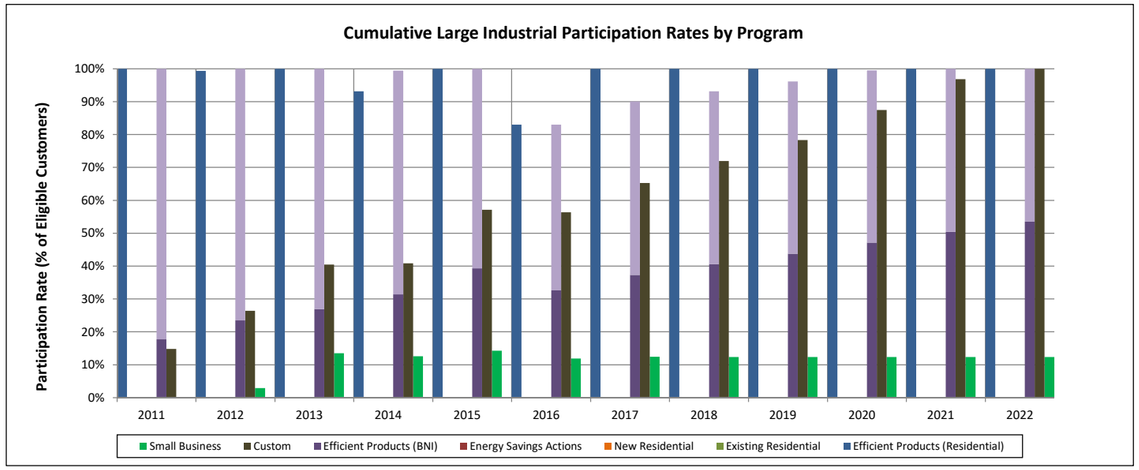
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.

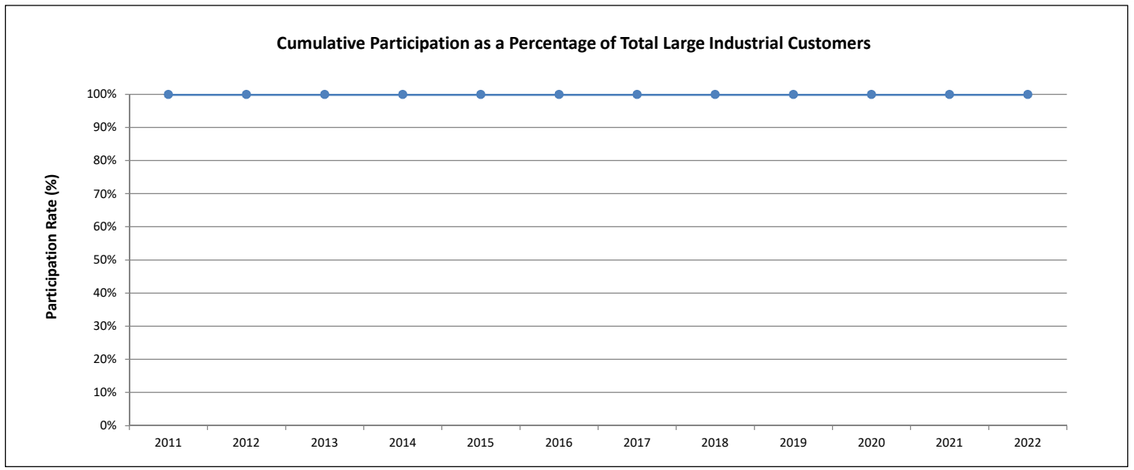


This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Large Industrial Class - PREFERRED PLAN

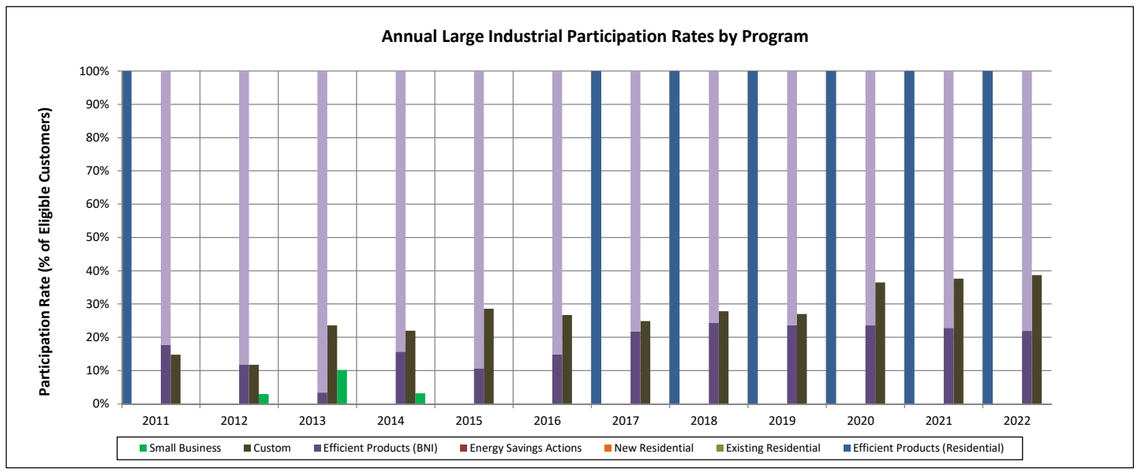
Line#	Impacts of DSM on the Large Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	8.2	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	16.2	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	16.6	8.4	0.0	0.0	0.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,935,664	2,007,106	2,068,172	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	235,839	477,659	724,766	724,766	724,766	724,766	724,766	724,766	724,766	724,766	724,766	488,927	247,107	0	0	0	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	53	51	50	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	145,826	152,976	160,993	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.093	2.098	2.102														cents/kWh

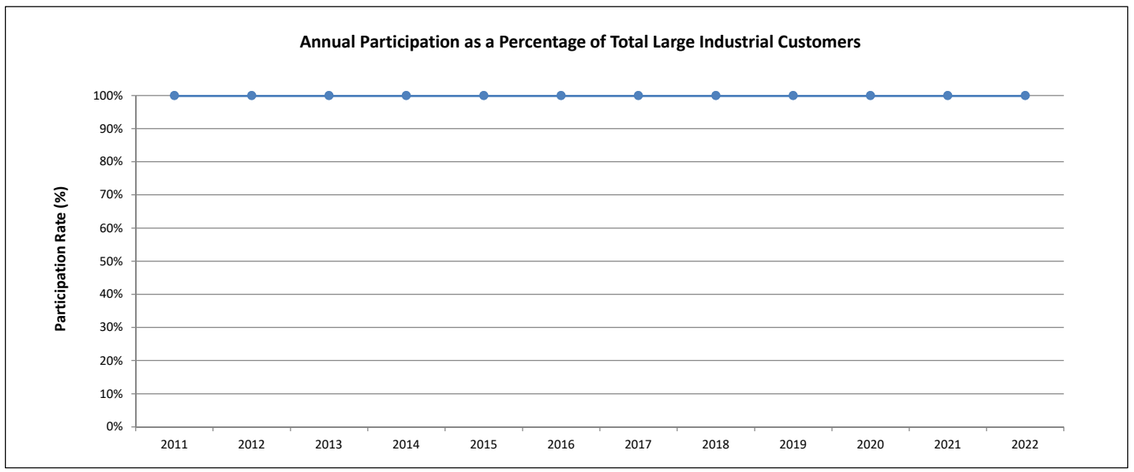




This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).

This graph shows cumulative program participation for the class, as a percentage of total customers in the class. Each participant is counted once, in the first that year they participate.



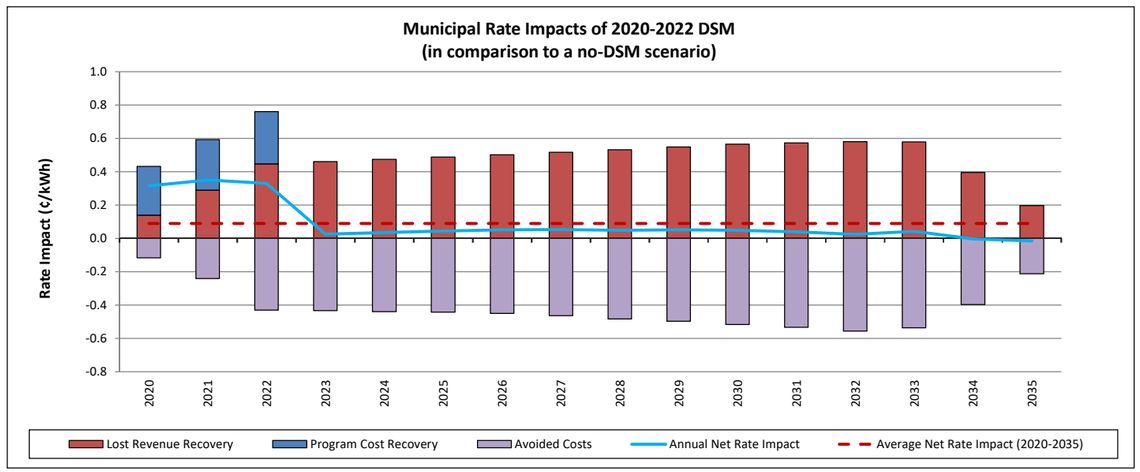


This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).

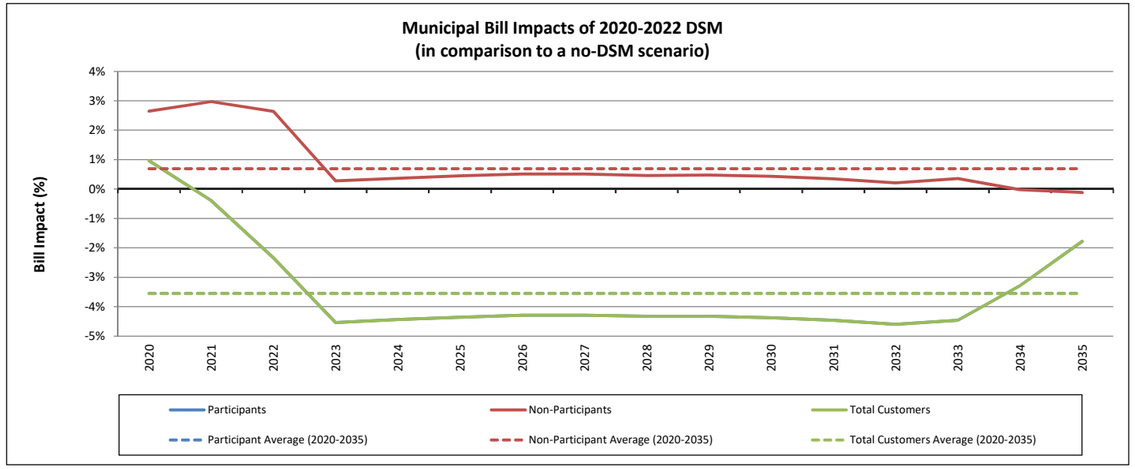
This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Municipal Class - PREFERRED PLAN

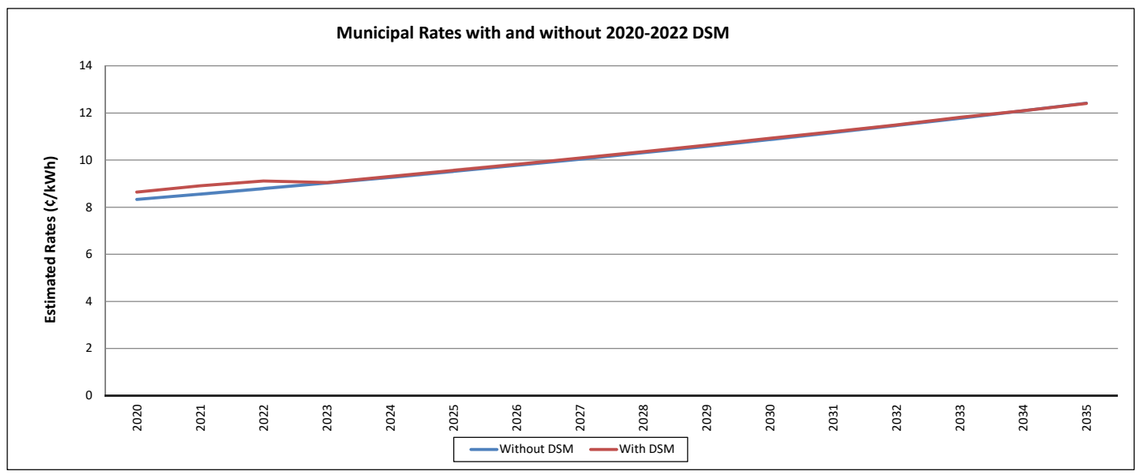
Line#	Impacts of DSM on the Municipal Utility Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	8.0	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	8.1	4.1	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,533,950	1,595,057	1,639,726	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	631,027	1,273,436	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,289,263	646,854	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	631,027	642,409	646,854	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.719	2.745	2.782														cents/kWh



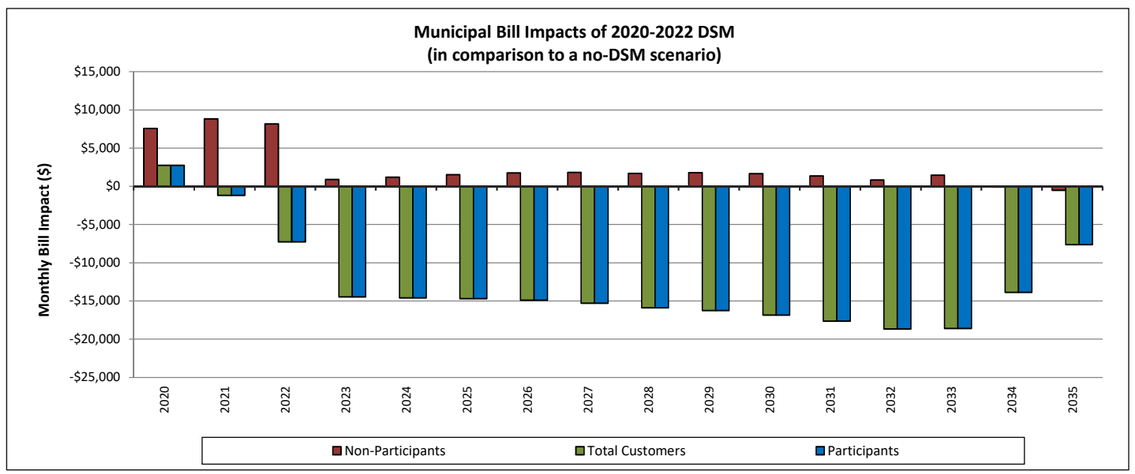
This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants. In this class, all customers are assumed to have participated, so the Participants line matches the Total Customers line (i.e., there are likely no customers whose impacts follow the Non-Participant line).



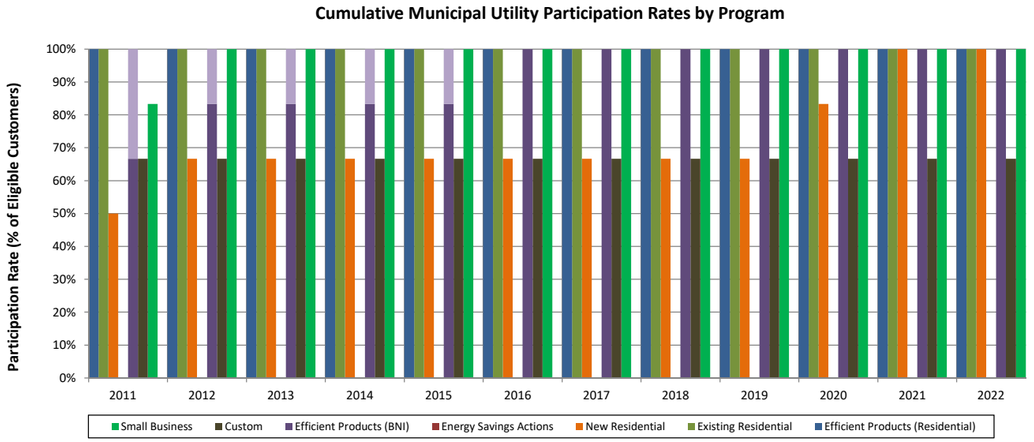
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.



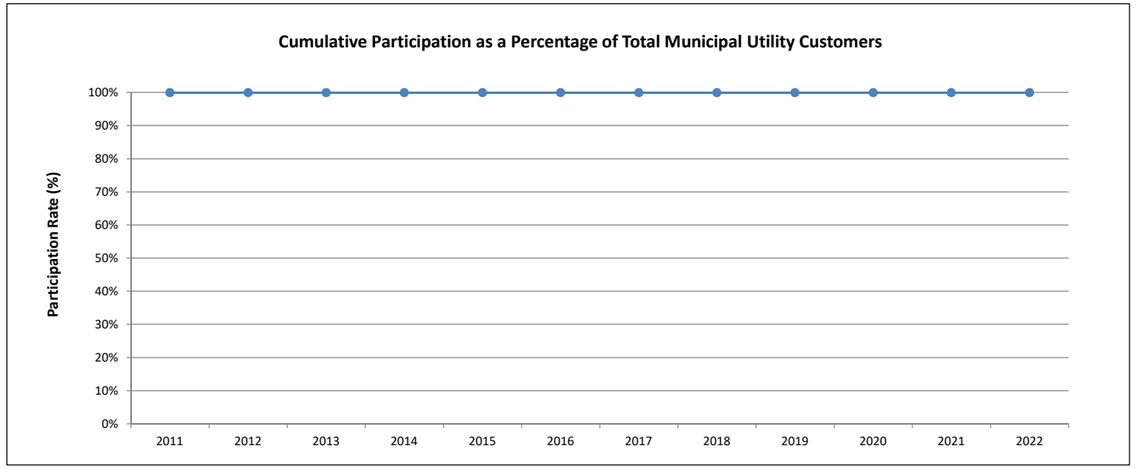
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Municipal Class - PREFERRED PLAN

Line#	Impacts of DSM on the Municipal Utility Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	8.0	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	8.1	4.1	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,533,950	1,595,057	1,639,726	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	631,027	1,273,436	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,920,290	1,289,263	646,854	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	631,027	642,409	646,854	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.719	2.745	2.782														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



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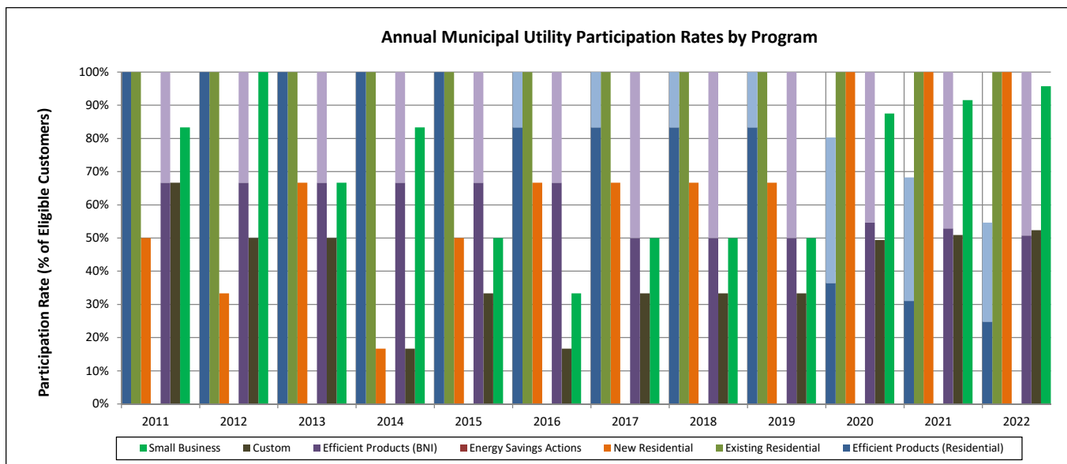

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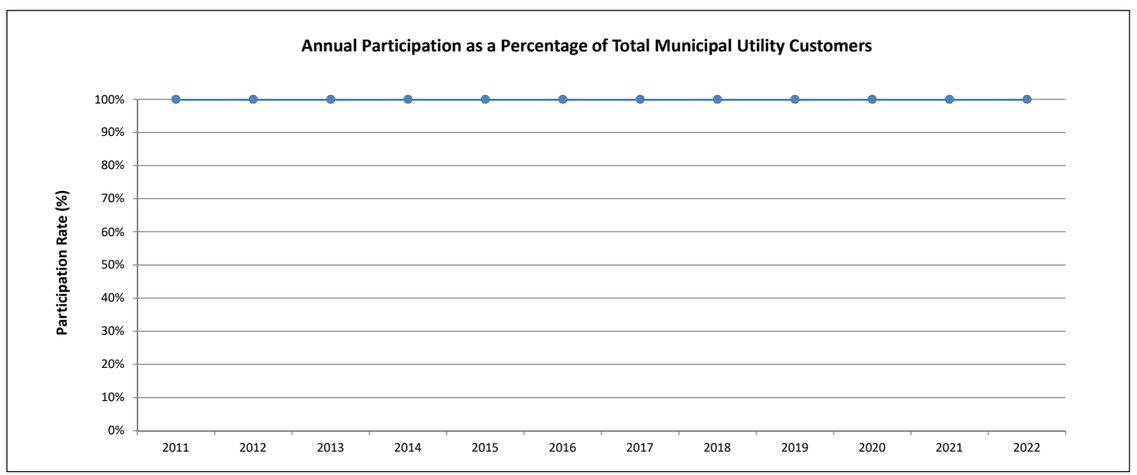

This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Appendix B – Attachment 2:

Results by Rate Class (Alternate Scenario)

Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

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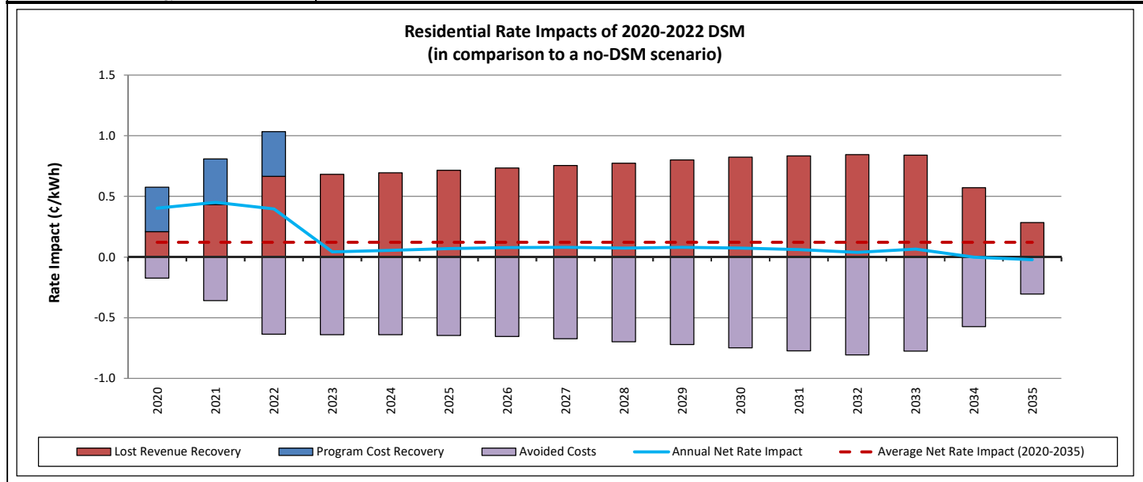
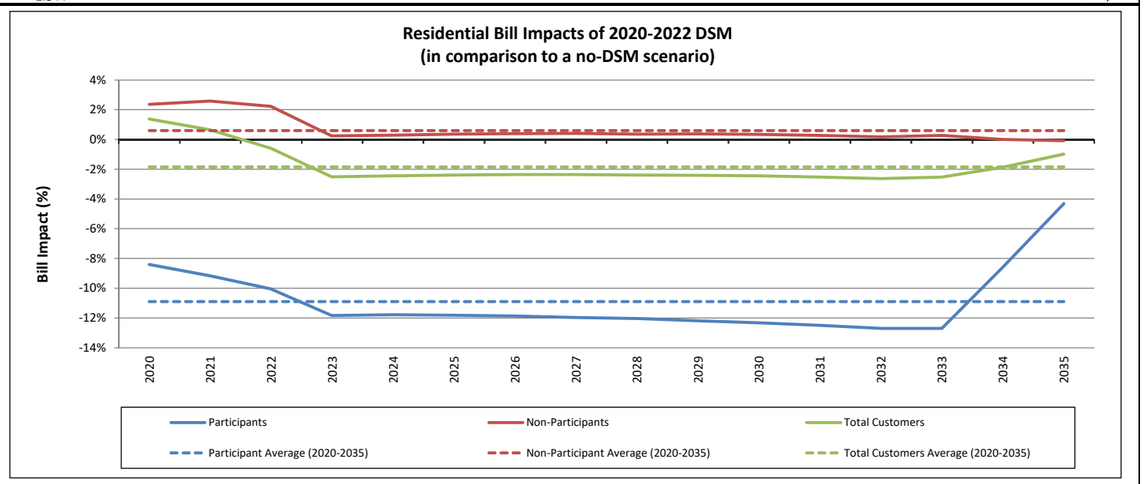
Rate and Bill Impacts of DSM on the Residential Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Residential Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.1	50.6	47.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.1	102.7	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	98.0	47.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	16,383,704	16,781,018	16,397,144	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	43,683	79,066	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	1,084	1,180	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	810	392	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	43,683	39,512	34,164	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	1,084	1,164	1,262	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.243	2.290	2.344														cents/kWh



This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



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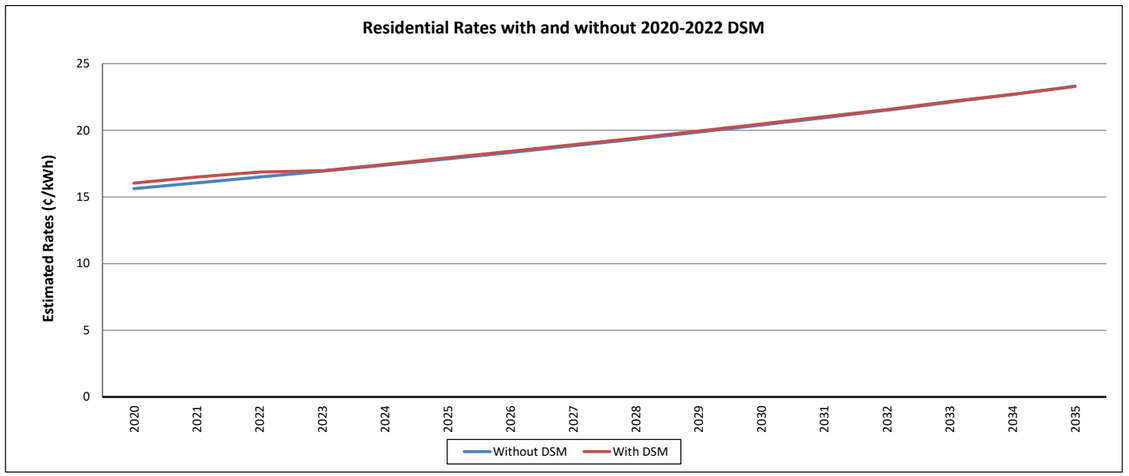

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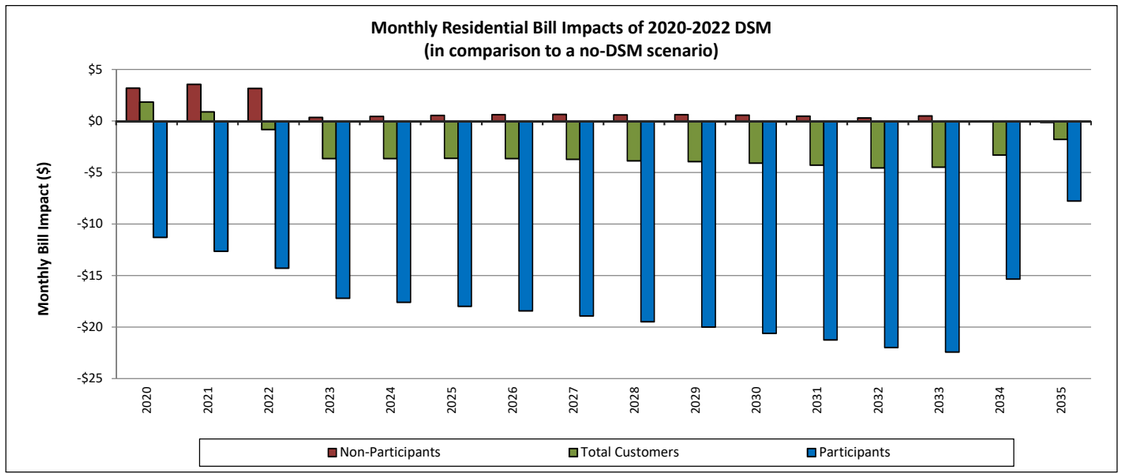
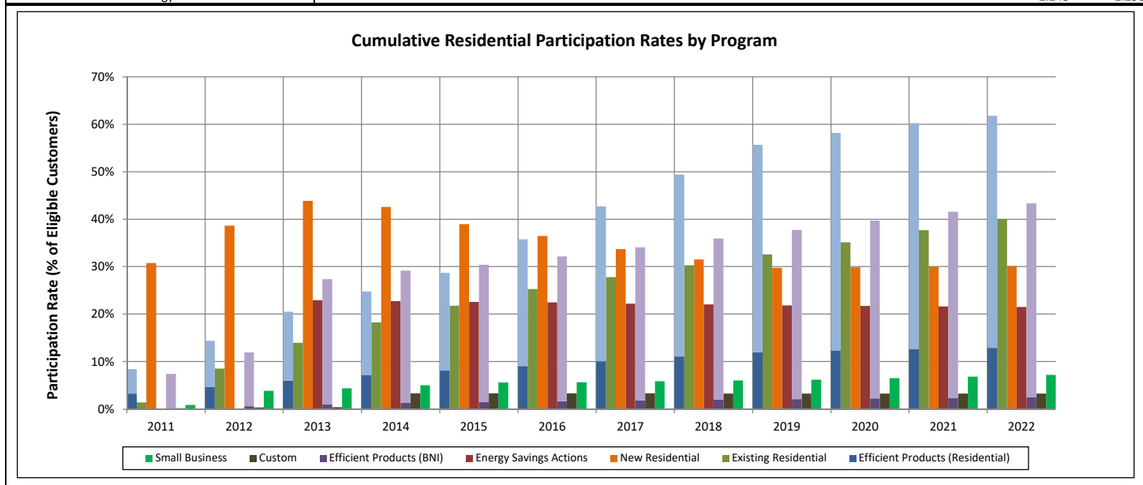


This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Residential Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Residential Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.1	50.6	47.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.1	102.7	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	150.1	98.0	47.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	16,383,704	16,781,018	16,397,144	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	43,683	79,066	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	109,935	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	1,084	1,180	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	810	392	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	43,683	39,512	34,164	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	1,084	1,164	1,262	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.243	2.290	2.344														cents/kWh



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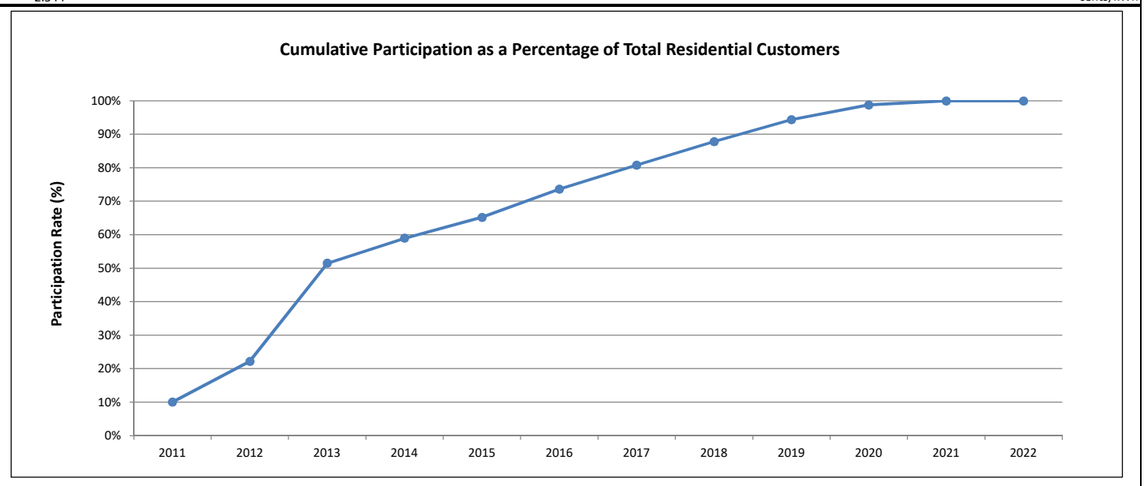

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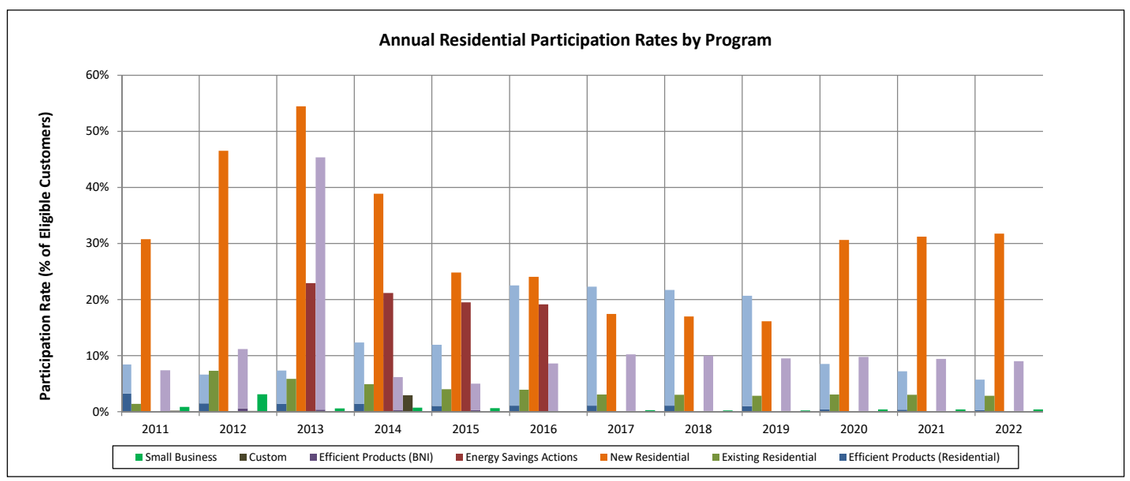

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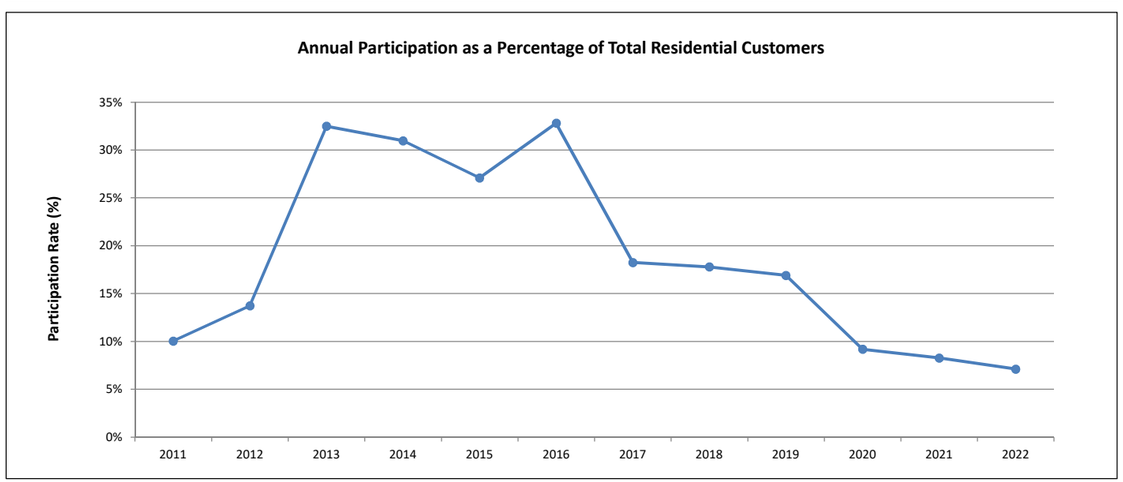

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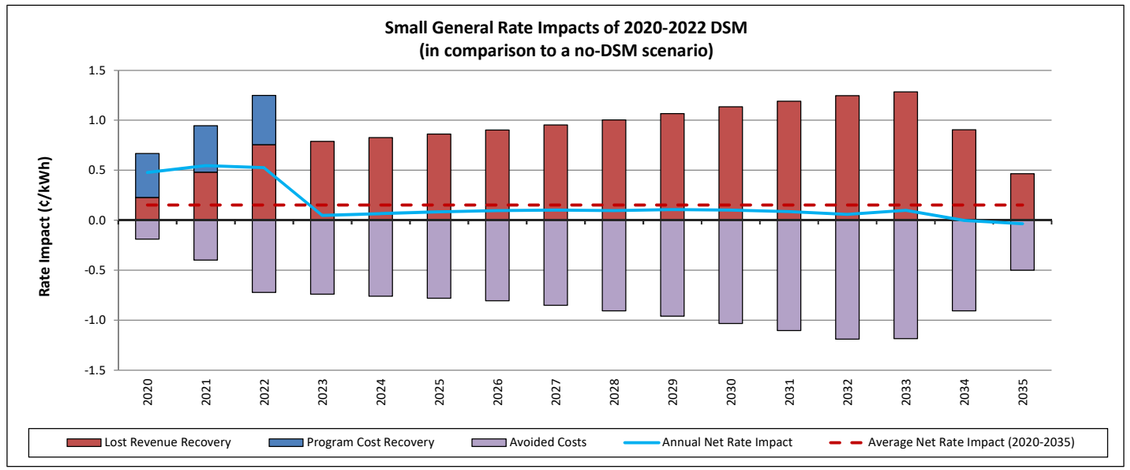
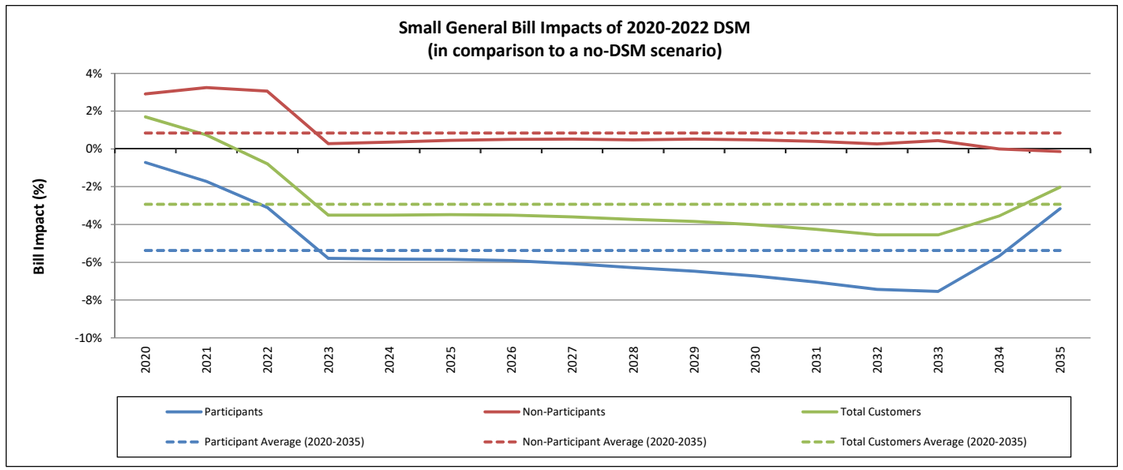
Rate and Bill Impacts of DSM on the Small General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Small General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.3	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	6.5	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	6.7	3.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	955,039	992,430	1,035,637	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	8,295	12,493	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	349	473	583	583	583	583	583	583	583	583	583	583	583	583	396	201	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	8,295	8,038	7,726	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	349	375	402	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.145	2.134	2.153														cents/kWh



This graph shows estimated rate impacts of DSM, relative to the no-DSM scenario. Blue bars show the impact of program cost recovery. Red bars show the impact of lost revenues due to reduced sales. Purple bars show the impact of avoided utility costs. The blue line is the net rate effect (sum of positive and negative rate pressures), which accounts for recovery of fixed costs that are not avoided due to DSM. The dotted red line shows the average net rate impact of DSM over the study period.



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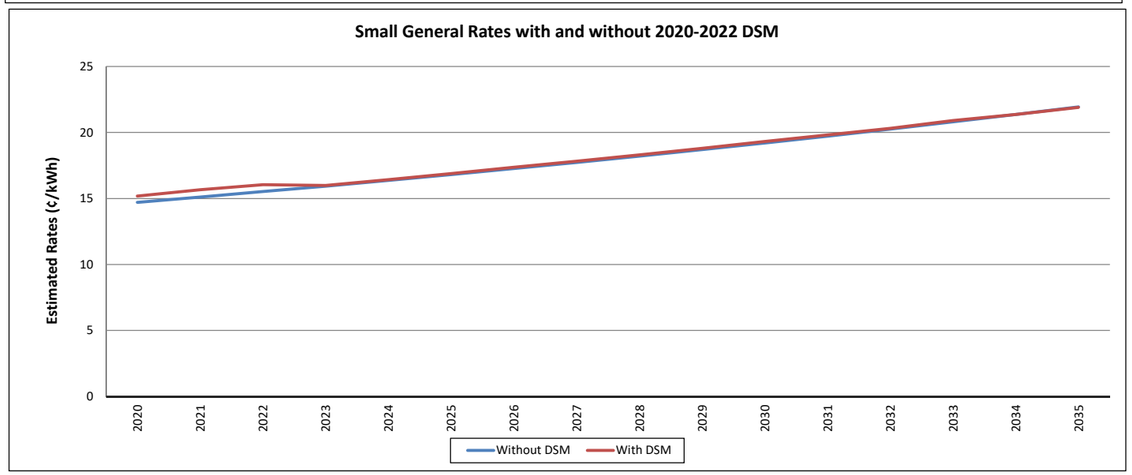

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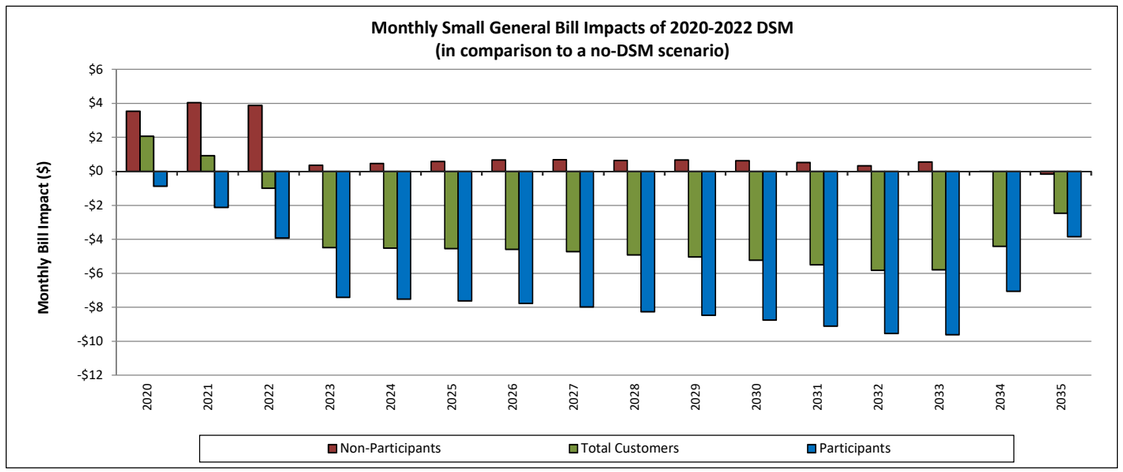

This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Small General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Small General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.3	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	6.5	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	6.7	3.4	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	955,039	992,430	1,035,637	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	8,295	12,493	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	15,455	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	349	473	583	583	583	583	583	583	583	583	583	583	583	583	396	201	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	8,295	8,038	7,726	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
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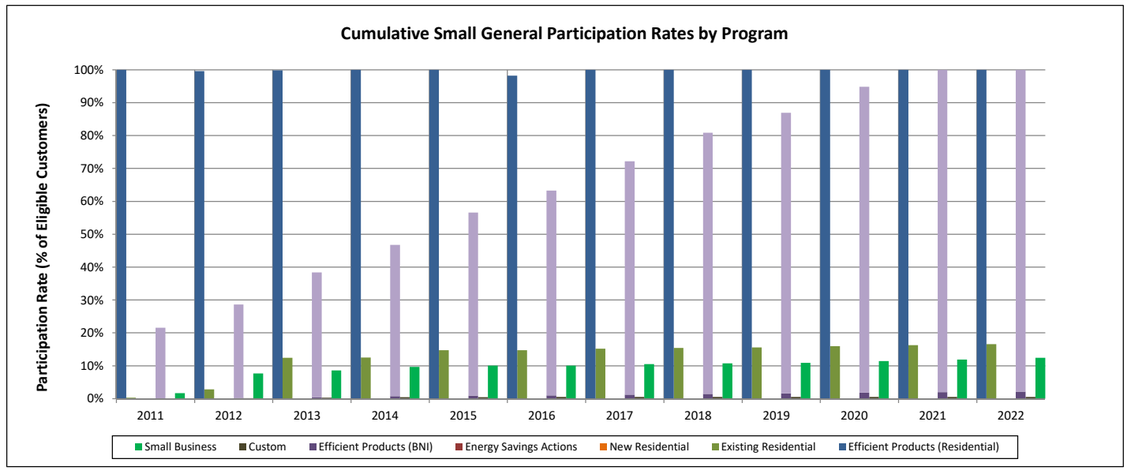
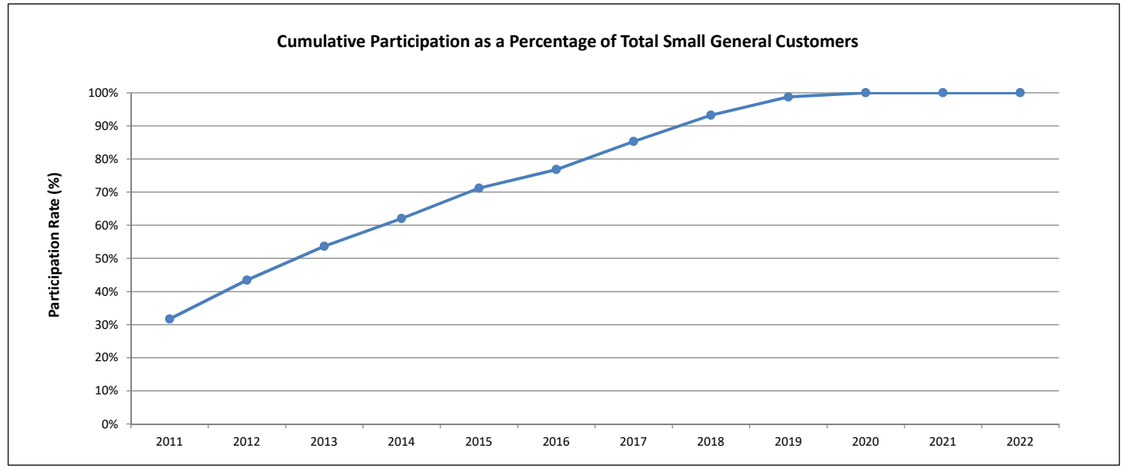
9	Levelized Cost of Saved Energy										2.145	2.134	2.153														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



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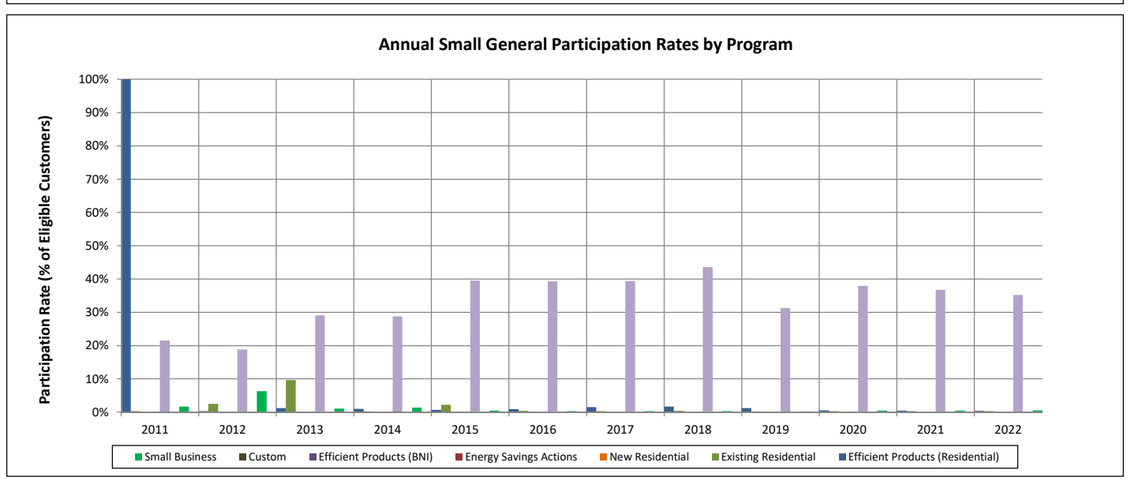

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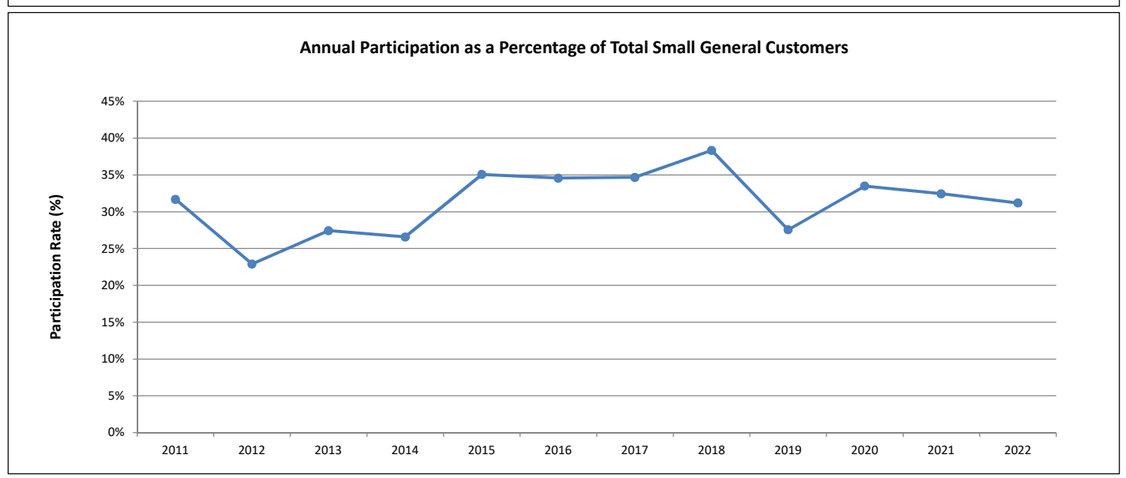

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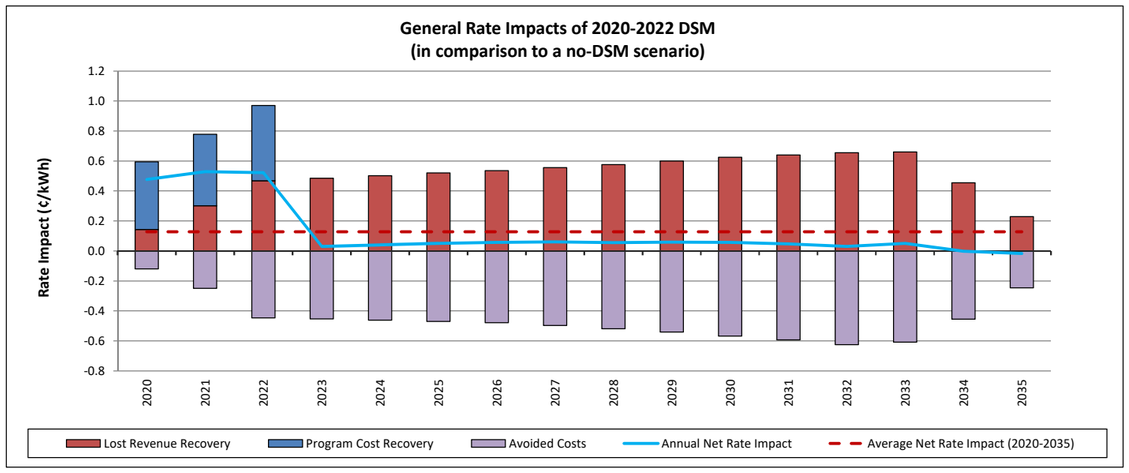
Rate and Bill Impacts of DSM on the General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.7	41.2	42.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.7	80.9	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	83.7	42.5	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	10,704,787	11,134,617	11,576,405	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	7,021	9,569	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,315	7,948	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	7,095	3,602	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	7,021	6,827	6,589	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,315	5,674	6,061	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										1.880	1.879	1.892														cents/kWh



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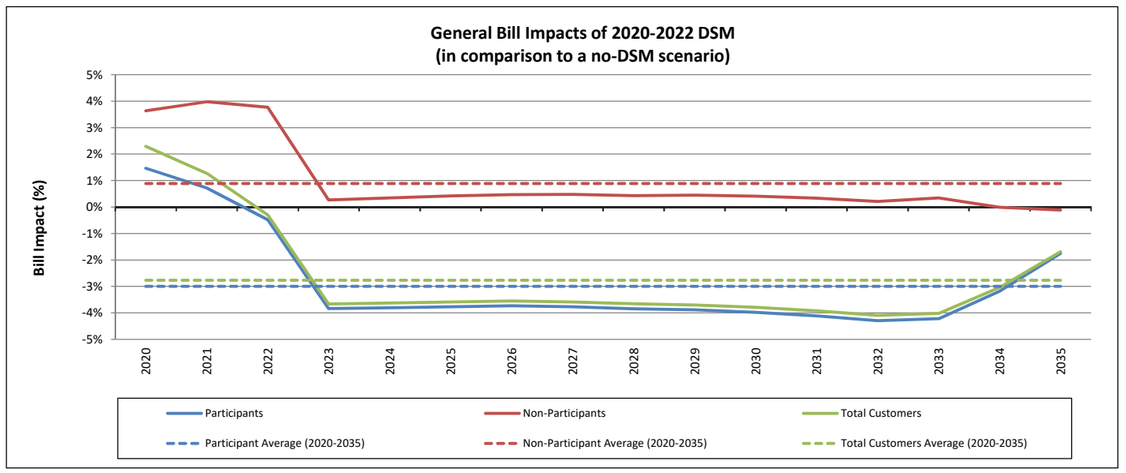

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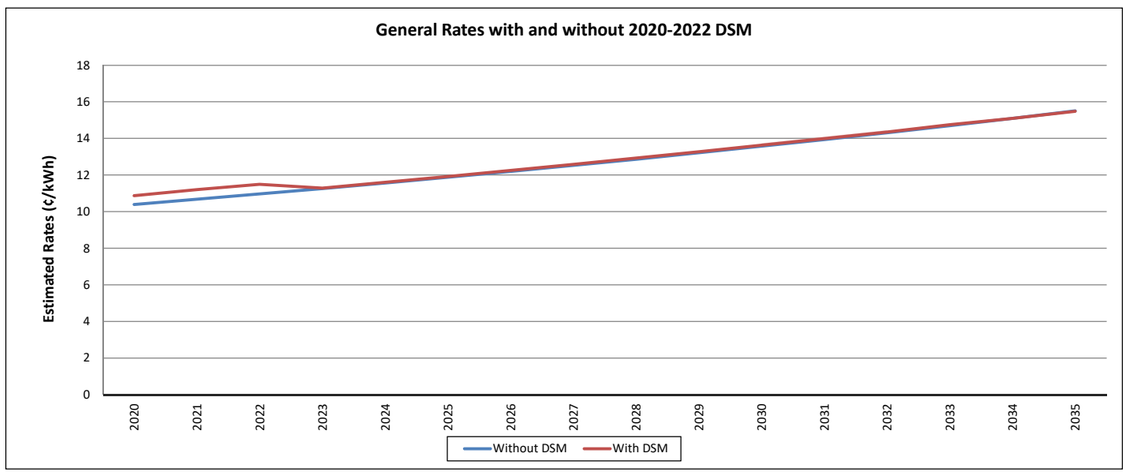

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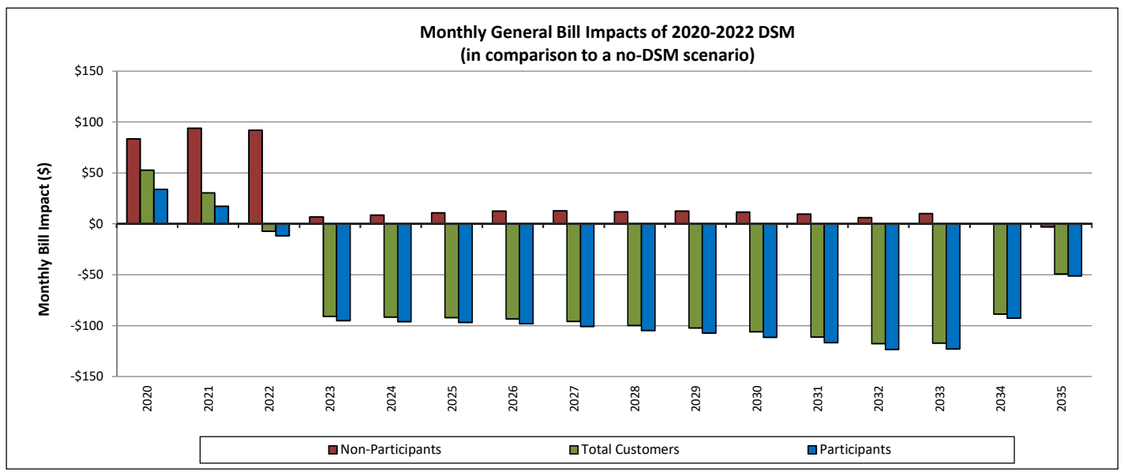

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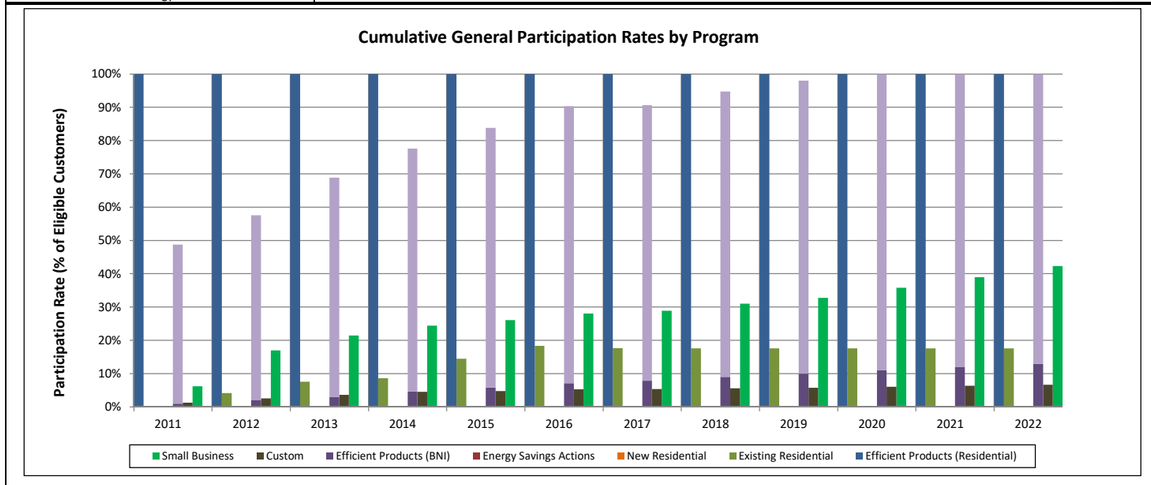
Rate and Bill Impacts of DSM on the General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.7	41.2	42.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.7	80.9	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	123.4	83.7	42.5	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	10,704,787	11,134,617	11,576,405	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	7,021	9,569	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	11,088	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,315	7,948	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	7,095	3,602	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	7,021	6,827	6,589	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,315	5,674	6,061	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.880	1.879	1.892														cents/kWh



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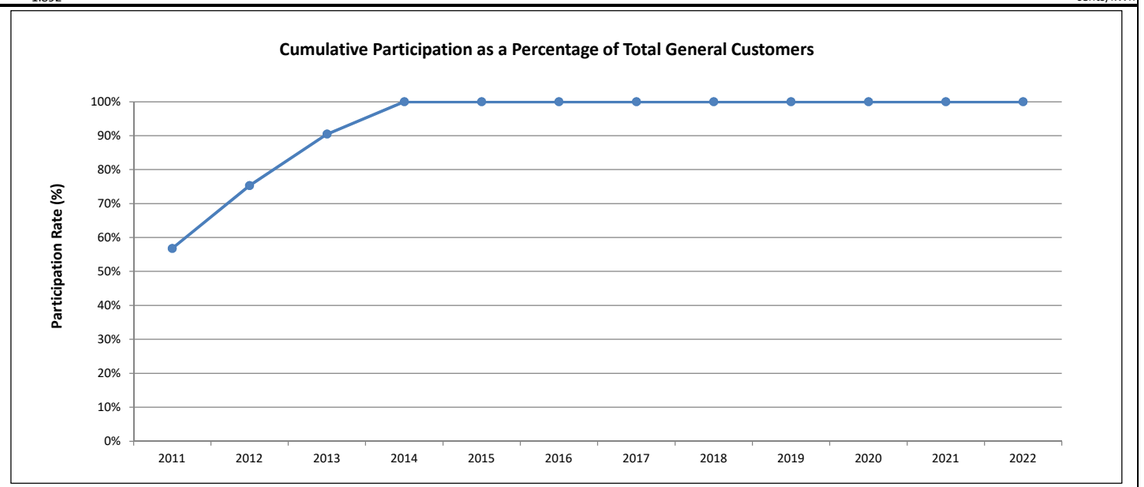

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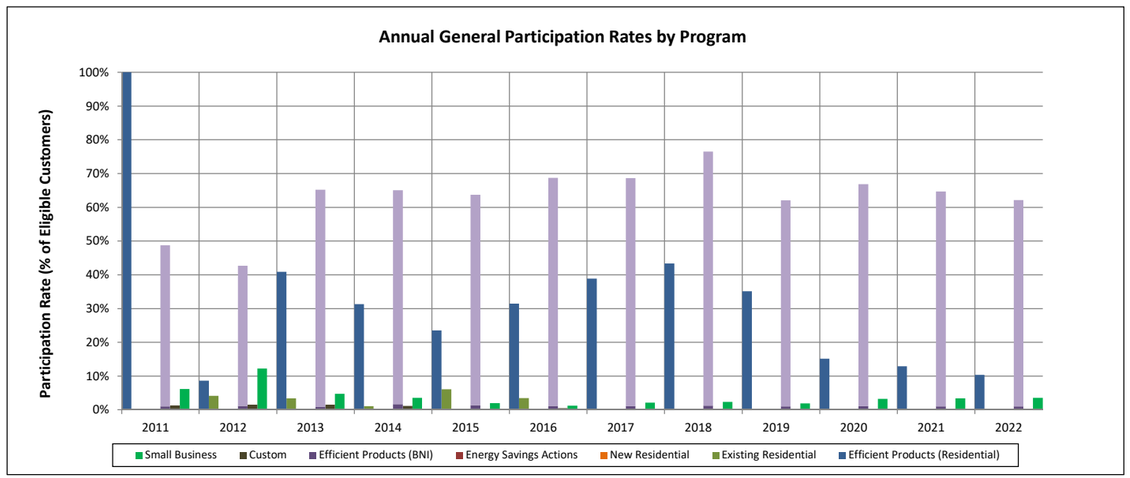

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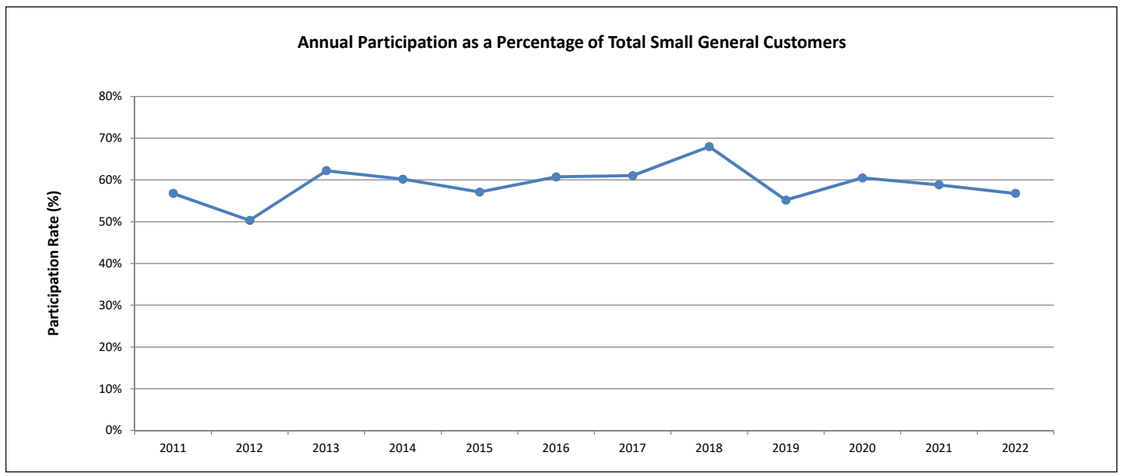

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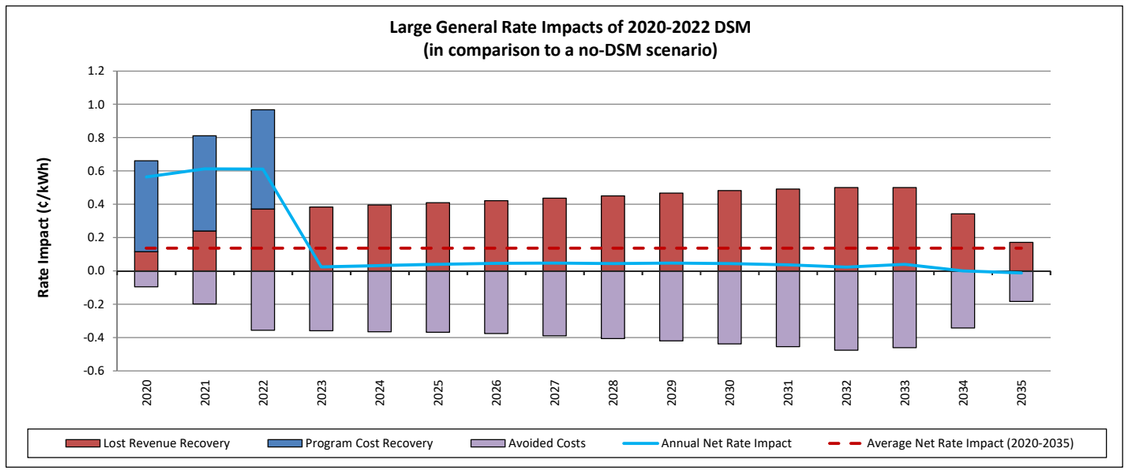
Rate and Bill Impacts of DSM on the Large General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Large General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.8	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	15.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	15.8	8.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	2,116,591	2,207,579	2,282,053	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	393,552	800,592	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	826,215	419,175	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	28	28	27	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	249,404	264,007	280,120	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.920	1.933	1.938														cents/kWh



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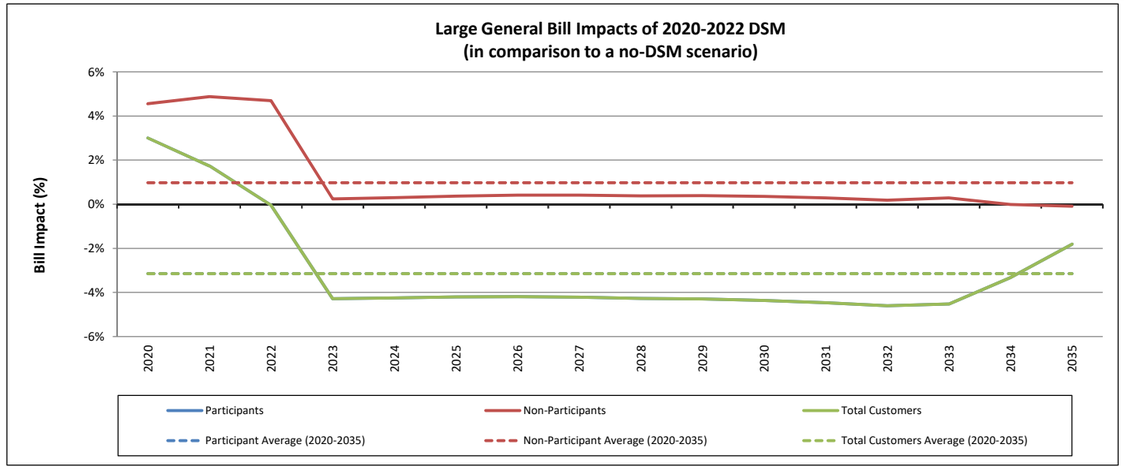
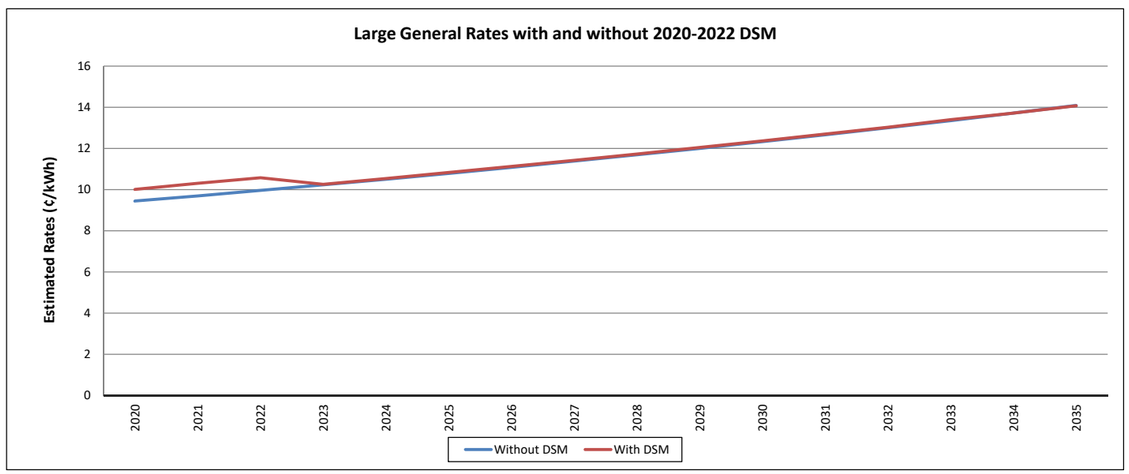
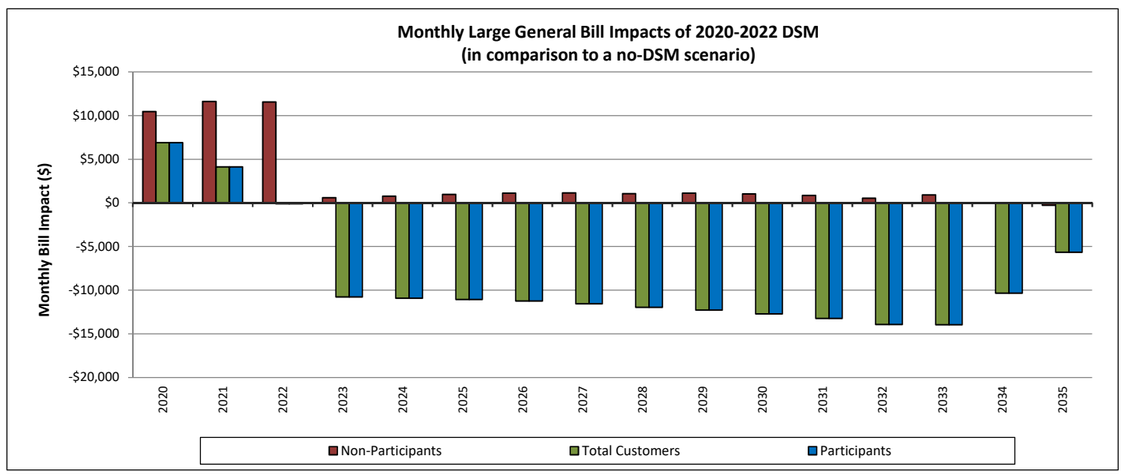


This graph shows bill impacts of DSM as percentage differences relative to the no-DSM scenario. 'Participants' represents a customer with average energy use and average DSM savings . 'Non-Participants' represents a customer with average energy use and no DSM savings. 'Total Customers' is a hypothetical scenario that does not differentiate between Participants and Non-Participants. In this class, all customers are assumed to have participated, so the Participants line matches the Total Customers line (i.e., there are likely no customers whose impacts follow the Non-Participant line).



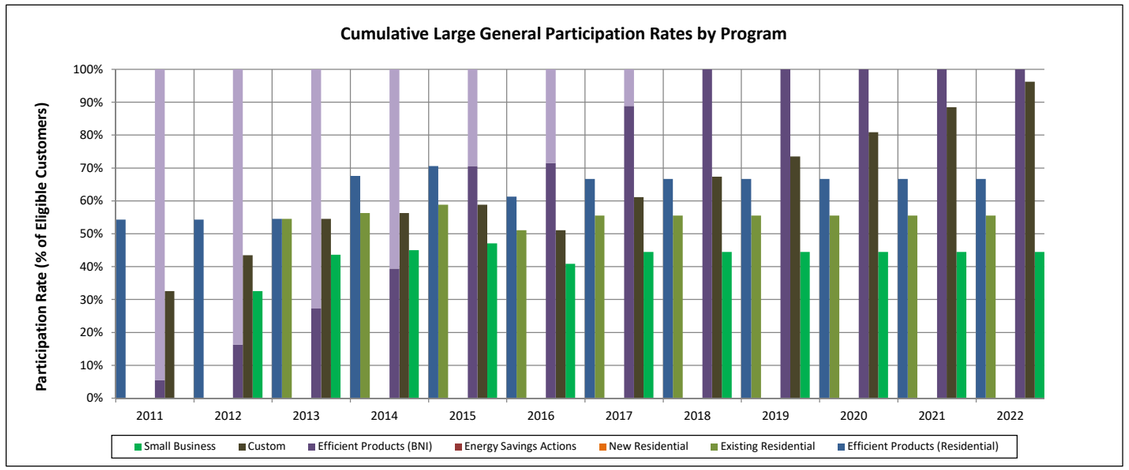
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.



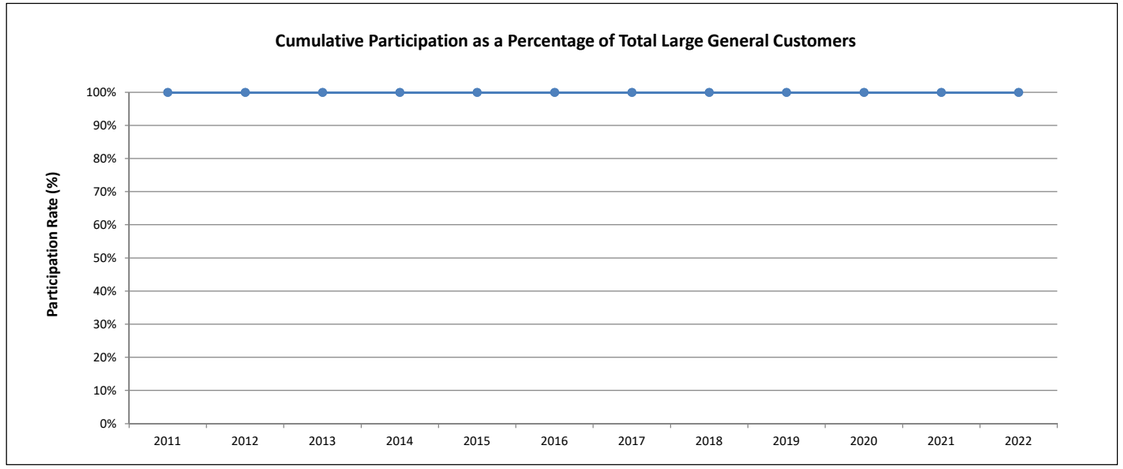
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Large General Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Large General Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.8	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	15.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	15.8	8.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	2,116,591	2,207,579	2,282,053	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	393,552	800,592	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	1,219,767	826,215	419,175	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	28	28	27	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	249,404	264,007	280,120	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.920	1.933	1.938														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



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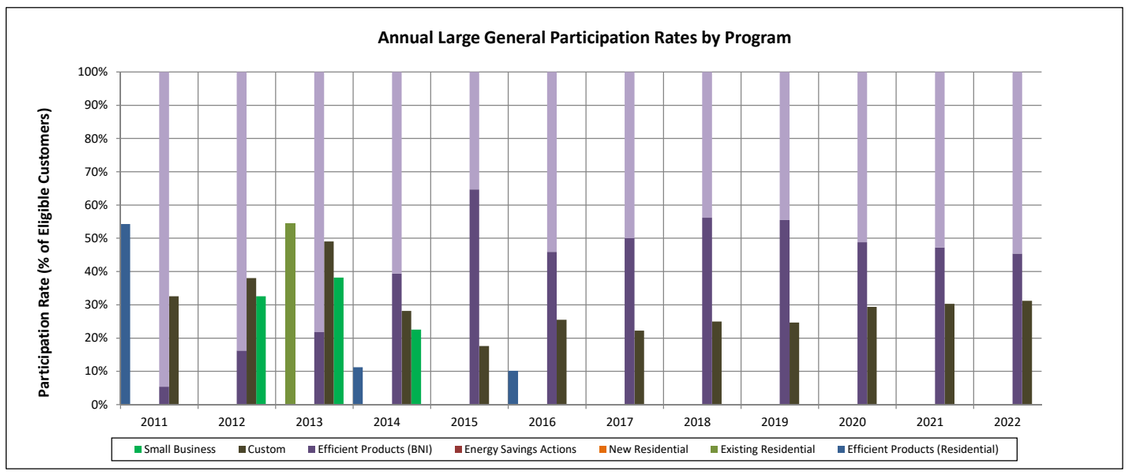
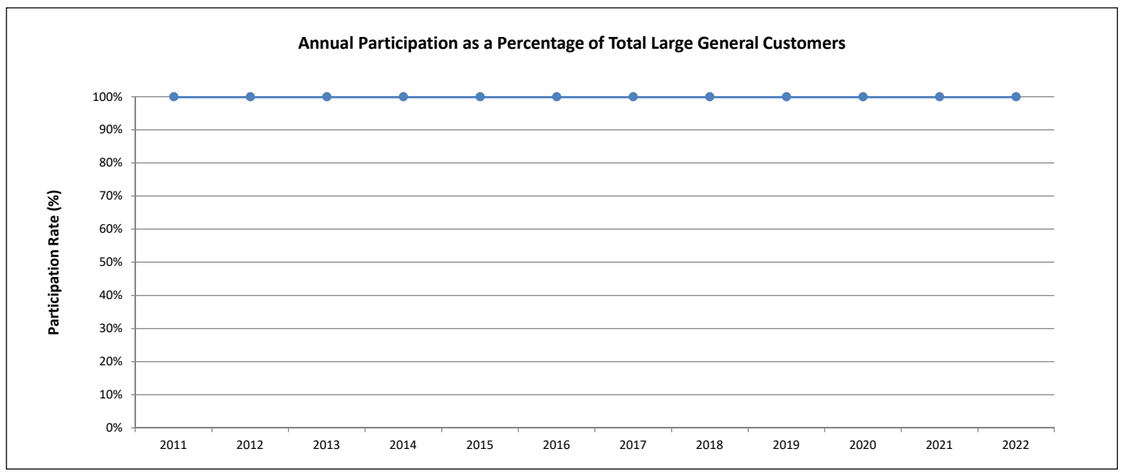


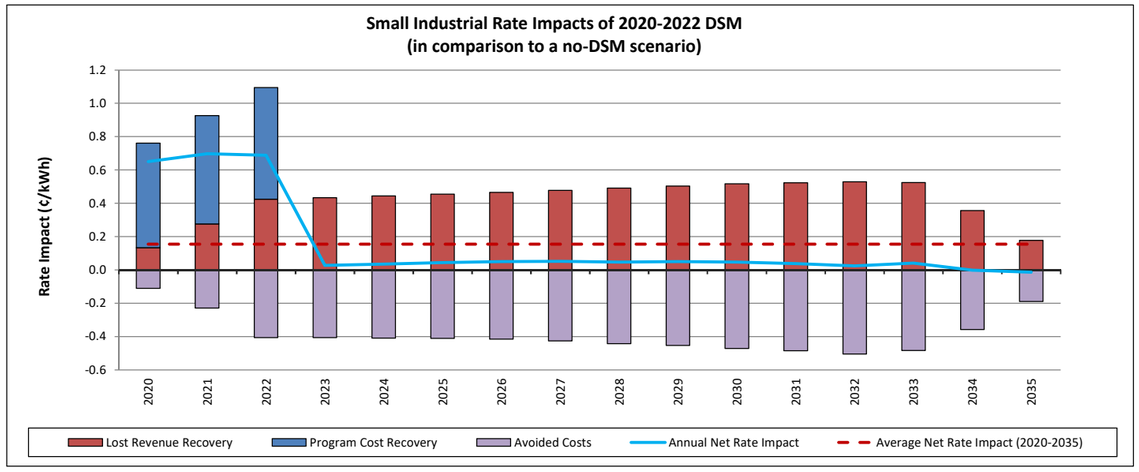
This graph shows annual program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once in each year that they participate. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Small Industrial Class - ALTERNATE PLAN

Impacts of DSM on the Small Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.5	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	10.8	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	11.2	5.7	GWh@gen
DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,583,805	1,650,183	1,709,671	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	970	1,327	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	NSPI acct.'s
Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,163	7,686	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	6,817	3,461	kWh@meter
Annual Number of Participants	0	0	0	0	0	0	0	0	0	970	941	905	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,163	5,518	5,912	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
Levelized Cost of Saved Energy										2.059	2.065	2.073														cents/kWh



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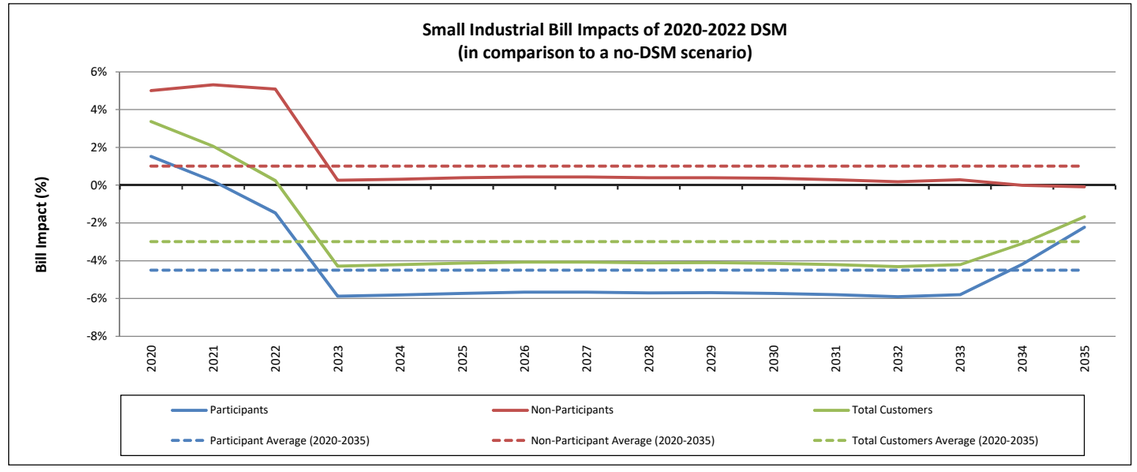

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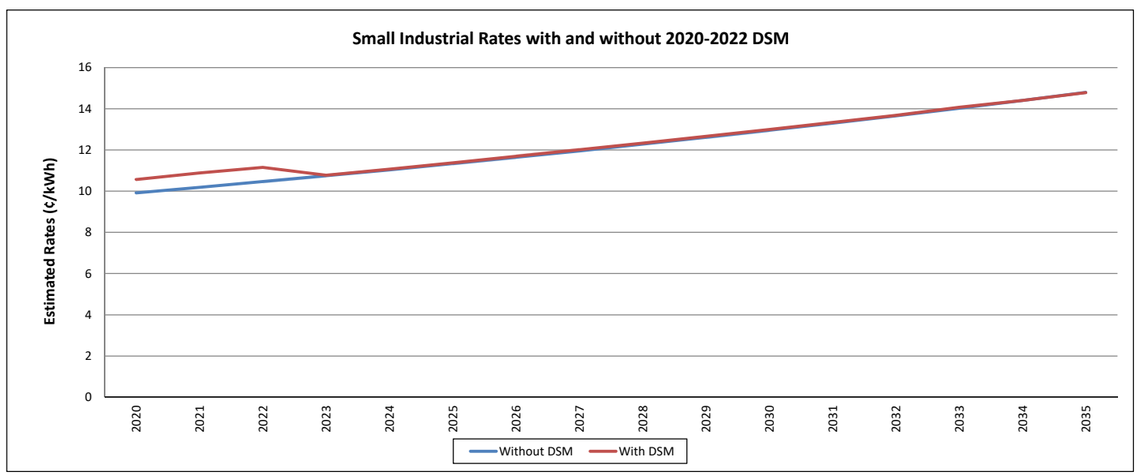
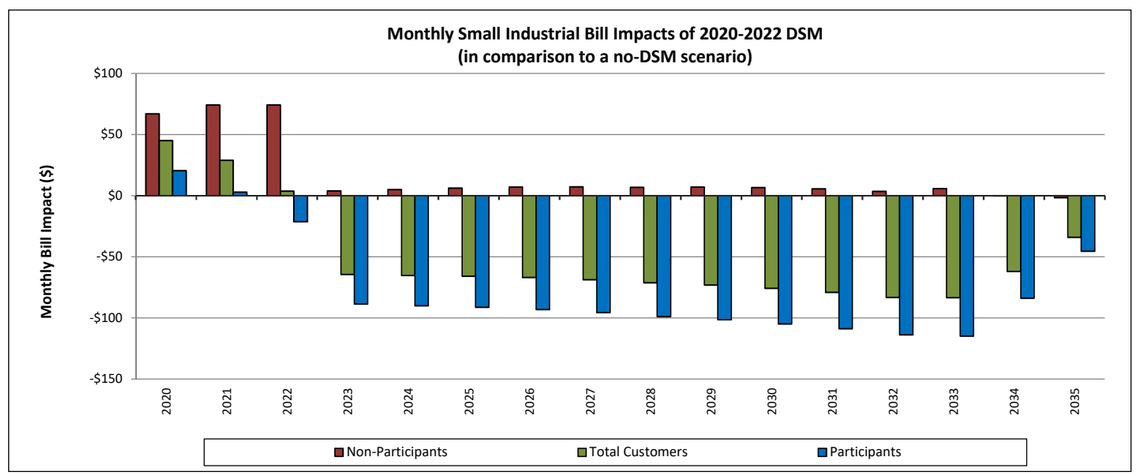


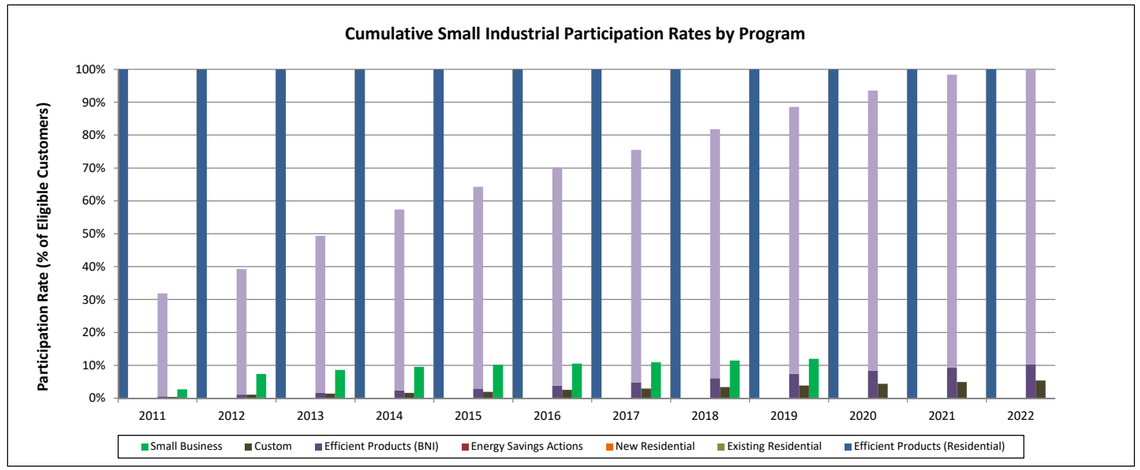
This graph shows estimated average rates with and without the effects of DSM. It is intended to show the relative magnitude of DSM rate impacts compared to total rates and total rate escalation over the study period.



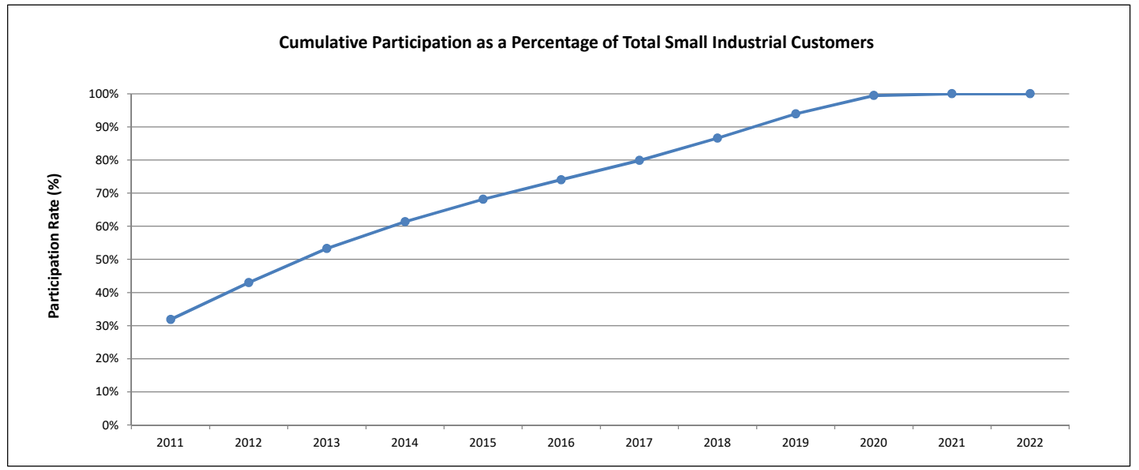
This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Small Industrial Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Small Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.5	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	10.8	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	11.2	5.7	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,583,805	1,650,183	1,709,671	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	970	1,327	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	5,163	7,686	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	10,056	6,817	3,461	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	970	941	905	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	5,163	5,518	5,912	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.059	2.065	2.073														cents/kWh



This graph shows cumulative program participation for the class, as a percentage of eligible participants for each program. Each participant is counted once for each program, in the first year that they participate in the program. Darker bars show "tracked" participants (i.e. programs that collect participant info); lighter bars show "untracked" participants (i.e. programs that do not collect participation info, where participant figures are estimated).



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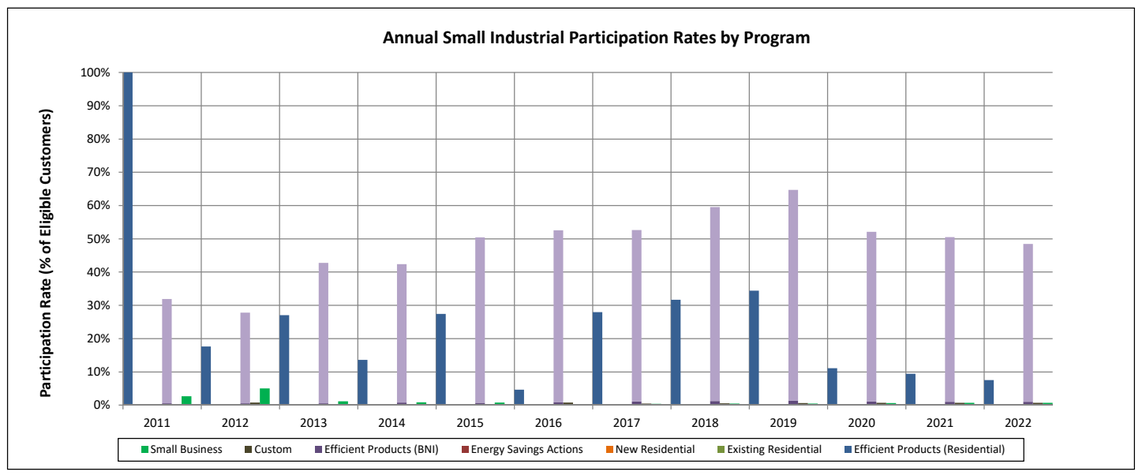

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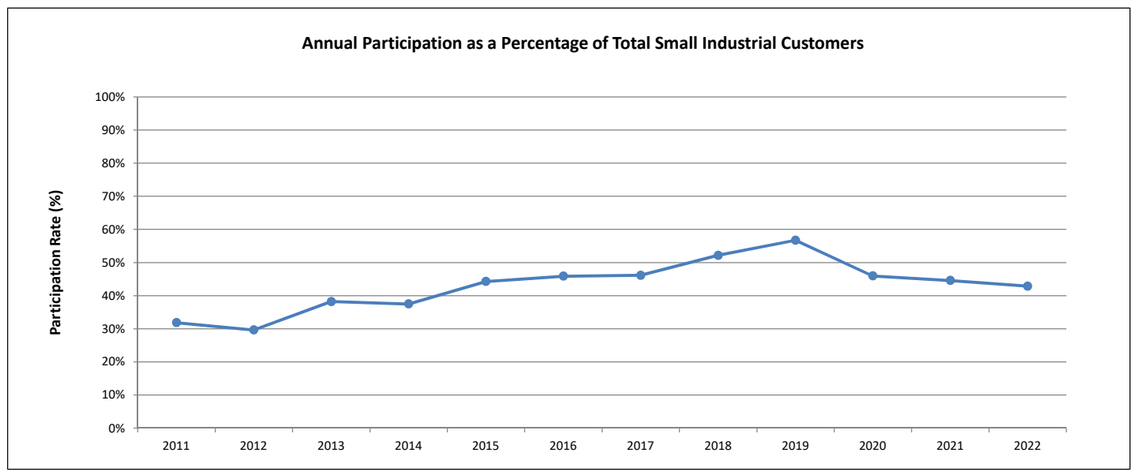
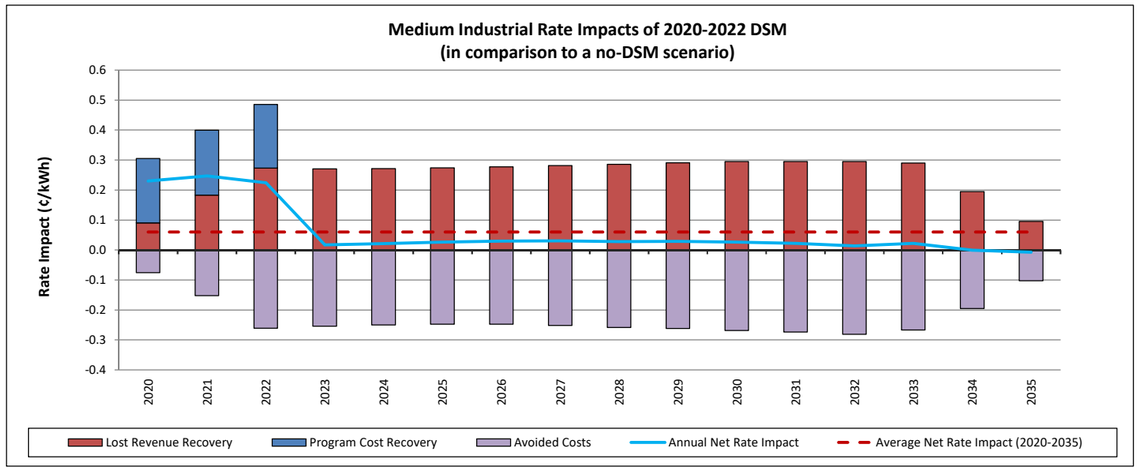


This graph shows annual program participation for the class, as a percentage of total customers in the class. Each customer is counted once for each year that they participate in any program.

Rate and Bill Impacts of DSM on the Medium Industrial Class - ALTERNATE PLAN

Impacts of DSM on the Medium Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.2	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	12.1	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	12.5	6.3	0.0	GWh@gen
DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,279,202	1,328,355	1,368,258	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	NSPI acct.'s
Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	37,955	77,070	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	79,276	40,160	0	kWh@meter
Annual Number of Participants	0	0	0	0	0	0	0	0	0	182	177	171	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	31,119	32,944	35,002	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
Levelized Cost of Saved Energy										1.597	1.602	1.602														cents/kWh



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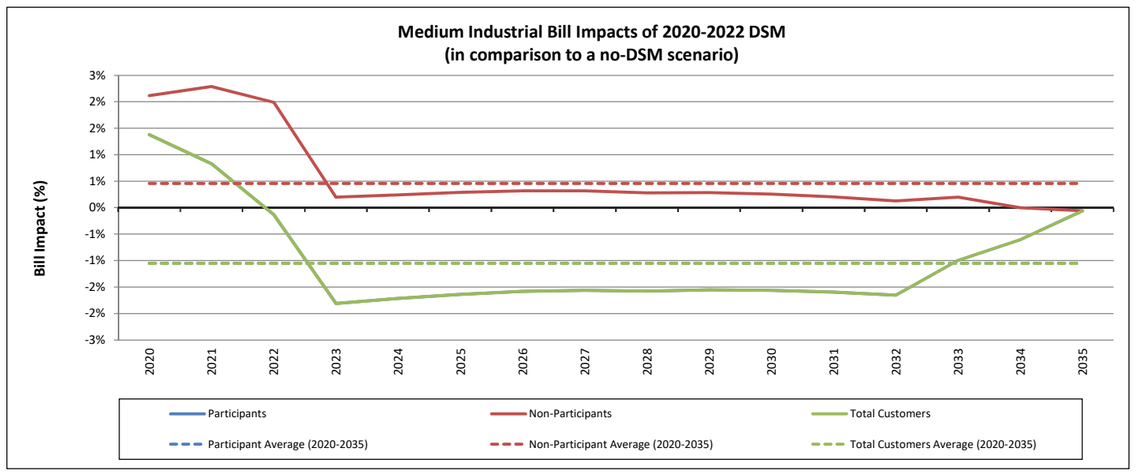

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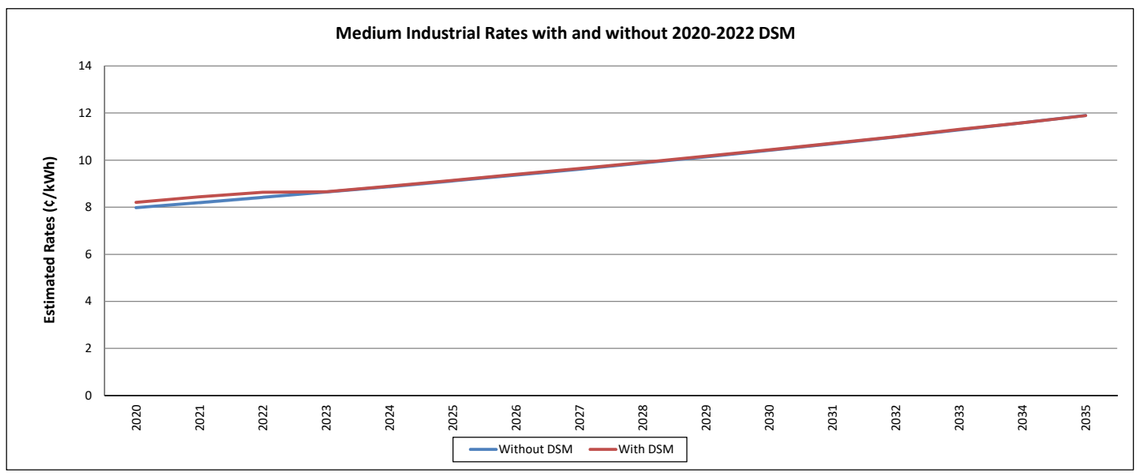

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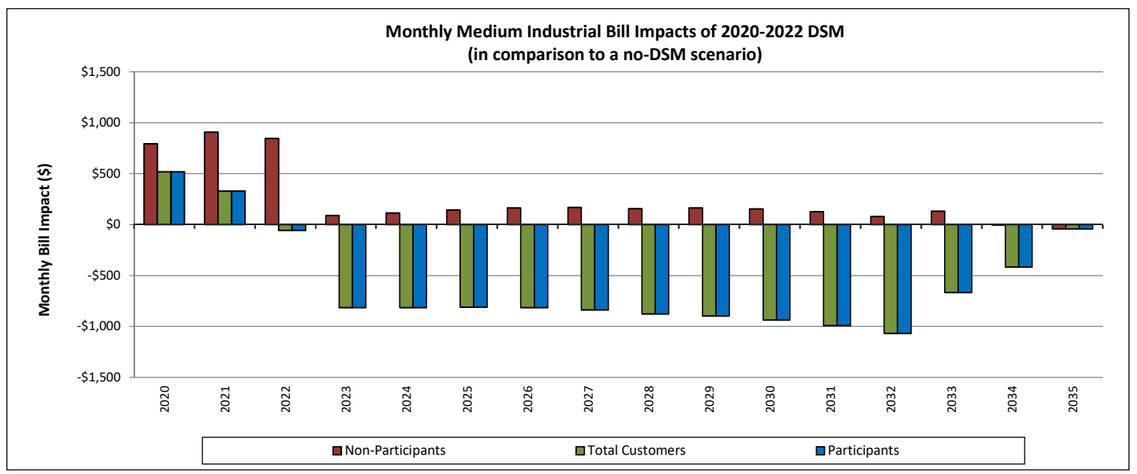
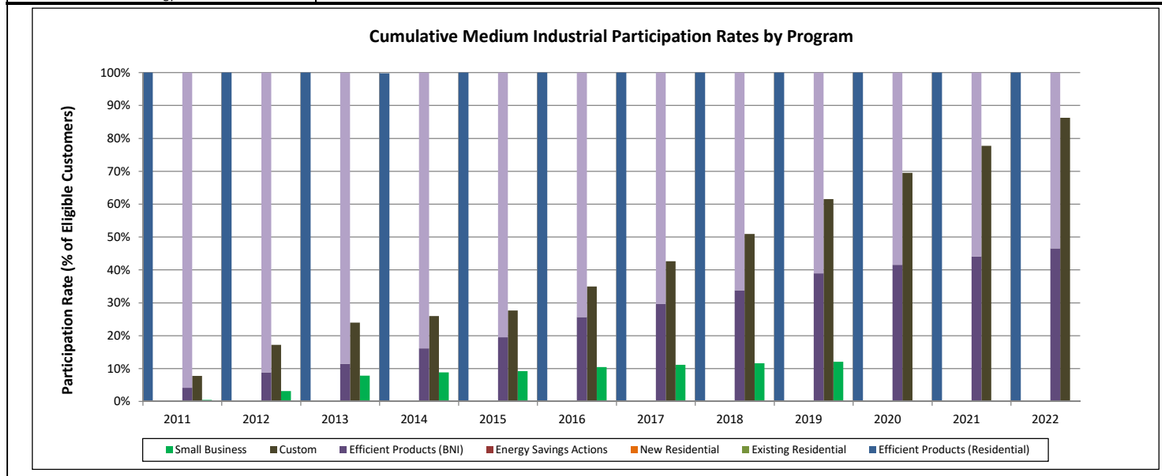


This graph shows monthly bill impacts relative to the no-DSM scenario in absolute terms, for the same groups of customers as the graph shown above it.

Rate and Bill Impacts of DSM on the Medium Industrial Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Medium Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.2	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	12.1	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	12.5	6.3	0.0	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,279,202	1,328,355	1,368,258	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	37,955	77,070	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	117,231	79,276	40,160	0	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	182	177	171	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	31,119	32,944	35,002	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										1.597	1.602	1.602														cents/kWh



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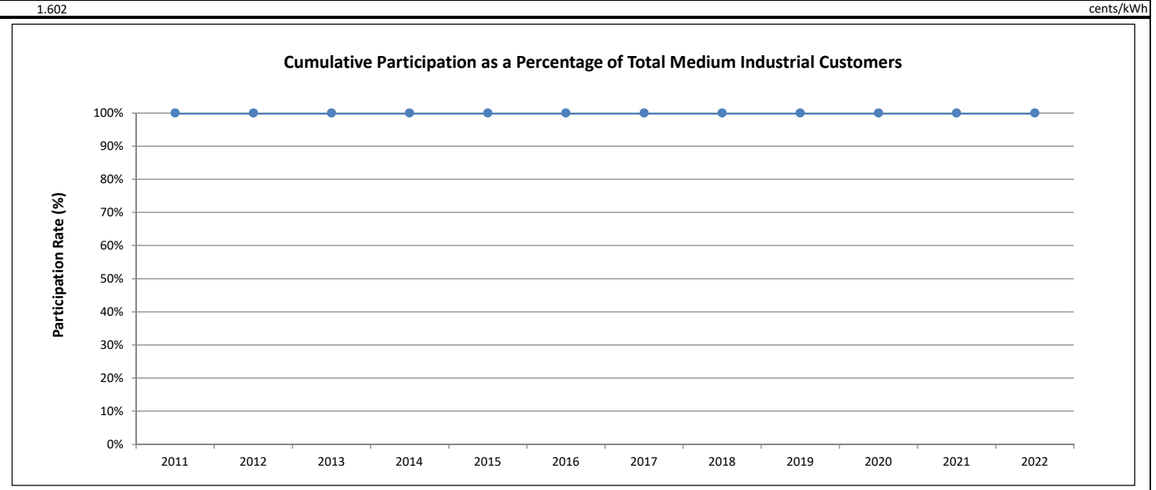

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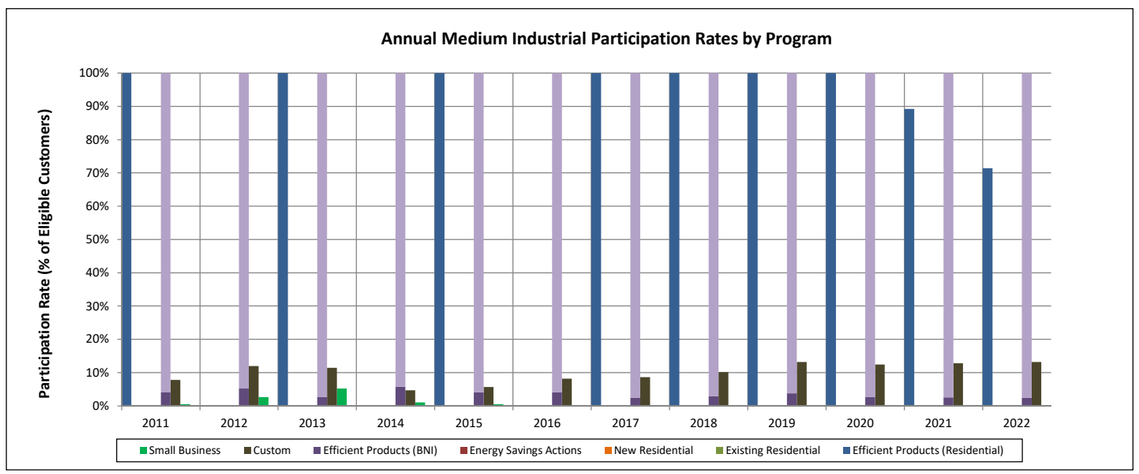

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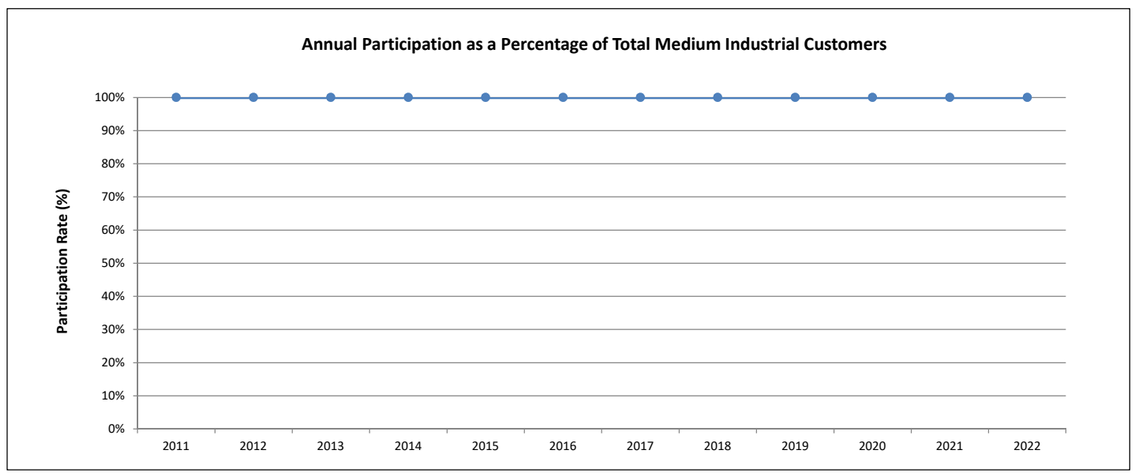

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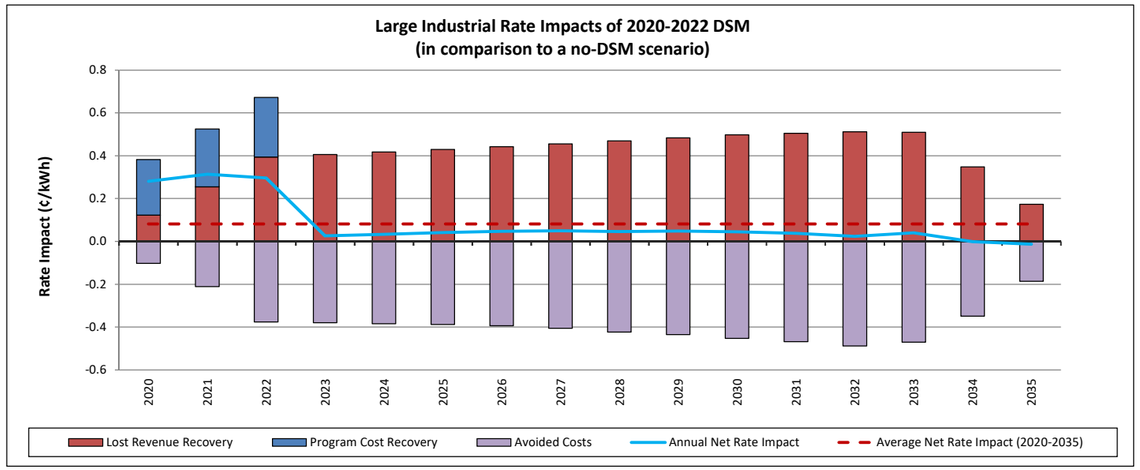
Rate and Bill Impacts of DSM on the Large Industrial Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Large Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.3	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	14.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	14.8	7.5	0.0	0.0	0.0	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,721,225	1,786,478	1,839,353	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	210,688	426,720	647,475	647,475	647,475	647,475	647,475	647,475	647,475	647,475	647,475	436,787	220,755	0	0	0	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	47	46	45	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	145,844	153,002	161,027	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.083	2.090	2.092														cents/kWh



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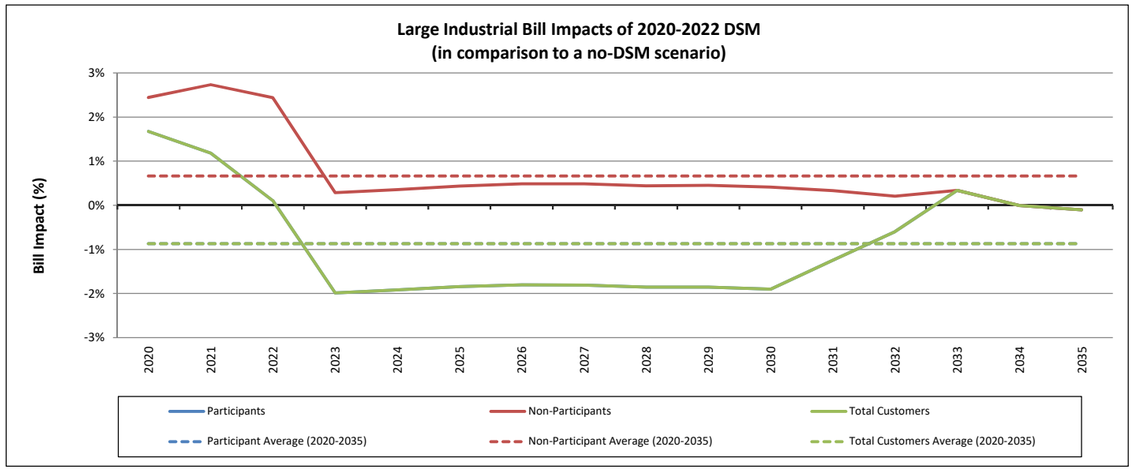

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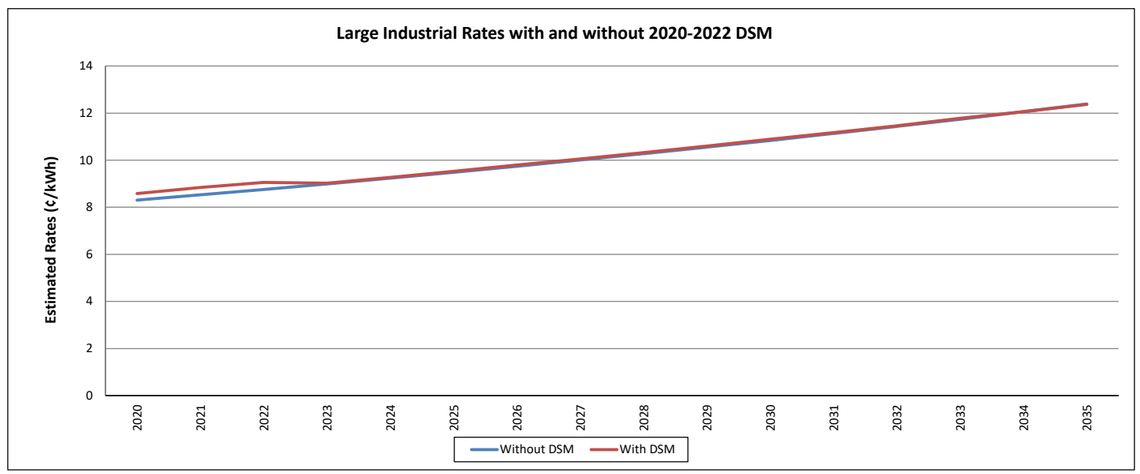

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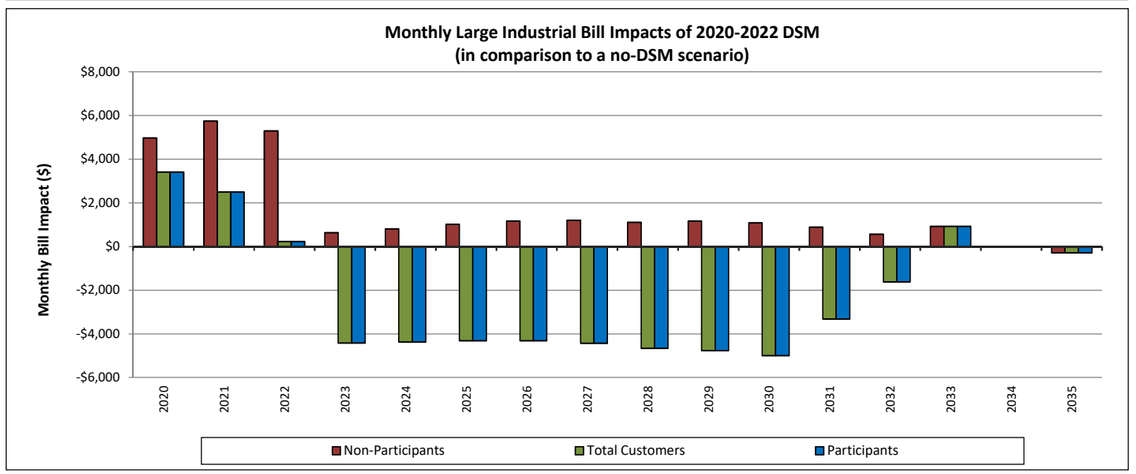

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Rate and Bill Impacts of DSM on the Large Industrial Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Large Industrial Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.3	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	14.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	14.8	7.5	0.0	0.0	0.0	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,721,225	1,786,478	1,839,353	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	210,688	426,720	647,475	647,475	647,475	647,475	647,475	647,475	647,475	647,475	647,475	436,787	220,755	0	0	0	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	47	46	45	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	145,844	153,002	161,027	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
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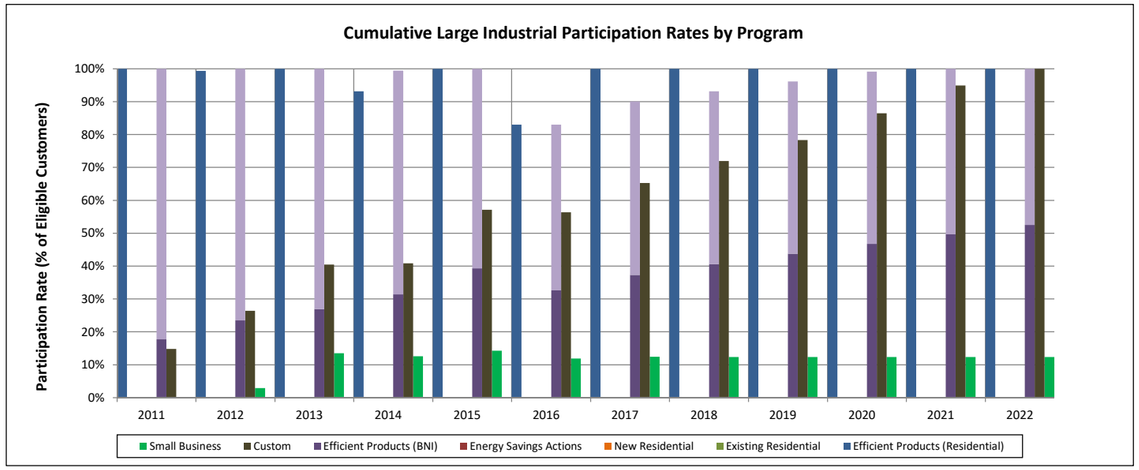

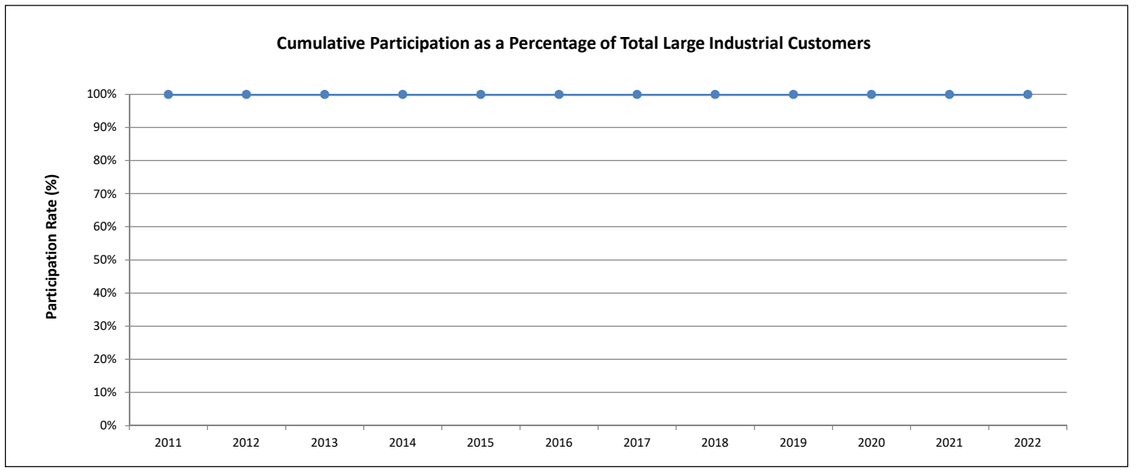

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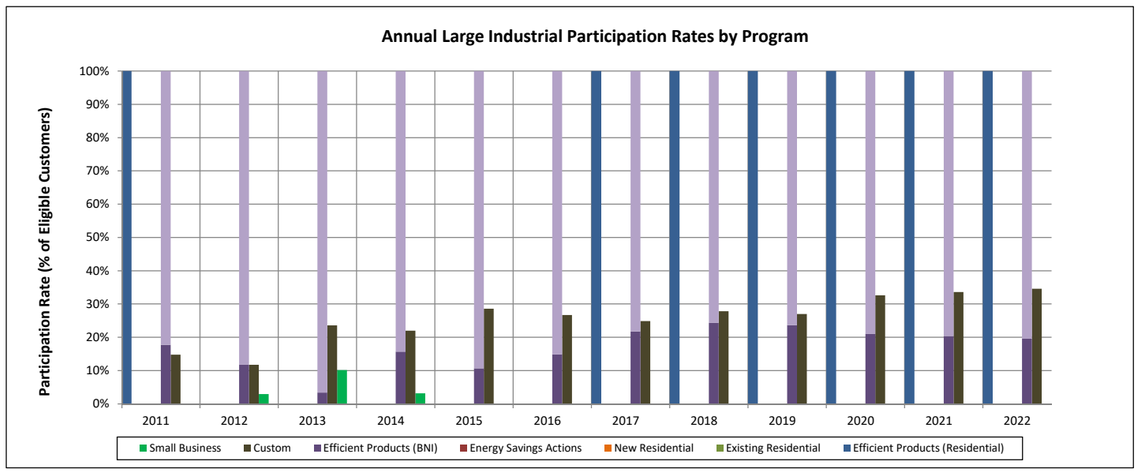

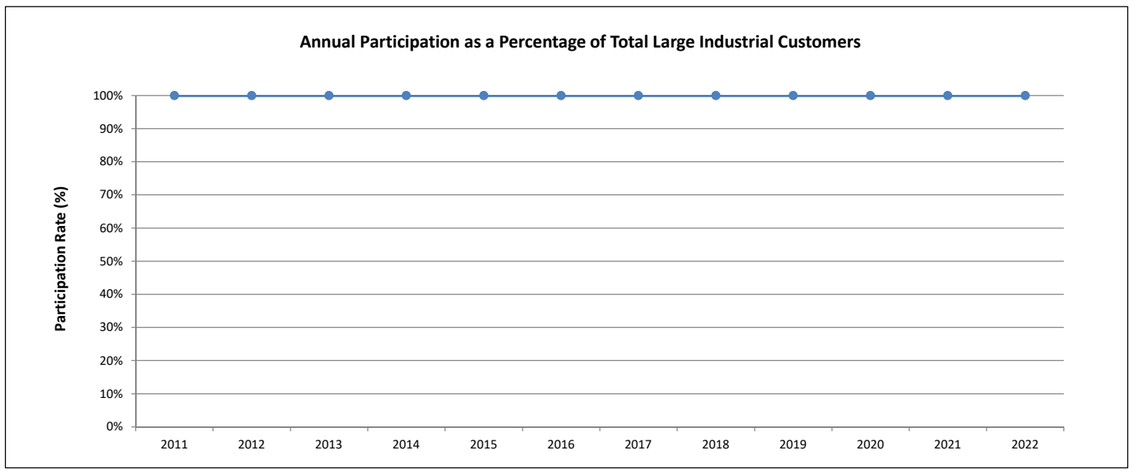

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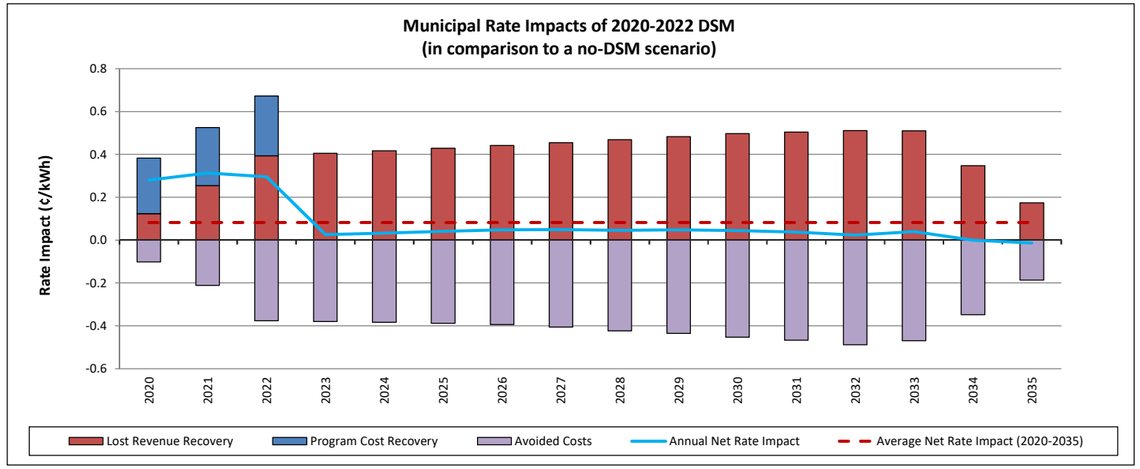
Rate and Bill Impacts of DSM on the Municipal Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Municipal Utility Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
2	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.6	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
3	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.1	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	7.2	3.6	GWh@gen
4	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,341,281	1,394,442	1,430,741	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
5	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
6	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	561,384	1,132,937	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,147,077	575,524	kWh@meter
7	Annual Number of Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
8	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	561,384	571,553	575,524	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
9	Levelized Cost of Saved Energy										2.674	2.699	2.730														cents/kWh



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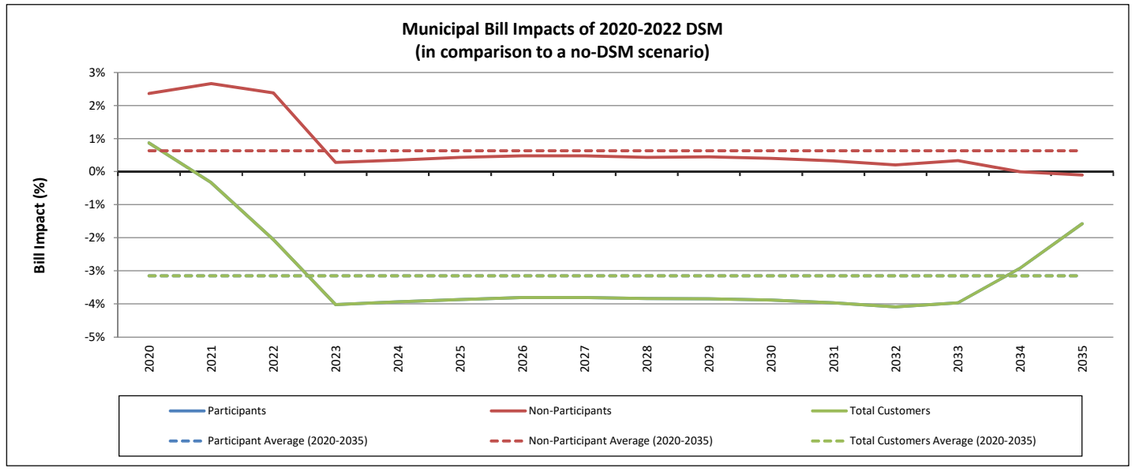

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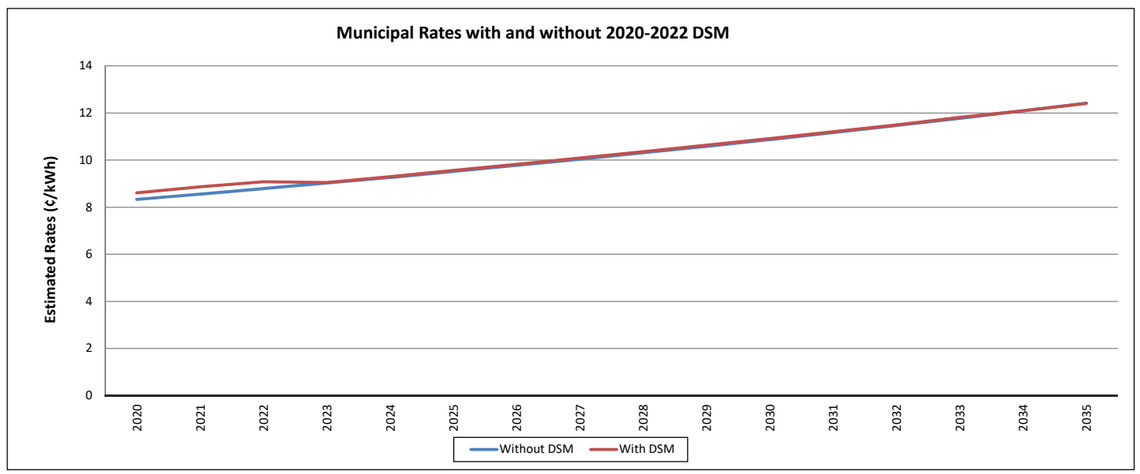

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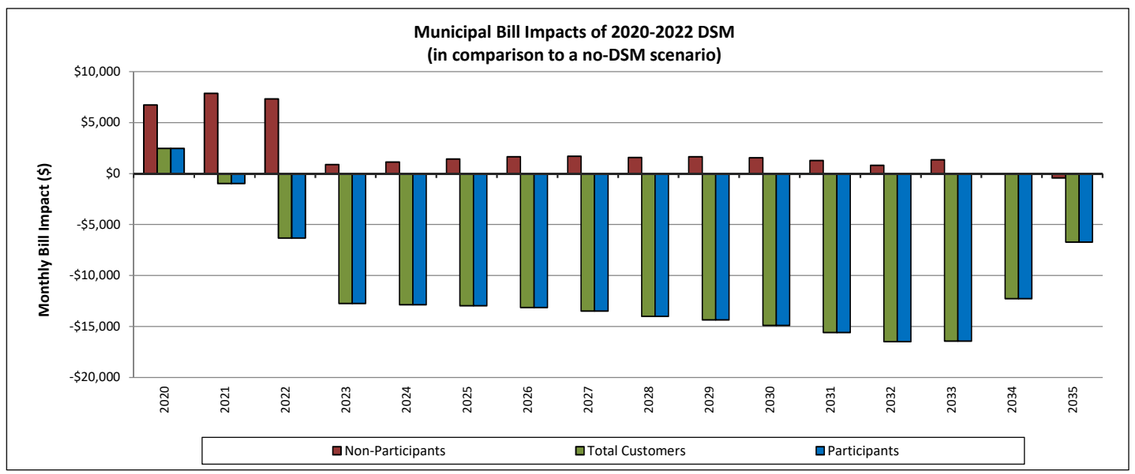

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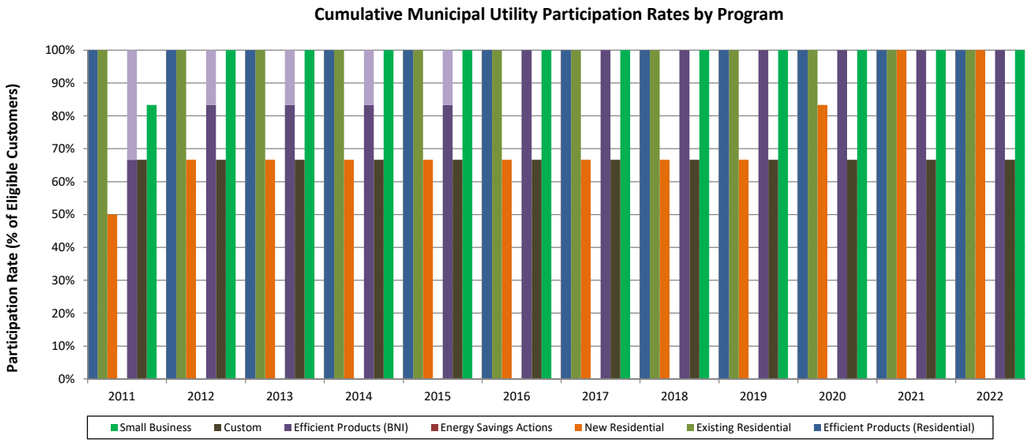
Rate and Bill Impacts of DSM on the Municipal Class - ALTERNATE PLAN

Line#	Impacts of DSM on the Municipal Utility Rate Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Units
1	Incremental DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.6	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GWh@gen
2	Cumulative DSM Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.1	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	7.2	3.6	GWh@gen
3	DSM Costs for the Rate Class	0	0	0	0	0	0	0	0	0	1,341,281	1,394,442	1,430,741	0	0	0	0	0	0	0	0	0	0	0	0	0	Dollars
4	Cumulative Number of New Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
5	Annual Average Savings per Participant (Cumulative)	0	0	0	0	0	0	0	0	0	561,384	1,132,937	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,708,461	1,147,077	575,524	kWh@meter
6	Annual Number of Participants	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	NSPI acct.'s
7	Annual Average Savings per Participant (Current Year)	0	0	0	0	0	0	0	0	0	561,384	571,553	575,524	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh@meter
8	Levelized Cost of Saved Energy										2.674	2.699	2.730														cents/kWh



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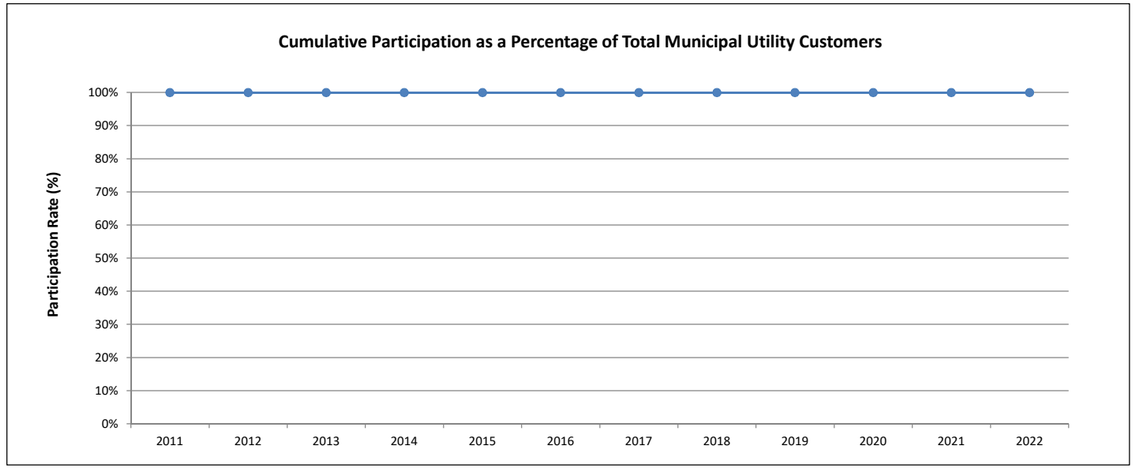

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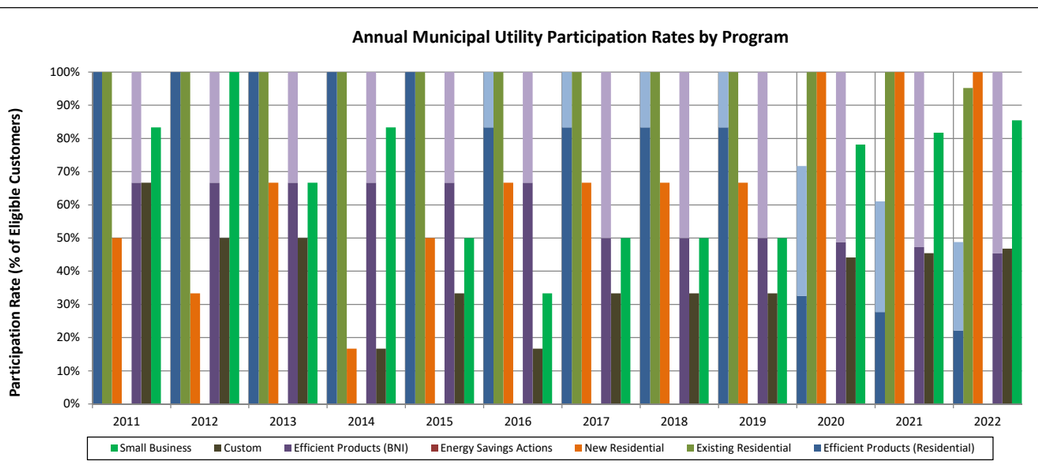

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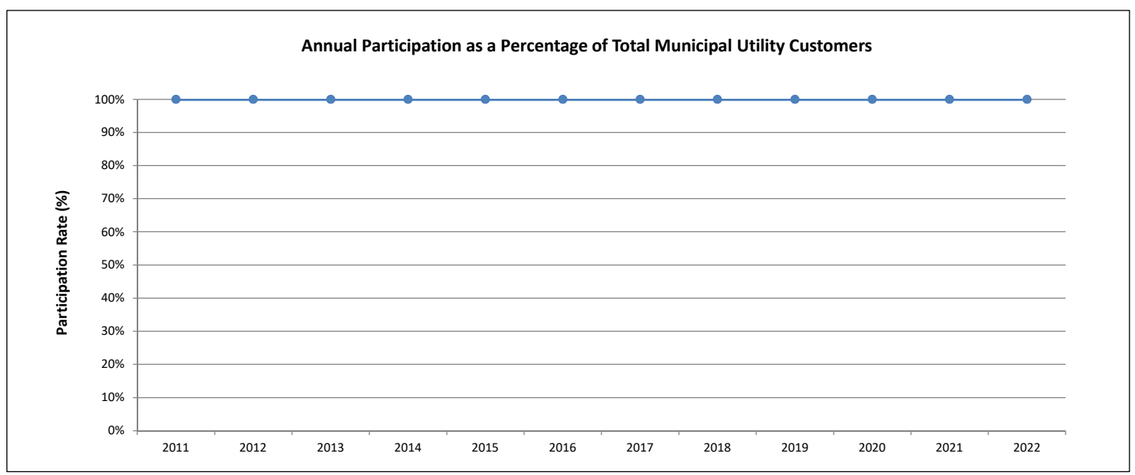

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Appendix B – Attachment 3:

Assumptions

Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

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Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

Attachment 3: Assumptions

This document is intended to provide an overview of the assumptions used in EfficiencyOne's 2020-2022 Plan Rate and Bill Impact Analysis (RBIA).

These assumptions are for RBIA purposes only and do not impact EfficiencyOne's construction of the Plan or calculation of energy savings.

Item	Description
General approach	EfficiencyOne has used the "snapshot" approach recommended by Synapse, in which the impacts of specific program years are analyzed (in this case 2020-2022 programs) rather than incorporating an assessment of Demand Side Management (DSM) over the long term.
Scenarios	Two separate models were created for this Plan: a Preferred Plan model and an Alternate Plan model. Each model compares two scenarios: a DSM scenario and a no-DSM scenario. The DSM scenario in each model includes the costs and benefits of DSM programs that are planned to run throughout 2020-2022, and the no-DSM scenario does not include these DSM costs or benefits.
Rate classes included	Synapse has indicated that providing results for a few representative rate classes is sufficient to meet the intent of the rate and bill impact analysis. EfficiencyOne has gone beyond this minimum to provide impacts for the following classes: • Residential (rate codes 2, 3, 4, 5 and 6) • Small General (rate code 10) • General (rate code 11) • Large General (rate code 12) • Small Industrial (rate code 21) • Medium Industrial (rate code 22)

	• Large Industrial (rate codes 23 and 25, and customers under the 'One part high voltage real time pricing' tariff) • Municipal (rate code 24) The Unmetered, Generation Replacement and Load Following (GRLF) and Shore Power rate classes are not included in the analysis. EfficiencyOne does not offer programs for the GRLF and Shore Power classes.
Energy and demand savings by class; participation counts by class	EfficiencyOne has evaluated and verified energy and system-peak demand savings for 2011-2017 DSM program years. For 2020-2022, savings developed at the program level were apportioned to rate classes in proportion with results for each program from 2017. Weighted-average measure lives for each rate class were developed based on the ratio of expected lifetime energy savings to expected first-year energy saving for each class. Participation estimates used in the RBIA model are different than participation estimates used in development of the 2019 and 2020-2022 DSM Plans, since the RBIA tracks participating accounts, rather than the number of products sold or installed, and also de-duplicates these accounts across programs and across years to produce estimates of the number of unique accounts that are expected to participate. Annual participation rates for 2011-2017 were tracked by EfficiencyOne, and then resolved with customer records from previous years to determine cumulative counts of unique participants. Participation rates for 2018 and 2019 were reused from the 2018 RBIA and were originally estimated by multiplying the 2017 participation rates (by program within each rate class) by the ratio of expected 2018 and 2019 program energy savings to actual 2017 program energy savings. Participant counts for 2020-2022 were estimated by multiplying 2017 participant counts by two factors: one to account for differences in overall program magnitude, and one to account for

	differences in the program measure mix relative to 2017. The first factor is the ratio of program component-level energy savings between each year of the Plan and 2017; this factor assumes that the number of participating Nova Scotia Power (NS Power) accounts will vary in proportion with the program energy savings. The second factor is the ratio of the number of rebated products per GWh of energy savings between each year of the Plan and 2017; this factor assumes that the number of participating NS Power accounts will also vary in proportion with the number of products rebated.
Point-of-sale program component participation counts	All forecasted 2018-2022 participation, inclusive of point-of-sale program participation, was estimated based on 2017 results, using the methodology described above. The 2011-2017 figures for point-of-sale program participation were estimated using the methods described in this section. In estimating participation rates for point-of-sale discount program components, EfficiencyOne assumes a value for re-participation rates (customers who participate in a point-of-sale program in more than one year) and for cross-participation rates (customers who participate in both a point-of-sale program and another program in the same year) for each of two point-of-sale programs, in each year. In the calculation of cumulative participation rates, EfficiencyOne has applied both the re-participation rate and cross-participation rate for rate class totals, but only the re-participation rate for point-of-sale program totals. In the calculation of annual participation rates, EfficiencyOne has applied only the cross-participation rate for rate class totals, and neither the re-participation rate or cross-participation rate for point-of-sale program totals. Residential Instant Savings:

	• Assume that all customers are purchasing items for Residential use (i.e., that all customers are in the Residential and Municipal rate classes). • To determine the number of participants in Instant Savings each year, EfficiencyOne used information from primary research studies. In 2011 and 2012 the studies indicated that participation levels were 6% of the general population, in 2013 it indicated 7%, and in 2014 it indicated 13%. The study was not conducted in 2015, so participation was assumed to remain at 13%. In 2016 the study indicated a participation level of 25%. The study was not conducted in 2017, so participation was assumed to remain at 25%. • Assume that historical re-participation of customers each year is 10%. This assumption is based on an initial proposal from Rhode Island's 2013 rate and bill assumptions, which is, to EfficiencyOne's knowledge, the only other jurisdiction making these estimations. Note: Rhode Island ended up using program-specific data for which EfficiencyOne does not have comparable research. EfficiencyOne reduced the number of unique participants by 10% in the first year of duplication (2012) and in 2013 accounted for 10% duplication in the remaining population. In 2014, Efficiency Nova Scotia Corporation engaged Corporate Research Associates to determine the number of re-participants in their quarterly omnibus survey. Of those who purchased products in 2014, 71% also purchased products in 2013. The study was not conducted in 2015-2017, so re-participation was assumed to remain at 71% for these years. • Assume that participation in Instant Savings does not affect the probability that a customer will participate in another Efficiency Nova Scotia (ENS) program (i.e. estimate the cross-

	participation rate by dividing the number of tracked Residential rate class program participants by the total number of customers in the class) • For the Municipal Utility class, assume that each municipal utility participates in every year. Business, Non-Profit and Institutional Business Energy Rebates - Instant Rebates (BER-IR): • For high-consumption rate classes (Large General, Medium Industrial, Large Industrial, and Municipal), assume that each account participates in every year. • For low-consumption rate classes (Small General, General, Small Industrial), research was conducted in 2016 to determine current and historical participation. To assist with recall over such a long time period, respondents were asked to group their memory of participation within the 2011-2014 period instead of providing answers for each individual year. o For Small General, participation was 46% over 2011-2014, and 29% in 2015 and 2016. For General, it was 73% over 2011-2014, 62% in 2015 and 68% in 2016. For Small Industrial, it was 55% over 2011-2014, 50% in 2015 and 52% in 2016. o For Small General, re-participation was 75% in 2015 and 79% in 2016. For General, it was 92% in 2015 and 96% in 2016. For Small Industrial, it was 88% in 2015 and 92% in 2016. o For Small General, cross-participation was 13% in 2016. For General and Small Industrial it was 15% in 2016. Cross-participation was not research for previous years, so these rates were applied to each year in the 2011-2015 period.

	○ The research was not conducted in 2017, so all 2016 values were applied to 2017. • As research indicated the total number of unique participants over the 2011-2014 period, but not the distribution of participants in each year therein, these figures were estimated using a shape factor based on total program activity in each year (i.e. within 2011-2014, more participants were allocated to years with high savings than years with low savings, with the sum total over 2011-2014 held constant to the values obtained from research). • A small number of BER-IR participants are assumed to come from the Residential class. Their rates of re-participation and cross-participation are assumed to match those determined for the Small General class. Participation rates were determined by assuming each BER-IR transaction was for a single participant, and that the rate class allocation of participants matched that which is used to allocate savings.
Energy Savings Actions (Home Energy Report) participation	Customers receiving the Home Energy Report were modeled as new participants in 2013. The same cross-participation rates used for Residential Instant Savings are used for the Home Energy Report, based on the assumption that participation in this program does not affect the probability that a customer will participate in another ENS program (i.e. estimate the cross-participation rate by dividing the number of tracked annual Residential rate class program participants by the total number of customers in the class). The Home Energy Report program formally ended in 2015, however some participants continued to access the web portal until it was shut down in 2016.
Energy and demand rates	NS Power provided estimates for 2019 by class, including block 1, block 2, Fuel Adjustment Mechanism, and demand charges where

<table>
<tr><td></td><td>applicable. Transformer credits are not included in rates. Customer base charges are assumed to remain flat after 2019.

An approximate 2019 Program Cost Recovery amount for each class was subtracted from the 2019 with-DSM rates, producing an estimate of 2019 no-DSM rates. This rate was then escalated by 2.7% to produce an estimate of the 2020 no-DSM rate. Beyond 2020, energy and demand rates are assumed to grow at 2.7% per year, as per NS Power's 2014 Integrated Resource Plan (IRP) DSM assumptions.</td></tr>
<tr><td>Energy and demand sales</td><td>NS Power has provided historical energy sales within each block, and billed demand sales for 2011-2016, and estimates for 2017-2019. Sales forecasts for 2020-2040 were taken from the 2014 IRP assumptions. The ratio of block 1 to total energy sales is assumed to remain constant after 2019, within each class, where applicable.

The aforementioned sales and forecasts are inclusive of DSM. The lifetime DSM savings from 2020-2022 programs were added to these figures to produce a theoretical no-DSM sales scenario.</td></tr>
<tr><td>Avoided costs</td><td>Avoided costs are calculated at the system level using evaluated DSM savings and avoided cost rates in four categories: generation, transmission, distribution, and fuel. All avoided cost estimates were provided by NS Power.

<table>
<tr><th>Avoided Cost Category</th><th>Unit</th><th>Value</th><th>Source</th></tr>
<tr><td>Capacity</td><td>$/MW</td><td>195,990</td><td>2014 IRP, Base DSM scenario (levelized over 2020-2035)</td></tr>
<tr><td>Transmission</td><td>$/MW</td><td>Starts at 10,521 in 2018</td><td>Provided by NS Power in 2018; assumed to escalate at 2% per year</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Distribution</td><td>$/MW</td><td>Starts at 4,358 in 2018</td><td>Provided by NS Power in 2018; assumed to escalate at 2% per year</td></tr>
<tr><td>Energy</td><td>$/MWh</td><td>Varies by year</td><td>2014 IRP, Base DSM scenario (annual)</td></tr>
</table>
</td></tr>
<tr><td>‘Lost’ fixed cost adjustments</td><td>‘Lost’ fixed cost effects are accounted by assuming that NS Power must recover through rates all lost revenues, including energy revenues, but also that NS Power need not recover any of the avoided costs, including avoided energy costs. Using both of these assumptions together, the net effect is that estimated rate impacts account for the reallocation of ‘lost’ fixed costs.</td></tr>
<tr><td>Eligible participants</td><td>As part of the rate and bill impact analysis, overall participation and participation rates for each rate class are presented. In order to calculate this result, EfficiencyOne has used the number of NS Power customer accounts in each rate class as the overall potential market. Because some customers have multiple account numbers, the total number of available accounts may be greater than that the actual number of customers in a rate class. To determine the number of eligible participants for each DSM program, EfficiencyOne determined the percentage of customers in the rate class who the program was being marketed to. This assumption was made based on feedback from the DSM Advisory Group on February 4, 2015.

The only exception to using the number of accounts per rate class is for the Municipal Utility rate class. NS Power currently has six utility customers but eight accounts, because the Antigonish Electric Utility has three accounts. EfficiencyOne does not track which Antigonish account is being served through particular programs or participants, so</td></tr>
</table>

	the rate and bill impacts include the number of customers (6) rather than the number of accounts (8) for the Municipal Utility rate class only.
Calculation of rate impacts	Rates for the DSM scenario are calculated by taking the estimated no-DSM rates, adding a program cost recovery component, adding a lost revenue recovery component, and subtracting an avoided cost component. The program cost recovery is determined through EfficiencyOne forecasting of expenditures within each rate class and converted to a $/kWh rate by dividing by with-DSM class energy sales. Lost revenues are calculated by class, by multiplying energy and system-peak demand savings by no-DSM rates. Lost revenues are then summed to the portfolio level. Avoided costs are calculated at the system level by multiplying portfolio-level energy and system-peak demand savings by the four categories of avoided costs. Avoided costs and lost revenues at the portfolio level are then each allocated back to rate classes based on each rate class' share of the total revenue requirement. For rate classes without demand charges, the balance is divided by kWh sales within the class to form a $/kWh component of energy rates. For rate classes with demand rates, it is assumed that energy and demand rates in the DSM scenario would change by the same percentage, and so the balance is allocated to both a $/kWh energy component and a $/kW demand component for the DSM scenario.
Lost revenue from system-peak demand reductions	For each rate class, it is assumed that the ratio between annual system coincident peak demand contribution and total billed demand is the same as the ratio between annual system coincident peak demand savings and total billed demand savings.

Calculation of bill impacts	Bill impacts are calculated in three categories: Participants, Non-Participants, and Total Customers. Non-Participants are assumed to use the same amount of energy and system-peak demand in the DSM scenario as they do in the no-DSM scenario. Their bills are only affected by changes in rates. Participants consume less energy in the DSM scenario than in the no-DSM scenario. In each year, total cumulative savings are divided by total cumulative participants and subtracted from the average customers' no-DSM energy and demand consumption to determine consumption for participants. Total Customers is a view of class impacts that does not differentiate between Participants and Non-Participants, and provides a clear view of overall class rate and bill effects.

Appendix B – Attachment 4:

Equations

Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

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Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan

Attachment 4: Equations

The following set of equations describes the modeling approach to calculating lost revenues and avoided costs, and their allocation to rate classes. Lost fixed revenues are not calculated directly; instead it is assumed that Nova Scotia Power must 'recover' the difference between revenues that were lost and costs that were avoided (which can be positive or negative).

$$LR_j = \sum_{i=1}^{8} \left(E_{ij} x_{ij} + P_{B_{ij}} y_{ij} \right)$$

LR_j System total Lost Revenue in year j

E_{ij} Demand Side Management (DSM) total annual energy savings for class i in year j

x_{ij} Average energy rate for class i in year j

$P_{B_{ij}}$ DSM total annual billed demand savings for class i in year j

y_{ij} Average billed demand rate for class i in year j

$$AC_j = \left[E_j a_j + P_{P_j} \left(b_j + c_j + d_j \right) \right]$$

AC_j System total Avoided Costs in year j

E_j System total DSM total annual energy savings for year j

a_j Avoided fuel cost rate in year j

P_{P_j} System total DSM total annual system-coincident peak demand savings for year j

b_j Avoided generation capacity cost rate in year j

c_j Avoided transmission capacity cost rate in year j

d_j Avoided distribution capacity cost rate in year j

$$LR_{ij} = LR_j \alpha_i$$

LR_{ij} Lost Revenues for class i in year j

α_i Attribution factor for class i

$$AC_{ij} = AC_j \alpha_i$$

AC_{ij} Avoided Costs for class i in year j

Description of the indices:

Parameter (Index)	**Index Value**	**Description**
Rate class (i)	1 2 3 4 5 6 7 8 9	Residential Small General General Large General Small Industrial Medium Industrial Large Industrial Municipal Unmetered/Other
Year (j)	1 to 30	Years 2011 (j=1) to 2040 (j=30)

Attribution factors by class:

Source: Class proportion of rate revenue as per 2013 GRA SR-01 Attachment 1 page 51 of 130 (Exhibit 7)

Index (i=)	**Rate Class**	**Value**
1	Residential	53%
2	Small General	3%
3	General	25%
4	Large General	3%
5	Small Industrial	3%
6	Medium Industrial	4%
7	Large Industrial	7%
8	Municipal	2%

Appendix C

Alternate Scenario

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4 Table 4: 2022 Alternate DSM Resource Scenario Investment and Savings 4

The Alternate scenario will deliver approximately 125 GWh of incremental energy savings for each year of the three-year plan period, for an average annual investment of approximately $37 million annually. Table 1 provides a summary of the energy and demand savings and investment for the 2020-2022 Alternate DSM scenario.

Table 1: 2020-2022 Alternate DSM Resource Scenario Investment and Savings

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Weighted-Average Measure Life (years)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	36.1	171.2	124.4	1,744.4	14.0	33.4	1.9	4.7
2021	37.3	182.1	125.4	1,786.1	14.2	34.5	1.9	4.9
2022	37.6	189.9	124.4	1,785.5	14.4	34.9	2.0	5.0
Total	**111.0**	**543.3**	**374.2**	**5,316.0**	**14.2**	**102.7**	**2.0**	**4.9**

Currency is expressed in nominal dollars. Columns may not add correctly, due to rounding. Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.

[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using the utility WACC.

[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

Tables 2, 3, and 4 provide the program-level savings and investment for 2020, 2021, and 2022 respectively.

Table 2: Alternate DSM Resource Scenario Investment and Savings

2020	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.3	7.8	14.1	100.9	1.5	1.3	2.4
Existing Residential	9.1	57.2	31.0	454.2	14.0	1.9	6.3
New Residential	2.5	11.4	4.9	148.1	1.4	1.5	4.5
Low Income Participation[d]	*2.9*		*7.1*	*65.8*	*1.0*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	6.4	44.6	36.2	518.4	6.8	2.2	7.0
Custom Incentives	8.0	39.7	29.7	408.7	7.9	2.0	4.9
Direct Installation	3.8	10.5	8.5	114.1	1.8	2.0	2.7
Low Income Participation[d]	*0.5*		*4.8*	*69.4*	*1.1*		
Enabling Strategies							
Education and Outreach	0.8						
Development and Research	0.8						
Other Enabling Strategies	1.5						
Total	**36.1**	**171.2**	**124.4**	**1,744.4**	**33.4**	**1.9**	**4.7**

Currency is expressed in 2020 dollars. Columns may not add correctly, due to rounding. Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.

[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using the utility WACC.

[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

[d] Reflects EfficiencyOne's planned participation by low income customers. Numbers are a subset of Efficient Products Rebates (Residential), Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

Table 3: 2021 Alternate DSM Resource Scenario Investment and Savings

2021	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.1	6.7	12.4	83.5	1.3	1.1	2.1
Existing Residential	9.3	60.4	30.9	466.3	14.3	1.9	6.5
New Residential	2.7	12.1	5.1	153.3	1.4	1.5	4.5
Low Income Participation[d]	*2.8*		*6.6*	*63.1*	*1.0*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	6.5	48.7	37.6	540.4	7.4	2.3	7.5
Custom Incentives	8.3	42.6	30.6	422.0	8.1	2.1	5.1
Direct Installation	4.0	11.7	9.0	120.6	2.0	2.1	3.0
Low Income Participation[d]	*0.5*		*5.0*	*72.1*	*1.2*		
Enabling Strategies							
Education and Outreach	1.8						
Development and Research	0.9						
Other Enabling Strategies	0.9						
Total	**37.3**	**182.1**	**125.4**	**1,786.1**	**34.5**	**1.9**	**4.9**

Currency is expressed in 2021 dollars. Columns may not add correctly, due to rounding. Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.

[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using the utility WACC.

b TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

[d] Reflects EfficiencyOne's planned participation by low income customers. Numbers are a subset of Efficient Products Rebates (Residential), Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

Table 4: 2022 Alternate DSM Resource Scenario Investment and Savings

2022	Investment ($ million)	Lifetime Benefits ($ million)[a]	First-Year Energy Savings (GWh)	Lifetime Energy Savings (GWh)	Peak Demand Savings (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.0	6.0	10.6	72.8	1.0	1.0	2.0
Existing Residential	8.9	59.8	29.1	436.2	14.0	2.0	6.7
New Residential	2.8	13.0	5.2	158.4	1.5	1.6	4.6
Low Income Participation[d]	*2.7*		*6.2*	*56.8*	*0.9*		
Business, Not-for-profit and Institutional Programs							
Efficient Product Rebates	6.8	52.4	38.5	555.5	7.8	2.4	7.7
Custom Incentives	8.5	45.8	31.5	435.4	8.4	2.2	5.4
Direct Installation	4.2	13.0	9.5	127.1	2.2	2.1	3.1
Low Income Participation[d]	*0.6*		*5.1*	*74.2*	*1.2*		
Enabling Strategies							
Education and Outreach	1.8						
Development and Research	0.9						
Other Enabling Strategies	0.9						
Total	**37.6**	**189.9**	**124.4**	**1,785.5**	**34.9**	**2.0**	**5.0**

Currency is expressed in 2022 dollars. Columns may not add correctly, due to rounding. Annual avoided costs of energy and capacity were provided by NS Power, from the 2014 IRP using the Base level of DSM. Avoided costs of transmission and distribution were provided by NS Power in 2018.

[a] Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using the utility WACC.

[b] TRC is a benefit/cost ratio comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c] PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

[d] Reflects EfficiencyOne's planned participation by low income customers. Numbers are a subset of Efficient Products Rebates (Residential), Existing Residential, Efficient Product Rebates (BNI), Custom Incentives, and Direct Installation.

Appendix D

Evidence of David Hill

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NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF THE PUBLIC UTILITIES ACT

- and -

IN THE MATTER OF AN APPLICATION BY EFFICIENCYONE

Direct Testimony of

David G. Hill, Ph.D.

Vermont Energy Investment Corporation

On Behalf of

EFFICIENCYONE

February 26, 2019

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I. Identification

Q: Please state your name.

A: I am David Hill. I am the Director of Distributed Resources, and Policy Fellow at the Vermont Energy Investment Corporation (VEIC).

Q: On whose behalf are you testifying?

A: I am testifying on behalf of EfficiencyOne. EfficiencyOne has the exclusive right to supply Nova Scotia Power (NS Power) with reasonably available, cost-effective efficiency and conservation activities for a ten-year term. The Efficiency Nova Scotia franchise is a public utility regulated by the Nova Scotia Utility and Review Board, which approves agreements between NS Power and EfficiencyOne on the level of DSM activity.

Q: Please describe the role of your current employer in the energy efficiency industry.

A: VEIC is a nonprofit organization founded in 1986 to reduce the economic and environmental costs of energy use. VEIC now has more than 300 employees, working in five office locations in the United States.

VEIC launched the first statewide energy efficiency utility in North America, with the creation in 2000 of Efficiency Vermont. Efficiency Vermont first operated under a competitively bid, performance contract to the Vermont Public Service Board from 2000 to 2011, and since then has operated under an Order of Appointment from that Board.

VEIC has subsequently launched and now operates successfully two other utility-scale efficiency initiatives: (1) the DC Sustainable Energy Utility (DCSEU), starting in 2011 under contract to what is now the District Department of Energy & Environment in Washington, D.C., and providing electric and gas efficiency and renewable energy services for residential, commercial, institutional, and industrial electricity and natural gas ratepayers in the District; and (2) Efficiency Smart, operating under contract to American Municipal Power (AMP), also starting in 2011, and providing electric energy efficiency

services for residential, commercial, institutional, and industrial ratepayers of approximately 20 municipal utilities in Ohio.

During the 34 utility-years that VEIC has procured energy efficiency as a resource through these three initiatives, we have supported more than 21 million energy savings measures, resulting in more than 2.47 terawatt-hours of electric savings, providing customer savings of more than $3.5 billion. **Figure 1** shows this achievement,

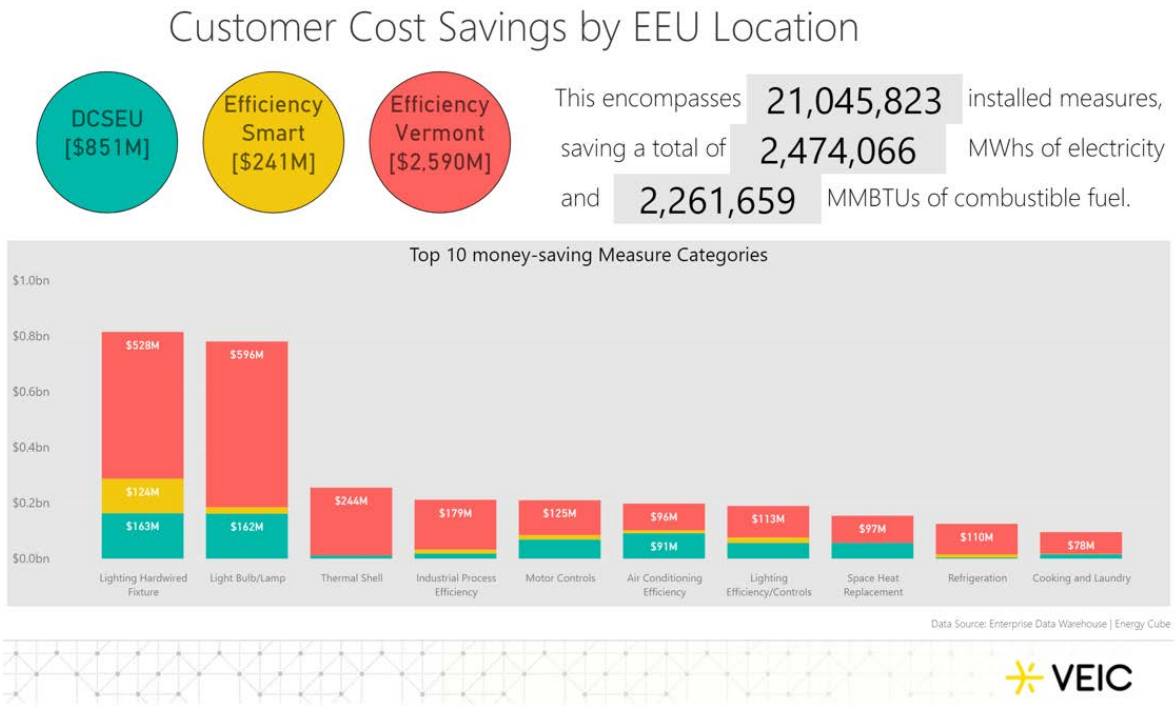

Figure 1. VEIC portfolio savings and impacts, 2000 – 2018, by measure category.

In relation to my testimony in this proceeding, please note that most of the energy and customer savings from VEIC's portfolio have come from efficient lighting. As program designers and implementers, we have been developing strategies to address the lighting transition issues.

Q: Please describe your education and work experience.

A: I received a Bachelor of Arts degree in Geography and Political Science in 1986 from Middlebury College, in the United States. I also hold a Master's degree in Appropriate Technology and International Development from the University of Pennsylvania (1989), and received a Ph.D. in Energy Management

and Policy Planning, also from the University of Pennsylvania, in 1993. I am a Fulbright Scholar, and conducted research on energy decision-making in rural Nepal (1991 – 1993).

As the Director of Distributed Resources and a Policy Fellow at VEIC, I am known in the United States for advancing sustainable energy program design and evaluation. For the last two decades, I have regularly led major consulting assignments at VEIC, and am best known for my work in distributed energy resources, particularly solar energy. I have provided expert testimony and regulatory support on renewable energy and energy efficiency in six jurisdictions, including Nova Scotia and Ontario. I am a regularly invited expert on renewable energy market design; and regulatory issues at international, national and regional conferences and workshops. I serve on national, state, and local level boards. I have also led policy committees and conferences, and have led comprehensive studies of the economic, technical, and achievable potentials for sustainable energy programming. My work also supports program budget planning and implementation.

In the context of program design, I have led or significantly contributed to the design and development of more than six large programs, with annual budgets of $100+ million, for initiatives in New Jersey, New York, Vermont, Arizona, and Maryland. My clients are in more than a dozen states and provinces, and six countries outside North America. I have conducted work for several international organizations, including the World Bank. I have also recently created and led the launch of Sun Shares, a subsidiary of VEIC that develops and provides community solar services to employers and their employees.

Q: Please summarize your experience as related to the diversification of efficiency portfolios and this proceeding.

A: Over the course of my professional career, I have contributed to the design, delivery, and evaluation of efficiency portfolios, and renewable energy initiatives. One recent highlight is my service as a senior advisor and expert witness for the Maryland Office of People's Counsel for the last eight years, providing review, comments, and strategic guidance on the EmPOWER Maryland portfolio. This work has involved regular analysis, review, comments, participation in working groups, and testimony before the Maryland Public Service Commission on how the EmPOWER Maryland portfolio of energy efficiency and demand response initiatives can best evolve to meet regulatory and legislative objectives by creating economic and environmental benefits for Maryland's ratepayers. In 2018, I was a senior

strategic advisor on an internal VEIC team considering the evolution of energy efficiency services and value that we can provide our partners. Also, in 2018, I led the program design for a new Solar for All initiative in the District of Columbia, through VEIC's work as the DCSEU. This initiative complements the energy efficiency services the DCSEU delivers by expanding opportunities to serve income-qualified households through community renewable energy facilities.

Over the last several years, I have authored several papers for the Smart Electric Power Alliance (SEPA) on emerging utility business models and roles, with a heavy emphasis on distributed resources—particularly energy efficiency, distributed generation, advanced metering infrastructure (AMI), and the integration of these assets.

From 2014 to 2017, I led a three-year study, Vermont Solar Market Pathways, as Principal Investigator for a project funded by the U.S. Department of Energy's (DOE's) SunShot Initiative. That work involved investigating the technical, regulatory, and business model implications of obtaining 20 percent of Vermont's total electric supply from solar energy, by 2025. Among other major themes, the study highlights the importance of efficiency in Vermont's energy future and the evolution of energy efficiency costs and savings during and after the lighting transition. I have also led the modeling team on a similar two-and-a-half-year study, "Pennsylvania's Solar Future." That project is currently wrapping up, under the direction of that state's Department of Environmental Protection.

I have led two statewide studies for the Alaska Energy Authority: the first, on renewable energy generation program awards and strategies; and the second, on investigating more specifically the potential for energy efficiency and renewable energy to benefit rural and remote communities. As a program designer and implementer, I led and was also senior policy advisor for the New Jersey Clean Energy Program's renewable energy program for more than a decade. During this time, I also advised members of the VEIC team supporting the portfolio of residential energy efficiency initiatives in New Jersey. I have also been the Strategic Advisor on the state energy plan for the state of Rhode Island (Office of Energy Resources) and advised on that state's System Reliability Procurement and Distributed Generation programs. Other experiences I can highlight are my leadership role in 2003 and again in 2012 for a 20-year forecast of energy efficiency and renewable energy potential for the New York State Research & Development Authority (NYSERDA).

Q: What is your experience in providing testimony?

A: I have provided testimony in regulatory hearings on more than a dozen occasions, and have participated in scores of technical workshops and working groups on behalf of many clients, during my tenure at VEIC. In 2018, I provided testimony on behalf of the Ecology Action Centre to the Nova Scotia Utility and Review Board regarding NS Power's Advanced Metering Infrastructure project.[1] For the last eight years, I have provided ongoing expert review and testimony on EmPOWER Maryland's energy efficiency portfolio on behalf of that state's Office of People's Counsel. I also led VEIC's team in a review of utility efficiency programs for the Pennsylvania Office of Consumer Advocate on that state's legislatively authorized efficiency initiatives (Act 129), providing testimony in 2013 and 2009. I have also provided expert review and testimony on proposed efficiency programs of Brampton and Hydro One in Ontario, on behalf of the Green Energy Coalition in 2005.

In addition, I have written, presented, and / or defended written analyses and / or testimony for regulatory workshops, commission staff, and legislative hearings on efficiency, alternative rate design, net metering and interconnection of distributed energy systems, and strategies for sustainable development of solar markets. This has included my work in New York, Pennsylvania, Vermont, Arizona, Michigan, and New Jersey.

Q: Have you been assisted with the development of this testimony?

A: Yes. My work on this testimony has been significantly supported by colleagues with expertise in efficiency portfolio design and delivery. **Attachment A** provides brief descriptions of each colleague, and their respective roles on the testimony for the team that has worked on the assignment. I appreciate and acknowledge their support. I also stand behind all the testimony provided here, and am responsible for the final content, findings, and recommendations.

II. Introduction and Summary

Q: Please summarize your perspective, testimony, and primary finding.

A: First, as for my overall perspective, I am interested in encouraging initiatives and technology that create economic value, enhance energy justice, protect consumers, and reduce environmental

[1] Nova Scotia Utility and Review Board, Matter M08349, Direct Testimony of David G. Hill on Behalf of Ecology Action Centre, January 18, 2018.

emissions. I support, and am an advocate for, initiatives that use energy efficiency and other clean-energy technologies to achieve these objectives. In regulatory and legislative proceedings, it is my opinion that energy program administrators and designers should be required to quantify and demonstrate how their activities justify ongoing policy and program investments in their portfolios.

For this testimony, EfficiencyOne requested that I investigate how changes in lighting technologies and markets are impacting efficiency program design and administration, and the potential implications of these changes for achieving cost-effective electric energy savings. In this testimony, I briefly cover historic savings and lighting technology and market evolution, and then address why lighting savings are likely to decline in their overall contribution to claimed program savings.

I then discuss, and provide specific examples of, how these trends are being proactively addressed through portfolio diversification, and that looking forward, even with higher unit costs for claimed savings, energy efficiency portfolios are likely to continue to be cost effective.

Based on my decades of experience in the industry, and on the research conducted for this assignment, my primary finding is to support EfficiencyOne's proactive stance and approach to addressing the lighting transition and to the development of a diversified portfolio. Their approach is both strategic for, and warranted in helping to maintain, a cost-effective portfolio that continues delivering ongoing economic benefit for Nova Scotia's ratepayers.

Q: Please summarize your additional findings.

A: The historical level of importance obtained from lighting savings, the projected decline in future claimed lighting savings, and the future projected higher unit costs anticipated by EfficiencyOne are all consistent with industry trends. I have reviewed EfficiencyOne's preferred and alternate portfolios and their approach and plan to create a more diversified portfolio that remains cost effective is consistent with industry trends and best practices. I find that rather than planning for static markets and conditions, EfficiencyOne is being proactive and following a strategy, to insure that energy efficiency investments continue to be an important contributor to the province's energy economy.

Q: Does your testimony include any specific recommendations? And if so, can you please summarize them?

A: Yes. I recommend that the Board not be misled into thinking that because the unit cost of saved energy increases, due to the lighting transition, it means that EfficiencyOne's proposals are not cost effective or that investments in efficiency should be reduced.

I also recommend that the Board and stakeholders continue to engage with EfficiencyOne as they monitor, evaluate, and report on the evolution of lighting and other markets that they serve. As efficiency programs evolve and mature, and as markets transform, the composition of energy efficiency portfolios will continue to change. Looking ahead, diversifying portfolios, and maintaining robust stakeholder engagement and review are all valuable components that contribute to success.

Another recommendation is for the Board, stakeholders, and market participants to be informed of and acknowledge the success of EfficiencyOne's achievements in the lighting markets. The lighting transition is sometimes seen as "a problem" of declining claimed lighting savings, while we forget that the savings that have been created through program initiatives and industry development are now embedded in baselines. In this respect, they continue to help Nova Scotia meet its energy, economic, and environmental policy goals.

Finally, I recommend EfficiencyOne continue to maintain distinctions between the residential and commercial lighting markets, and to recognize the continued potential for savings through supporting lighting measures and applications that are still earlier in their level of market adoption. Continued lighting efficiency savings, in both the residential and commercial markets, are also available through use of smart and connected technologies.

III. The Lighting Transition

Q: Please start by commenting on changes in the lighting technologies.

A: Over the past decade, the lighting market has experienced a dramatic transformation away from the long-standing incandescent, CFL, and linear fluorescent technologies to LED technologies. As is often true with rapid adoption of new technology, this change is being driven by decreasing product cost, improvements in product quality, and an increasing variety of product types and applications. What started with LED exit signs and traffic signals has grown to uses ranging from decorative residential lights to large-scale commercial and industrial applications. The improved efficiency and product lifetime gains from this technology shift offer significant energy and cost savings for customers. **Figure 2** compares

some the key characteristics of these different technologies, including ones that are being phased out in the United States, due to state and federal standards and market forces.[2]

	Being Phased Out			Available Now		
	60 Watt Incandescent	40 Watt, 4'-0" Fluorescent T-12	50 Watt Halogen Bi-Pin Base	13 Watt CFL Bulb	32 Watt, 4'-0" Fluorescent T-8	9.5 Watt LED Bulb
Bulb Information						
Lumens	850	2,600	1,200	800	2,800	800
Watts	60	40	50	13	32	9.5
Lumens per Watt (LPW)	14	65	24	62	88	84
Life Span (hrs)	1,000	20,000	2,000	8,000	20,000	25,000
Price per Bulb	$0.50	$2.00	$2.50	$5.00	$2.50	$10.00
Analysis						
kWh of electricity used over 25,000 hours	1500	1000	1250	325	800	238
Cost of electricity to operate for 25,000 hours (at $0.11 per kWh)	$165	$110	$138	$36	$88	$26
Bulbs needed for 25,000 hours of use	25.0	1.3	12.5	3.1	1.3	1.0
Cost to buy light bulbs for 25,000 hours of use	$12.50	$2.50	$31.25	$15.63	$3.13	$10.00
Cost to operate for 25,000 hours	**$177.50**	**$112.50**	**$168.75**	**$51.38**	**$91.13**	**$36.13**

Figure 2. Lighting comparison chart, showing the recent state of the technologies in lighting market.

Q: How have markets for efficient lighting been affected by these trends?

A: **Figure 3** shows the current and expected distribution of these various lighting technologies in terms of installed stock in the United States and how they are expected to trend over the next two decades. The figure shows the anticipated phaseout of incandescent, halogen, and fluorescent

[2] Meyer, Chris, 2015. "Lightbulb Efficiency Comparison Chart. Greater Cincinnati Energy Alliance. https://greatercea.org/lightbulb-efficiency-comparison-chart/.

technology as they are gradually replaced by LED lamps and fixtures.[3]

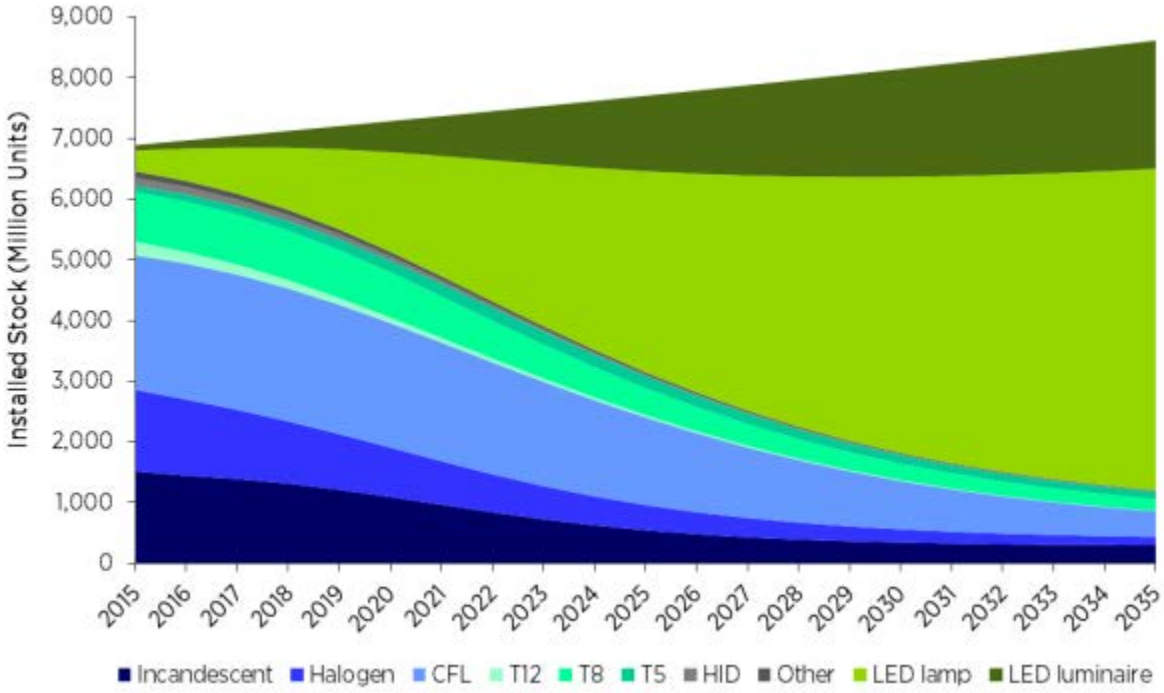

Figure 3. Installed stock projections for the current path scenario for solid-state lighting.

Lighting needs and design vary between the residential and commercial industrial markets, and so too does the predominant lighting product mix. Although residential lighting inventory is 90 percent screw-based lighting products with only 8 percent linear, commercial and industrial (and institutional) (C&I) facilities primarily use linear fixtures (72 percent of installed products), followed by outdoor fixtures (10 percent), and indoor non-linear products (8 percent). Only 10 percent of C&I lighting uses screw-based technology, as shown in **Figure 4**.[4]

[3] U.S. Department of Energy, 2016. "Energy Savings Forecast of Solid-State Lighting in General Illumination Applications." p. 17. https://www.energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf.
[4] Mellinger, Dan. 2018. "Energy Savings Potential of DLC Commercial Lighting and Networked Lighting Controls." Medford, Mass.: DesignLights Consortium, p. 3. https://www.designlights.org/resources/energy-savings-potential-of-dlc-commercial-lighting-and-networked-lighting-controls/.

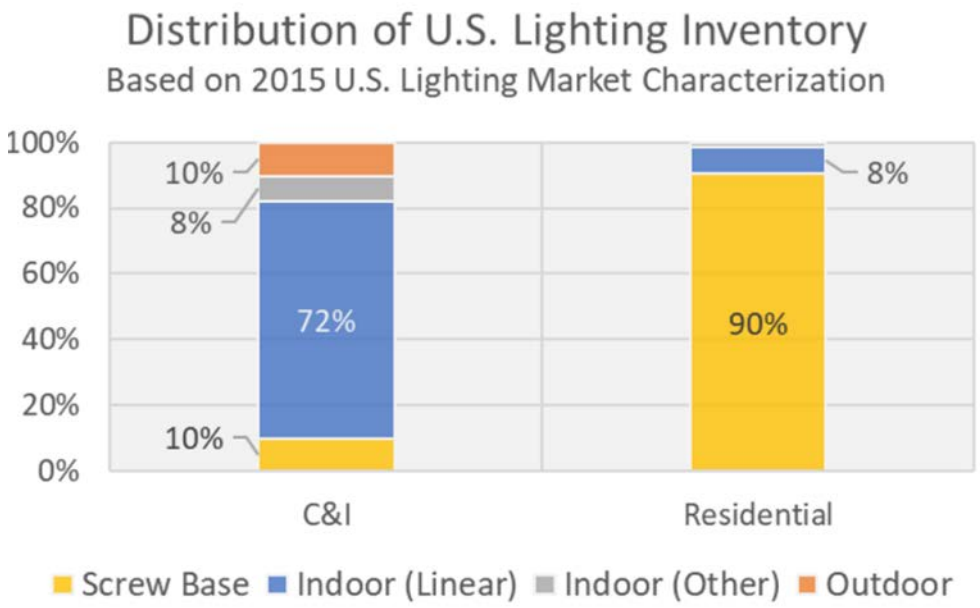

Figure 4. U.S. distribution of lighting products.

The projected mix for lighting by technology, and the expanding share for LEDs in both sectors, based on the DOE's *Annual Energy Outlook,* are illustrated in **Figure 5.**

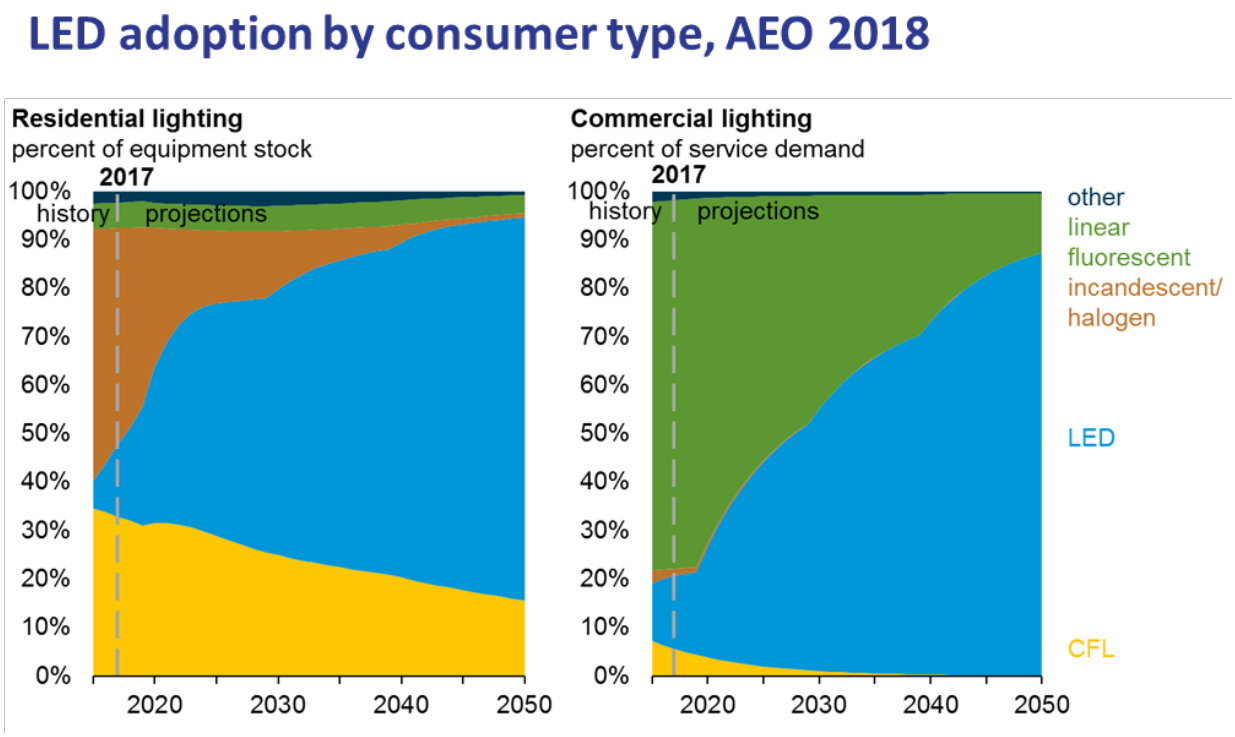

Figure 5. Residential and commercial LED adoption, as a percent of equipment stock and service demand, respectively.

A primary driver of increased market share of screw-based LEDs in recent years has been decreasing cost. The cost for screw-based LED products has declined, decreasing by an average of 28 percent per year between 2010 and 2015.[5] However, the product quality and availability of different types of bulbs have increased (**Figure 6**). This combination of lower cost, higher quality, and increased availability has dramatically increased the number of installed LED bulbs across all bulb types in U.S. households—from 9 million in 2010 to more than 200 million by 2015.[6]

[5] Gerke, Brian F., Allison T. Ngo, and Kibret S. Fisseha, 2015. "Recent Price Trends and Learning Curves for Household LED Lamps from a Regression Analysis of Internet Retail Data." Berkeley, Calif." Lawrence Berkeley National Laboratory, June. p. 13.

[6] U.S. Department of Energy, 2017. *2015 U.S. Lighting Market Characterization.* November. https://www.energy.gov/sites/prod/files/2017/12/f46/lmc2015_nov17.pdf
U.S. Department of Energy, 2012. *2010 U.S. Lighting Market Characterization.* https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf.

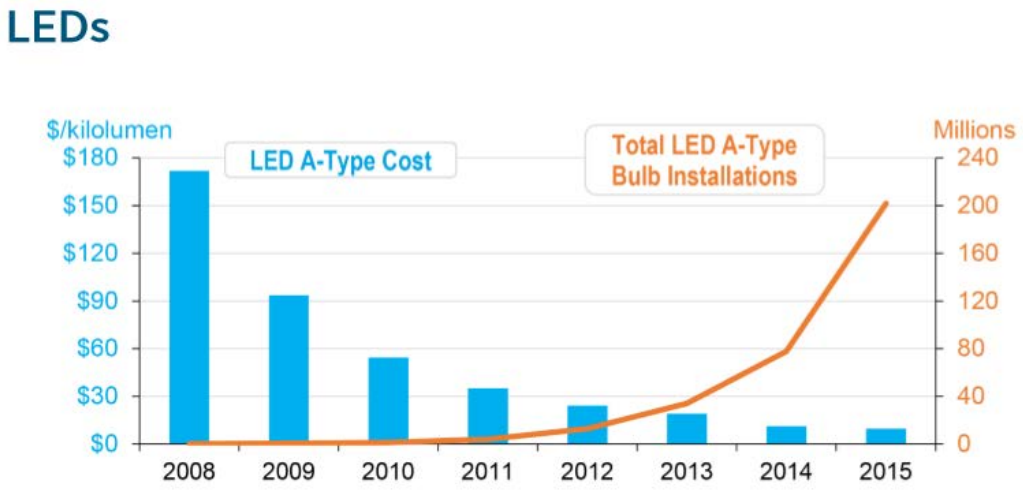

Figure 6. The cost in U.S. dollars / kilolumen of A-Type LED bulbs in the United States, from 2008 to 2015, and the corresponding increase in U.S. installations during that time period.

According to DOE, between 2014 and 2016 the installation of LED lighting continued its rapid increase across all applications, more than quadrupling from 215 million to 874 million units. Of these LED lighting installations, the majority were in indoor applications (94 percent), with the highest being A-type lamps (roughly 50 percent), whereas linear fixtures represent about 8 percent of installations. The breakdown of the 2016 LED lighting installed across these various applications is shown in **Figure 7.**[7]

[7] U.S. Department of Energy, 2017. *Adoption of Light-Emitting Diodes in Common Lighting Applications.* Solid-State Lighting Program. July, p. 27. https://www.energy.gov/sites/prod/files/2017/08/f35/led-adoption-jul2017_0.pdf.

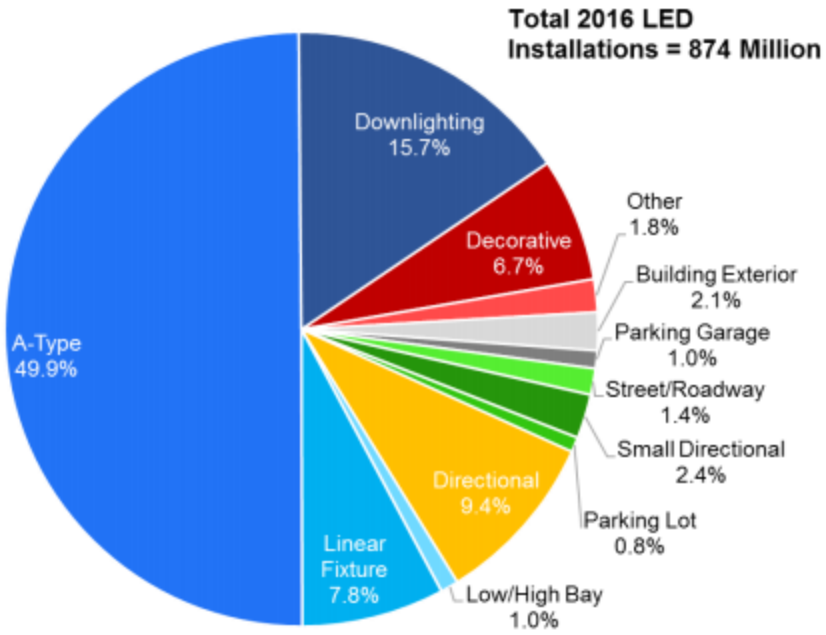

Figure 7. Total 2016 LED unit installations by application.

These different lighting applications for LED technologies have achieved varying levels of market maturity, adoption, and saturation. A-type LED lamps, for instance, might lead the applications in terms of number of units installed, but their overall market penetration is still relatively low (less than 20 percent), as shown on the following market adoption curve for various technologies (**Figure 8**).[8]

Of particular importance for the industry, in terms of retrofit potential, are the linear and low- and high-bay fixtures. These have high volume in the C&I market, but they currently still have low market penetration. This reflects LED lighting's challenge in penetrating the linear fixture market, due to comparable performance from linear fluorescent lamps at a much lower cost. Similar to the historical growth of LED A-bulbs, fixtures are expected to grow in volume of installations as the price continues to drop and performance improves.

[8] DOE, *Adoption of Light-Emitting Diodes*, p. 28.

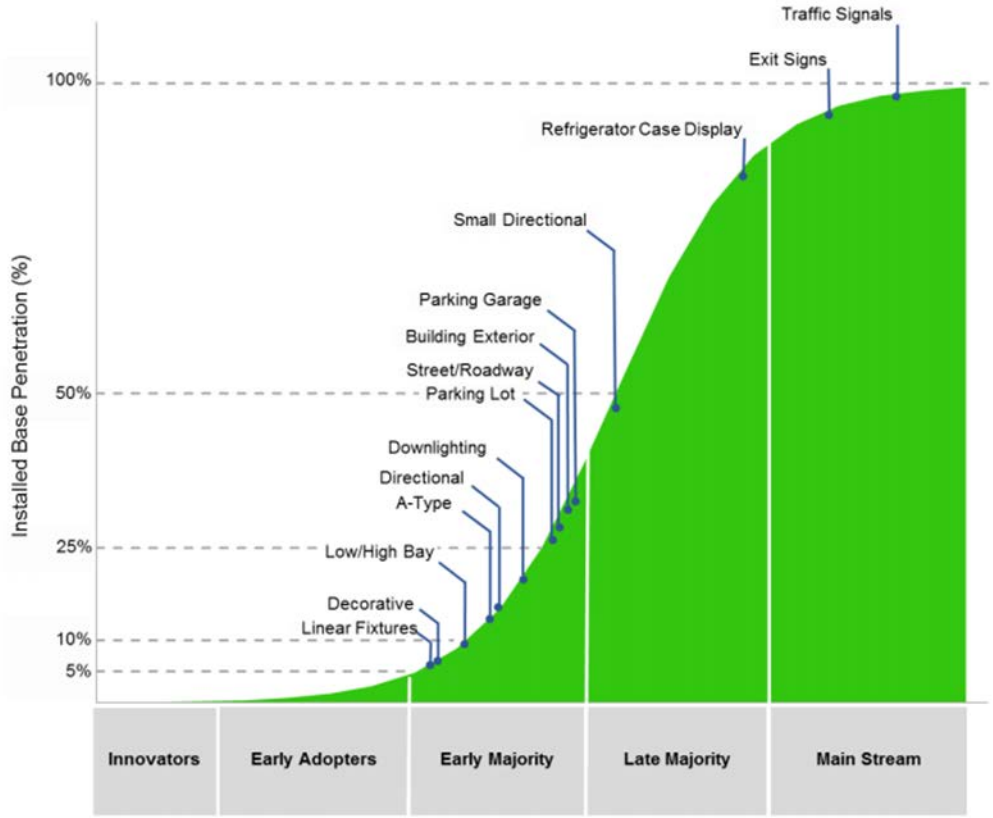

Figure 8. Installed adoption in 2016 of LED lighting applications.

Q: Please comment on the role that lighting has historically played in energy efficiency portfolios.

A: As the lighting industry continues to rapidly transform toward LED technology, and pending the effective dates of state and federal lighting standards, the amount of energy savings that efficiency programs claim from lighting is expected to decline. The following discussion provides historical and predicted lighting savings for Efficiency Vermont.

From 2010 through 2018, lighting savings averaged 68 percent of the portfolio in terms of MWh savings. Future lighting savings are expected steadily to trend downward, reaching 20 percent by 2028. **Figure 9** shows the relationship of lighting to Efficiency Vermont's overall portfolio of measures.[9]

[9] Source: VEIC (2018), based on Efficiency Vermont data from annual reports and projections prepared for the 2016 Demand Resources Plan.

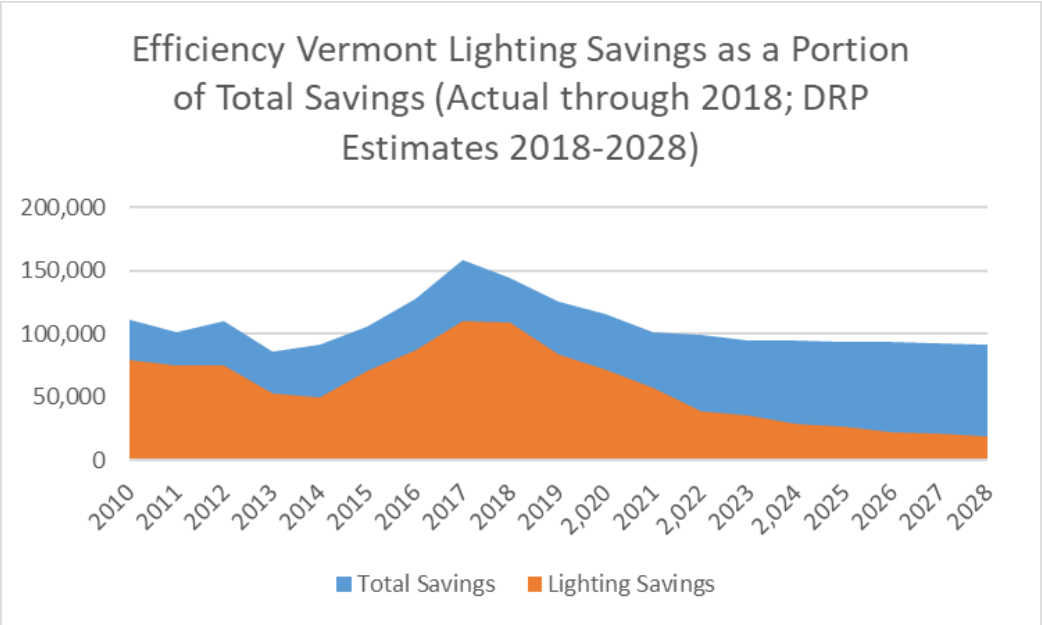

Figure 9. Efficiency Vermont experience with, and projected, lighting savings, as a component of energy savings from all other technologies and programs, 2010 – 2028.

The historical share of portfolio savings from lighting is consistent with experience from other initiatives and programs throughout North America. Below are three other examples, which I will compare to EfficiencyOne.

In the state of Rhode Island, lighting accounts for 53 percent of residential energy savings, and 52 percent of C&I program savings, as shown in **Figure 10**. **Figure 11** shows the experience and projections in Maryland, where lighting share is expected to be significant through 2020.

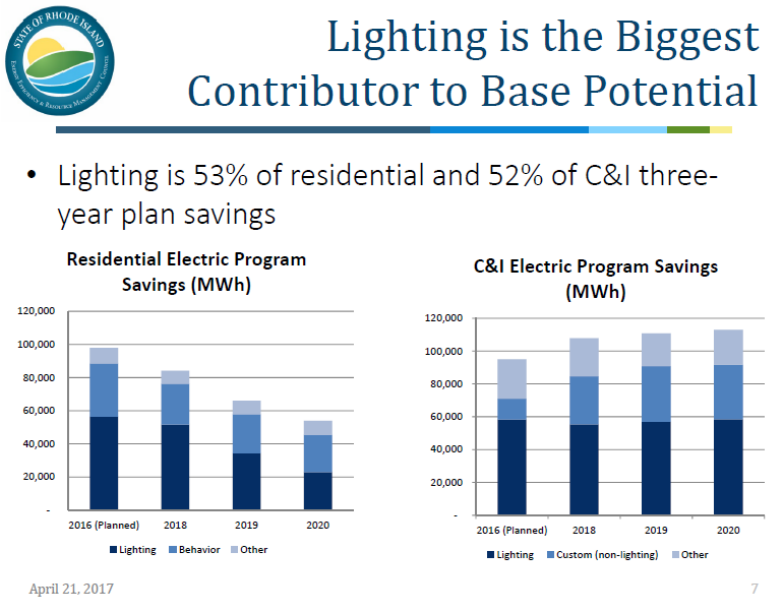

Figure 10. Rhode Island lighting experience and potential as a proportion of overall savings.[10]

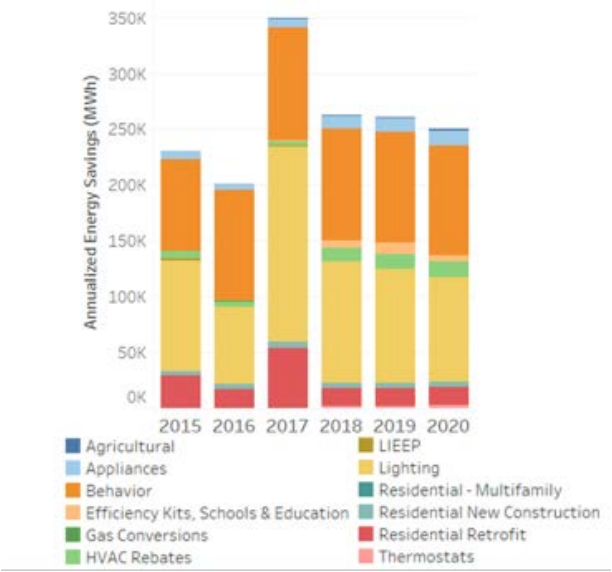

Figure 11. Residential program electric savings and spending by program type, as reported (2015-2016), projected (2017), and forecast (2018-2020).[11]

[10] Levin, Emily, Jeff Loiter, and Mike Guerard. 2017. "Impact of 2018-2020 Targets and Least-Cost Procurement Standards on the 3-Year Plan." Presentation to Rhode Island Energy Efficiency Resource Management Council, April 20.

[11] VEIC, 2017. EmPOWER Maryland 2018-2020 Proposed Plans, Maryland Office of People's Counsel Written Comments, October 10. Figure 6: Residential Program Electric Savings and Spending By Program Type, as Reported (2015-2016), Projected (2017), and Forecast (2018-2020),

The New England region has tracked annual costs and annual energy use for lighting in both market rate and low-income households, comparing them to lighting for C&I installations (**Figure 12**).

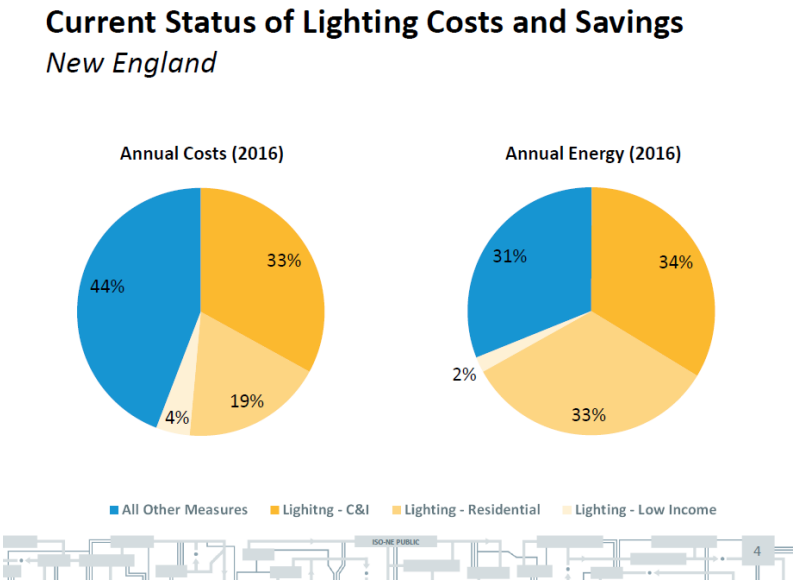

Figure 12. Lighting share of energy efficiency portfolios: New England as a whole.[12]

Q: Is there a way to further characterize the historical lighting savings by measure type and application?

A: Yes. The lighting savings represented in the portfolios shown in **Figures 9, 10, and 11** are not "homogeneous." Deeper levels of data analysis on the mix of measures and savings are not always readily available; however, I can share three figures from VEIC's data tracking system to illustrate how "lighting savings" can be tracked and reported at a more granular level. Note the following three figures relate to VEIC's cumulative historical portfolio involving Efficiency Vermont, the DCSEU, and Efficiency Smart's collective activities. They also present real-time data, as of early February 2019.

Figure 13 illustrates the share of net electric savings (in MWh) by measure category across all of the 21 million-plus measures that have been installed or otherwise implemented.

[12] Rojo, Victoria. 2018. "The Future of Lighting Savings in New England." Holyoke, Mass.: ISO New England, Energy Efficiency Forecast Working Group, February 23. https://www.iso-ne.com/static-assets/documents/2018/02/2018-02-23_ee_lightinganalysis_v6.pdf.

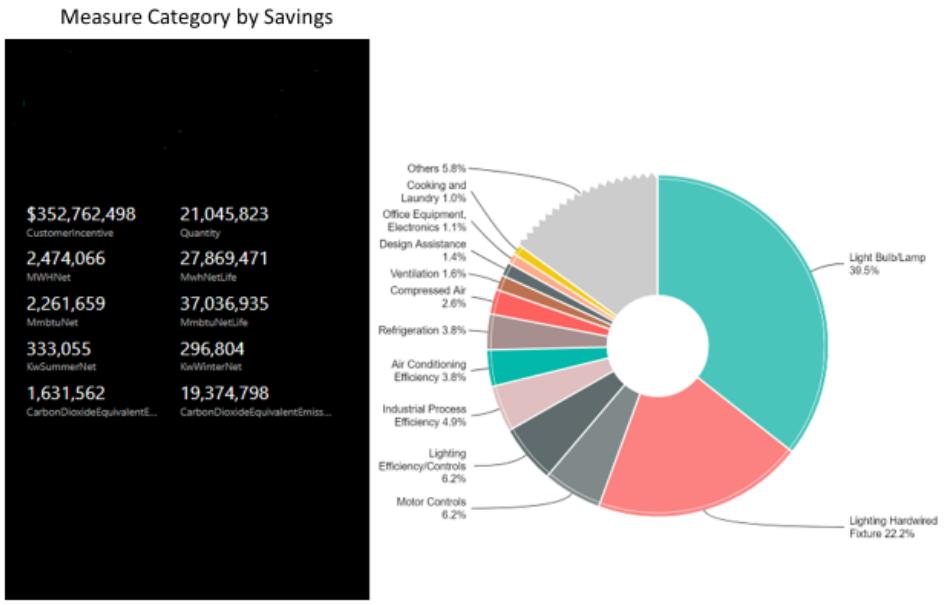

Figure 13. VEIC historical savings net MWh by measure category.

Light bulbs and lamps represent roughly 40 percent, hardware and fixtures 22 percent, and lighting efficiency controls 6 percent of the total portfolio. **Figure 14** takes a further dive, expanding the 40 percent slice of the lamps and bulbs into the variety of products VEIC has supported.

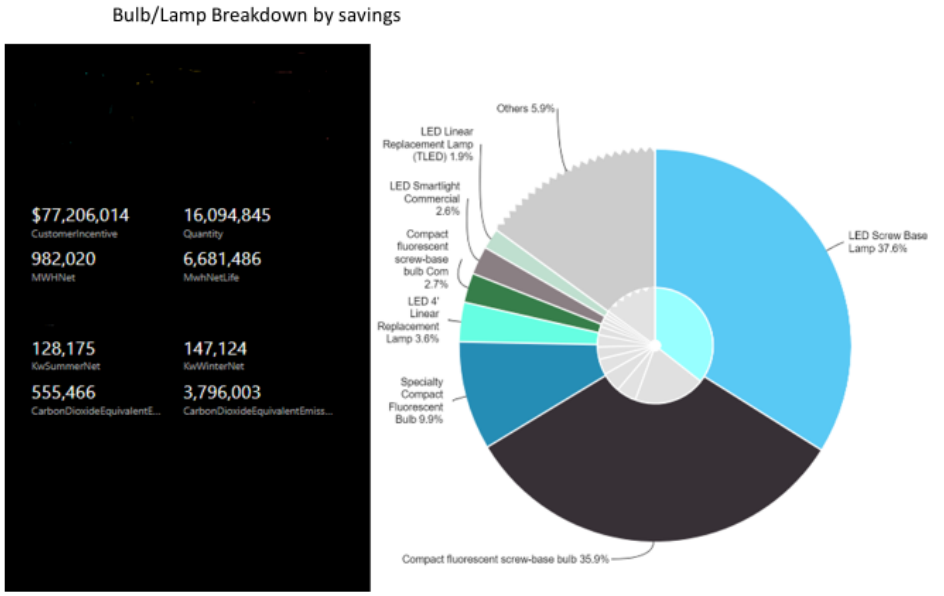

Figure 14. VEIC historical savings, with net MWh breakdown by lamp / bulb type.

In **Figure 14,** compact fluorescent screw-based bulbs and LED screw-based lamps have provided roughly equal savings, although recently we can see higher level of savings from the new LED applications. There is more diversity when we take a deeper dive into the savings by type of fixture and hardware, as illustrated in **Figure 15**.

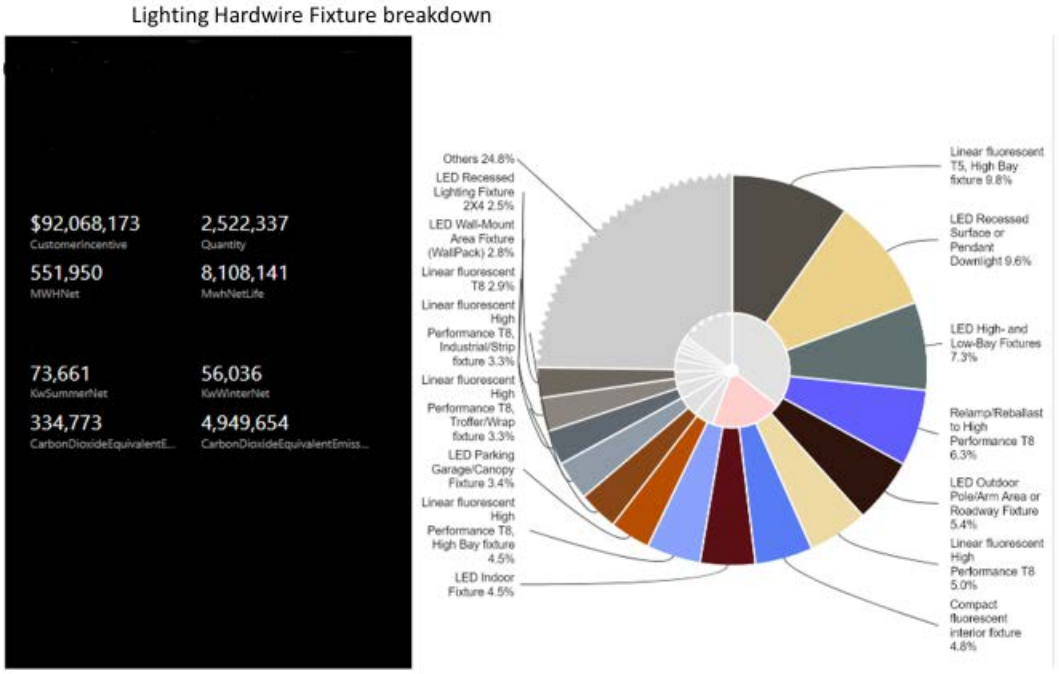

Figure 15. VEIC historical savings net MWh breakdown, by hard-wired fixture type.

Being able to disaggregate and categorize the savings by various categories in this manner is a key tool to help portfolio planners and managers be proactive in diversifying savings, whether from lighting or from other measure categories.

Q: Are the experience of EfficiencyOne and the importance of lighting in its portfolio savings comparable to the examples cited above?

A: Yes, like all of the examples cited above, and all of the efficiency portfolios I am aware of, EfficiencyOne's portfolio has obtained the majority of its claimed savings from efficient lighting, in both the residential and the business, non-profit, and industrial market segments. **Figure 16** illustrates the share of savings from lighting measures for the portfolio during the 2015-2017 plan, and shows overall share of lighting in the range of 56 to 61 percent.

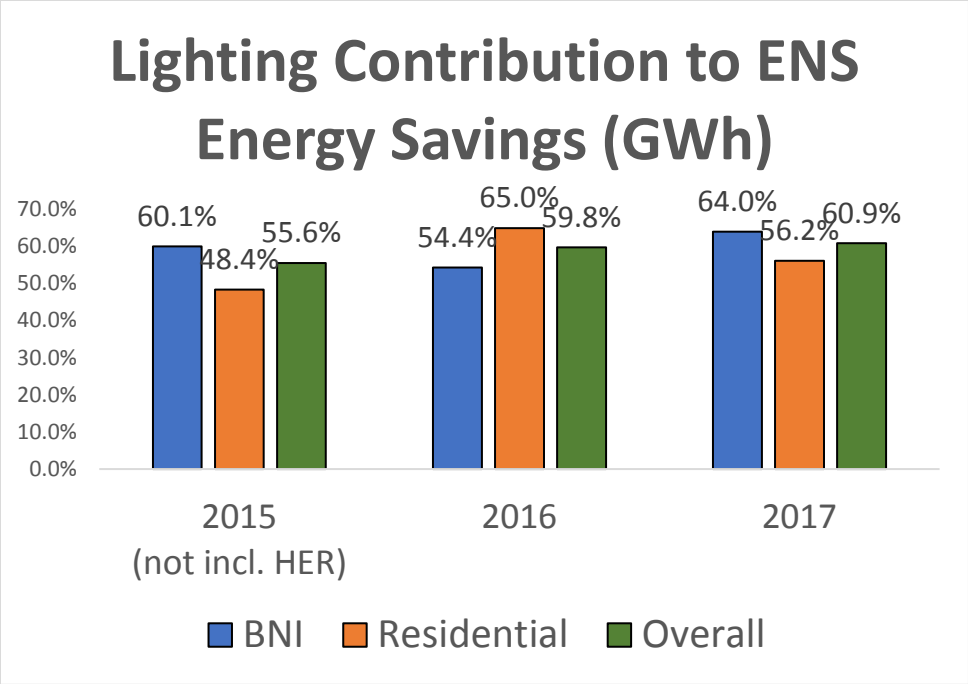

Figure 16. Efficiency Nova Scotia lighting share of total electric savings (2015-2017).

Looking at the same time period, **Table 1** allocates these savings by program component.

Table 1. Efficiency Nova Scotia share of savings from lighting, in both residential and business customer classes, 2015 - 2017

% of Savings from Lighting		2015	2016	2017
BNI Program Components	Business Energy Rebates	84%	84%	86%
	Small Business Energy Solutions	87%	73%	80%
	Custom	20%	9%	14%
	Energy Management Information Systems	0%	0%	0%
	Strategic Energy Management	0%	0%	0%
Residential Program Components	Appliance Retirement	0%	0%	0%
	Instant Savings	82%	95%	92%
	Efficient Products Installation	65%	64%	69%
	Home Energy Assessment	0%	0%	0%
	Green Heat	0%	0%	0%
	New Home Construction	0%	0%	0%

Q: Generally speaking, do you consider the high level of importance that lighting technologies have played in energy efficiency portfolios to be a "good thing" or a "bad thing"?

A: It is my unequivocal opinion that the high level of importance of lighting in energy efficiency portfolios has been very positive. I would say it is a "very good thing."

Q. Please explain your support for this position.

First, solid-state lighting and efficient lighting have created a significant amount of economic value by providing savings at a total cost that is far less than the cost of energy supply. These savings manifest themselves at both the consumer level and the utility system level. Customers see lower energy bills, and the utility has lower total system costs and revenue requirements, which in turn mean that rates for all customers can be lower.

Energy efficiency programs are ubiquitously governed by regulatory and legislative mandate, required to be cost effective, and must deliver energy efficiency savings at a cost lower than that of supply. As I have documented above, efficient lighting has contributed significantly to cost-effective portfolios.

At the national level, VEIC recently commissioned third-party expert research from Synapse Energy Economics, Inc., of Cambridge, Massachusetts, to quantify the benefit to the electric system that has been created through efficiency programs. The study also characterizes future potential.[13] In this section of the testimony, I will briefly summarize the findings from the historical, back-casting element of the research. In **Section VI,** I will examine the forecasting of this research.

The research examined data sets from the American Council for an Energy-Efficient Economy (ACEEE) and the DOE's Energy Information Administration (EIA). The two data sets were roughly consistent. For this research, the analysts selected the EIA data, providing utility reported costs and savings for more than 3,000 utility-years of data from all classes of utilities across the United States. The median and savings weighted mean lifetime costs of savings across this portfolio were 2.5 cents (2016 U.S. dollars) per kWh. Seventy-seven percent of the savings had costs between 1 cent per kWh and 3.5 cents per kWh. These are the "utility costs" for the energy efficiency savings for an entire portfolio, not

[13] Synapse Energy Economics, Inc. 2018. *Energy Efficiency in the US: Savings Costs and Benefits*. Prepared for Vermont Energy Investment Corporation.

just lighting. They do not include consumer costs, but rather only the utility cost for incentives and administering a program.

Considering the activities and impacts from 2010 to 2016, the efficiency programs, which are all likely to have lighting as the highest individual contributor to savings, resulted in annual savings of 161 terawatt-hours (TWh) in 2016. This is equivalent to 4.1 percent of the total retail sales in that year. By providing these savings with the median cost of 2.5 cents per kWh, the utility efficiency programs provided consumers nationwide with net savings of $4.1 billion in 2016. The savings were due to lower production costs, avoided capacity need, and avoided transmission and distribution spending.

Improvements in lighting technology have also created economic value by saving consumers on their energy bills and by lowering maintenance costs. The average lifetime for incandescent bulbs has ranged from 1,000 to 3,000 hours. For CFLs, it has been 10,000 hours; and for LEDs, 25,000 hours. In many applications, users and researchers alike acknowledge that lighting efficiency upgrades improve productivity.[14] In one lighting project at a school in the state of Wisconsin, students and teachers reported fewer headaches and effects from seasonal affective disorder (SAD), after five interior classrooms were retrofitted with tunable LED lighting. Since 2007, the use of LEDs for mitigating the effects of SAD has been supported in the scientific literature.[15]

Because lighting is a ubiquitous end use across all sectors, it represents a substantial opportunity for all customer classes to participate in energy efficiency savings. Therefore, the prominent role of lighting in energy efficiency portfolios has also helped address energy justice issues. "Energy justice" relates to the application of ethical principles in delivering energy to all people. It emphasizes

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[14] Jones, Carol, and Kelly Gordon. 2004. "Efficient Lighting Design and Office Worker Productivity." *Proceedings of the 2004 Summer Study of Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy: (3-) 112-23. https://aceee.org/files/proceedings/2004/data/papers/SS04_Panel3_Paper10.pdf.
Hood, Morgan and Lauren Morlino. 2018. "The Customer Is Always Right: How Design Thinking Saved a Dim Lighting Program." *Proceedings of the 2018 Summer Study of Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy. https://aceee.org/files/proceedings/2018/#/paper/event-data/p109: p. (4)-8.
Neeley, Cory. 2018. "Tunable Lighting in Stoughton School District." Presentation at the Customer Connections Conference of the American Public Power Sun Prairie, Wisc.: WPPI Energy. https://www.youtube.com/watch?v=ipl1OyQKsB0.

[15] Desan, Paul H., Andrea J. Weinstein, Erin E. Michalak, Edwin M. Tam, Ybe Meesters, Martine J. Ruiter, Edward Horn, John Telner, Hani Iskandar, Dian B. Boivin, and Raymond W. Lam, 2007. "A Controlled Trial of the LItebook Light-Emitting Diode (LED) Light Therapy Device for Treatment of Seasonal Affective Disorder (SAD)," *BMC Psychiatry* (7) *38*, doi: 10.1186/1471-244X-7-38. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1971065/.

the role of clean energy in environmental justice principles[16] and how they affect vulnerable populations. The feature of including all customer classes and types is bolstered by the modularity and lower cost of entry into energy efficiency practices, via lighting efficiency. That is, lighting efficiency upgrades require less capital investment, and thus customers can acquire them seriatim, as opposed to becoming more energy efficient via a large initial investment such as heating and cooling systems, or building thermal shell improvements or improvements in process energy use.

Lighting measures comprise a good entry point for efficiency programs that want to engage with customers of all types. Positive experiences from lighting savings show that customers can be more inclined to engage in additional energy efficiency upgrades that might involve deeper customer investment and longer payback periods. Blue Seal, an animal feed producer, provides a case study with testimonials. This commercial industrial customer for Efficiency Vermont started with lighting upgrades and is now looking to expand efficiency to capture compressed air and other opportunities.[17]

Q: Do the historical success and importance of lighting in the energy efficiency portfolios you have discussed suggest that lighting will play the same role in the years ahead?

A: No. Although lighting savings will still contribute to the savings claimed by programs, the volume of savings will be less in the future. Lighting is a very good example of market transformation in energy efficiency. Energy efficiency programs have helped to identify and reduce customer barriers to participation in efficient lighting. Programs reduce barriers through incentives, product quality assurance and labeling, distribution and stocking channels, and direct install and other approaches tailored for hard-to-reach markets. As a positive and desired outcome, more efficient lighting is in the marketplace, the more it becomes the norm, over time.

Therefore, today we see higher saturation, and thus more efficient baselines against which future savings would be claimed. This phenomenon can lead to the eventual creation of lighting standards that bring up the floor, so that all lighting becomes more efficient.

[16] "The Principles of Environmental Justice," 1991. Drafted and adopted at the First National People of Color Environmental Leadership Summit, Washington, DC, October 24 - 27. http://www.ejnet.org/ej/principles.pdf.
[17] Blue Seal Doubles Down on Savings with New Equipment and Controls. https://www.efficiencyvermont.com/about/customer-stories/blue-seal-doubles-down-on-savings-with-new-equipment-and-controls

For example, Massachusetts undertook a residential lighting market assessment study, which examined socket saturation trends. The study showed that the state saw a "steady increase in efficient bulb saturation" between 2009 and 2018 (totaling more than 50 percent for CFL and LED bulbs), and a decline to 36 percent in inefficient bulbs. The study also looked at the effects of energy program incentives on socket saturation and market penetration of the various technologies.[18] Saturation studies can also help to identify under-realized areas for savings. For example, Focus on Energy, a Wisconsin energy efficiency program, conducted a potential study in 2016 on both residential and C&I lighting. The results showed low saturation of efficient lighting technologies across both customer classes, with a total of only 41 percent socket saturation of LED and CFL bulbs, combined, in the residential sector; and 48 percent saturation of incandescent and halogen bulbs. In the C&I sector, the saturation of linear LEDs ranged from 0.2 percent to 10 percent, depending on the building segment.[19]

For reference, Efficiency Nova Scotia has commissioned two residential market socket saturation studies, finding 66 percent of sockets had efficient lighting in 2016, up from 50 percent in 2011.[20]

Although high baselines and saturation for efficient lighting mean that the energy savings claimed and attributed to lighting initiatives will diminish, the savings realized through lighting technologies and market transformation are still there. It is just that they have just been incorporated into a new baseline.

The shift to fluorescent and LED technology has improved the overall efficacy, in lumens per watt (lm / W) of installed lighting in the United States by over 40 percent since 2001. According to the DOE, across all sectors, the average system efficacy of installed lighting has increased from 36 lm / W in 2001 to 40 lm / W in 2010, and to 51 lm / W by 2015, as shown in **Figure 17**.[21]

[18] NMR Group, Inc. 2018. "RLPNC Study 17-9: 2017-18 Residential Lighting Market Assessment Study." Presented to the Electric and Gas Program Administrators of Massachusetts. http://ma-eeac.org/wordpress/wp-content/uploads/RLPNC_179_LtgMarketAssessment_28March2018_FINAL-1.pdf.

[19] The Cadmus Group, Inc. 2017. "Focus on Energy: 2016 Energy Efficiency Potential Study." Madison, Wisc.: Public Service Commission of Wisconsin. https://www.focusonenergy.com/sites/default/files/WI%20Focus%20on%20Energy%20Potential%20Study%20Final%20Report-30JUNE2017_0.pdf.

[20] Matthew Davidson, personal communication.

[21] DOE, 2017. *2015 U.S. Lighting Market Characterization*, p. 96.

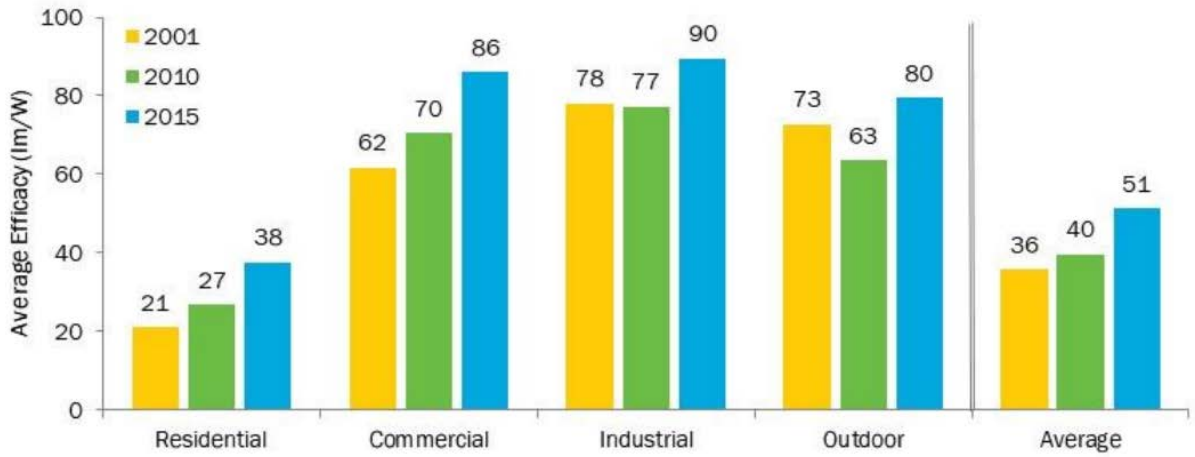


Figure 17. Average efficacy of U.S. lighting technology by sector in 2001, 2010, and 2015.

Sometimes I hear program planners and regulators express a concern about the increasing saturation of efficient lighting and about higher baselines against which savings can be claimed. Although I understand their concerns, and appreciate how much planners and regulators need to work hard to create strategies to address the lighting transition, saturation and rising baselines are not the problems that they are perceived to be. Instead, these trends are really an indication of program, policy, and market success. This broad success should be acknowledged and communicated freely. It essentially means that an energy efficiency program can more productively transition to next-generation efficiency measures, and proactively plan for greater diversification of the portfolio. I discuss diversification of the portfolio further in **Section V**.

Q: Can you discuss whether the lighting transition is dependent on changes in standards?

A: The potential for changing standards is a clear indicator of the increasing prevalence of efficient lighting. However, just as this testimony is being drafted in early February 2019, DOE has announced its intention not to implement a standards upgrade that was published in 2017 and was due to go into effect in 2020.[22] The new standard was going to implement a lm / W performance-based criterion that LED lamps can meet, but which today's incandescent lamps cannot meet.

[22] American Council for an Energy-Efficient Economy, 2019. "Rollback of Light Bulb Standards Would Cost Consumers Billions--$100 per Household Each Year." Press release. Washington, DC: ACEEE and the Appliance Standards Awareness Project. https://aceee.org/press/2019/02/rollback-light-bulb-standards-would.

Although new standards can effectively solidify a more efficient baseline, the markets documented in this testimony are well under way, and the lighting transition is likely to continue—regardless of the extent to which legal challenges to the standards, and / or now to the standard roll-back, will play out.

Q: Would it be reasonable to say that lighting savings are "going away" for future energy system planning?

A: No. It is important to distinguish that, rather than "going away," the benefits of the transition to the more efficient technology are now widely enjoyed across the entire economy. The savings claimed from lighting by energy efficiency portfolio administrators, like EfficiencyOne, will likely decline. But the ratepayers of Nova Scotia will continue to benefit from the transformation of the lighting market for decades to come.

IV. The Lighting Transition and the Unit Cost of Saved Energy

Q: You have reviewed how lighting markets have transitioned. What does this mean for the unit costs of saved energy in energy efficiency portfolios?

A: In both the commercial and residential markets, the increase in non-lighting measures (which historically have required larger customer incentives) causes the portfolio cost-per-MWh-savings to rise steadily in future years. The shift away from lighting measures is expected to require higher levels of customer engagement and information sharing to stimulate the market for the more complex efficiency measures.

The necessary engagement and technical support for information sharing will increase non-incentive costs of implementing initiatives for the more complex and sophisticated efficiency measures and systems. As the low-cost lighting measures leave the portfolio, the yield rate (that is, the dollars spent per first-year MWh saved) increases. For Efficiency Vermont, **Figure 18** shows the impact of the shift away from lighting on overall portfolio yields over the next 20-year period (*RA* in the figure refers to efficiency program resource acquisition).

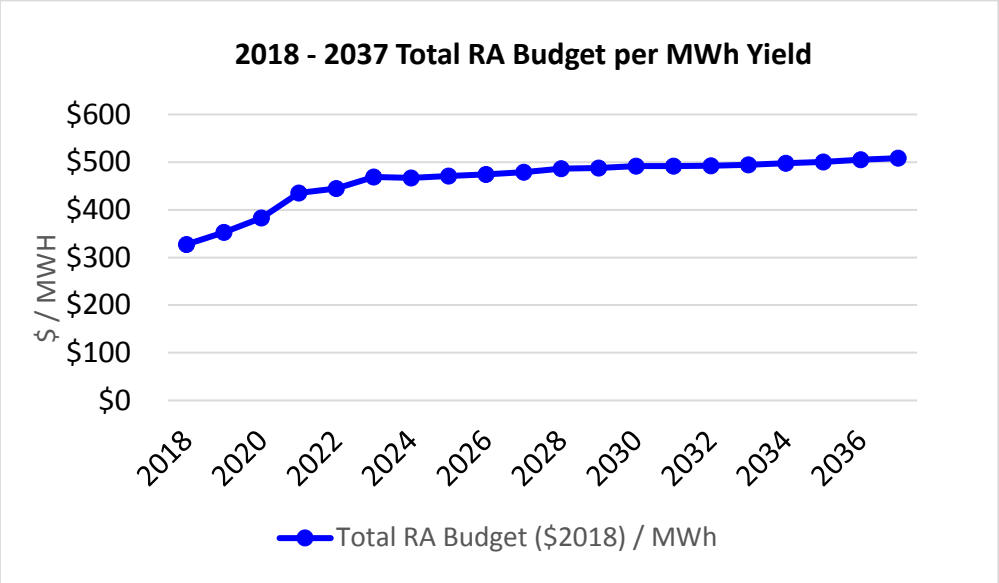


Figure 18. In the 2018-2020 performance period, the average cost for achieving 1 MWh in first-year savings is approximately $350, but as low-cost lighting leaves the portfolio, the cost goes up.

For EfficiencyOne, a snapshot from 2016 to 2018 in **Table 2** shows a similar, though shorter-term, trend with non-lighting measure costs trending upward. Note that both **Figure 18** and **Table 2** are based on first-year costs, and would be modified to a levelized cost of saved energy by applying average measure lifetimes.

Table 2. EfficiencyOne first-year unit costs of lighting and non-lighting measures, for 2016 to 2018.

2016-2018 DSM Results
Restated for Lighting Changes

	2016-2018 Results					
Sector	First Year Energy Savings (GWh)	First Year Energy Savings (GWh) Lighting Removed	Fully Allocated Spend ($M)	Fully Allocated Spend ($M) Lighting Removed	Fully Allocated Unit Cost ($/kWh)	Fully Allocated Unit Cost ($/kWh) Lighting Removed
Residential	174.4	132.7	40.5	35.4	0.23	0.27
BNI	247.5	180.9	45.6	39.3	0.18	0.22
Enabling Strategies			9.1	9.1		
	421.9	313.6	95.1	83.7	0.23	0.27

	2016 Results					
Sector	First Year Energy Savings (GWh)	First Year Energy Savings (GWh) Lighting Removed	Fully Allocated Spend ($M)	Fully Allocated Spend ($M) Lighting Removed	Fully Allocated Unit Cost ($/kWh)	Fully Allocated Unit Cost ($/kWh) Lighting Removed
Residential	69.1	46.7	14.7	12.0	0.21	0.26
BNI	67.8	55.7	13.1	11.5	0.19	0.21
Enabling Strategies			3.0	3.0		
	136.9	102.4	30.8	26.5	0.23	0.26

	2017 Results					
Sector	First Year Energy Savings (GWh)	First Year Energy Savings (GWh) Lighting Removed	Fully Allocated Spend ($M)	Fully Allocated Spend ($M) Lighting Removed	Fully Allocated Unit Cost ($/kWh)	Fully Allocated Unit Cost ($/kWh) Lighting Removed
Residential	53.9	44.2	12.7	11.2	0.24	0.25
BNI	76.9	59.1	14.8	13.0	0.19	0.22
Enabling Strategies			2.8	2.8		
	130.8	103.3	30.3	27.0	0.23	0.26

	2018 Results (Not Finalized)					
Sector	First Year Energy Savings (GWh)	First Year Energy Savings (GWh) Lighting Removed	Fully Allocated Spend ($M)	Fully Allocated Spend ($M) Lighting Removed	Fully Allocated Unit Cost ($/kWh)	Fully Allocated Unit Cost ($/kWh) Lighting Removed
Residential	51.4	41.9	13.0	12.3	0.25	0.29
BNI	102.8	66.1	17.6	14.8	0.17	0.22
Enabling Strategies			3.3	3.3		
	154.3	107.9	33.9	30.3	0.22	0.28

Q: Are the drivers for unit costs also declining?

A: Yes. As we see in **Table 2,** lighting average unit costs continue to decline. Many program administrators have now realized reduced costs for lighting programs by shifting initiatives from a downstream approach (direct-to-customer rebate or incentive) to a midstream one (incentives to distributor or retailer) or even to an upstream one (incentives to manufacturers). I will discuss how the

experience gained from midstream-based lighting initiatives is now being applied to non-lighting measures and programs in Section V, on portfolio diversification.

Q: With increasing costs, will there still be some cost-effective savings from lighting?

A: Yes. Although expected savings will decline, the opportunity and need for lighting savings and market support will continue.

In residential markets, rapid adoption of LEDs represents a transformational shift in the market, which is positive in terms of reduced electricity use and customer cost savings. However, it has created an opportunity for manufacturers to introduce lower-quality product lines. These "value" products have a similar appearance and packaging to their higher-quality counterparts. But they are offered at discount prices. Unfortunately, these products typically do not pass the rigorous standards of ENERGY STAR® (U.S. Environmental Protection Agency standard) and other certifying agencies. They also tend to underperform when installed, which can lead some customers to become disappointed and "backslide" to less-efficient technologies. As a result, even as the industry transitions away from high-volume lighting programs, it is important to consider ways to continue to support the market in ways that prevent increased adoption of these lower-quality, lower-performing products. This could be via "stocking incentives" to encourage retailers to stock higher-quality products and marketing materials, to help inform smart consumer purchases toward these higher-performing bulbs.

"Smart" or "connected devices" are becoming increasingly available and could offer an additional source of lighting savings in the future. This next generation of products and technologies are beginning to take hold, especially with screw-based products for the residential market. Connected lighting could be part of a growing whole-house energy management system, managing all the loads in the home: lighting, appliances, plug loads, HVAC, electric vehicles, and so on. Thus, connected lighting could bring back some additional savings in the residential market, similar to how adding integrated lighting controls in the C&I market (as described below) offer the potential for significant increased savings in that market. **Table 3** shows the estimated percentage of savings increases from lighting technology, if connected controls are integrated with the product.[23]

[23] DOE, 2017. *Adoption of Light-Emitting Diodes* , p. 22.

Table 3. Estimate of additional energy savings per connected LED lighting installation

Application	Connected Controls Energy Savings (%)[1]
A-Type	71%
Decorative	67%
Downlight	68%
Small Directional	67%
Directional	69%
Linear Fixture	63%
Low/High Bay	62%
Street/Roadway	61%
Parking Garage	53%
Area/Parking Lot	53%
Building Exterior	57%
Other	71%

Q: What about the potential for continued savings in C&I lighting?

A: The opportunities for continued lighting savings are expected to be greater in the C&I market than in the residential market. Compared to the decrease in residential lighting, the lighting savings from C&I buildings in the United States is actually expected to increase in the short term, reaching a peak of 18 TWh in 2021, before steadily decreasing by 50 percent by 2030.

As seen in **Figure 19,** combining LED fixtures with integrated network lighting controls could raise the peak annual energy savings potential of C&I lighting to 20 TWh in 2025, if promoted through "aggressive" efficiency program support and promotion. The C&I market offers greater and longer-term lighting savings, especially with integrated controls. However, beginning in 2025, market saturation of LED technologies is expected to steadily lower lighting savings to 10 TWh by 2035.[24] It is also possible that future federal and / or state standards could affect the baselines of these non-residential fixtures. This in turn could decrease the claimable savings potential for efficiency programs five to ten years from now, and create a new "lighting cliff"—this time in the commercial lighting market.

[24] Mellinger, 2018. "Energy Savings Potential." p. 6.

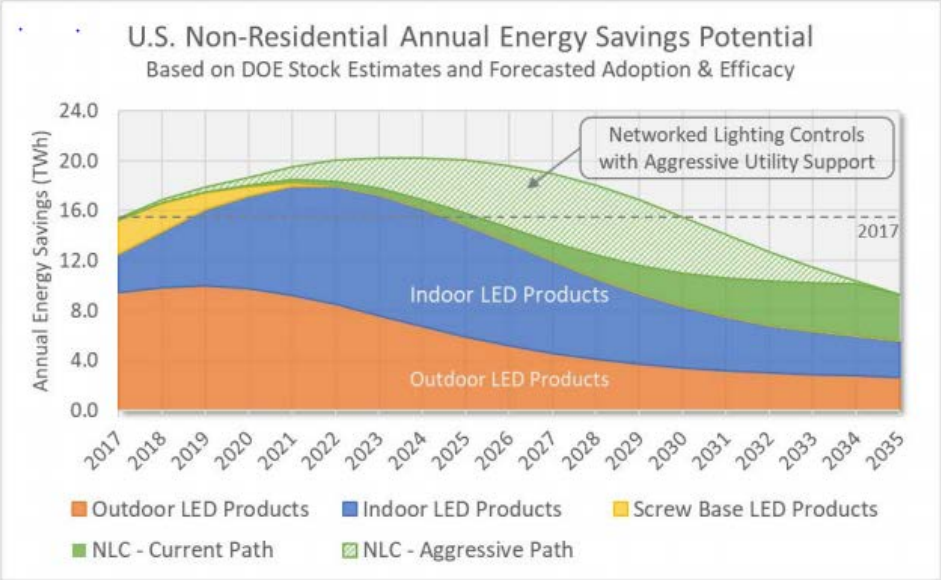


Figure 19. Non-residential (C&I) annual energy savings potential in the United States from LED & networked lighting controls, assuming aggressive support from utilities.

The forecasted market adoption rate of five of the most common non-residential interior and exterior LED lighting types is shown in **Figure 20.** The saturation of LEDs for linear tubes and fixtures is currently estimated at less than 10 percent of C&I linear fixtures, and closer to 15 percent for high- and low-bay fixtures for U.S. C&I buildings. The current adoption rate of exterior lighting is higher: between 25 and 35 percent, which reflects how these longer-hour applications, many on all night long, are more economical to replace and often the first to retrofit in a commercial building.[25] As the cost of interior troffer and high-bay fixtures continues to decrease, adoption is expected to continue to grow over the next five years in the United States.

[25] Mellinger, 2018. "Energy Savings Potential." p. 4.

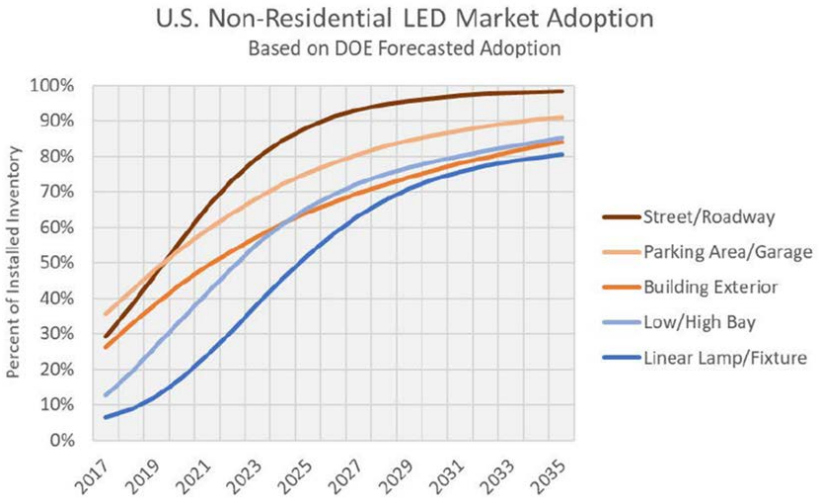
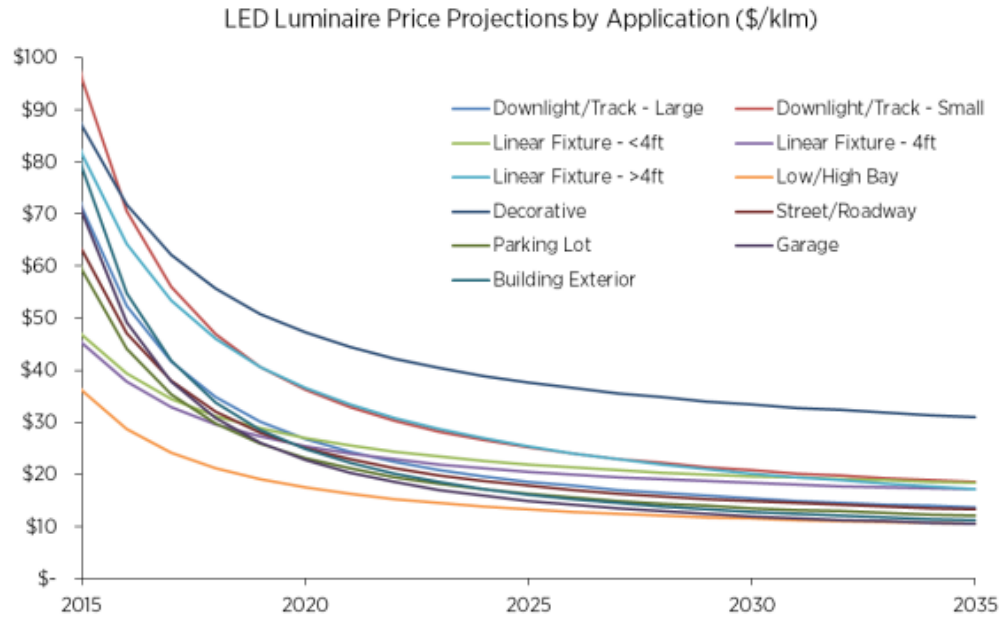


Figure 20. Forecasted non-residential (C&I) adoption of LED lighting in the United States.

Similar to the rapid decrease in cost in A-type bulbs between 2008 and 2014, LED fixtures are expected to continue steadily dropping in price over the next several years. This declining cost, combined with increasing quality for both fixtures and lights, are expected to drive LED fixture sales over the next decade. **Figure 21** shows the anticipated decrease in cost (U.S. $ / klm) of fixture types over the next 20 years.[26]



[26] DOE, 2016. "Energy Savings Forecast."

Figure 21. LED lamp and luminaire price projections by application submarket (U.S. $ / klm).

The total remaining savings from 2018 to 2035 for non-residential LED fixtures in the United States is estimated at over 250 TWh. **Figure 22** shows the amount of remaining savings potential by fixture type, both with and without networked lighting controls. Linear lamps and fixtures show the largest saving potential and screw-based show the least.[27]

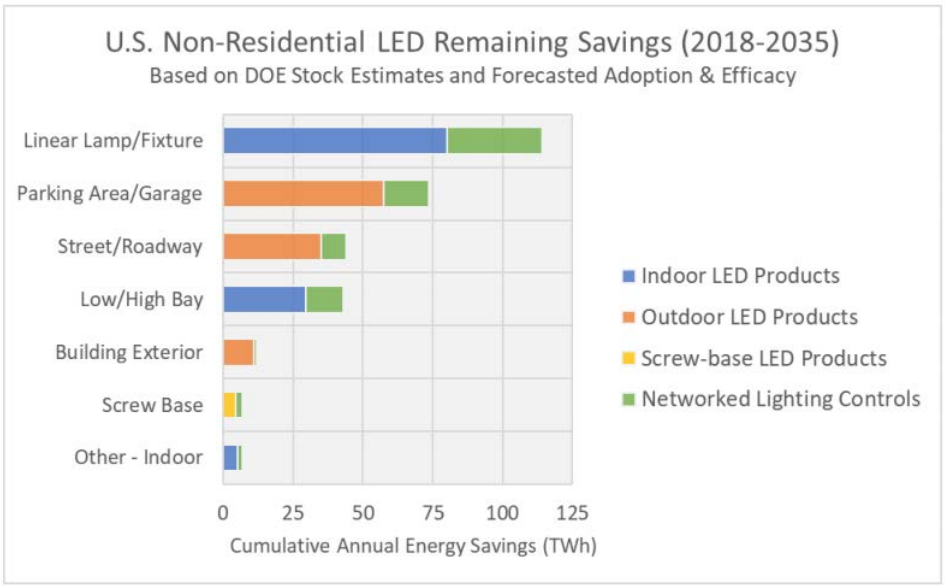


Figure 22. U.S. non-residential (C&I) lighting savings potential by product type.

For Efficiency Vermont, the expected savings from C&I lighting is expected to follow a similar trend. As seen in **Figure 23,** savings from lighting average 59 percent of the portfolio from 2010 to 2018. This percentage is expected to drop steadily over the next decade, reaching 27 percent by 2028.

[27] Mellinger, 2018. "Energy Savings Potential." p. 8.

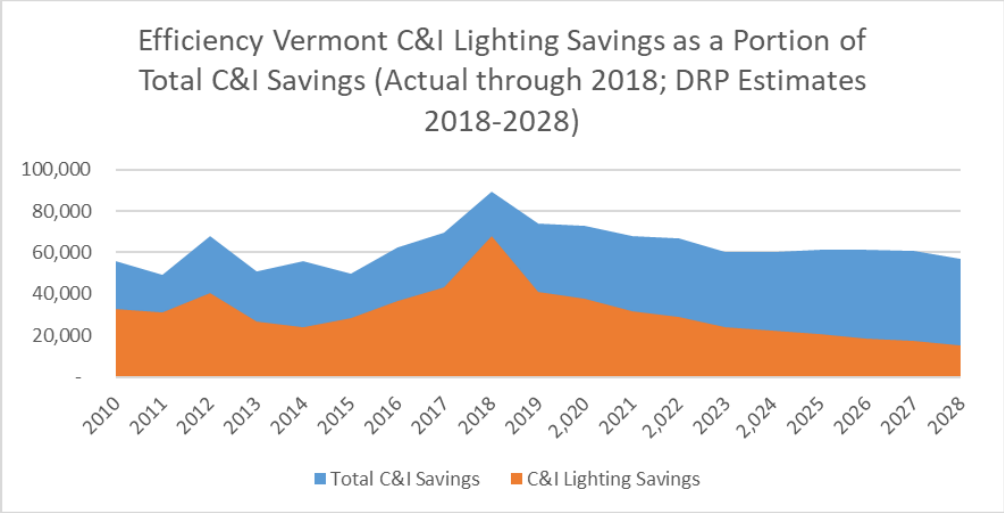


Figure 23. C&I lighting savings, relative to total C&I savings, as forecast through 2028.

V. Diversifying Energy Efficiency Portfolios

What can you say about the response of program design and implementation to the trends and shifts you have described above?

A: Over time, programs will ramp down spending for lighting, while phasing in new program measures and expanding existing ones. Although this will put upward pressure on overall program yield rate, it offers an opportunity to increase funding and support for a wider variety of technologies and service delivery approaches.

For example, in the residential and low-income markets, Efficiency Vermont expects to capture increased savings from appliances, behavior effects, consumer electronics, motors, space heat efficiency, and ventilation. In the C&I market, Efficiency Vermont will expand air conditioning efficiency, behavior effects, industrial process efficiency, motors and controls, electric space heating efficiency, refrigeration, and ventilation.

As an example of how this shift away from lighting can affect a program's overall portfolio, **Figure 24** shows Efficiency Vermont's forecasted total electric savings by major end use, across the next 20 years, based on a flat budget scenario (US$2018). Note that this is an example, and does not imply that budgets are proposed or will necessarily be flat during the period. The decrease in projected

lighting savings is clear in **Figure 24.** However, the expected increase in savings from the other non-lighting technologies is less visible.

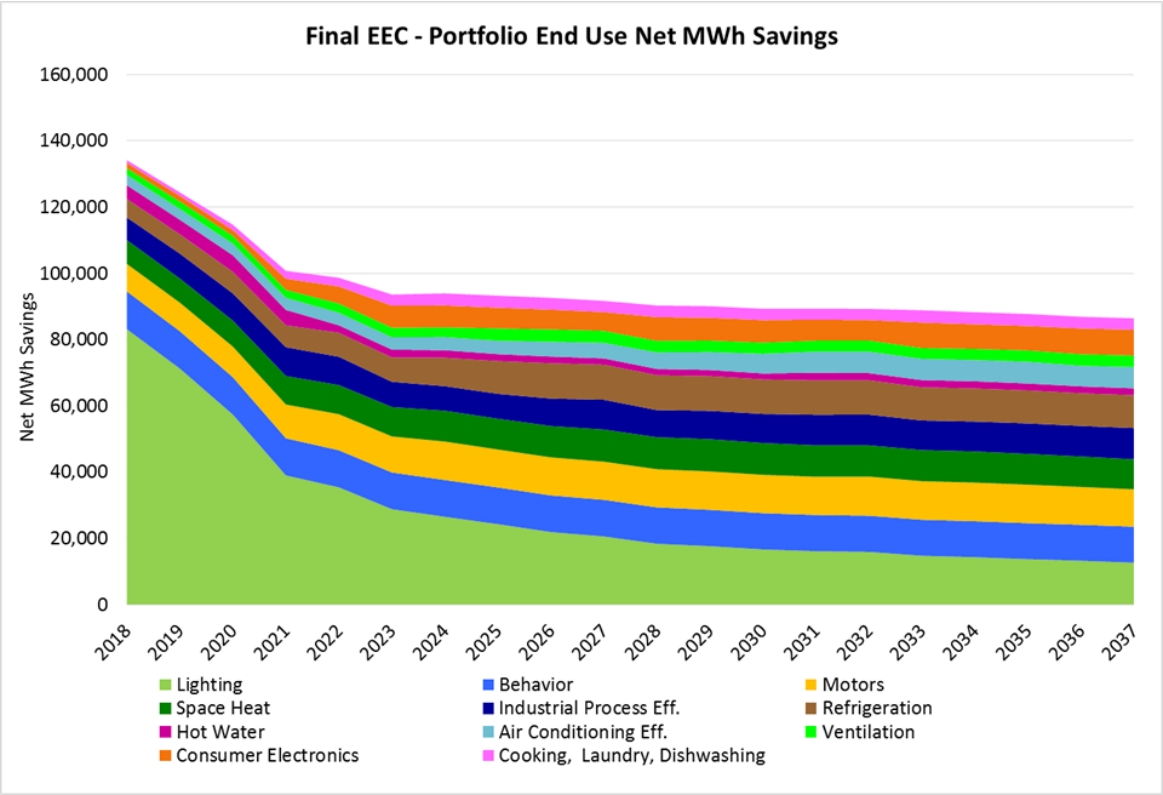


Figure 24. Efficiency Vermont forecasted portfolio, 2018 – 2037, showing decrease in lighting savings.

By removing the lighting savings, **Figure 25** illustrates more clearly the steady increase of most other non-lighting technologies over the next 20 years. Only two technologies are not expected to increase during this time period: behavior and hot water savings.[28]

[28] Efficiency Vermont Final Resource Acquisition Model Results for the 2018-2037 Demand Resources Plan; July 2017; p. 8-9 (DRP)

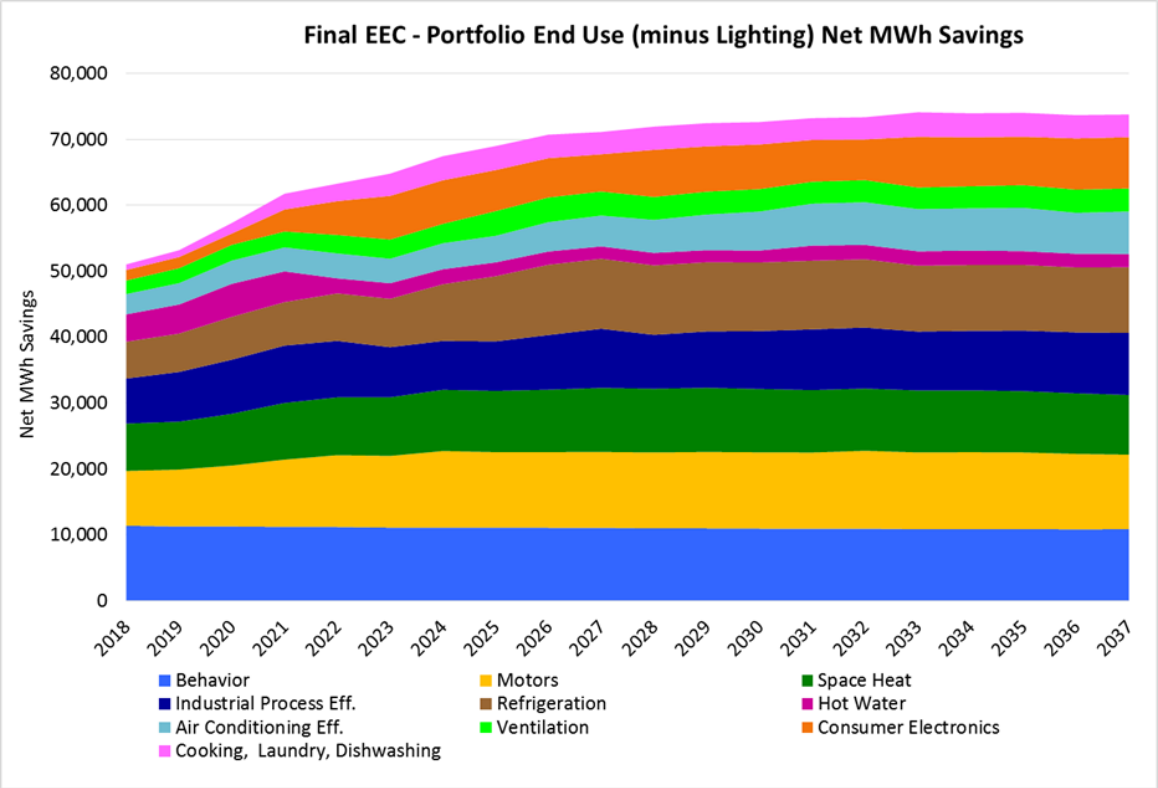


Figure 25. Efficiency Vermont's forecast, showing increases in savings from non-lighting measures.

Consistent with the patterns in **Figures 24 and 25**, **Figure 26** shows one potential national scenario developed by ENERGY STAR, for residential market initiatives in cool climates. In this analysis, the United States could achieve over 50 percent of residential energy savings from midstream non-lighting programs by 2028.[29]

[29] Pudleiner, David, and Peter Lemoine, 2018. "Where Will Electric Energy Efficiency Program Savings Come from in the Next Decade? A Scenario Analysis." Washington, DC: U.S. Environmental Protection Agency, ENERGY STAR. https://www.energystar.gov/sites/default/files/asset/document/Pudleiner%20Where%20Will%20EE%20Savings%20Come%20From%20Next_508.pdf.

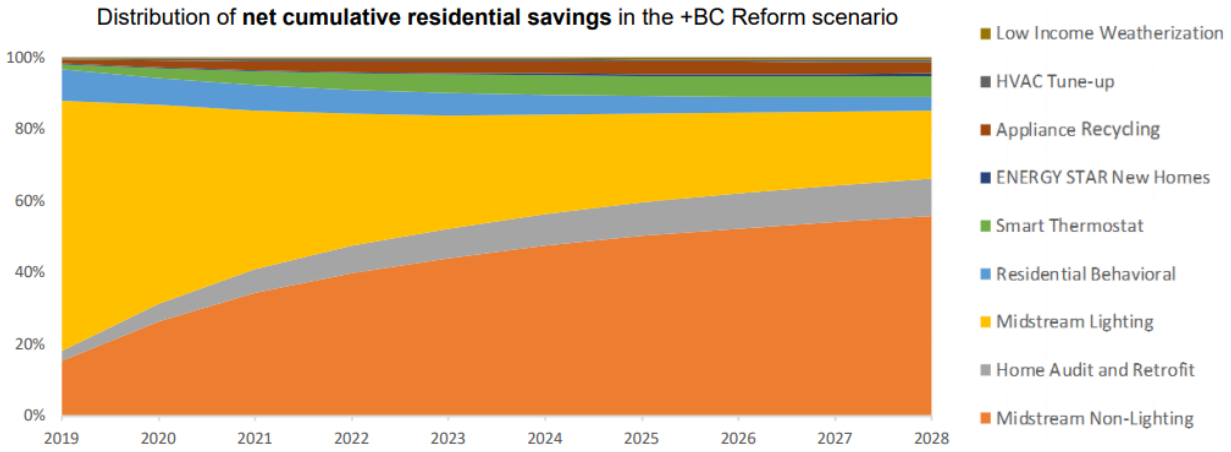


Figure 26. Potential distribution of net cumulative residential savings for cool climates in United States.

Smart building controls also offer the potential for increased savings from HVAC systems, plug loads, and lighting. These interconnected devices benefit from control algorithms to optimize energy savings from building occupant patterns and external environmental conditions. One study found that smart technology in a typical office building could save between 18 and 33 percent of energy consumption, depending on controlled devices, as shown in **Figure 27**.[30]

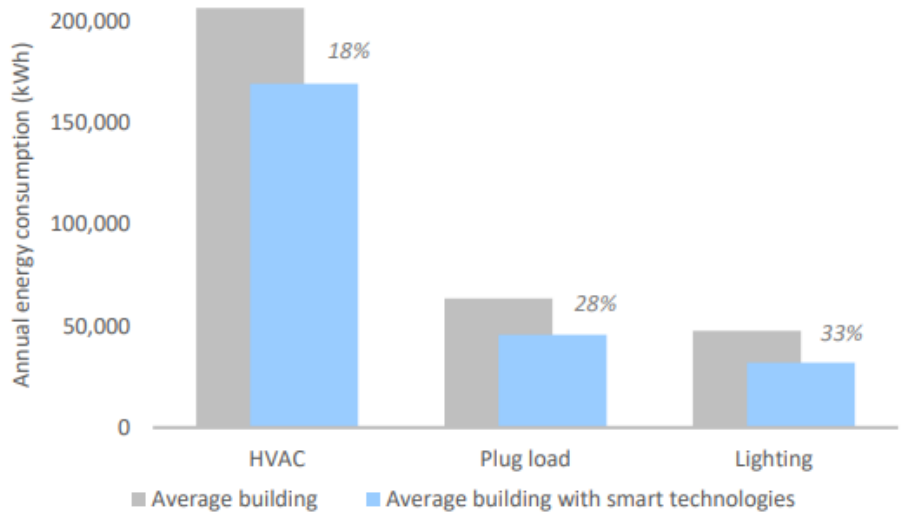


Figure 27. Average office energy savings with smart technology.

[30] Perry, Christopher. 2017. "Smart Buildings: A Deeper Dive into Market Segments." Washington, DC: ACEEE. https://aceee.org/research-report/a1703.

Q: Please discuss the strategy and potential for other markets to learn from the success of the "midstream" approach to programs that has been successful with lighting.

A: Switching from prescriptive and custom program service delivery to a "midstream" approach can be an effective way to drive greater savings from non-lighting technologies such as HVAC, appliances, consumer electronics, and pool pumps.

The ENERGY STAR analysis of midstream program scenarios shows that moving non-lighting equipment from downstream (retailers and end use customers) approaches to midstream approaches is projected to increase net savings on those measures by 20 percent, in 2028, as shown in **Figure 27.**

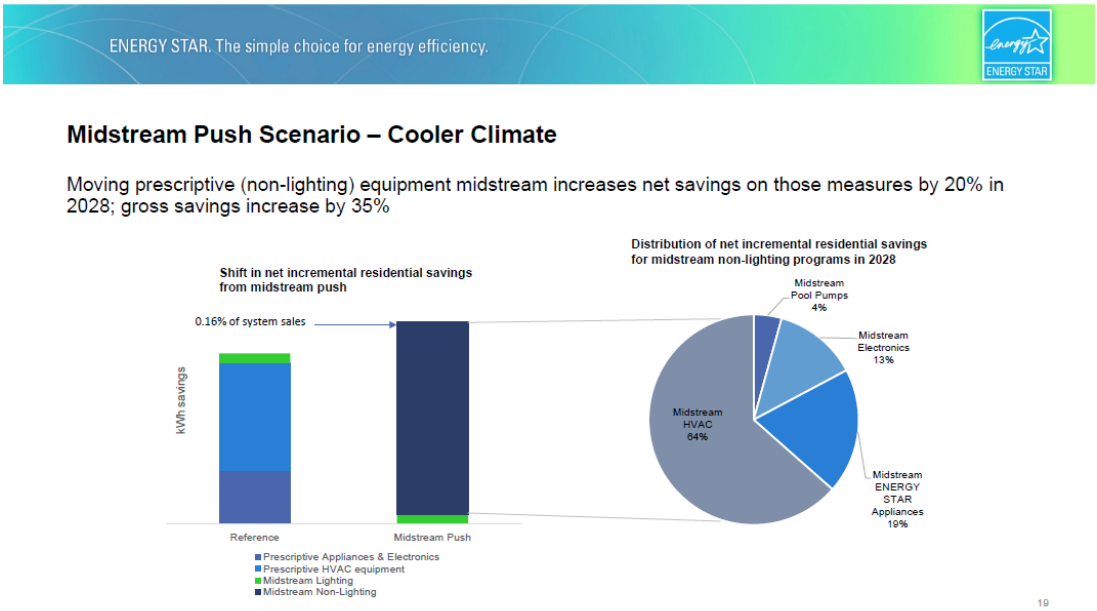


Figure 27. Expanding midstream-based programs could result in net savings increases of 20 percent by 2028, absent any reforms in calculating cost effectiveness.[31]

In fact, many American states are in the process of expanding their next-level (or midstream) approaches for non-lighting equipment. Efficiency Maine, for example, is expanding its midstream approach (incentives to wholesaler / distributors, rather than to retailers and end use customers) to its HVAC portfolio and its C&I lighting retail products portfolio.[32] California utilities will soon be issuing a

[31] Pudleiner and Lemoine. "Where Will Electric Energy Efficiency Program Savings Come From?"
[32] Efficiency Maine Trust, 2019. "Request for Proposals (RFP) for Delivery Services for the Commercial and Industrial Prescriptive Incentive Program and the Lighting Component of the Distributor Initiatives Program." RFP EM-009-2019. January 28. https://www.efficiencymaine.com/docs/CIP-RFP-EM-009-2019.pdf.

statewide request for applications for similar midstream HVAC programs.[33] Con Edison, a New York utility, recently launched a rebate program for HVAC distributors.[34] Efficiency Vermont, which expanded the concept of offering incentives to non-lighting midstream market actors, and then designed an advanced engagement approach with those actors, has now expanded its midstream programs to encompass more HVAC, water heating, and refrigeration equipment program strategies.[35] We know of other midstream, non-lighting programs in place or in development in Maryland, Oregon, Wisconsin, and the District of Columbia.

Q: Are there any other brief examples you can provide about approaches to mature or saturated markets?

A: Yes. Even when markets are considered transformed, and saturated, there are often remaining opportunities to have positive impacts. Code compliance is a common example where, although energy efficient measures are "required," there can be opportunities to support and bolster realized savings. Maryland recently participated in a DOE study of the effects of energy code training on the residential new construction market. The training is a more recent example of this approach to achieving more savings from an established, "saturated" market whose efficiency measures are considered transformed. The results indicate a strong range of positive improvements in total energy efficiency, energy cost, and greenhouse gas emission reductions from the energy code project.[36] The goal of the study, which has other state participants, has been to document baseline practices, to target areas for improvement, and to quantify related savings potential.

VI. Cost-Effectiveness Impacts

Q: Do the rebalanced / post-lighting transition portfolios remain cost effective?

[33] Proposal Evaluation & Proposal Management Application (PEPMA), 2019. "Public Events" and other listings. https://www.pepma-ca.com/public/PublicEvents.aspx?type=0.
[34] ConEdison, 2019. "Rebates for HVAC Distributors." https://www.coned.com/en/business-partners/business-opportunities/rebates-for-hvac-distributors.
[35] Merson, Howard C., Brian Barnacle, Daniel Cornejo, Chris Burmester, John Terborgh, and Frances Huessy. 2018. "Five Years and Beyond with Supply Chain Engagement: What's Next with Upstream and Midstream?" *Proceedings of the 2018 Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy: (7-)1-12. https://aceee.org/files/proceedings/2018/#/paper/event-data/p218.
[36] Maryland Energy Association, n.d. "Measuring the Value of Education and Training on the Maryland Energy Code Project Results." http://newportpartnersllc.com/PDFs/MEA_Project_Results.pdf. See also the Project Overview at http://newportpartnersllc.com/projects/residential_energy_efficiency.html.

A: Yes. Even with the higher per-unit costs associated with a more diversified portfolio, and after the lighting transition, efficiency portfolios can and will remain robustly cost effective. For example, the 2018 - 2020 portfolio for Efficiency Vermont has a benefit-to-cost ratio of **3.94 to 1**. Over the longer time horizon, with steady (real-dollar) budget levels, the diversified portfolio for the 2018-2037 time horizon has a lower benefit-to-cost ratio of **2.78 to 1**. Energy efficiency as a resource thus continues to provide create significant net economic benefits. **Table 4** presents the planned cost effectiveness and other performance metrics for these two time periods.

Table 4. Efficiency Vermont projected savings according to Vermont's Demand Resources Plan, 2018 - 2020 and 2018 - 2037

Performance output	Total 2018-2020	Total 2018-2037
Annual MWh, net	375,069	1,933,683
Lifetime MWh, net	3,759,301	22,993,891
First-year summer peak kW, net	48,180	260,913
Lifetime summer peak kW, net	472,358	3,276,277
Lifetime winter peak kW, net	642,056	3,722,814
Total resource benefits, net	$333,837,852	$1,950,529,931
Cost effectiveness	**3.94 : 1**	**2.78 : 1**
Net societal benefits	$419,193,045	$1,929,292,269
Greenhouse gas (GHG) reductions	207,689	1,090,100

Note that these results apply with level, real budgets, and with an increase in the average unit cost of savings as presented in **Figure 18**.

Q. Does this experience in Vermont likely translate to other markets and regions in the United States or Canada?

A: Yes. I can comment and give two further examples of national studies for the United States. I would expect that results would be consistent for Canada, although in this assignment I did not have time to research the Canadian market in depth. The overall question of cost effectiveness of energy efficiency portfolios, looking forward, is of vital strategic interest to VEIC. As mentioned in **Section III,** in 2018 VEIC's new Chief Executive Officer wanted to obtain an external view of both the historical spending, value, and savings of energy efficiency in Vermont, and a forecast of continuing potential and cost effectiveness, given increasing per-unit costs of savings. This study was meant to address not just the Vermont market, but the situation nationally, across markets in the United States, where efficiency initiatives have been both more and less active in the past.

VEIC commissioned a third-party (Synapse Energy Economics, Inc.) quantitative study of energy efficiency potential through 2030. In **Section III** of this testimony, I summarized the historical findings, indicating that between 2010 and 2016, utility efficiency programs achieved savings that were equivalent to 4.1 percent of national sales in 2016, with a net benefit of $4.1 billion in utility costs.

As a second task, Synapse was asked to project the future potential for cost-effective energy efficiency savings, including a case where the average per-unit cost increases from the historical 2.5 cents per kWh up to 4.5 cents per kWh.[37] These increasing cost assumptions are consistent with the unit cost increases projected in Efficiency Vermont portfolio. The results show that in 2030 the cumulative annual efficiency savings of 5.5 percent of annual sales are based on a "steady state" case, where efficiency programs maintain historic levels of effort. For a "progressive case," where efficiency efforts across the nation steadily ramp up to the level attained by leading states today, the cumulative annual savings in 2030 are equivalent to 14.9 percent of retail sales. The net annual benefits for utility costs realized in 2030 are $5.6 billion for the steady state case, increasing to $9.6 billion for the progressive case.

[37] Synapse Energy Economics, Inc. 2018. *Future Energy Efficiency Market Valuation.* Prepared for Vermont Energy Investment Corporation, June.

Efficiency Vermont results and the separate Synapse study commissioned by VEIC are supported by a 2017 Electric Power Research Institute study.[38] Citing directly from the Executive Summary of that study:

> "In 2014, the Electric Power Research Institute (EPRI) commissioned a study, U.S. Energy Efficiency Potential Study through 2035, to assess the potential energy savings achievable through energy efficiency (EE) and demand response programs in the U.S, across the residential, commercial, and industrial sectors.
>
> The results are based on a bottom-up, stock turnover approach and were presented at both a national and Census division-level, along with three large, individual states: Florida, Texas and California.
>
> The study found a total of 790,639 gigawatt-hours (GWh) of cost-effective electric energy efficiency economic potential economically available from 2012 to 2035, which represents 17.5% of baseline retail sales in 2035."

This estimate of cost-effective potential is consistent with the savings in the progressive case of the Synapse study. I also note that the EPRI report indicates the continuing importance of commercial lighting efficiency,[39] and the ongoing importance of providing incentives for commercial lighting.[40]

Q: Are there specific concerns around the items that you have discussed in this testimony that the Board should watch for?

A: I would say that if EfficiencyOne were not to proactively address the lighting transition in their program planning and future portfolios, that would be a major concern. I have not found this to be the case. My review of the preferred and alternate plans indicates that EfficiencyOne is very aware of the lighting transition issues and the portfolios address the opportunities and strategies I have discussed in this testimony. My findings are that EfficiencyOne is proposing a diversified approach that continues to gain savings from lighting, where appropriate, but also diversifies the savings to maintain a cost-effective portfolio benefiting ratepayers and Nova Scotia's economy.

[38] Electric Power Research Institute, 2017. State Level Electric Energy Efficiency Potential Estimates: 3002009988, Technical Update, May.
[39] EPRI, page 3-3.
[40] EPRI page 6-9.

VII. Recommendations

Q: Please list any recommendations you have for the Board.

A: In this proceeding, I am recommending that the Board commend EfficiencyOne for the proactive approach they are taking to recognizing the lighting transition and the impacts this has on future program planning. The Board should direct EfficiencyOne to keep a discerning eye on remaining opportunities for cost-effective lighting, paying particular attention to ongoing cost-effective savings in C&I markets.

Further, the Board should direct EfficiencyOne to communicate the success and benefits that have come from their historical efficient lighting portfolio, and use strategies that have been effective in lighting. They should apply these to other markets. I would also recommend the Board recognize that because the unit cost of efficiency can be expected to go up in the next three-year portfolio, EfficiencyOne should be expected to maintain a cost-effective portfolio and to get a larger share of savings from non-lighting measures. The lighting transition is not unique to Nova Scotia. The impending decrease in claimed lighting savings does not mean that future energy efficiency portfolios will not be cost effective.

In summary, I recommend the Board continue to consider efficiency as a valuable resource for Nova Scotia's electric power system, and to direct EfficiencyOne to continue in their efforts to translate and build upon the past success with lighting efficiency to capture opportunities in additional technologies and markets. Doing so will create additional value for Nova Scotia's economy, environment, and rate payers.

Q: Does this conclude your testimony?

A: Yes, it does.

David G. Hill, Ph.D.
M
On behalf of Ecology Action Centre
February 26, 2018 **ATTACHMENT A**

David G. Hill, Ph.D.

Curriculum Vitae
Testimony, Presentations, and Publications
February 2019

Expert in advancement of energy efficiency and renewable energy policies and initiatives, including emerging business models for distributed energy resources

Professional Experience

Vermont Energy Investment Corporation (VEIC)

- Director, Distributed Energy Resources, Policy Fellow 2014 – present
- Managing Consultant 2010 – 2014
- Deputy Director, Planning and Evaluation 2008 – 2010
- Senior Consultant 2000 – 2008
- Consultant 1998 – 2000

Tellus Institute and the Boston Center of the Stockholm Environment Institute

- Research Associate 1993 - 1998

Selected Projects (from more than 100)

U.S. Department of Energy. Principal Investigator for a three-year SunShot Initiative Solar Market Pathways study, investigating the technical, regulatory, and business model implications of getting 20 percent of Vermont's total electric supply from solar by 2025.

Sun Shares. Created and launched, and responsible for management and business development of, a community solar business subsidiary to provide "Easy and Affordable Solar for Employers and their Employees," 2015 – present.

New Jersey Clean Energy Program. Program design and policy advisor for the renewable energy program for more than a decade.

Rhode Island Office of Energy Resources. Strategic Advisor on State Energy Plan and System Reliability Procurement and Distributed Generation programs.

Alaska Energy Authority. Principal consultant for two studies on renewable and energy efficiency financing and funding strategies.

New York State Energy Research and Development Authority (NYSERDA). Twice led the renewable energy analysis for 20-year forecast of energy efficiency and renewable energy potential, 2003 and 2012.

World Bank. Expert consultant on a short-term study of efficiency and micro- / mini-grid opportunities in Tanzania, 2014.

Arizona Public Service. Managed a rapid assessment and redesign of PV and solar hot water incentives, 2009.

Testimony as Expert Witness

Expert witness at technical working groups and before commissions on renewable energy and energy efficiency initiatives in Vermont, New York, New Jersey, Maryland, Pennsylvania, and Ontario.

2018 Maryland Public Service Commission. On behalf of Office of People's Counsel on EmPOWER Maryland Utilities Semi Annual Reports. Presentation and testimony, May 3, 2018.

2018 Maryland Public Service Commission. On behalf of Office of People's Counsel on EmPOWER Maryland Utilities Semi Annual Reports. Presentation and testimony, October 25, 2018.

2018 *Becoming an Advanced Solar Economy.* Testimony before the Vermont House Committee on Energy and Technology, Montpelier.

2017 Maryland Public Service Commission. On behalf of Office of People's Counsel on EmPOWER Maryland Utilities 2018-2020 plans. Presentation and testimony, October 25-26, 2017.

2016 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015 Semi Annual (Q3 and Q4) Review.* Presentation and testimony, May 4, 2016.

2015 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015 Semi Annual Review.* Presentation and testimony, October 14-15, 2015.

2014 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015-2017 Utility Proposed Plans.* Presentation and testimony, October 21-22, 2014.

2014 Maryland Office of People's Counsel, EmPOWER Maryland. Evaluation of Semi-Annual Reports - Case Nos. 9153-9157. Presentation and testimony, April 7, 2014.

2013 Pennsylvania Public Utility Commission. On behalf of the Office of Consumer Advocate, regarding Petitions of the Pennsylvania Power Company for Approval of its Act 129 Phase II Energy Efficiency and Conservation Plan (Docket Nos. M-2012-2334395 and M-2012-2334392); Petition of Metropolitan Edison Company (Docket No, M-2012-2334387); and Petition of West Penn Power Company (Docket No. M-2012-2334398). Written testimony. January 8, 2013.

2013 Maryland Office of People's Counsel, EmPOWER Maryland. *Written comments on 2012 Q3-Q4 Semi-Annual Report.* Presentation and testimony, October 2-3, 2013.

2011 Maryland Office of People's Counsel. *Utility-Specific Comments on the 2012-2014 EmPOWER Maryland Program Plans*. Case Nos. 9153-9157. Written testimony. October 19, 2011.

2011 Maryland Office of People's Counsel. *Written Comments on 2010 Annual Reports, and Q4 2010 reports*. Case Nos. 9153-9157. Presentation and testimony. March 31, 2011.

2011 Maryland Public Service Commission. On behalf of the Maryland Office of People's Counsel. *Comments on the 2012-2014 EmPOWER Maryland Utility Program Plans.* October 2011.

2009 Pennsylvania Public Utility Commission. On behalf of the Office of Consumer Advocate, regarding Petition of First Energy Company for Approval of Its Energy Efficiency and

Conservation and Demand Response Plan, Docket No. M-2009-2092222, M-2009-2092112952, and M-2009-2112956. August 7, 2009.

2009 Pennsylvania Public Utility Commission. On behalf of the Office of Consumer Advocate, regarding Petition of Duquesne Light Company for Approval of Its Energy Efficiency and Conservation and Demand Response Plan, Docket No. M-2009-2093217. August 7, 2009.

2005 Ontario Energy Board. On behalf of Green Energy Coalition, regarding Hydro One Networks and Brampton Conservation and Demand Management Plans. February 4, 2005 (written comments) and February 17-18, 2005 (testimony).

2005 Pennsylvania Public Utility Commission. On behalf of Penn Future, regarding net metering standards. Written comments and testimony. June 2005.

2005 Pennsylvania Public Utility Commission. On behalf of Penn Future. Written testimony and comments on interconnection standards. April 2005.

2005 Testimony to the Vermont State Legislature House Committee on Energy and Natural Resources on Vermont's Solar and Small Wind Incentive Program. February 9, 2005.

Selected Presentations

2017 *Sun Shares: Easy and Affordable Solar for Employers and their Employees,* American Solar Energy Society, Solar 2017, Denver, Colorado.

2017 *Vermont Solar Market Pathways,* American Solar Energy Society, Solar 2017, Denver, Colorado.

2016 *Oxymoron: Harmonizing Distributed Energy Integration Realities with Policy Frameworks*. Solar Power International.

2015 World Bank, International Conference on Energy Efficiency in Cities, Puebla, New Mexico. Invited Panel speaker on Efficiency Vermont and Third-Party Administration Model. February.

2015 *Vermont Solar Market Pathways.* Presentations at Solar 2015 (State College, Pennsylvania), and Renewable Energy Vermont Conference (Burlington).

2014 *Renewable Energy Potential Study Results,* NYSERDA, Albany.

2013 *Transformative Energy Planning*. Invited speaker at Innovations in Renewable Energy Symposium, Metcalf Institute for Marine and Environmental Reporting, Narragansett, Rhode Island.

2012 World Renewable Energy Forum, 2012 – Welcome Address and Introduction of Keynote Plenary Speakers. American Solar Energy Society, Denver, Colorado.

2012 *Efficiency Vermont: A Successful Statewide Clean Energy Utility Model.* Presented at the 2012 Business of Clean Energy in Alaska Conference, Anchorage.

2011 Nova Scotia Feed-in Tariff Forum: Invited speaker for two panels addressing Regional Coordination and Export Potential and International Feed-in Tariffs.

2011 *Integrating Renewable Energy and Efficiency Services.* Presentation to the Clean Energy States Alliance Fall Meeting, Washington, DC.

2010 *The Potential for Energy Efficiency and Renewables as Resources in Wholesale Capacity Markets,* Presentation at EUEC 2010 Conference, Phoenix, Arizona.

2008 "Technology and Policy; Getting it Right," Solar Power International: Invited panel speaker. San Diego, California.

2008 *Solar Market Transition in New Jersey: Promise and Progress towards Sustained Growth*. Solar 2008, American Solar Energy Society.

2008 *Review of Efficiency Vermont Administrative Structure and Experience*. Penn Future 2008 Clean Energy Conference, May 2008.

2006 *Scoping Analysis of Potential Photovoltaic Contributions Towards Offsetting Transmission System Upgrades in Southern Vermont.* Solar 2006, American Solar Energy Society.

2006 *Growing New Construction Markets for Photovoltaics: Recent Strategies and Activities from LIPA's Solar Pioneer Program.* Solar 2006, American Solar Energy Society, 2006.

2005 *Market Response to Photovoltaic Incentive Offerings: An Analysis of Trends and Indicators*. Presented at the International Solar Energy Society Solar World Congress, 2005.

2003 *Solar Energy Value and Opportunities in Vermont*, Invited Session Panel Moderator and Speaker, 2nd Annual Power for a New Economy Conference, Burlington, Vermont, October 8, 2003. Renewable Energy Vermont.

2003 *Renewable Energy Case Studies: Redefining the Models, Refining the Messages, and Getting the Word Out*, Invited Session Panel Moderator, Solar 2003 National Solar Energy Conference, Austin, Texas June 22, 2003. American Solar Energy Society.

2002 *Transforming Markets for Customer Sited Clean Renewable Energy: Connecting Field Experience with Lessons from the Efficiency World*, Invited Session Panel Moderator, Solar 2002 National Solar Energy Conference, Reno, Nevada June 18, 2002. American Solar Energy Society.

1997 *IDENTIFY: Improving Industrial Energy Efficiency and Mitigating Global Climate Change.* Software and paper prepared for the United Nations Industrial Development Organization, presented at the 1997 ACEEE Summer Study on Energy Efficiency in Industry.

1997 *E2/FINANCE: A Software System for Evaluating Industrial Eco-Efficiency Opportunities*, sponsored by the U.S. Department of Energy. ACEEE 1997 Summer Study on Energy Efficiency in Industry.

1995 *Process Evaluation of Three Gas Utility Commercial Industrial Demand Side Programs.* Prepared for the Colonial Gas Company, and presented at ACEEE 1995 Summer Study on Energy Efficiency in Industry.

Selected Publications

2018 *Pennsylvania's Solar Future Plan: Strategies to Increase Electricity Generation from In-state Solar Energy.* Pennsylvania Department of Environmental Protection, November. Led the VEIC team that conducted the scenario modeling presented in the report.

2017 Smart Electric Power Alliance, 51st State Initiative, *Role of Utilities in the Transforming Energy Economy of the 51st State*, September 2017.

2016 *Vermont Solar Market Pathways: From a Developed to an Advanced Solar Economy*. A Phase II Roadmap document prepared for the *Smart Electric Power Alliance 51st State Initiative*.

2016 *Vermont Solar Market Pathways,* Vols. 1-4. U.S. Department of Energy, Sun Shot Initiative, Office of Energy Efficiency and Renewable Energy. Award DE-EE-0006911. www.Vermontsolarpathways.org.

2016 *Energy Efficiency Program Evaluation and Financing Needs Assessment*. Report prepared for the Alaska Energy Authority, May 2016.

2015 *Michigan Renewable Resource Assessment*. Final Report, prepared for the Michigan Public Service Commission Staff under agreement with the Clean Energy States Alliance. April 2015.

2012 *Renewable Energy Grant Recommendation Program: Process and Impact Evaluations.* Principal in Charge for comprehensive two-volume study. Alaska Energy Authority.

2011 "Solar in Nepal: Small Systems, Big Benefits." *Solar Today.* July / August 2011.

2011 "National Clean Energy Standard: Congress Needs to Design It Properly." Perspective with Shaun McGrath and Jeff Lyng. *Solar Today.* July / August 2011.

2010 "National RPS Now!" *Solar Today*. July / August 2010.

2009 "Carbon Regulation: What's the Most Effective Path?" *Solar Today*. June 2009.

2009 "Policy Recommendations for the 111th Congress: Tackling Climate Change and Creating a Green Economy." Prepared by the American Solar Energy Society Policy Committee.

2008 "Pennsylvania Solar Assessment." Final Report, November 25, 2008. Incorporated into American Council for an Energy-Efficient Economy, *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania.* ACEEE Report No. E093. Washington, DC: ACEEE, April 2009.

2008 "Solar Market Transition in New Jersey: Promise and Progress towards Sustained Growth." *Proceedings of Solar 2008*, American Solar Energy Society.

2004 "Cost Effective Contributions to New York's Greenhouse Gas Reduction Targets from Energy Efficiency and Renewable Energy Resources." *Proceedings of 2004 ACEEE Summer Study on Energy Efficiency in Buildings.*

2002 "The Ten Percent Challenge: A Participatory Community Scale Climate Campaign." *Proceedings of 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Volume 9, (with Tom Buckley, Jennifer Green, and Debra Sachs).

2000 "Implementing and Monitoring Community-Based Climate Action Plans." *Proceedings of 2000 ACEEE Summer Study on Energy Efficiency in Buildings.* Volume 9, pp. 149-160 (with Tom Buckley, Mark Eldridge, Debra Sachs, and Abby Young).

1998 *Eco-Efficiency Financing Resource Directory*. Electronic web-site, and printed directory prepared for the Environmental Protection Agency, Region I, New England.

Leadership

2017 – present Energy Coop of Vermont, Board Member and Treasurer.

2013 Solar 2013, "Power Forward, Baltimore Maryland." Chair of Conference Advisory Committee responsible for recruiting and coordinating four main conference plenary sessions.

2012 – 2013	American Solar Energy Society (ASES), Chair of the Board.
2012	Policy Track Chair for the World Renewable Energy Forum, Denver, Colorado, May.
2009 – 2012	ASES Policy Committee, Board Member and Chair.
2007	Vermont Governor's Climate Change Committee, Member of the Plenary Working Group.
2000 – 2010	Renewable Energy Vermont, Founding Board Member, Past Board Chair.

Regulatory and Other Governmental / NGO Documents

2000 – 2012	*New Jersey's Clean Energy Programs – Honeywell Team Program Plans.* Led team on designing and implementing of Renewable Energy Program plans and initiatives. Many program plans and strategies for transition to market-based incentives.
1998 – 2008	*Long Island Power Authority's Clean Energy Initiative.* Lead Technical and Senior Advisor on Renewable Energy Plans, including the Solar Pioneer Initiative and Residential Energy Efficiency Programs.
2000	*The Climate Action Plan: A Plan to Save Energy and Reduce Greenhouse Gas Emissions*, Lead author for the Burlington (Vermont) Climate Protection Task Force.
1998	*Home Weatherization Assistance Program Environmental Impact Analysis*. Prepared for the Ohio Department of Development, Office of Energy Efficiency.
1997	*Achieving Public Policy Objectives Under Retail Competition: The Role of Customer Aggregation*. Prepared for the Colorado Governor's Office of Energy Conservation.
1997	*IDENTIFY: Improving Industrial Energy Efficiency and Mitigating Global Climate Change*, software and paper. For the United Nations Industrial Development Organization.
1997	*Review of the Swaziland Energy Information System and Report on LEAP Training Activities*. Prepared for the Ministry of Natural Resources and Energy, Government Kingdom of Swaziland.
1996	*Evaluation of the IDB's Policies and Practices in Support of Renewable Energy and Energy Efficiency: A Report to the Inter-American Development Bank*. Brower and Company and Tellus Institute.
1996	*Action Plan for the Massachusetts' Industrial Services Program (ISP)*, prepared for the Sustainable Industries Initiative of the Corporation for Business Work and Learning.
1995	*Framework for National Energy Planning: Mission Report*, The Republic of Maldives. United Nations Department for Development Support and Management Services.
1994	*The SEI / UNEP Fuel Chain Project: Methods, Issues, and Case Studies in Developing Countries. Venezuela Case Study*.
1994	*Future Energy Requirements for Africa's Agriculture (Sudan Case Study)*. Report to the African Development Bank by the UN Food and Agriculture Organization.
1994	Report to the Idaho Public Utility Commission on Suggested Cost Allowances for the Idaho Power Company's DSM Programs. Prepared for the Idaho Public Utilities Commission, Tellus Report No. 94-177.

1994 Review of Pennsylvania Electric Company's 1995 Demand Side Management Filing. Prepared for: Pennsylvania Office of Consumer Advocate. Tellus Study No. 94-071.

1994 Review of Union Electric Company's Electric Utility Resource Planning Compliance Filings. Prepared for: The Missouri Office of Public Counsel. Tellus Study No. 93-300.

1994 *Incorporating Environmental Externalities in Energy Decisions: A Guide for Energy Planners*. A Report to the Swedish International Development Agency. SEI-B Report No. 91-157.

Education

Ph.D., University of Pennsylvania, Energy Management and Policy Planning, 1993.

- Fulbright Scholar: Research on energy decision-making in rural Nepal, 1991 – 1993.

Master's, University of Pennsylvania, Appropriate Technology and International Development, 1989.

B.A., Middlebury College, Geography and Political Science, 1986.

Other Qualifications

Nepal, Himalayan Light Foundation. Installed solar lighting systems in 3 remote health clinics and 3 homes, 2010.

Advanced PV Installation certificate. Solar Energy International, 2010.

Peace Corps volunteer. Sierra Leone, 1984 – 1986.

Languages

- Nepali: ILR Level 3, speaking; ILR Level 2, reading
- Krio and Mende (Sierra Leone): ILR Level 2, speaking

Software competency

- LEAP (Long-range Energy Alternatives Planning System), Stockholm Environment Institute. Former trainer and current Principal Investigator of team using scenario modeling on three projects.
- NREL System Advisor Model. Financial and technical modeling tool for renewable energy systems.

David G. Hill, Ph.D.
M
On behalf of Ecology Action Centre
February 26, 2018

Testimony of David Hill, Ph.D.

Attachment B

Support from Other VEIC Staff for This Testimony

The testimony presented here has been supported by the following VEIC staff persons. The primary statement describes their respective roles in this testimony; the subsequent descriptions contain further information about work experience.

- **Emily Levin, Managing Consultant, Energy Services:** Experience from other jurisdictions in energy efficiency lighting program trends and analysis, and diversification of portfolios.
    - **Areas of expertise and projects.** Emily provides energy efficiency and renewable energy program design, planning, and implementation support services for utility and state government customers. She is an expert in next-generation energy efficiency program models, including behavioral and upstream program designs. Her team specializes in designing program models of market transformation in energy efficiency. She leads VEIC's Pay for Performance project with the New York State Energy Research and Development Authority (NYSERDA). Emily led a team that recommended new goals for EmPOWER Maryland, led comprehensive strategic review of a Florida utility, and has reviewed efficiency programs in New Jersey and Prince Edward Island.
    - **Background at VEIC.** She joined VEIC in 2007, leading strategic planning for the residential portfolio of Vermont's energy efficiency utility, Efficiency Vermont. She also managed Efficiency Vermont's Existing Homes Program, prior to joining VEIC's Consulting division.

- **Pierre van der Merwe, Director, Data & Technical Services:** Program analytics, and lighting metrics and data trends, and portfolio analytics
    - **Areas of expertise and projects.** Pierre is a national leader in high-performance, comprehensive-energy technical operations, with specific expertise in the sustainable energy market. He leads VEIC's team of 40 staff responsible for evaluation, measurement, and verification activity; business and customer intelligence; advanced metering infrastructure; third-party data integration; and software development. In addition to building the technical resources for carrying out custom projects in the Commercial and Institutional market, he assists in program design for prescriptive energy efficiency measures for commercial and residential markets. He oversees and is responsible for all of these functions for VEIC's three sustainable energy utilities (the District of Columbia Sustainable Energy Utility, Efficiency Vermont, and Efficiency Smart in Ohio), and the VEIC Consulting Department.

- **Other expertise.** Pierre also leads the data integrity and infrastructure integration of VEIC's Technical Reference Manuals and their software applications, energy efficiency and renewable energy savings claims, and technical and regulatory verification. His work is critical to VEIC's turnkey participation in three regional transmission organizations' capacity markets, on behalf of ratepayers in the District of Columbia, Vermont, and Ohio.

- **Jay Pilliod, Scenario Planning Director, Efficiency Vermont:** Program design and planning information related to lighting and non-lighting measures
  - **Expertise and projects.** Jay leads his team in creating strategic plans for Efficiency Vermont's markets for long-term market transformation. Jay helped establish Green Revolving Funds for colleges and universities, ensuring that institutions have the financial capacity to make energy efficiency investments, relieving constraints such as enrollment and endowment performance. His leadership has led to the establishment of building performance standards recognized by Vermont hospitals, with services and resources that support all Vermont hospitals in meeting or exceeding their building standards. Jay has overseen the planning and outreach initiatives for the hospitality market. Jay has led strategic planning management teams, and supported the State of Vermont's *Comprehensive Energy Plan,* Project Green School, and the Green Grocer Brand.
  - **Background.** Prior to being named Scenario Planning Director for Efficiency Vermont, Jay was Director of Strategy and Planning. He began his career at VEIC as the Director of Business Energy Services, overseeing VEIC's C&I engineering projects.

- **Frances Huessy, Senior Technical Writer:** Substantive editing, fact-checking, and content alignment with testimony objectives.
  - **Expertise and projects.** Frances is a career editor / writer, and a member of VEIC's Strategy, Policy, and Public Affairs department. She leads or contributes to large proposals, policy position papers, research, plans, reports, testimony, and other essential documents. She has supported Dr. Hill in many publications, including the *Vermont Solar Market Pathways* reports, and VEIC's entry in the Smart Electric Power Alliance's *51st State* Phase II proposals. She supported the successful bid for a 5-year, $96 million contract with the District of Columbia to provide providing sustainable energy services.
  - **Other background.** She is the author, co-author, or editor of more than 70 publications, including peer-reviewed articles and books in the academic press. She has a Master's degree in Professional Writing from the University of Southern California, and holds a Certificate in the Editing of Historical Documents from the National Historical Publications and Records Commission (National Archives and Records Administration).

Appendix E

Evidence of Glenn Reed

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NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF THE PUBLIC UTILITIES ACT

- and -

IN THE MATTER OF AN APPLICATION BY EFFICIENCYONE

Direct Testimony of

Glenn Reed

Energy Futures Group

On Behalf of

EFFICIENCYONE

February 27, 2019

DATE FILED: February 28, 2019

I. Identification

Q: Please state your name

A: My name is Glenn Reed. I am a Partner at Energy Futures Group (EFG), an energy efficiency and renewable energy consulting firm which is headquartered in Hinesburg, Vermont USA.

Q: On whose behalf are you testifying.

A: I am testifying on behalf of EfficiencyOne, which operates Efficiency Nova Scotia, the efficiency provider franchisee in Nova Scotia. The Efficiency Nova Scotia franchise is a public utility regulated by the Nova Scotia Utility and Review Board, which approves agreements between Nova Scotia Power and EfficiencyOne on the level of demand side management (DSM) activity.

Q: Please describe your education and work experience.

A: I have a Bachelor of Arts in Biology from Wesleyan University and a Master of Science in Energy Management and Policy from the University of Pennsylvania.

Prior to co-founding Energy Futures Group in 2010, I was a Managing Consultant at the Vermont Energy Investment Corporation (VEIC) from 2005 to 2010, Director of Regional Initiatives and Residential Program Manager at the Northeast Energy Efficiency Partnerships (NEEP) from 2001 to 2005, Deputy Director of East Coast Consulting at XENERGY (now part of DNV GL) from 1987 to 2000, and a Principal Planner at the Massachusetts Executive Office of Energy Resources from 1983 to 1987.

My current responsibilities include serving for the past decade as the lead Residential Consultant to the Connecticut Energy Efficiency Board. I am also a consultant to the Massachusetts Energy Efficiency Advisory Council and to the Rhode Island Energy Efficiency Resource Management Council. In these two states, I work with the respective states' DSM Program Administrators (PAs) on their residential new construction, demand response, lighting, appliances, consumer electronics, electric and gas HVAC and DHW, and behavioural programs.

Mostly recently, my engagement on HVAC and DHW has included fuel switching and strategic electrification. Each of these three states is a recognized leader in DSM program implementation.

I have also been involved in the development or critical review of over 25 potential studies throughout North America, including managing an all sector potential study for Prince Edward Island.

A full copy of my CV is attached.

Q. Have you appeared before this or other regulatory boards?

A. I submitted testimony and appeared before the Nova Scotia Utility and Review Board in 2011, on behalf of the Ecology Action Centre.[1] Additionally, I have appeared before regulatory boards, provided written testimony or evidence to, or played a significant role in the preparation of testimony or evidence for proceedings in Ohio, Maine, Louisiana (New Orleans), Massachusetts, Oklahoma, and Connecticut.

II. Introduction and Summary

Q: Please summarize your testimony, and primary findings.

A: The analysis presented below supports the contention that EfficiencyOne's proposed budget in its Preferred 2020-2022 DSM Plan is affordable, will lower the long-term costs of power generation in Nova Scotia, generate significant bill savings to many customers, and will have little long-term impact on rates.

More specifically, from 2020 to 2035 EfficiencyOne's proposed three-year investment of $129.1 million dollars will:[2,3]

- Generate $494 million in net lifetime avoided cost benefits for Nova Scotia Power.
- Provide $477 million in customer bill savings.

[1] Evidence of Glenn Reed, Energy Futures Group. On behalf of the Ecology Action Centre. E-ENSC-R-10. April 8, 2011.
[2] EfficiencyOne as Holder of the Efficiency Nova Scotia Franchise. Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan. February 28, 2019.
[3] EfficiencyOne 2020-2022 DSM Resoruce Plan Filing. Appendix A. DSM Resource Plan. February 28, 2019.

- From Nova Scotia Power's perspective, yield 4.8 dollars for every dollar invested in DSM over the lifetime of the installed measures.
- From a total resource cost perspective, which includes participating customer costs, yield 2.0 dollars for every dollar invested in DSM over the lifetime of the installed measures.
- Yield average 2020-2035 rate impacts that vary from 0.8% to 1.7%, depending on the rate class.
- More importantly, generate average participant bills reductions of 1-11%, depending on the rate class, with participating residential customers seeing an average 11% bill reduction. While nonparticipants will, on average, see their bills increase by 1.1% or less.
- Nonparticipant rate and bill impacts are further mitigated by the high participation rates in EfficiencyOne programs. For several rate classes, it is assumed that there are no nonparticipants, i.e., there is 100% participation among customers in that rate class and no nonparticipant bill impacts.

Additional analysis conducted for this evidence benchmarked EfficiencyOne's planned DSM activities against filed plans of other, leading North American efficiency program administrators. This benchmarking looked at EfficiencyOne's savings and budgets and compared them to these other program administrators using the following metrics:

- Savings as percentage of annual sales
- DSM expenditures as a percentage of utility revenues
- Cost of saved energy
  - $/annual kWh saved
  - $/lifetime kWh saved

This benchmarking was done to assess where EfficiencyOne falls compared to its North American peers on commonly used benchmarking metrics. This allows for an assessment of the reasonableness of EfficiencyOne's proposed savings goals and spending levels.

III. DSM Program Benchmarking

Q: Please describe in more detail this benchmarking effort.

A: EFG identified and reviewed DSM plans from several leading North American DSM program administrators. These PAs were identified in one of two ways, both tied to reports generated by the American Council for an Energy Efficient Economy.

First, we examined the top 10 states listed in ACEEE's 20017 State Efficiency Scorecard.[4] For each of these states, we identified one or more leading PAs to include in the benchmarking. Second, we reviewed ACEEE's 2017 Utility Energy Efficiency Scorecard and identified the top 10 ranked utilities.[5] As Table 1 shows, there was, not surprisingly, some significant overlap between the two Scorecards.

In addition to the utilities listed in Table 1, we also considered non-utility PAs like Efficiency Vermont that were excluded from the ACEEE Utility Efficiency Scorecard. The Utility Energy Efficiency Scorecard was restricted to utilities with a retail distribution function and did not include efficiency utilities.

[4] Berg, W, et. al. 2017 State Energy Efficiency Scorecard. American Coalition for an Energy Efficiency Economy. Washington. D.C. June 2017.

[5] Relft, G., Baatz, B., and Nowak, S. 2017 Utility Energy Efficiency Scorecard. American Coalition for an Energy Efficiency Economy. Washington. D.C. June 2017.

Table 1

Program Administrators used in EfficiencyOne Benchmarking

State	Utility	Name Used in Figures	ACEEE Top 10 Utility	ACEEE Top 10 State	Data Available for:		
					2020	2021	2022
MA	Eversource	Eversource – MA	X	X	X	X	
MA	National Grid	NGRID – MA	X	X	X	X	
CA	Pacific Gas and Electric		X	X			
RI	National Grid	NGRID - RI		X	X		
VT	Efficiency Vermont			X			
CT	Eversource	Eversource - CT	X	X	X	X	
NY	NYSERDA			X			
OR	Portland General Electric		X	X			
MN	Xcel MN		X	X			
WA	Puget Sound Energy Inc			X			
MD	Baltimore Gas and Electric	BGE	X	X	X		
CO	Public Service of Colorado	PSCO	X		X		
IL	Commonwealth Edison	Com Ed	X		X	X	

The rows that are highlighted in tan are program administrators that were included in the benchmarking as there were forward-looking DSM plans available. For the other listed states and/or program administrators we could not readily find planning documents that overlapped, in whole or in part, with EfficiencyOne's 2020-2022 Preferred Plan timeframe.

Q: Why did you use forward-looking savings and budget projections, and not historic data, for this benchmarking?

A: We believe that is important to use comparable data that overlaps with EfficiencyOne's 2020-2022 Plan timeframe in comparing metrics across PAs. As Dr. David Hill of Vermont Energy Investment Corporation detailed in his testimony, there are significant changes underway in the landscape for efficient lighting and these changes will affect portfolio level costs and savings.[6] Due to a combination of factors including falling prices, improved product performance, and U.S. federal product efficiency standards (as uncertain as they may be at this time), lighting will be a smaller part of EfficiencyOne's portfolio, particularly in the Residential sector. To maintain savings at or above historic levels will require EfficiencyOne to diversify its portfolio, including pursuing efficiency activities that are likely to have higher costs than lighting.

Other program administrators face similar challenges in developing plans that acknowledge the changing contribution of lighting to DSM portfolios. To ensure that we compared efficiency metrics that had underlying commonalities, we determined that it was most appropriate to only compare the EfficiencyOne Plan to plans of other PAs in the same 2020-2022 timeframe. Unfortunately, this constraint limited the number of plans that we could locate for this benchmarking exercise.

Note that for those non-EfficiencyOne PAs for which forward-looking plan data were available, these data were only available for 2020 or for both 2020 and 2021. None of the non-EfficiencyOne plans covered 2022.

Finally, we note one caveat to the use of forward-looking data in the benchmarking. We used 2017 sales and revenue data as the denominator, respectively, for the savings as a percentage of sales and DSM budget as a percentage of revenue metrics for all of the benchmarked PAs. 2020-2022 projections for these values were even less readily available than were the DSM plan savings and budget values. 2017 reported sales and revenues were the most current data that were available for all of the benchmarked PAs.

Note that using 2017 Nova Scotia sales and revenue data results in some very small variations in the values of the metrics reported in this evidence compared to those reported in the filed 2020-2022 DSM Plan. We believe that these small differences do not reduce the value of the benchmarking analysis.

Q: Then are the available non-EfficiencyOne plans directly comparable in all other ways to the filed EfficiencyOne 2020-2022 Plan?

[6] Direct Testimony of Dr. David Hill, Vermont Energy Investment Corporation. In the Matter of the Public Utilities Act and in the Matter of an Application by EfficiencyOne. February 28, 2019.

A: Not necessarily, for the reasons discussed below. Nonetheless, these caveats do not significantly diminish the value of undertaking such a benchmarking exercise, particularly in assessing whether any of the EfficiencyOne metrics are outliers compared to the benchmarking peer group.

Q: Please describe some of the factors that might contribute to varying planning and program assumptions, as well as other considerations in benchmarking metrics across PAs.

A: Listed below are several program design, implementation, and planning considerations that should be considered when comparing benchmarking metrics across PAs.

- **Support of delivered fuel efficiency activities**. Many PAs in the Northeast US use electric DSM funds to support delivered fuel efficiency efforts, particularly in their low-income and residential sector programs. These activities will raise the electric cost of savings as program budget is expended for activities that do not yield electricity savings.
- **Annual vs. Lifetime savings**. Annual cost of savings metrics can be skewed by measures with short measure lives, most notably by residential behavior efforts.
- **Low income program activity.** The extent of low-income program funding may have an impact on cost of savings. Incentives for low-income programs are typically at or near full measure cost. As a result, low-income programs have a high cost of saved energy compared to most other programs in a PA's portfolio. Higher proportional amounts of low-income program activity will tend to raise the cost of savings at the portfolio level.
- **Residential vs. C&I program spending**. Residential programs usually have higher costs of savings given higher per participant transaction costs and lower hours of use compared to commercial programs and measures. PAs providing greater proportions of efficiency services to the residential sector will tend to have higher overall portfolio-level costs of saved energy.
- **Depth of Savings.** Deeper and/or more comprehensive savings may require higher incentives (as a percent of incremental cost) to induce greater participation and more comprehensive measure uptake.
- **Presence of residential behavioral programs**. Residential behavioral programs typically have low annual (but high lifetime) costs of savings. For some PAs these programs represent a significant portion of their residential sector savings, potentially lowering portfolio-level annual costs of saved energy.
- **Differences in how energy savings are determined**. Program administrators in different jurisdictions may claim different savings for the same measure. Some of these differences may reflect actual variations in net measure savings due to differences in parameters like hours of use, net-to-gross ratios, or heating and cooling degree days, but some may reflect different evaluation cycles and the use of potentially dated planning assumptions.

- **Program Administrator Size**. Economies of scale may be achieved when delivering DSM programs. These economies may also be attained, or amplified, through statewide program implementation, including coordinated statewide electric and gas DSM program delivery, as is in place in Massachusetts and Connecticut.
- **Program Maturity**. Well established programs may have lower administrative costs compared to a PA that is still ramping up their DSM efforts. However, they may also have higher costs of savings as programs mature since inexpensive "low-hanging fruit" savings may represent a smaller proportion of their program activities.
- **Provision of Account Management and Technical Services**. For C&I customers, particularly larger ones, providing focused account management and technical services may allow a PA to attain significant savings from these customers at potentially lower incentive costs.

Q: What are the results from your benchmarking?

A: First, it is important to put EfficiencyOne's proposed savings levels into context relative to its benchmarked peers. As can be seen from Figures 1 and 2 below, EfficiencyOne's 2020 and 2021 savings as a percent of sales of 1.4% is equal to or considerably lower than its peers with the exception of Eversource CT. In comparison to EfficiencyOne's savings levels, several PAs are projected to attain savings at or above 1.5%, with the two benchmarked MA PAs planning to achieve savings in excess of 2.0%in both years.

Figure 1

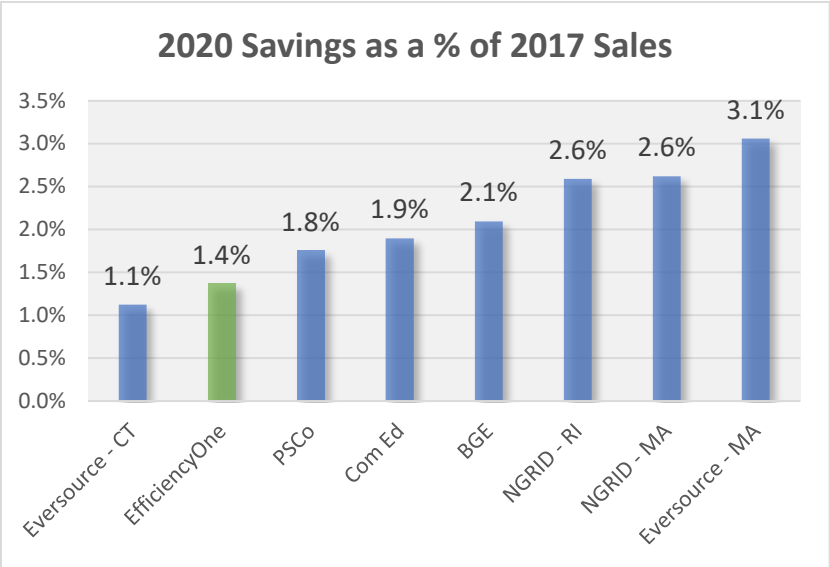
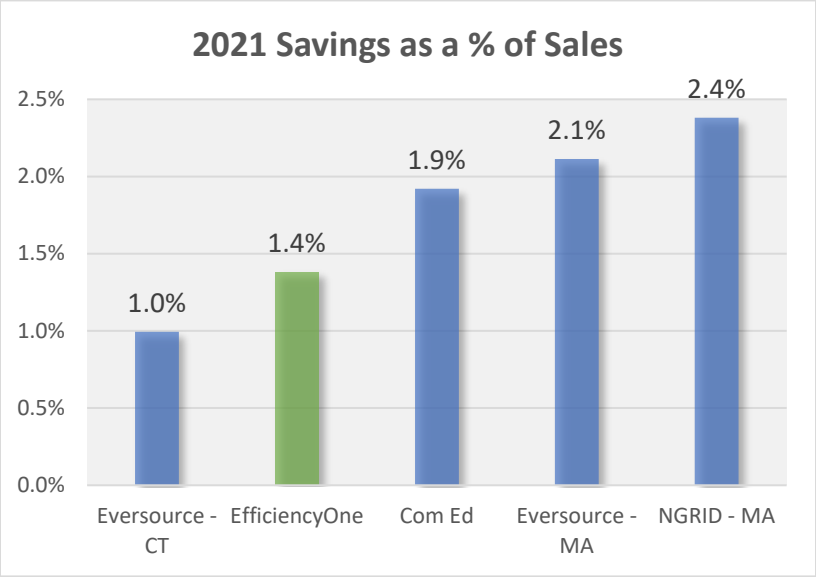


Figure 2



To achieve these savings, all of the non-EfficiencyOne benchmarked PAs propose spending 4% or more of revenue in 2020 and 5% in 2021, with the MA PAs spending in excess of 12% in both 2020 and 2021 (Figures 3 and 4). Eversource Connecticut, which has savings levels most comparable to EfficiencyOne, has proposed spending in excess of 5% in both 2020 and 2021. In comparison, EfficiencyOne is proposing spending as a percent of 2017 revenues of approximately 3%.

Figure 3

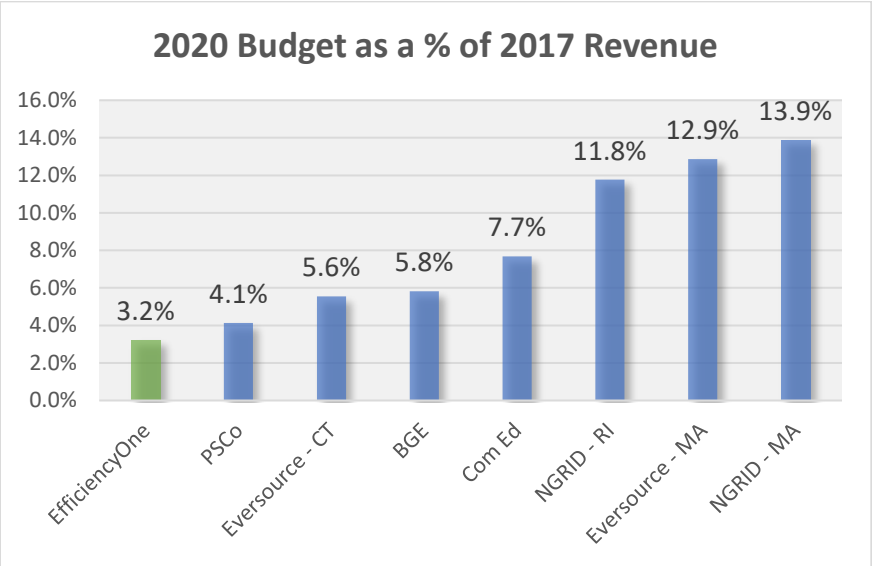
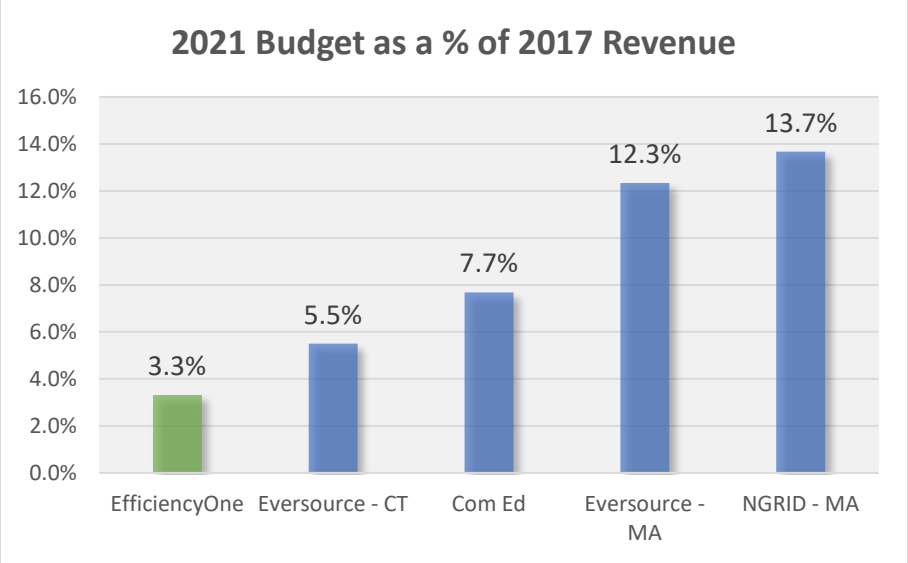


Figure 4



One of the most useful benchmarking metrics is the cost of saved energy: comparing program expenditures to program savings. This metric can be presented based on annual savings and on lifetime savings.

Figures 5 and 6 present the annual cost of saved energy ($/annual kWh) metrics. Using this metric, EfficiencyOne appears to track more closely with the non-New England PAs. The New England PAs all track at $0.60/kWh or higher compared to $0.30 and $0.31/kWh for

EfficiencyOne in 2020 and 2021, respectively. EfficiencyOne's annual cost rates are projected to be slightly higher than the non-New England PAs which project cost rates of $0.28-$0.29/kWh.[7]

Figure 5

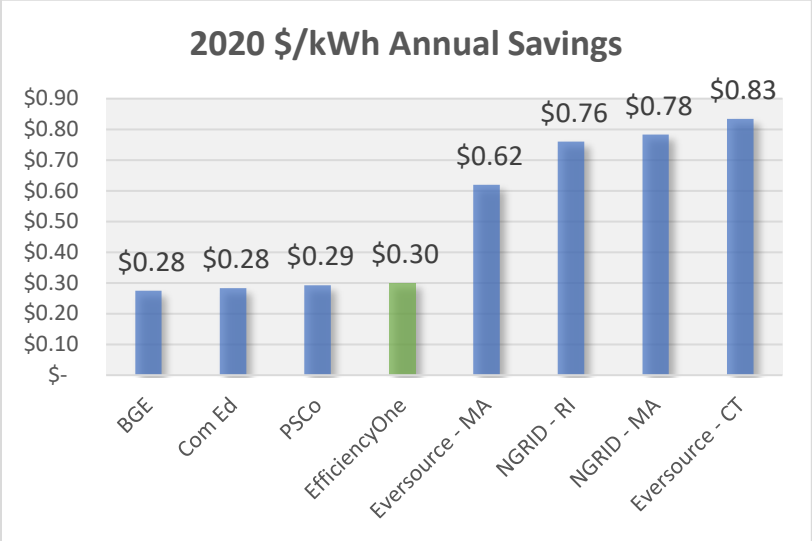
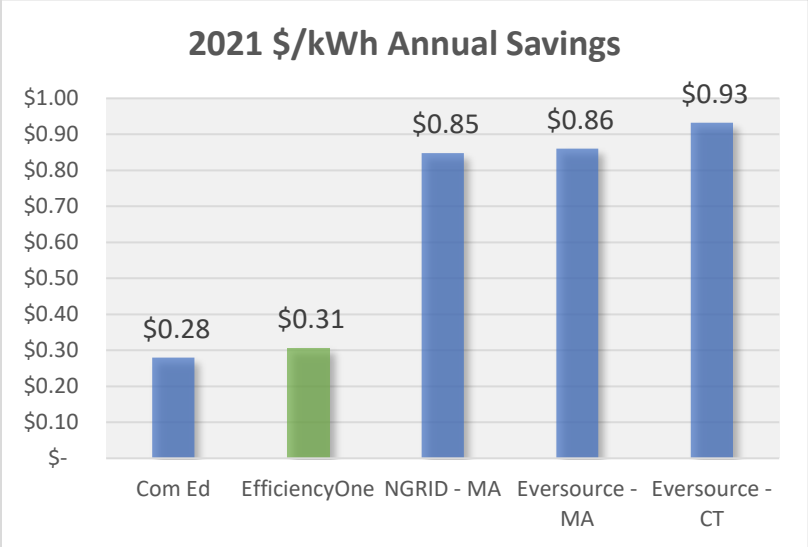


Figure 6



[7] US dollars were converted to Canadian dollars at a conversion rate of $1.32 Canadian to $1.00 US.

From a lifetime cost rate perspective (Figures 7 and 8), EfficiencyOne had the lowest $/lifetime kWh at $0.02/kWh. In comparison to the highest lifetime cost rate PAs, EfficiencyOne's $/lifetime cost is projected to be one-third to one-quarter of those values.

Figure 7

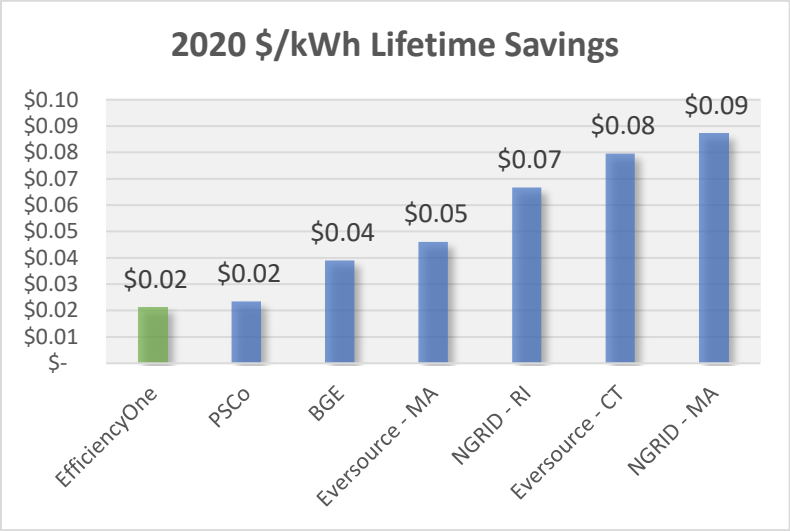
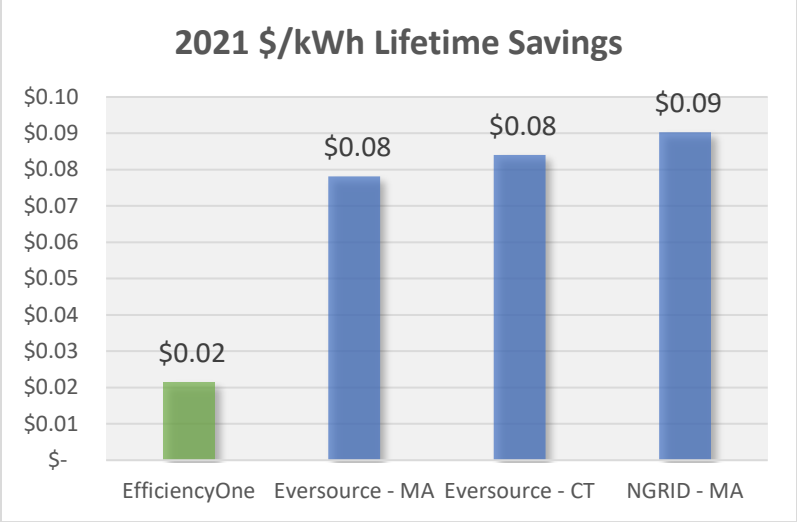


Figure 8



Q: Can you summarize your benchmarking findings?

A: Based on the available 2020 and 2021 data, EfficiencyOne's DSM savings and budget expenditures are projected to largely be at or below its North American peer group. In particular, its cost of saved energy values, both annual and lifetime, were several-fold lower than several of the leading North American PAs, which have projected lifetime cost rates approaching as high as $0.09/kWh compared to EfficiencyOne's lifetime cost rate of $0.02/kWh.

IV. Rate and Bill Impacts

Q: What are the expected rate and bill impacts of EfficiencyOne's proposed 2020-2022 DSM expenditures?

A: I will only summarize the high-level takeaways from the comprehensive and detailed Long-Term Rate and Bill Impact Analysis that EfficiencyOne has filed as part of its 2020-2022 DSM Plan.[8]

In considering rate and bill impacts it is important not to overly focus on rate impacts, though these are fairly small across all of Nova Scotia Power's rate classes. It is more appropriate to focus on bill impacts as these reflect the out of pocket cost to Nova Scotia ratepayers. That is, what will the average Nova Scotia Power customer spend on their electricity bill because of EfficiencyOne's investment in DSM? Bill impacts are a function of monthly kWh usage times the rate per kWh.[9] For the average Nova Scotia Power customer the small increase in rates over the analysis's 2020-2035 timeframe is significantly offset by the reduction in energy usage due to participation in the EfficiencyOne DSM programs.

Figure 9 shows the rate and bill impacts of the Preferred 2020-2022 DSM Plan. The figure shows expected rate impacts under the Preferred Plan for all customers. Bill impacts are shown for DSM program participants, for non-participants, and for all ("Total") customers within a rate class. Over the 16-year study period, rates increase an average of 0.8% to 1.7%, depending on the rate class. For bill impacts, the Rate and Bill Impact Analysis provides the following summary:

> The analysis shows that between 2020 and 2035, participants in 2020-2022 DSM programs under the Preferred Plan will see average bill reductions between 1% (Medium and Large Industrial) and 11% (Residential). The average bill impact for non-participants over this period is an increase of 0.5% (Medium Industrial) to 1.1% (Large

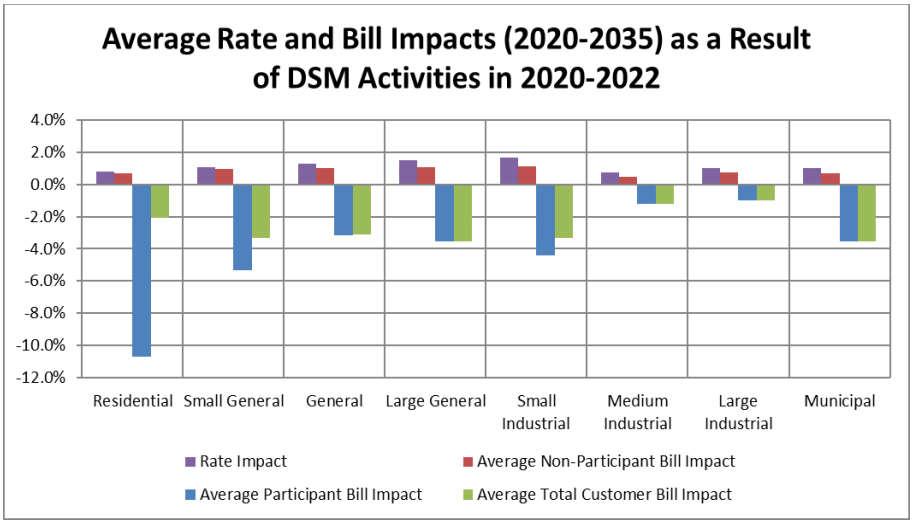
[8] EfficiencyOne as Holder of the Efficiency Nova Scotia Franchise. Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan. February 28, 2019.

[9] Some BNI customers also have a demand component to their bills. The EfficiencyOne Rate and Bill Impact Analysis assumed that all rate and bill impacts will be captured in the energy ($/kWh) charge.

General and Small Industrial). Over the study period, NS Power customers will save over $475 million as a result of 2020-2022 DSM programming.[10]

Further, average bill savings for total customers will range from 1% to 3.6%, depending on rate class and total $477 million based on an investment of $129.1 million.

Figure 9



V. Portfolio and Program Cost Effectiveness

Q: From a total resource cost (TRC) and program administrator cost (PAC) perspective, are the proposed programs cost effective?

A: Yes, from both perspectives the proposed 2020-2022 Preferred Plan is clearly cost effective. The TRC benefit-cost ratio (BCR) is 2.0 and the PAC BCR is 4.8. Individual programs have projected TRC BCRs ranging from 1.0 to 2.4. PAC program-level BCRs range from 2.2 to 7.4.

Ratepayer net benefits, based on net avoided cost savings, total $494 million over the 2020-2035 timeframe.

VI. Summary and Conclusion

Q: Given the analyses presented above, do you conclude that EfficiencyOne's proposed Preferred Plan is affordable?

[10] Pp18-19, ibid.

A: Yes. EfficiencyOne is proposing to achieve its Plan savings at or below many of its peer PAs on a percentage spending basis and on an annual and lifetime cost rate basis. In doing so it will create minimal rate impacts of 0.8% to 1.7%, depending on rate class, while providing bill savings totaling $477 million over the 2020 to 2035 analysis period.

Benchmarking References

2019-2021 Conservation & Load Management Plan. Connecticut's Energy Efficiency and Demand Management Plan. November 1, 2018.

Baltimore Gas and Electric (BGE) 2018-2020 EmPOWER MD Program Filing. September 1, 2017.

Commonwealth Edison Company's 2018 – 2021 Energy Efficiency and Demand Response Plan. June 30, 2017.

Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan. October 31, 2018.

National Grid (Rhode Island) 2018-2020 Energy Efficiency and System Reliability Procurement Plan.

Public Service Company of Colorado 2019/2020 Demand-Side Management Plan - Electric and Natural Gas (Publicly filed but not yet approved). February 8, 2019.

GLENN REED, PRINCIPAL

EDUCATION

M.S., Energy Management and Policy, University of Pennsylvania, 1982
B.A., Biology, Wesleyan University, 1979

EXPERIENCE

2010-present: Principal, Energy Futures Group, Hinesburg, VT
2005-2010: Managing Consultant, Vermont Energy Investment Corporation, Burlington, VT 2001-2005: Dir. of Regional Initiatives, Northeast Energy Efficiency Partnerships, Lexington, MA
1987-2000: Deputy Dir. of East Coast Consulting, XENERGY, Inc. (now DNV GL), Burlington, MA
1983-1987: Principal Planner, Massachusetts Executive Office of Energy Resources, Boston, MA

PROFESSIONAL SUMMARY

Glenn Reed has more than 30 years of experience in demand-side management (DSM) program planning and evaluation; energy-efficiency policy development and implementation; building codes and appliance standards development; and group facilitation and consensus building. For the last ten years, he has been the lead Residential Technical Consultant to the Connecticut Energy Efficiency Board. Mr. Reed is also a lead residential advisor to the Massachusetts Energy Efficiency Advisory Council and to the Rhode Island Energy Efficiency Resource Management Council. For both Councils, he assists and oversees program design and implementation of residential lighting, new construction, fuel switching, appliance, HVAC/DHW, and consumer electronics programs. Prior to co-founding EFG, Mr. Reed was a Managing Consultant at the Vermont Energy Investment Corporation, Director of Regional Infinitives at the Northeast Energy Efficiency Partnerships (NEEP), Deputy Director of East Coast Consulting at XENERGY (now DNV GL) and principal analyst and the Massachusetts Executive Office of Energy Resources. At NEEP, Mr. Reed oversaw the development and implementation of the residential upstream lighting initiative that became the model for most of North America's current upstream lighting efforts.

SELECTED PROJECTS

- ***Connecticut Energy Efficiency Board (EEB).*** Leads residential team to provide oversight of the state's electric and gas residential efficiency programs. Works closely with the state's utilities to develop, implement, and evaluate cost-effective program designs and goals for the Three-Year Conservation and Load Management Plan. Also plays a key role in the scoping and review of residential program evaluation activities.
- ***Rhode Island Energy Efficiency Resource Management Council.*** Senior Advisor providing on-going technical and programmatic advice to, and oversight of, Rhode Island's residential efficient products (lighting, appliances and consumer electronics) and HVAC programs. Works closely with National Grid staff to develop cost-effective program designs and goals for their energy efficiency plans.

GLENN REED, PRINCIPAL

- *Massachusetts Energy Efficiency Advisory Council.* Provides on-going technical and programmatic advice to, and oversight of, the Massachusetts gas and electric program administrators' residential efficient products (lighting, appliances and consumer electronics) and HVAC programs. This includes review of key screening tool inputs and development of three-year program savings goals. Also, assists Council evaluation consultants in review of key residential evaluation and market research studies and plays a key role in program and measure cost effectiveness review.
- *New York State Energy and Research Development Authority (NYSERDA).* Part of evaluation oversight team that assisted NYERDA with planning, coordinating, implementing and reviewing a wide range of program evaluation efforts. Principal engagement has been on evaluation of NYSERDA's residential lighting program and transportation RD&D activities.
- *Delaware Department of Natural Resources and Environmental Control (DNREC).* Led EFG's support of the residential components of this two-phase study. Reviewed all measure characterizations and program and sector savings estimates. Developed draft and final program descriptions and assisted in program budget development.
- *Natural Resources Defense Council.* Managed a nine-state affordable multifamily technical, economic, and achievable potential study for the Energy Efficiency for All advocacy group. This study was subsequently expanded to include California. Results from this study have been used in several regulatory proceedings.
- *Oklahoma Sustainability Network (OSN).* Providing ongoing support to this key stakeholder group. Have assisted with re-writing the state's DSM rules and provided critical review of the utilities' 2013 and 2014 annual reports. Provided review and comment on a statewide technical, economic and achievable potential study and on recently filed three-year plans.
- *PennFUTURE and Keystone Energy Efficiency Alliance.* Providing technical support for those two efficiency stakeholder groups in Pennsylvania. Provided review and comments on recently filed draft Five-year Plans.
- *Prince Edward Island Office of Energy Efficiency.* Managed a potential analysis, measure screening, and program design and cost-effectiveness assessment for the provincial government. This analysis included the residential, C&I, and transportation sectors. Both energy and carbon savings were analyzed and estimated.
- *Regulatory Assistance Project (RAP).* Co-authored report on the ten most common pitfalls encountered when performing potential studies: Ten Pitfalls of Potential Studies. Co-presented webinar on report findings.
- *Long Island Power Authority (LIPA).* Led the VEIC residential team to provide ongoing technical and programmatic advice to LIPA on the design, implementation, and evaluation of their residential and renewable energy program.

GLENN REED, PRINCIPAL

- ***Association of Energy Services Professionals (AESP).*** Lead trainer for AESP's DSM 101 workshops in NY, KS, IL, WA, and NC. Developed or co-developed Residential and C&I Technology, Cost-effectiveness, and Program Planning and Design training modules. These workshops, lasting as long as five days, provided efficiency program staff with details on all aspects of energy efficiency program planning, design, implementation, and evaluation.
- ***Massachusetts Board of Building Regulations and Standards (BBRS).*** Managed a residential code impact study for the Massachusetts Board of Building Regulations and Standards (BBRS). Nearly 200 on-site surveys of recently built homes were completed.
- ***Management of Regional Market Transformation Initiatives.*** Responsible for NEEP's six residential and C&I regional market transformation Initiatives - ENERGY STAR® Products, Residential HVAC, ENERGY STAR Windows, Premium Efficiency Motors, Unitary HVAC and C&I Information Exchange - and for Initiative-related research and evaluation activities.

SELECTED PUBLICATIONS

- *Accelerating the Pace to Fossil-Free New Construction*. Glenn Reed, Richard Faesy, and Jamie Howland. 2018 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, California, August 2018
- *Residential Lighting: The End is Near*. G. Reed. Proceedings of the International Energy Program Evaluation Conference (IEPEC), August 2017.
- *All in on LEDs: The Northeast Residential Lighting Strategy*. C. Miziolek, G. Reed, et. al. 2014 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, California, August 2014.
- *The Costs and Benefits of Measuring if States Meet 90% Compliance with Building Codes*. R. Wirtshafter, Glenn Reed, et. al.), Proceedings of the International Energy Program Evaluation Conference (IEPEC), August 2011.
- *Do CFLs Still Pass the Test.* Chris Granda and Glenn Reed. Home Energy. May/June 2010.
- *Comparative Performance of Electrical Energy Efficiency Portfolios in Seven Northeast States*. Stuart Slote, Glenn Reed, and John Plunkett. 2006 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, California, August 2006.
- *Engaging Industry: Better Their Money than Ours*. Glenn Reed, Peter Bardhi, Ed Murphy, Jeff Pratt, and Subid Wagley. 2002 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, California, August 2002.

Filed Electronically

Appendix F

HST Tables

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Appendix G

2020-2022 DSM Supply Agreement

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Supply Agreement for

Electricity Efficiency and Conservation Activities

Between

Nova Scotia Power Incorporated

and

EfficiencyOne

Effective Date – January 1, 2020

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List of Schedules

Schedule "A":	Electricity Efficiency and Conservation Activities
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Schedule "C":	Performance Requirements
Schedule "D":	Confidentiality Agreement
Schedule "E":	Approved EECA Plan

THIS AGREEMENT made as of the _____ day of _____, 2019 and effective as of the 1st day of January, 2020 (the "**Effective Date**").

BETWEEN:

NOVA SCOTIA POWER INCORPORATED,
a body corporate, organized under the laws
of the Province of Nova Scotia

(hereinafter called "**NSPI**")

- and -

EFFICIENCYONE,
a body corporate, organized under the laws of
Canada

(hereinafter called "**EfficiencyOne**")

WHEREAS:

A. EfficiencyOne and NSPI are both public utilities pursuant to the Act; and

B. Pursuant to the Act, EfficiencyOne has the exclusive right to supply NSPI with reasonably available, cost-effective Electricity Efficiency and Conservation Activities as the Franchise Holder; and

C. Pursuant to the Act, NSPI is obligated to undertake cost-effective Electricity Efficiency and Conservation Activities that are reasonably available in an effort to reduce costs for its customers; and

D. Pursuant to the Act, NSPI shall meet its obligations by entering into an agreement with the Franchise Holder for the supply of cost-effective Electricity Efficiency and Conservation Activities.

NOW THEREFORE witnesses that in consideration of the premises and the mutual covenants and obligations herein and other good and valuable consideration, the sufficiency and receipt of which are hereby acknowledged, the parties agree as follows:

1. INTERPRETATION

1.1 The following terms shall be interpreted as follows in this Agreement:

(a) "**Act**" shall mean the *Public Utilities Act*, R.S.N.S. 1989, c.380, as amended from time to time.

(b) "**Agreement**" means this agreement between NSPI and EfficiencyOne including all Schedules attached hereto.

(c) "**Business Day**" means Monday to Friday, except federal, provincial, and civic holidays within the Province of Nova Scotia.

(d) "**Consequential Losses**" means consequential, special, incidental, multiple, exemplary or punitive damages including lost profits, whether such claim of lost profits is categorized as indirect, direct or consequential damages or under any alternative theory of recovery.

(e) "**Contract Documents**" means without limitation, the following documents, including any amendments thereto agreed in writing by the parties:

(i) this Agreement; and

(ii) all Schedules to the Agreement.

(f) "**Contract Price**" has the meaning ascribed to it in Section 4.1.

(g) "**EECA Plan**" means the plan prepared by EfficiencyOne and approved by the UARB and attached hereto as Schedule "E".

(h) "**Electricity Efficiency and Conservation Activities"** or "**EECA**" means the electricity efficiency and conservation activities as identified in Schedule "A" attached hereto.

(i) "**Event of Default**" has the meaning ascribed to it in Section 20.4.

(j) "**Environmental Laws**" means all applicable federal, provincial, regional, municipal or local laws with respect to environmental matters contained in the statutes, regulations, rules, standards, requirements, ordinances, policies, guidelines, orders, approvals, notices, permits or directives having the force of law, in effect as at the date hereof and as may be brought into effect at future date.

(k) "**Force Majeure Event**" means any event or circumstance not reasonably within the control of the Party affected which wholly or partly prevents the performance by that Party of its obligations under this Agreement, provided that such Party is in good faith unable to perform such obligations by any commercially reasonable substitute. A Force Majeure Event includes acts of God, war, riot, fire, explosion, flood, hurricane, epidemics, acts of governmental authorities, acts of terrorism. Notwithstanding anything else contained herein, a Force Majeure Event excludes (a) any event or circumstance causing direct or indirect delay in, or failure to perform any of a Party's obligations under this Agreement, attributable to a lack of reasonable diligence on the part of a Party or on the part of any vendor or subcontractor of a Party, including any event or circumstance which a Party or any vendor or subcontractor, acting diligently, could reasonably have been expected to foresee, avoid or overcome in the performance of its obligations; and (b) any event or circumstance caused by the breach of a Party's obligations or the fault or negligence of a Party or the fault or negligence of any vendor or subcontractor, or by violation of applicable laws or regulations by a Party or any of a Party's vendors or subcontractors. For certainty, adverse weather of any kind other than events specified above shall not be considered a Force Majeure Event.

(l) "**Franchise**" has the meaning ascribed to it in the Act.

(m) "**Franchise Holder**" has the meaning ascribed to it in the Act.

(n) "**Governmental Authority**" means any federal, provincial, regional, municipal or local government or authority or other political subdivision thereof and entity or person exercising executive, legislative, judicial, regulatory or administrative functions of, or pertaining to, government.

(o) "**Hazardous Substances**" means any substance or material that is prohibited, controlled or regulated by any Governmental Authority pursuant to Environmental Laws, including any contaminants, pollutants, petroleum or other hydrocarbons and their derivatives and by-products, dangerous substances or goods, including asbestos, liquid wastes, special wastes, toxic substances, hazardous or toxic chemicals, hazardous wastes, hazardous materials or hazardous substances as defined in or pursuant to any Environmental Law, or any substance or material not inherently hazardous but which would, in sufficient quantities, be hazardous.

(p) "**Indemnified Costs**" means all liabilities, claims, actions, causes of action, judgments, orders, damages, costs (including those incurred in connection with any investigation of site conditions or any clean-up, environmental remediation, removal or restoration work), expenses (including all reasonable consultant, expert and legal fees and expenses), fines, penalties, losses, or any resulting damages, harm or injuries to the person or property of any third parties or to any natural resources and for which the indemnified party is liable and has incurred losses. Without limiting the foregoing, Indemnified Costs shall include:

(i) the costs of defending and/or counterclaiming or claiming over and against third parties in such manner as the indemnified party in its sole discretion may determine;

(ii) the costs relating to any governmental investigation, proceeding or claim; and

(iii) any costs, liabilities or damages arising out of a settlement of a claim by the indemnified party, with or without the consent of the indemnifying party.

(q) "**Law**" means the common law, the law of equity and all federal or provincial statutes or municipal by-laws and all regulations, orders, directives, permits and licenses thereunder, which apply to or otherwise affect NSPI or EfficiencyOne with respect to the supply of the EECA, or the property of NSPI or EfficiencyOne, real or personal, or any part thereof, including the Act and all environmental, occupational, health and safety laws.

(r) "**Liens Indemnities**" has the meaning ascribed to it in Section 18.1.

(s) "**Liens and Claims**" has the meaning ascribed to it in Section 18.1.

(t) "**Minister**" has the meaning ascribed to it in the Act.

(u) "**Party**" means either EfficiencyOne or NSPI. "**Parties**" means EfficiencyOne and NSPI.

(v) "**Personal Information**" shall mean the information provided by NSPI to EfficiencyOne pursuant to Section 79K of the Act.

(w) "**Release**" or "**Released**" means a releasing, adding, spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, migrating, dispersing, dispensing, disposing or dumping.

(x) "**Significant Changes**" means any proposed change to the EECA Plan for which the UARB orders or directs EfficiencyOne to obtain the approval of the UARB prior to the implementation of such proposed change.

(y) "**Subcontractor**" means any contractor, supplier or consultant hired by EfficiencyOne in accordance with this Agreement to perform any portion of the EECA.

(z) "**Term**" has the meaning ascribed to it in Section 2.1.

(aa) "**UARB**" means the Nova Scotia Utility and Review Board.

(bb) "**CASL**" means An Act to promote the efficiency and adaptability of the Canadian economy by regulating certain activities that discourage reliance on electronic means of carrying out commercial activities, and to amend the Canadian Radio-television and Telecommunications Commission Act, the Competition Act, the Personal Information Protection and Electronic Documents Act and the Telecommunications Act, S.C. 2010, c. 23, as amended from time to time.

1.2 Unless otherwise specified in this Agreement or unless the context otherwise requires:

(a) words of any gender include each other gender;

(b) using the singular or plural number also include the plural or singular number, respectively;

(c) the insertion of headings in this Agreement is for convenience only and shall not be construed so as to affect the interpretation or construction of this Agreement;

(d) the terms "hereof," "herein," "hereto," "hereunder" and words of similar or like import refer to this entire Agreement and not to any particular Section, Schedule or other subdivision of this Agreement;

(e) references to a particular "Section" or "Schedule" are, unless otherwise noted, references to that Section of, or Schedule to this Agreement;

(f) the words "include," "includes" and "including" shall be deemed to be followed by "without limitation" or "but not limited to";

(g) references to any applicable law, legislation or regulation shall be construed as a reference to such law, legislation or regulation as each may be in effect from time to time;

(h) references to any agreement or document (including this Agreement) shall (i) include all Schedules, appendices, and other attachments thereto, and (ii) be construed at the particular time as a reference to such agreement or document as amended, modified or supplemented and in effect from time to time and shall include a reference to any document which amends, modifies or supplements it, or is entered into, made or given pursuant to or in accordance with its terms;

(i) references to (i) days shall refer to calendar days unless Business Day is specified, (ii) weeks and months shall refer to calendar weeks and months, respectively, and (iii) years shall refer to calendar years;

(j) in computing any period of time prescribed or allowed under this Agreement, the day of the act, event or default from which the designated period of time begins to run shall be included. If the last day of the period so computed is not a Business Day, then the period shall run until the close of business on the next Business Day;

(k) the Contract Documents are complementary, and what is required by any one shall be as binding as if required by all;

(l) words and abbreviations which have well known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings; and

(m) as both Parties were actively involved in preparing the terms and conditions of this Agreement and as they both had access to and relied upon counsel in this process, there shall be no presumption that any one or the other Party prepared this Agreement and no provision of this Agreement shall be construed against either Party based upon the process of preparation of proposals and drafts of the Agreement.

1.3 If there is a conflict within the Agreement, the order of precedence of documents, from highest to lowest, shall be:

(a) Sections 1 to 27;

(b) Schedule "A" – Electricity Efficiency and Conservation Activities; and

(c) all other Schedules.

2. TERM & RESERVATION OF RIGHTS

2.1 The term of this Agreement shall be three (3) years from the Effective Date and shall automatically terminate on December 31, 2022 unless terminated earlier in accordance with the terms of this Agreement and the Act (the "**Term**").

2.2 During the Term, NSPI shall purchase from EfficiencyOne and EfficiencyOne shall supply to NSPI, the EECA in accordance with the terms and conditions of this Agreement and the Act.

2.3 Notwithstanding anything contained herein, and subject to any requirement for review or approval by the UARB, nothing contained in this Agreement shall in any way effect the rights of NSPI pursuant to Section 79I(3) of the Act.

3. ELECTRICITY EFFICIENCY and CONSERVATION ACTIVITIES

3.1 For the Term of this Agreement, EfficiencyOne will,

(a) provide the EECA in accordance with this Agreement;

(b) provide sufficient resources to enable EfficiencyOne to perform its obligations on time and in accordance with this Agreement;

(c) carry out the EECA in a professional, expeditious and economical manner, in accordance with the Act;

(d) manage the EECA in an efficient manner; and

(e) perform and supply the EECA in a safe and environmentally sound manner and in compliance with applicable Law.

3.2 The Parties acknowledge and agree that EfficiencyOne shall be solely responsible for the delivery of the EECA Plan. For greater certainty and notwithstanding the attachment of the EECA Plan as Schedule "E" – Approved EECA Plan, NSPI shall have no liability with respect to the EECA Plan saving and excepting any liability which may arise as a result of NSPI's failure to comply with the Act.

4. PRICE & PAYMENT

4.1 NSPI agrees to pay EfficiencyOne for EECA as set out in Schedule "B" – Compensation (the "**Contract Price**").

4.2 The Contract Price shall constitute full compensation for the EECA, and no additional compensation shall be payable to EfficiencyOne arising out or resulting from any productivity losses, overhead or indirect costs or other costs and expenses of any kind whatsoever.

4.3 NSPI shall make monthly payments on the first Business Day of each month in accordance with Schedule "B" to EfficiencyOne on account of the Contract Price when due, together with applicable HST. EfficiencyOne will submit an invoice to NSPI in advance of the payment date referenced in Schedule "B".

4.4 Unless otherwise indicated all dollar amounts referred to in this Agreement are in lawful money of Canada.

4.5 If applicable, payments shall be subject to harmonized sales tax (as defined in the *Excise Tax Act* (Canada)) ("**HST**"). No additional taxes (foreign or domestic), customs, duties or brokerage fees shall apply.

4.6 If applicable, NSPI will withhold from payments to EfficiencyOne any amounts required to be withheld under applicable Laws and treaties in respect of services rendered in Canada by a non-resident and may remit them to the relevant authority. Where available, statutory withholding may be waived if EfficiencyOne delivers to NSPI a formal waiver of the withholding requirement issued and signed by Canada Revenue Agency. The Parties shall cooperate at all times to ensure that all proper withholdings are deducted from payments and if any withholdings are overlooked then such withholdings may be deducted from later payments.

5. NOTIFICATION OF SIGNIFICANT CHANGES

5.1 EfficiencyOne shall provide notice of Significant Changes to NSPI at the same time as EfficiencyOne makes application to the UARB for the approval of the Significant Changes. Subject to the terms of the Act and the general discretion of the UARB under the Act, NSPI

shall, have the right to make written submissions to the UARB on any such Significant Changes to the EECA Plan.

6. SAFETY

6.1 EfficiencyOne shall at all times be responsible for safety and loss management in the supply or performance of the EECA.

6.2 EfficiencyOne shall ensure that all employees, Subcontractors, agents and representatives of EfficiencyOne comply with all federal, provincial and municipal health, safety and environmental statutes, regulations, policies and guidelines and all health, safety and environmental rules as prescribed by EfficiencyOne.

7. PROTECTION OF PROPERTY

7.1 EfficiencyOne shall take all commercially reasonable steps to protect the property of NSPI's customers and other third parties from damage which may occur as the result of the performance of the EECA.

7.2 Should EfficiencyOne damage the property of NSPI's customers or property of other third parties while performing the EECA, EfficiencyOne shall make good such damage at EfficiencyOne's expense and shall indemnify NSPI from and against all liabilities, claims, damages, settlements, awards, costs, expenses and proceedings incurred by NSPI or its servants, employees and/or agents in respect of such damage, except to the extent such damage occurs as a result of the negligent acts of NSPI or those for which NSPI is responsible at Law.

8. ENVIRONMENT

8.1 EfficiencyOne and its Subcontractors shall at all times comply with all Environmental Laws that apply in any way to the supply or performance of the EECA. EfficiencyOne and its Subcontractors shall not cause, permit or suffer the Release of a Hazardous Substance in contravention of any Environmental Laws.

8.2 Notwithstanding any other provision in this Agreement (and in addition to any other right to indemnity held by NSPI under the terms of the Agreement) EfficiencyOne shall indemnify NSPI, NSPI's parent, their respective subsidiaries, affiliates and related companies, and their respective officers, directors, employees, agents and shareholders, and agrees to hold each of them harmless from and against any and all Indemnified Costs resulting from any Release of any Hazardous Substance which is caused or contributed to by EfficiencyOne or its Subcontractors or any breach of any Environmental Law by EfficiencyOne or its Subcontractors.

9. EFFICIENCYONE'S COVENANTS

9.1 EfficiencyOne warrants, covenants and agrees with NSPI that:

(a) it has all requisite capacity and authority to execute, deliver and perform its obligations under this Agreement;

(b) this Agreement has been duly and validly executed and delivered by EfficiencyOne and constitutes a legal, valid and binding obligation of EfficiencyOne enforceable against EfficiencyOne in accordance with its terms;

(c) to its knowledge, there is no matter, thing or event, including without limitation, any litigation, proceeding, breach, default or financial circumstance that would adversely affect EfficiencyOne's ability to perform its obligations under this Agreement;

(d) it will furnish all labour, materials, products, tools, and other necessary components necessary to perform and provide the EECA, unless otherwise provided herein;

(e) it shall diligently perform or cause to be performed the EECA in a proper and workmanlike manner;

(f) it has the skills, expertise and resources to carry out the EECA and to comply, observe and perform the obligations to which it is subject in accordance with the terms of this Agreement;

(g) prior to commencing any work hereunder, it shall obtain and maintain all permits, licenses and notices that a prudent supplier acting in accordance with industry standards would be required to obtain, maintain and provide in comparable circumstances and shall comply with all applicable Laws, ordinances, rules, regulations, codes and orders of any and all authorities having jurisdiction which are or become in force during the Term in respect of the EECA;

(h) it will comply with applicable federal, provincial and municipal statutes, regulations and bylaws pertaining to the EECA performed by or on behalf of EfficiencyOne under this Agreement. EfficiencyOne shall be responsible for ensuring similar compliance by any suppliers and Subcontractors;

(i) it is the Franchise Holder pursuant to the Act;

(j) it is not a non-resident of Canada for the purposes of the *Income Tax Act*;

(k) it will execute or cause to be made, done and executed all further acts, deeds, assurances, agreements, instruments or other documents as may be reasonably required to ensure fulfillment of the terms of this Agreement;

(l) the EECA shall be delivered and performed by individuals duly licensed and authorized by Law, if applicable, to perform said undertakings;

(m) the EECA shall be delivered and performed solely by EfficiencyOne or its Subcontractors and EfficiencyOne acknowledges that EfficiencyOne shall at all times remain responsible for the proper completion of this Agreement; and

(n) upon becoming aware of a potential disruption having a material impact in the supply of the EECA, EfficiencyOne shall provide notification to the UARB and NSPI.

10. SUBCONTRACTORS

10.1 EfficiencyOne shall be permitted to subcontract the performance of any part of the EECA without the prior written approval of NSPI.

10.2 Where EfficiencyOne subcontracts any part of the EECA, EfficiencyOne shall preserve and protect the rights of the Parties under this Agreement with respect to the EECA to be supplied or performed under subcontract, and shall be as fully responsible to NSPI for the acts and omissions of Subcontractors and of persons directly or indirectly employed by them, as if they were acts and omissions of persons directly employed by EfficiencyOne.

10.3 Nothing contained in the Contract Documents shall create a contractual relationship between a Subcontractor and NSPI.

11. CONFIDENTIAL AND PERSONAL INFORMATION

11.1 The Parties have executed or agree to execute the confidentiality agreement attached hereto as Schedule "D" - Confidentiality ("**Confidentiality Agreement**").

11.2 EfficiencyOne shall be responsible for all physical and electronic security required to ensure the security of the Personal Information which has been provided by NSPI to EfficiencyOne.

11.3 EfficiencyOne shall indemnify and hold harmless NSPI for any liabilities, claims, damages, settlements, awards, costs, expenses and proceedings incurred by NSPI or its servants, employees and/or agents in consequence of EfficiencyOne's misuse of the Personal Information or any disclosure, whether intentional, inadvertent, negligent or otherwise of any of the Personal Information by EfficiencyOne contrary to the terms of this Agreement or the Act, or in consequence of EfficiencyOne's contravention of CASL.

12. PERFORMANCE REQUIREMENTS AND EVALUATIONS

12.1 EfficiencyOne's performance under the terms of this Agreement shall be measured in accordance with the performance requirements established by the UARB pursuant to Section 79M of the Act as set out in Schedule "C" – Performance Requirements.

13. FORCE MAJEURE

13.1 Neither Party shall be in breach of its obligations under this Agreement where failure to perform or delay in performance of any obligation is due, wholly or in part, to a Force Majeure Event.

13.2 Each Party shall notify the other Party promptly of any Force Majeure Event and shall take reasonable steps to minimize the impact of the failure or the delay and to resolve the event or occurrence that has given rise to the Force Majeure Event in order to resume performance. The time for performing an obligation as a result of Force Majeure Event shall be extended for the period lost, subject to the condition that the Term of this Agreement shall not be extended as a result of any Force Majeure Event.

13.3 Each Party suffering a Force Majeure Event shall take, or cause to be taken, such action as may be necessary to void, or nullify, or otherwise to mitigate, in all material respects, the effects of such Force Majeure Event. The Parties shall take all reasonable steps to ensure normal performance under this Agreement, including the resumption of any disrupted obligations.

13.4 For certainty, in no case shall the failure or omission of EfficiencyOne to carry out or observe any of the terms, provisions, or conditions of this Agreement or any negligent act

or omission of EfficiencyOne, or others for whom EfficiencyOne is responsible constitute an event of Force Majeure or result in an extension of the time to perform the EECA.

14. INDEMNITY

14.1 EfficiencyOne shall assume all risk of loss, damage or injury, including death, to person or property, caused by its directors, officers, employees, Subcontractors, agents or representatives, and agrees not to make or bring any claim, action or demand against NSPI or its directors, officers, servants, agents, or employees in respect of such loss, damage or injury excepting such loss, damage or injury caused by the negligence or wilful misconduct of NSPI or NSPI's directors, officers, servants, agents or employees.

14.2 EfficiencyOne agrees to indemnify and save harmless NSPI, its directors, officers, servants, agents, or employees, and their heirs, executors, administrators, successors and assigns, or any of them, from and against any liabilities, losses, expenses (including legal costs on a solicitor-client basis), claims, demands, actions, and causes of action, whatsoever suffered by NSPI by reason of, or in any way arising out of or in connection with a breach of this Agreement by EfficiencyOne excepting only to the extent caused by the negligence or wilful misconduct of NSPI or NSPI's directors, officers, servants, agents or employees.

14.3 NSPI agrees to indemnify and save harmless EfficiencyOne, its directors, officers, servants, agents, or employees, and their heirs, executors, administrators, successors and assigns, or any of them, from and against any liabilities, losses, expenses (including legal costs on a solicitor-client basis), claims, demands, actions, and causes of action, whatsoever suffered by EfficiencyOne by reason of, or in any way arising out of or in connection with a breach of this Agreement by NSPI excepting only to the extent caused by the negligence or wilful misconduct of EfficiencyOne or EfficiencyOne's directors, officers, servants, agents or employees.

14.4 The provisions set forth in this Section shall apply and be effective with respect to any claim, cause of action, or legal theory whatsoever including without limitation, claims based upon breach of contract, failure to meet performance guarantees, tort (including negligence) and strict liability.

14.5 EfficiencyOne shall defend, indemnify and hold harmless NSPI from any claim, suit, cause of action, judgment, cost or expense (including legal fees) based on a claim by a third party that any intellectual property which is part of the EECA or supply or performance of EfficiencyOne's obligations under this Agreement infringes any patent, copyright, trade secret or other intellectual property right, provided the EfficiencyOne is promptly notified of such claim and is given complete authority for defense of same. EfficiencyOne shall pay all damages, costs and expenses resulting from such a claim, including legal fees and settlement costs, but shall not be responsible for any cost, expense or compromise incurred by NSPI without EfficiencyOne's prior consent.

15. LIMIT OF LIABILITY

15.1 Neither Party shall be liable to the other Party for any Consequential Losses with respect to the performance or non-performance under this Agreement or for any actions undertaken in connection with or related to this Agreement.

15.2 EfficiencyOne's total liability to NSPI with respect to the performance or non-performance under this Agreement or for any actions undertaken in connection with or related to this

Agreement shall be limited to the greater of the sum of two million dollars ($2,000,000) or the proceeds of the applicable insurance policies taken out by EfficiencyOne under this Agreement ("**EfficiencyOne Limit of Liability**") provided that the EfficiencyOne Limit of Liability shall not apply to:

(a) indemnification of NSPI by EfficiencyOne under the terms of this Agreement for any third party claims (including but not limited to EfficiencyOne's obligations pursuant to Sections 7.2, 8.2, 11.3, 14.5 and 18.1);

(b) any wilful misconduct or fraud of EfficiencyOne or its employees, agents or representatives; and

(c) any obligation on the part of EfficiencyOne to refund in whole or in part the Contract Price pursuant to this Agreement or the Act.

15.3 NSPI's total liability to EfficiencyOne with respect to the performance or non-performance under this Agreement or for any actions undertaken in connection with or related to this Agreement shall be limited to the sum of two million dollars ($2,000,000) ("**NSPI Limit of Liability**") provided that the NSPI Limit of Liability shall not apply to:

(a) any wilful misconduct or fraud of NSPI or its employees, agents or representatives; and

(b) NSPI's liability for payment of the Contract Price pursuant to the Agreement or the Act.

16. INSURANCE

16.1 EfficiencyOne shall obtain, maintain and pay for, during the entire Term of this Agreement, the following minimum insurance coverage as follows, such insurance as it relates to this Agreement shall be in a form and from an insurer acceptable to NSPI:

(a) General liability insurance shall be in the name of EfficiencyOne and shall name NSPI as an additional insured and shall have limits of not less than five million dollars ($5,000,000) inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof. Such insurance shall be primary and non-contributing with, and not in excess of, any other insurance available to NSPI. This policy shall also contain cross liability and severability of interest and blanket contractual liability.

(b) Environmental impairment insurance with limits of not less than five million dollars ($5,000,000);

(c) Automobile liability insurance in respect of licensed vehicles shall have limits of not less than two million dollars ($2,000,000) inclusive per occurrence for bodily injury, death, and damage to property. For automobiles not owned or operated by or on behalf of EfficiencyOne the insurance shall be in the form of a standard non-owned automobile policy and shall include standard contractual liability endorsement. For automobiles owned or operated by or on behalf of EfficiencyOne the insurance shall be in the form of a standard owner's form automobile policy and shall provide third party liability and accident benefits insurance covering licensed vehicles owned or operated by or on behalf of EfficiencyOne.

(d) Property Insurance covering all loss of or damage to EfficiencyOne's property and equipment of EfficiencyOne or for which EfficiencyOne is legally liable or responsible used in performance of the EECA for the full replacement value, which insurance shall not allow subrogation claims by the insurer against NSPI.

(e) To the extent that the EECA includes the provision of professional services, professional liability errors and omissions insurance covering all claims arising out of errors and omissions of EfficiencyOne in the performance of professional services as part of the EECA with a limit of two million dollars ($2,000,000). In the event other claims erode EfficiencyOne's professional errors and omissions insurance below two million dollars ($2,000,000), in the annual aggregate, EfficiencyOne agrees to reinstate the limit.

(f) Workers' compensation to the full extent required in Nova Scotia and wherever EfficiencyOne's personnel contracts of employment are made or are expressed to be made.

16.2 If EfficiencyOne fails to effect or keep in force any of the foregoing insurances, NSPI may, without prejudice to any other right or remedy, effect such insurance and pay the premiums due and recover the same as a deduction from any other monies due to EfficiencyOne under this Agreement.

16.3 EfficiencyOne shall be responsible to pay deductible amounts and for determining the deductible amount in respect of each policy. EfficiencyOne shall not violate, nor knowingly permit to be violated, any conditions of the policies maintained according to the provisions of this Section, and it shall be EfficiencyOne's duty and responsibility to impose upon each Subcontractor the same responsibilities and obligations imposed upon EfficiencyOne under such provisions.

16.4 EfficiencyOne agrees to provide proof of insurance to NSPI on an annual basis. Such proof shall be in the form of a certificate of insurance signed by EfficiencyOne's insurance broker.

17. INTELLECTUAL PROPERTY

17.1 NSPI acknowledges that all branding, trade and business marks of EfficiencyOne used in the course of provision of EECA pursuant to this Agreement, (the **"EfficiencyOne Brands"**) are, and shall remain, the sole and exclusive property of EfficiencyOne and shall not be used by NSPI without EfficiencyOne's express consent. Upon termination of this Agreement, NSPI shall immediately upon instruction from EfficiencyOne return or destroy, as instructed by EfficiencyOne, the EfficiencyOne Brands.

17.2 Any trademarks, brands, logos or other branding or trade or business marks used in NSPI's business ("**NSPI Brands**") shall remain the sole and exclusive property of NSPI and shall not be used by EfficiencyOne for any purpose except in connection and as necessary for the provision of the EECA. Upon termination of this Agreement, EfficiencyOne shall immediately upon instruction from NSPI return or destroy, as instructed by NSPI, the NSPI Brands.

18. LIENS AND CLAIMS

18.1 EfficiencyOne shall indemnify and hold harmless NSPI, NSPI's parent and their subsidiaries and affiliates (collectively the "**Lien Indemnitees**" or singularly "**Lien**

Indemnitee") and defend each of them from and against any and all losses and costs arising out of any and all claims for payment, liens, attachment or any other process, filed against any property of the Lien Indemnitees by or in respect of a Subcontractor of any tier or any other party providing work, materials in respect of the EECA or any part thereof (referred to in this Section as "**Liens or Claims**"), including solicitor and client fees and expenses incurred by NSPI in discharging any such Liens or Claims or similar encumbrances.

18.2 EfficiencyOne shall discharge promptly any Liens or Claims. If EfficiencyOne does not promptly satisfactorily discharge such Liens or Claims, NSPI at its sole option may (i) require EfficiencyOne to pay, within five (5) Business Days after request by NSPI, or (ii) subject to any requirements of the *Builders' Lien Act* of Nova Scotia, offset against any holdback or other amounts due or to become due to EfficiencyOne, all costs and expenses incurred by NSPI or other Lien Indemnitee in causing the release of, paying or settling such Liens or Claims. EfficiencyOne shall have the right to contest any such Liens or Claims, provided it first provides to NSPI a bond or other assurance of payment reasonably satisfactory to NSPI in the amount of such Liens or Claims and in form and substance reasonably satisfactory to NSPI. In no circumstance whatsoever shall NSPI be liable for a greater amount than the amount payable by NSPI to EfficiencyOne.

19. DISPUTE RESOLUTION

19.1 In the event of a dispute in connection with this Agreement, a senior representative of EfficiencyOne and a senior representative of NSPI shall promptly meet to discuss and resolve the dispute and the Parties shall have thirty (30) days to resolve the dispute (or ten (10) days if either Party notifies the other Party that the matter requires urgent resolution).

19.2 Unless the parties agree otherwise, in the event resolution cannot be achieved in accordance with Section 19.1 of this Agreement, then such dispute or difference shall be referred to the UARB in accordance with Section 79P of the Act.

19.3 Notwithstanding any dispute, EfficiencyOne shall diligently carry out the EECA, and shall not suspend, impair, interfere with, restrict or discourage the prompt completion of any portion of the EECA, unless specifically authorized to do so by the UARB. .

20. DEFAULT AND TERMINATION

20.1 This Agreement may be terminated immediately by either Party, in whole or in part, upon the happening of one or more of the following events:

(a) EfficiencyOne's Franchise is terminated and the Agreement has not been assigned by the Minister; or

(b) The UARB approves the termination of the Agreement.

In the event of a termination pursuant to this Section 20.1, neither Party shall be entitled to any compensation or damages for any Consequential Losses as a result of such termination. Immediately upon receipt of such termination notice, EfficiencyOne will discontinue all EECA under this Agreement and will only finish such portions of the EECA as may be necessary to preserve and protect the EECA already in progress. Such termination does not relieve either Party from any of their respective obligations under this

Agreement for EECA provided up to the date of termination. Any claim for payment by EfficiencyOne must be asserted within thirty (30) days from the date of such termination.

20.2 Notwithstanding any other provision in this Agreement, in the event this Agreement is terminated in accordance with Section 20.1(a), EfficiencyOne shall:

(a) Immediately return all monies paid on account of the Contract Price which amounts have not been legitimately incurred or subject to contractual commitments for expenditure which cannot otherwise be mitigated to NSPI; and

(b) Provide to NSPI all reasonable required termination assistance to allow the EECA provided under this Agreement to continue and to facilitate the orderly transition of the EECA to NSPI or any third party as directed by NSPI, provided that EfficiencyOne shall be entitled to commercially reasonable payment for such transition services on a time and material basis.

20.3 The Parties acknowledge that this Agreement is subject to the general supervision of the UARB.

20.4 A Party shall be determined to be in default of its obligations under this Agreement if (each a "**Event of Default**"):

(a) it is in breach of any material term or condition of this Agreement, which breach is not cured by the Party within thirty (30) days after written notice from the other Party;

(b) it assigns this Agreement other than as permitted by the Act and/or the UARB;

(c) any representation or warranty made by either Party shall prove to be untrue when made in any material respect;

(d) there is a sale, transfer or relinquishment, voluntary or involuntary, by operation of law or otherwise, of legal control of the business of either Party except for a transfer to a related corporation or a transfer resulting from a merger, acquisition, amalgamation or reorganization, or, in the case of EfficiencyOne, a change in the Membership of the corporation;

(e) Either Party sells, transfers or assigns all or substantially all of its assets;

(f) a petition in bankruptcy is filed with respect to either Party; or

(g) any proceeding is commenced under any bankruptcy or insolvency legislation or under any other federal, state or provincial law relating to insolvency or bankruptcy, the adjudication of either Party as a bankrupt, the appointment by any competent court having jurisdiction of a temporary or permanent receiver, trustee or other officer having similar powers over either Party its business or assets, or the making of any assignment by either Party for the benefit of its creditors.

20.5 If a breach notified pursuant to Sections 20.4(a) cannot be corrected within the period required therein, the defaulting Party shall not be in breach or violation if it:

(a) commences and diligently and continuously carries out the correction of the breach or violation within the specified time;

(b) provides to the non-defaulting Party, and the UARB an acceptable plan for such correction; and

(c) corrects the breach or violation in accordance with such plan.

20.6 Upon the occurrence of an Event of Default, the non-defaulting Party may apply to the UARB to terminate this Agreement in whole or in part.

21. NOTIFICATIONS

21.1 All notices to be given to either Party under this Agreement shall be written and addressed to the NSPI and to EfficiencyOne as follows:

To NSPI:

Nova Scotia Power Incorporated
1223 Lower Water Street
PO Box 910
Halifax, NS B3J 3S8
Attention: Corporate Secretary
Facsimile: (902) 428-6171

To EfficiencyOne:

EfficiencyOne
230 Brownlow Avenue
Suite 300
Dartmouth, NS B3B 0G5
Attention: CEO
Facsimile: (902) 470-3599

21.2 All notices may be sent by facsimile, a nationally recognized overnight courier service, first class mail or hand delivered. Notice shall be given when received by the addressee on a Business Day. In the absence of proof of the actual receipt date, the following presumptions will apply:

(a) Notices sent by facsimile shall be presumed to have been received upon the sending Party's receipt of its facsimile machine's confirmation of successful transmission. If the day on which such facsimile is received is not a Business Day or is after five p.m. (local time for the recipient) on a Business Day, then such facsimile shall be deemed to have been received on the next following Business Day.

(b) Notice by overnight courier shall be presumed to have been received on the next Business Day after it was sent.

(c) Notice by first class mail shall be presumed delivered five (5) Business Days after mailing.

21.3 Either Party may modify its address for notices by advance written notice to the other Party.

22. AUDIT AND INSPECTION

22.1 EfficiencyOne shall, during the Term and for a period of thirty-six (36) months thereafter, keep accurate records of all EECA supplied to NSPI, as necessary to determine that the EECA was provided in accordance with the terms and conditions of this Agreement.

22.2 NSPI shall have the right to apply to the UARB to request access to any of the records referred to in 22.1.

22.3 NSPI shall have the right to apply to the UARB to inspect or observe the EECA at all times, whether using its own forces or those of a designated third party. EfficiencyOne shall facilitate such inspections and provide sufficient, safe and proper facilities at all times for inspection of the EECA.

23. ASSIGNMENT

23.1 Neither Party shall assign all or any portion of this Agreement without the prior written approval of the UARB and/or the Minister as the situation requires.

24. SHARING OF DATA AND INFORMATION

24.1 EfficiencyOne shall work co-operatively with NSPI to provide NSPI with information and data from time to time in order to assist NSPI with planning and load forecasting as may be reasonably required by NSPI. For greater certainty, such information and data shall be consistent with the past practices of the Parties.

24.2 In the event of a dispute regarding any request for information by NSPI, NSPI shall have the right to apply to the UARB to request access to the information and data referred to in 24.1.

25. COORDINATION MEETINGS AND REPORTS

25.1 During the Term of this Agreement, EfficiencyOne shall prepare and deliver to the UARB and NSPI a quarterly report (the "**Quarterly Report**") in a form acceptable to the UARB.

25.2 EfficiencyOne shall prepare and deliver to the UARB and NSPI an annual report (the "**Report**") in a form acceptable to the UARB. For greater certainty, the Report shall summarize and provide details as to the EECA and milestones achieved in the prior year, contain a discussion and analysis of major discrepancies relative to the EECA Plan's intent and forecasts, EfficiencyOne's financial statement for the previous year with respect to the EECA, evaluation reports and a summary of planned versus actual savings and costs for each metric.

25.3 The Parties agree that ongoing coordination and regular communication between NSPI and EfficiencyOne is important in order to ensure effective planning. To that end, the Parties shall meet quarterly or as otherwise agreed upon to discuss the provision of the EECA.

26. GENERAL

26.1 This Agreement shall only be renewed in accordance with the provisions of the Act.

26.2 This Agreement shall extend to, be binding upon and enure to the benefit of the respective successors and permitted assigns of the Parties hereto.

26.3 EfficiencyOne will be an independent contractor. EfficiencyOne shall not act as an agent for NSPI, bind NSPI to any obligation with a third party, nor hold itself out as having authority to bind or obligate NSPI. None of the persons engaged by EfficiencyOne or any of its Subcontractors in the performance of the EECA will be considered employees of NSPI.

26.4 This Agreement shall be deemed to have been made in and shall be governed by, construed and interpreted in accordance with the laws of the Province of Nova Scotia and the laws of Canada, as applicable therein. Where the provisions of this Agreement or the Act permit or require a matter to be referred to or proceeded with before a court, or in any other case where the Parties bring a matter in respect of this Agreement before a court, the Parties irrevocably attorn to the jurisdiction of the Supreme Court of Nova Scotia.

26.5 No consent or waiver, express or implied, by any Party to this Agreement of any breach or default by any other Party in the performance of its obligations under this Agreement or of any of the terms, covenants or conditions of this Agreement shall be deemed or construed to be a consent or waiver of any subsequent or continuing breach or default in such Party's performance.

26.6 Time shall be of the essence for purposes of this Agreement.

26.7 This Agreement, upon approval by the UARB, shall represent the entire Agreement between the Parties with respect to the subject matter hereto and shall not be modified, varied or amended except by an instrument in writing signed by the Parties and approved by the UARB or as ordered or directed, by the UARB at any time.

26.8 Should any provision of the Agreement be declared by a judicial or other competent authority to be unenforceable, the remaining provisions of the Agreement shall remain in full force and effect.

26.9 The Parties acknowledge that this Agreement and all related documents shall be in English.

26.10 This Agreement may be executed by the Parties in counterparts, each of which when so executed and delivered shall be deemed to be an original and when taken together shall be deemed to be one and the same instrument. The electronic delivery, including, without limitation, by email or facsimile transmission, of any signed original of this Agreement shall be the same as the delivery of an original.

27. SURVIVAL

27.1 Subject to the provisions of the Act, all provisions of this Agreement which by their express terms or nature are continuing shall survive the expiration or termination of this Agreement, including, without limitation, this provision, and the provisions relating to the EECA Plan (s. 3.2), EfficiencyOne's covenants (s.9), confidentiality (s. 11), indemnity (s.14), intellectual property (s. 17), notification (s. 21) and general provisions (s. 26) as

well as any provisions which are required to determine, or which exclude or limit, any liability or which are otherwise required to give effect to or interpret any such provisions which are continuing.

[Remainder of page intentionally left blank]

IN WITNESS THEREOF, the Parties have duly executed this Agreement, in duplicate, as of the date set forth above.

NOVA SCOTIA POWER INCORPORATED

Per: _____
Name:
Title:

Per: _____
Name:
Title:

_____
Witness

_____
Witness

EFFICIENCYONE

Per: _____
Name:
Title:

Per: _____
Name:
Title:

_____
Witness

_____
Witness

SCHEDULE A

ELECTRICITY EFFICIENCY AND CONSERVATION ACTIVITIES

Schedule A

Electricity Efficiency and Conservation Activities

The figure below identifies the scope of savings (3 year Cumulative Annual Energy Savings,Cumulative Annual Peak Demand Savings and Lifetime Energy Savings) associated with carrying out EECAs over the Term.

	Cumulative Annual Net Energy Savings at Generator over the Term (GWh)	Cumulative Annual Net Peak Demand Savings at Generator over the Term (MW)	Lifetime Energy Savings (GWh)
Performance Targets*			

The Performance Targets will be achieved in accordance with the EECA Plan as set out in Schedule E.

* For certainty, in accordance with the performance requirements set out in Schedule "C" attached hereto, EfficiencyOne shall be deemed to be in substantial compliance with the approved Performance Targets if the stipulated percent level of achievement is reached on each Performance Targets. If less than the stipulated percent level any of the Performance Targets is achieved, a regulatory process will be triggered.

**

SCHEDULE B

COMPENSATION

Schedule B (Page 1 of 2)

Compensation

I. Net Contract Price

The figure below identifies the Contract Price to be paid by NSPI allocated for each year of the Term.

		2020	2021	2022
UARB Approved				
Contract Price to be Paid by NSPI				

The Parties acknowledge that any surplus realized by EfficiencyOne in delivering the Performance Targets at the end of the Term shall be reported to the UARB and refunded to NSPI[1] unless EfficiencyOne is directed to do otherwise by the UARB.

[1] Together with all accumulated interest earned by EfficiencyOne on such surplus.

Schedule B (Page 2 of 2)

Compensation

II. **Payments**

In accordance with Section 4.3 of the Agreement, the monthly payments to be made by NSPI to EfficiencyOne over the Term shall be as set out below. The monthly payment amounts referred to following are exclusive of required HST. HST shall be remitted to EfficiencyOne in addition to these monthly amounts.

On the First Business Day of:	2020	2021	2022
January February March April May June July August September October November December			
Total			

SCHEDULE C

Performance Requirements

I. UARB-APPROVED PERFORMANCE TARGETS, THRESHOLDS, AND INDICATORS

a) Performance Targets and Thresholds:

i. Performance Targets are set over the three year contract period, rather than annually.

ii. EfficiencyOne is deemed to be in substantial compliance with the UARB-approved Plan Performance Targets if ninety percent (90%) or greater achievement is reached on the cumulativeannual net energy savings at generator and cumulative net peak demand savings at generator Performance Targets listed at b) i and ii below. If less than ninety percent (90%) of either Performance Target at b) i and ii below is achieved, a regulatory process will be triggered.

iii. EfficiencyOne is deemed to be in substantial compliance with the UARB-approved Plan Performance Targets if Seventy Five Percent (75%) or greater achievement is reached on the Lifetime Energy Savings Performance Targets listed at b) iii. If less than Seventy Five percent (75%) of r Performance Target at b) iii below is achieved, a regulatory process will be triggered.

b) Performance Targets consist of:

i. Cumulative annual net energy savings at generator
ii. Cumulative annual net peak demand savings at generator
iii. Lifetime Energy Savings

c) Performance Indicators (for UARB reporting) consist of:

i. Annual incremental energy savings (reported by program and rate class);
ii. Cumulative annual energy savings (reported by program and rate class);
iii. Annual lifetime energy savings (reported by program and rate class);
iv. Annual incremental system-peak demand savings (reported by program and rate class);
v. Cumulative annual system-peak demand savings (reported by program and rate class);

vi. Total ratepayer benefits;
vii. Total spending (reported by program and rate class);
viii. Customer satisfaction;
ix. An analysis of the impact on rates through the implementation of the programs will be included as part of EfficiencyOne's historical-looking rate and bill impact analysis, filed by October 31st of each year; and
x. Reporting on low-income program participation, expenditures, and savings through a variety of methods, including estimation based on geographic census information.

SCHEDULE D

CONFIDENTIALITY AND NONDISCLOSURE AGREEMENT

THIS CONFIDENTIALITY AGREEMENT made effective this 1st day of January, 2020

Between:

EfficiencyOne, hereinafter “EfficiencyOne”

Party of the First Part

And

Nova Scotia Power Incorporated, hereinafter “NSPI”

Party of the Second Part

Whereas the Parties have entered into a Supply Agreement for Electricity Efficiency and Conservation Activities made effective as of January 1, 2020 (“Supply Agreement”) whereby Efficiency One is to provide EECA (as that term is defined in the Supply Agreement) to NSPI;

And whereas in accordance with the Supply Agreement, and the Electricity Efficiency and Conservation Act (Nova Scotia) and the Public Utilities Act (Nova Scotia) (together hereinafter referred to as the “Legislation”), and as may be directed by the Nova Scotia Utility and Review Board, and as may be further agreed between the Parties, the Parties will be receiving, reviewing, and analyzing Confidential Information from each other;

And whereas the Parties wish to clarify the manner in which any Confidential Information disclosed by one Party (“Disclosing Party”) to the other is to be treated by the recipient of the Confidential Information (“Recipient”);

In consideration of the agreements of the Parties set forth below, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

Confidential Information

1. The Parties agree that for the purpose of this Agreement "Confidential Information" means all information, regardless of the form in which it is communicated or maintained and prepared by the Disclosing Party, and is disclosed directly or indirectly to the Recipient, pursuant to the Supply Agreement, the Legislation, as directed by the Nova Scotia Utility and Review Board or as otherwise agreed between the Parties. Confidential Information includes, but is not limited to the following: all reports analyses, notes, memoranda, correspondence, spreadsheets, drawings, survey plans, maps, contracts, commercial arrangements, intellectual property, trade secrets, corporate strategies, business plans or other information that is based on, contain or reflect any Confidential Information, material, whether printed or electronic, which has been designated by the Disclosing Party as confidential information, including proprietary information and other commercially sensitive information. This includes but is not limited to information which has been or may be filed with the Nova Scotia Utility and Review Board ("the Board") in confidence in answer to Information Requests and any further material that may be filed with the Board in confidence whether in response to future Information Requests or otherwise, and whether printed or electronic. Confidential Information shall also include any explanation or other information provided by either Party to the Recipient concerning the foregoing and which has been identified by the Party providing the information as confidential at the time it is initially provided, whether printed or electronic. Confidential Information may also include any password or other information necessary to access electronic copies of Confidential Information.

Permitted Scope of Use

2. The Recipient may use the Confidential Information solely for the purposes of providing or receiving EECA, as the case may be, in accordance with the Legislation and the Supply Agreement and for no other reason or purpose.

No Obligation to Disclose

3. This Agreement does not obligate either Party to disclose any Confidential Information to the other.

Protection of Confidential Information

4. The Recipient shall hold the Confidential Information in strict confidence and shall strictly protect the Confidential Information from all harm, loss, theft, reproduction and unauthorized access, employing at least the same degree of care that the Recipient employs to protect its own confidential information of a similar nature, but in any event, not less than reasonable care. The Recipient shall ensure that such Confidential Information is not disclosed, published, released, transferred or otherwise made available in any form to, for the use or benefit of, any person except as provided in this Agreement.

Acknowledgements

5. The Recipient acknowledges that the Confidential Information is confidential and a trade secret and is owned by the Disclosing Party and is highly valuable and material to the interests, business and affairs of the Disclosing Party and that any unauthorized disclosure thereof by the Recipient would be detrimental to the Disclosing Party.

Permitted Disclosures

6. The Recipient shall be permitted to disclose relevant aspects of the Confidential Information to its employees and professional advisors to the extent that such disclosure is reasonably necessary for the performance of its duties and obligations; provided, however, that prior to such disclosure the Recipient shall inform such persons and parties of the confidential nature of the Confidential Information and each such person or party signs the undertaking attached to this Confidentiality Agreement. The Recipient shall inform the Disclosing Party of the name of each person to whom it has disclosed the Confidential Information in accordance with this provision and shall provide to the Disclosing Party the signed undertaking. The Recipient shall be fully responsible for ensuring that any such persons to whom it discloses the Confidential Information complies with the confidentiality obligations contained in this Agreement and shall be liable for any breach of this Agreement by such persons.

7. The non-disclosure obligations in this Agreement shall not restrict any disclosure by the Recipient pursuant to any applicable law or an order of any court of competent jurisdiction or regulatory body with regulatory responsibilities over the Recipient, provided that the Recipient shall provide the Disclosing Party with prompt prior written notice of its obligation to disclose so that the Disclosing Party may seek a protective order or other appropriate remedy concerning the disclosure of its Confidential Information and/or waive compliance with the confidentiality provisions of this Agreement. In addition, the Recipient shall take reasonable steps, to the extent permitted by law, to remove from the Confidential Information that is required to be disclosed, any information that is commercially sensitive to the Disclosing Party. In the event of an order for disclosure by a court of competent jurisdiction or regulatory body with regulatory responsibilities over the Recipient, the Recipient shall first notify the Disclosing Party of such order and allow the Disclosing Party not less than ten (10) days to remove any such information that is commercially sensitive.

Term

8. The term of this Agreement shall commence on the effective date of the Supply Agreement unless superceded by another form of writing, and notwithstanding the return of any Confidential Information or any other event, shall continue in full force and effect for a period of FIVE (5) years from the effective date of this Agreement.

Equitable Remedy

9. The Recipient acknowledges that any unauthorized use of the Confidential Information or any breach of its obligations under this Agreement will result in

irreparable harm to the Disclosing Party which cannot be adequately compensated for by damages. Neither the Recipient, nor any term in this Agreement, shall interfere with, delay, or prevent the Disclosing Party from seeking an interim and interlocutory equitable remedy to enforce any provision of this Agreement. The Recipient agrees not to oppose an application for equitable relief by the Disclosing Party in such circumstances. Any such relief or remedy shall not be exclusive, but shall be in addition to all other available legal or equitable remedies. The Recipient agrees that the provisions of this Section are fair and reasonable in the commercial circumstances of this Agreement. This Article shall survive the termination of this Agreement.

Return of Information

10. On the earlier of either thirty (30) days following the termination of the Supply Agreement or at the written request of the Disclosing Party (and unless superceded by another form of writing), the Recipient shall return or destroy (at the Disclosing Party's direction) and delete from all electronic devices all Confidential Information provided to it, including all copies (and all notes and documents prepared by the Recipient that may incorporate same) and still in the Recipient's possession (and otherwise under its control or in the possession of other persons to whom it has been provided as permitted hereunder) and, if requested by the Disclosing Party, shall provide written confirmation to the Disclosing Party to that effect. Notwithstanding the forgoing, the Recipient shall be entitled to retain the Confidential Information in one legal file copy that may be retained solely for the determination of its legal obligations under this Agreement.

Residual Information

11. The Recipient or its designate or any other person having access to the Confidential Information pursuant to this Agreement shall not, during and after the termination of this Agreement, use in its business any Residual Information. "Residual Information" means the ideas, know-how and techniques that would be retained in the unaided memory of an ordinary person skilled in the art, not intent on appropriating the proprietary information of the disclosing party, as a result of such person's access to, use, review, evaluation, or testing of the Confidential Information of the disclosing party for the purposes described herein. An employee's memory is unaided if the employee has not intentionally memorized the Confidential Information for the purpose of retaining and subsequently using or disclosing it.

Limited Rights

12. The Recipient agrees that no rights are granted to Recipient other than the limited rights to use the Confidential Information on the terms of this Agreement. For certainty, no license is granted under this Agreement (directly or indirectly) under any patent, discovery, copyright, or other intellectual or industrial property right now or in the future.

Indemnity

13. The Recipient shall indemnify and hold the Disclosing Party harmless from any and all loss, liability, cost or expense (including, without limitation, solicitor's costs on a solicitor and client basis and all other costs of defence) caused in whole or in part by the Recipient's breach of any provision of this Agreement. This Article shall survive the termination of this Agreement.

Governing Law

14. This Agreement is governed and shall be construed in accordance with the laws of the Province of Nova Scotia.

General Provisions

15. This Agreement is binding on the Parties, their administrators, successors, executors and assigns.

Executed and delivered this day of 20__.

EfficiencyOne	Nova Scotia Power Incorporated
By: _____	By: _____
Name:	Name:
Title:	Title:

SCHEDULE "A" to CONFIDENTIALITY AGREEMENT

UNDERTAKING

I _____, HAVE READ AND AGREE TO ABIDE AND AM BOUND BY THE TERMS AND CONDITIONS SET OUT IN THE CONFIDENTIALITY AGREEMENT DATED THE ____DAY OF _____ BETWEEN EFFICIENCYONE AND NOVA SCOTIA POWER INCORPORATED.

Dated the day of 201__.

_____ _____

Witness Name:

Recipient Designate

SCHEDULE E

EECA PLAN

[Subject to approval by the UARB]

Appendix H

eTRM Presentation

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PREPARED BY: Ryan Kelly
DATE: 2018-10-18
RE: eTRM presentation

Presentation Summary

EfficiencyOne has developed an electronic technical reference manual (eTRM) which relies on three core components:

1. Energy Savings Platforms (ESP)
2. Dynamic DSM (DDSM)
3. Evaluation reports

These three components work together to create a TRM which is operationalized, i.e. it is integrated with day-to-day program administration functions. This integration reduces opportunity for user error and provides a central location for energy and demand savings algorithms. Savings methodologies can be easily modified and implemented in E1's data management system instantly. This contrasts with a traditional TRM, which is a written document that cannot directly affect a data management system. E1's approach offers greater levels of flexibility, accuracy, and integration with DDSM and increases transparency by allowing users to view which savings methodologies are being used in real-time, in addition to providing a historical record of calculations in use at any given time.

The presentation will review key eTRM components and demonstrate their role in executing eTRM core functions.

Presentation Outline

- Review of TRMs as a concept:
  - Traditional TRMs: what they look like and what they contain;
  - E1 eTRM: how it is structurally and functionally different from a traditional TRM; and
  - The pros and cons of a traditional TRM and E1's eTRM.
- Review the relationship between DDSM and ESP:
  - Information contained in DDSM;
  - Information contained in ESP; and
  - How DDSM and ESP interact.
- An example of eTRM implementation – Air conditioner retirement measure
  - Review the role of each key eTRM component in calculating savings for this measure:
    - ESP,
    - DDSM, and
    - Evaluation reports.
- Live walkthrough of ESP environment

Electronic TRM Review

Presentation to DSMAG

October 24, 2018

ENERGY STAR Integrated Screw Based SSL (LED) Lamps

Measure Number: IV-E-13-d (Efficient Products Program, Lighting End Use)

Version Date & Revision History
Draft date: Portfolio 84
Effective date: 1/1/2013
End date: TBD

Referenced Documents:
1) LED ESTAR specs_NewCats.xls
2) 2013 EISA Adjustment Calculations.xls
3) IntegralLamps.pdf
4) 2013 LED Sales Review.xlsx

Description
An ENERGY STAR Integrated Screw Based SSL (LED) Lamp (specification effective August 2010) is purchased in place of an incandescent lamp. This measure is broken down in to Omnidirectional (e.g. A-Type lamps), Decorative (e.g. Globes and Torpedoes) and Directional (PAR Lamps, Reflectors, MR16). Further, the Omnidirectional are broken down in to <10W and >=10W and Directional Lamps in to <15W and >=15W categories to best reflect the delta wattage in each range. The ENERGY STAR specification can be viewed here: http://www.energystar.gov/ia/partners/manuf_res/downloads/IntegralLampsFINAL.pdf

Algorithms
Demand Savings
$\Delta kW = ((Watts_{BASE} - Watts_{EE}) / 1000) \times ISR \times WHF_d$

Energy Savings
$\Delta kWh = ((Watts_{BASE} - Watts_{EE}) / 1000) \times ISR \times HOURS \times WHF_e$

Where:

ΔkW	= gross customer connected load kW savings for the measure
$Watts_{BASE}$	= Baseline connected kW.
$Watts_{EE}$	= Energy efficient connected kW.
ΔkWh	= gross customer annual kWh savings for the measure
ISR	= in service rate or the percentage of units rebated that actually get used
WHF_d	= Waste heat factor for demand to account for cooling savings from efficient lighting. For commercial lighting, the value is 1.082 (calculated as 1 + (0.47*0.67*.808) / 3.1))[601]. The cooling savings are only added to the summer peak savings. The value for Residential lighting is assumed to be 1.0.
WHF_e	= Waste heat factor for energy to account for cooling savings from efficient lighting. For commercial lighting, the value is 1.033 (calculated as 1 + ((0.47*0.29*.75) / 2.5))[602]. The value for Residential lighting is assumed to be 1.0.
HOURS	= average hours of use per year

Values used in algorithm[603] and results:

[601] Based on the following assumptions: 3.1 COP typical cooling system efficiency; average 47% of spaces have mechanical cooling; 25% average outside air; and 80.8% coincidence of cooling with the summer peak period. See WasteHeatAdjustment.doc for additional discussion.
[602] Based on the following assumptions: 3.1 COP typical cooling system efficiency; average 47% of spaces have mechanical cooling; 25% average outside air; and 29% of annual lighting energy contributes to cooling load. See "Calculating lighting and HVAC interactions", Table 1, ASHRAE Journal November 1993 and WasteHeatAdjustment.doc for additional discussion.

ENERGY STAR Integrated Screw Based SSL (LED) Lamps

Measure Number: IV-E-13-d (Efficient Products Program, Lighting End Use)

Version Date & Revision History
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Energy Savings
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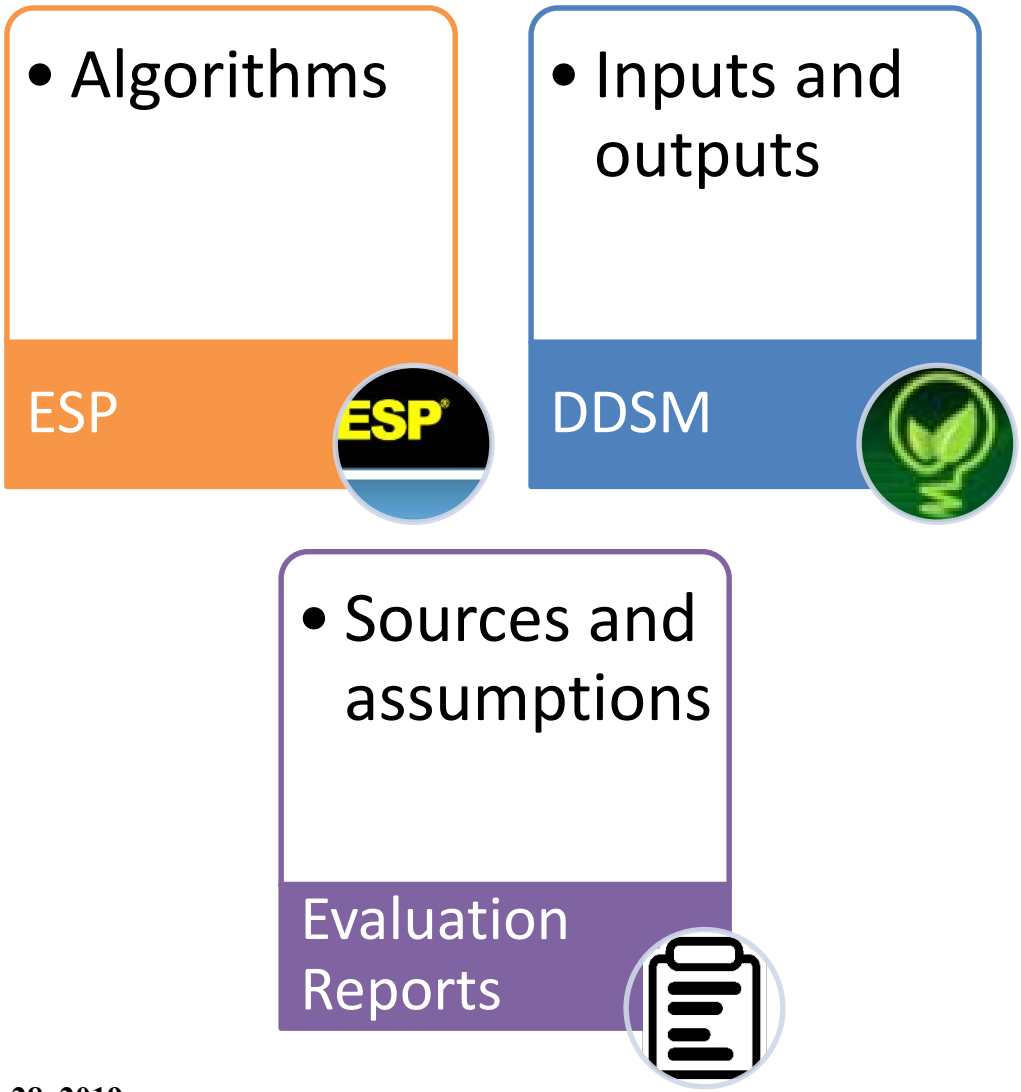
Algorithm

Inputs

Sources and Assumptions

Efficiency Vermont TRM (no. 2014-87), ENERGY STAR Integrated Screw Based SSL (LED) Lamps


• Algorithms
ESP
• Inputs and outputs
DDSM
• Sources and assumptions
Evaluation Reports

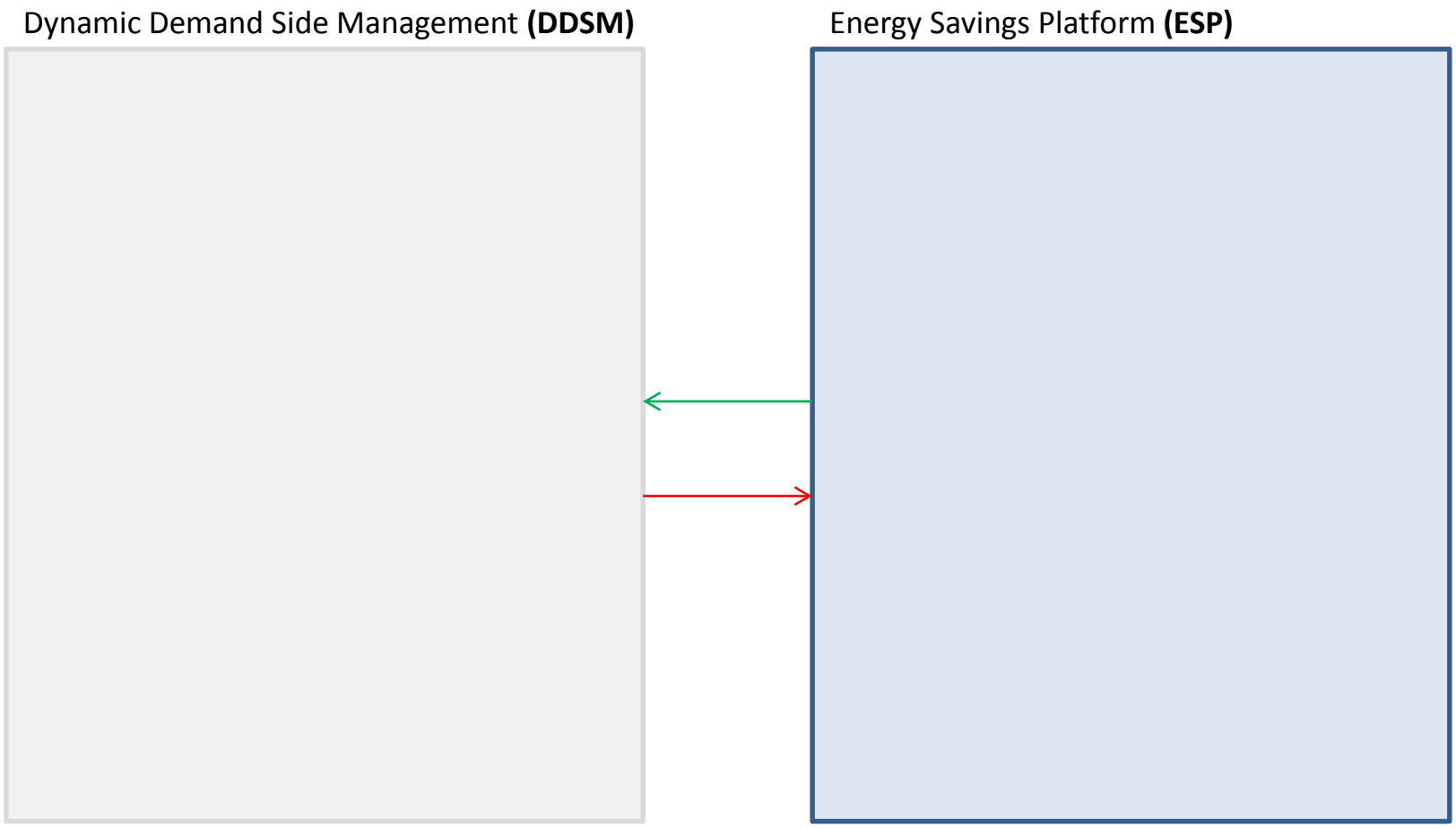
E1 approach compared to traditional TRMs

Traditional TRM	E1 eTRM
TRM and tracking systems must be reconciled on a regular basis, i.e. whenever the TRM is updated, the tracking system must be updated to reflect it.	The eTRM is a functional element of E1's program tracking infrastructure, i.e. the eTRM performs energy and demand savings calculations.
Summarizes inputs, sources, assumptions, and algorithms. Can be printed or emailed.	Sources and assumptions are documented in evaluation reports annually. Algorithms and inputs are accessible online through ESP and DDSM, respectively.
In order to view new measures or changes to methodologies, a new TRM version must be published.	Changes to methodologies or new measures can be made as needed and viewed by users instantly (evaluation, and applicable revisions to methodologies, will occur annually or as needed).
Version history is managed through each iteration of the TRM document itself. Previous methodologies are accessible via previous TRM versions.	Each measure has detailed version history showing version timing and access to previous version methodologies.

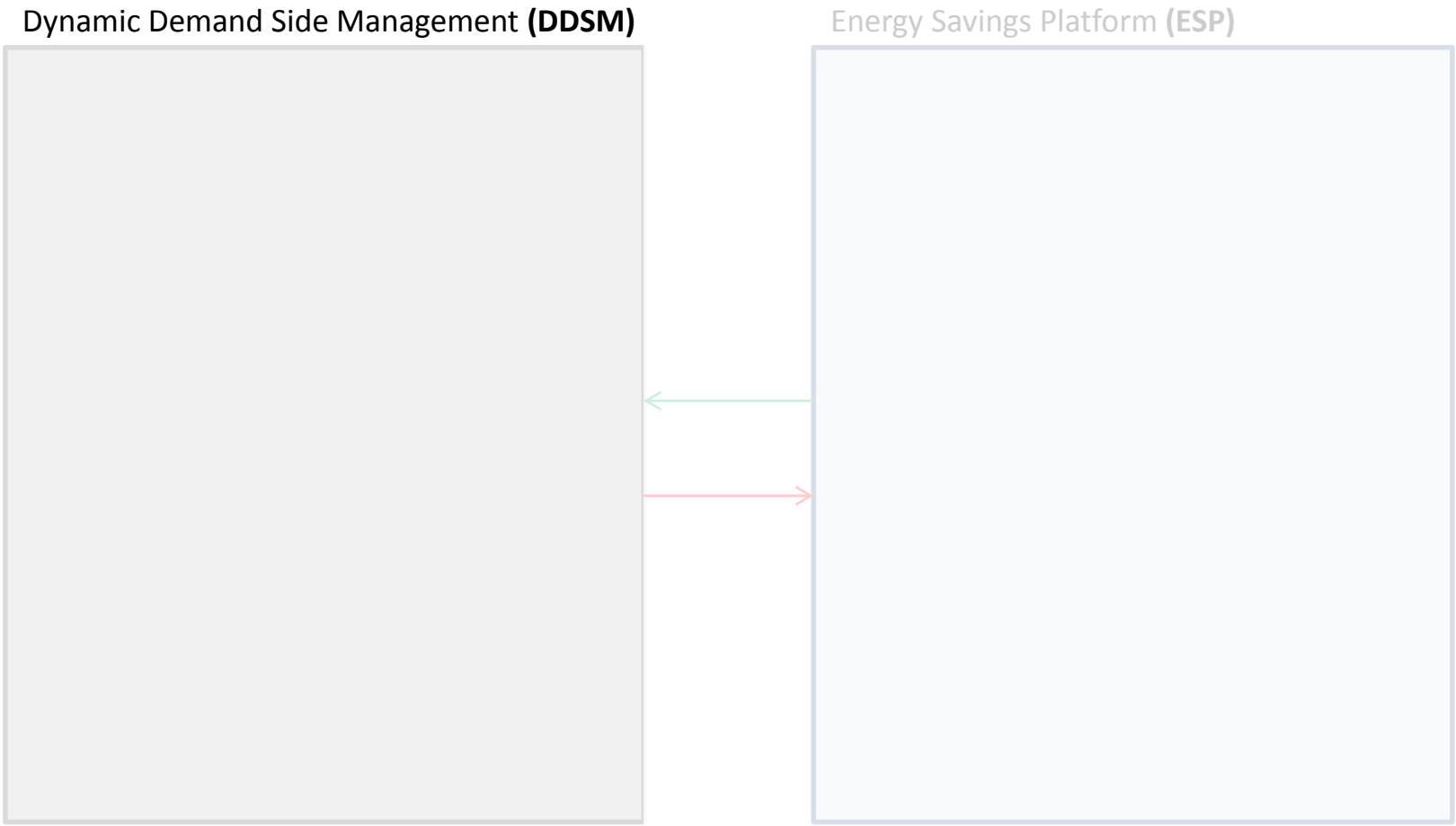
True of both approaches:

The evaluation of energy and demand savings occurs independent of TRM content; the TRM does not supplant, but is informed by and reflects independent program evaluations

DDSM and ESP work together to evaluate measure savings



DDSM and ESP work together to evaluate measure savings



Data stored in DDSM

The DDSM comprises multiple tables which hold data on ENS activities. For example:

DDSM

Project

Energy savings
Demand savings

Site

Heating equipment
Hours of operation

Measure

Existing equipment wattage
Replacement equipment wattage
Quantity of measure installed

Account

Primary contact
Utility account number

Data stored in DDSM

Some values are entered by users and some are calculated by ESP

DDSM

Project

Energy savings (calculated)
Demand savings (calculated)

Site

Heating equipment (user-entered)
Hours of operation (user-entered)

Measure

Existing equipment wattage (user-entered)
Replacement equipment wattage (user-entered)
Quantity of measure installed (user-entered)

Account

Primary contact (user-entered)
Utility account number (user-entered)

Data needed to perform calculations

Certain data are required to produce the calculated values

DDSM

Project

Energy savings (calculated)
Demand savings (calculated)

Site

Heating equipment (user-entered)
Hours of operation (user-entered)

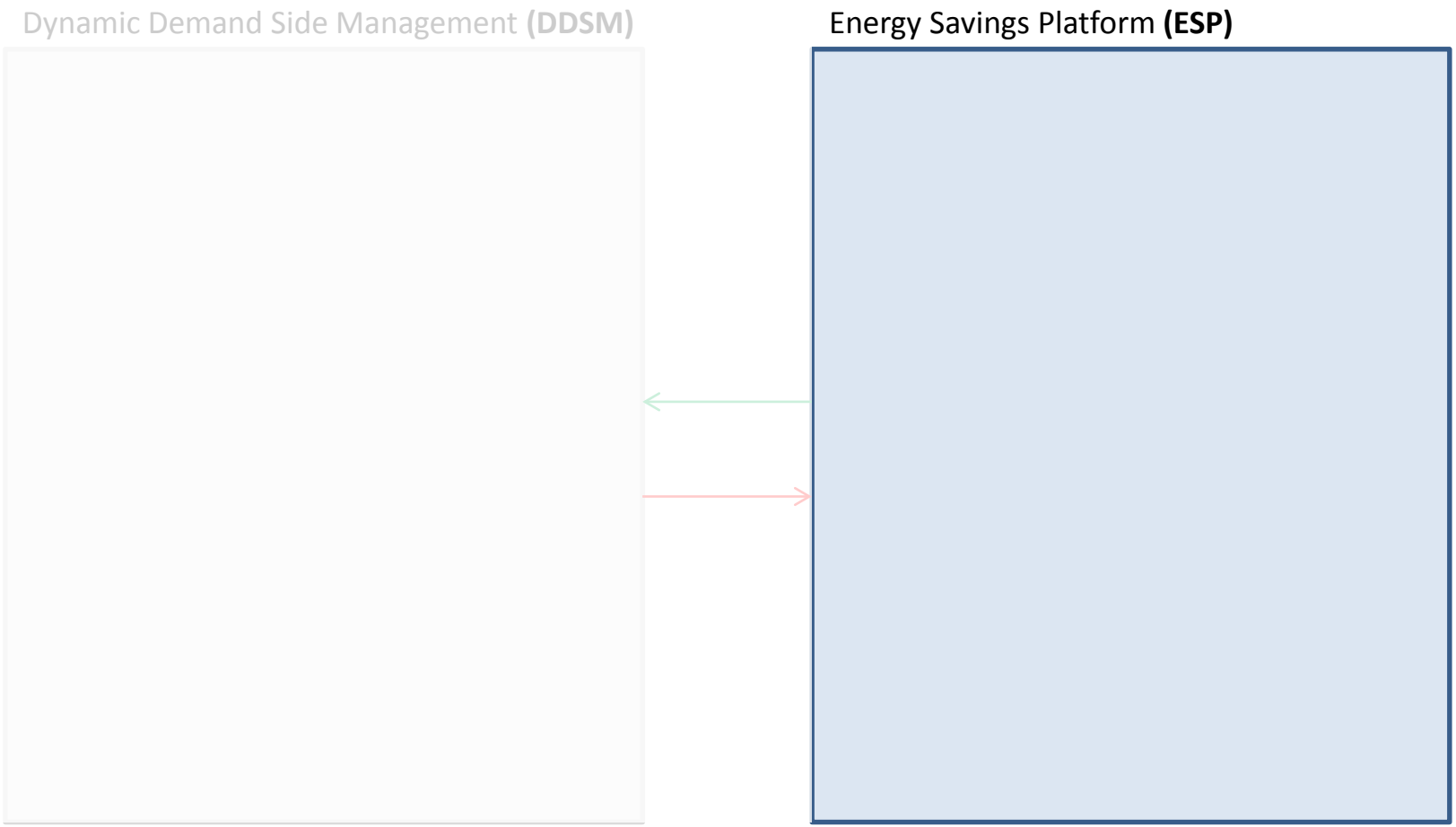
Measure

Existing equipment wattage (user-entered)
Replacement equipment wattage (user-entered)
Quantity of measure installed (user-entered)

Account

Primary contact (user-entered)
Utility account number (user-entered)

DDSM and ESP work together to evaluate measure savings



Calculations stored in ESP

ESP holds a library of engineering calculations used to estimate savings. For example:

ESP

Lighting Calculator

$$\Delta kWh = (W_b - W_e) * HRS * QTY$$
$$\Delta kW = (W_b - W_e)\, x * QTY$$

Heat Pump Calculator

$$\Delta kWh = \left(HC * \left[\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}} \right] * FLH_h + CC * \left[\frac{1}{SEER_{base}} * AC - \frac{1}{SEER_{ee}} \right] * FLH_c \right) * QTY$$

$$\Delta kW = \frac{HC_{min}}{3.412} * \left[1 - \frac{1}{COP_{ee_min}} \right] * QTY$$

Measure Application Data (MAD) - Inputs

Data which is transferred from the DDSM to ESP

Queryable Datum Definitions (QDD) - Outputs

Data which is transferred from ESP to the DDSM

DDSM

Project

Measure

Existing equipment wattage
Replacement measure wattage
Quantity of measure installed

Site

Heating equipment
Hours of operation

Account

Primary contact
Utility account number

ESP

Lighting Calculator

$$\Delta kWh = (W_b - W_e)\ x\ HRS\ x\ QTY$$
$$\Delta kW = (W_b - W_e)\ x\ QTY$$

Heat Pump Calculator

$$\Delta kWh = \left(HC * \left[\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}} \right] * FLH_h + CC * \left[\frac{1}{SEER_{base}} * AC - \frac{1}{SEER_{ee}} \right] * FLH_c \right) * QTY$$

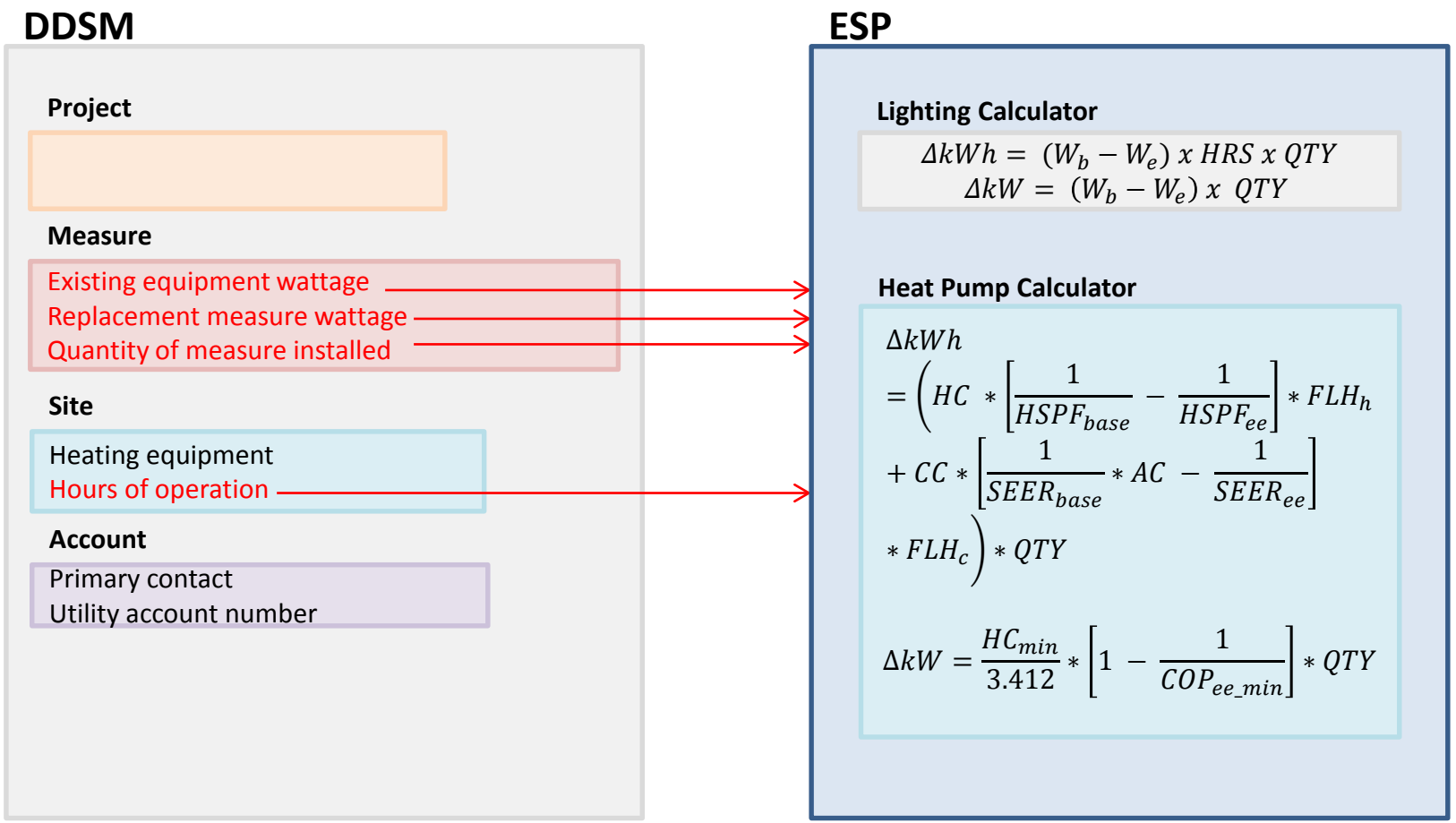
$$\Delta kW = \frac{HC_{min}}{3.412} * \left[1 - \frac{1}{COP_{ee_min}} \right] * QTY$$

Measure Application Data (MAD) - Inputs

Data which is transferred from the DDSM to ESP

Queryable Datum Definitions (QDD) - Outputs

Data which is transferred from ESP to the DDSM

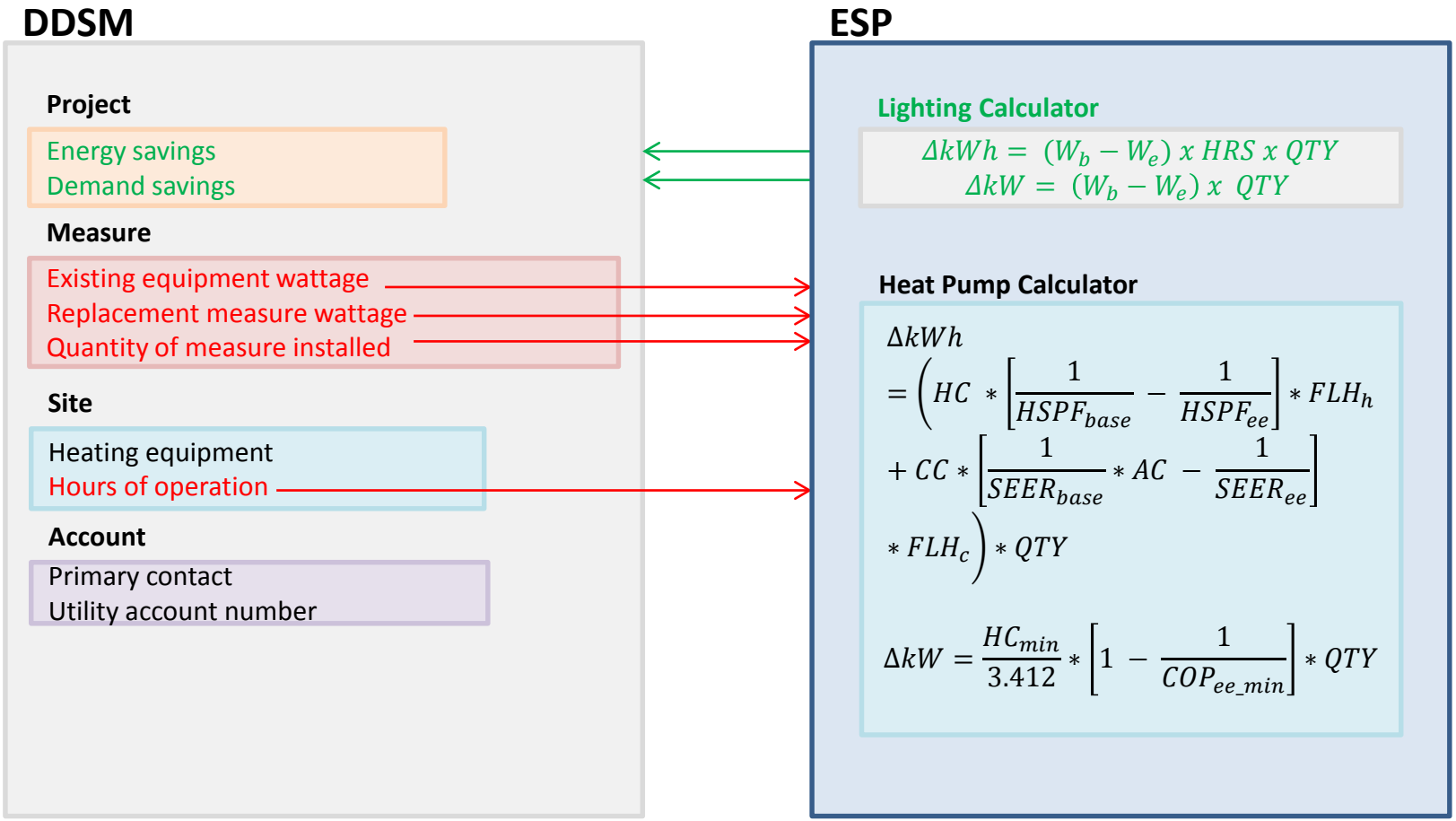


Measure Application Data (MAD) - Inputs

Data which is transferred from the DDSM to ESP

Queryable Datum Definitions (QDD) - Outputs

Data which is transferred from ESP to the DDSM



Measure Application Data (MAD) - Inputs

Data which is transferred from the DDSM to ESP

Queryable Datum Definitions (QDD) - Outputs

Data which is transferred from ESP to the DDSM

DDSM

Project

Energy savings
Demand savings

Measure

Existing equipment wattage
Replacement measure wattage
Quantity of measure installed

Site

Heating equipment
Hours of operation

Account

Primary contact
Utility account number

ESP

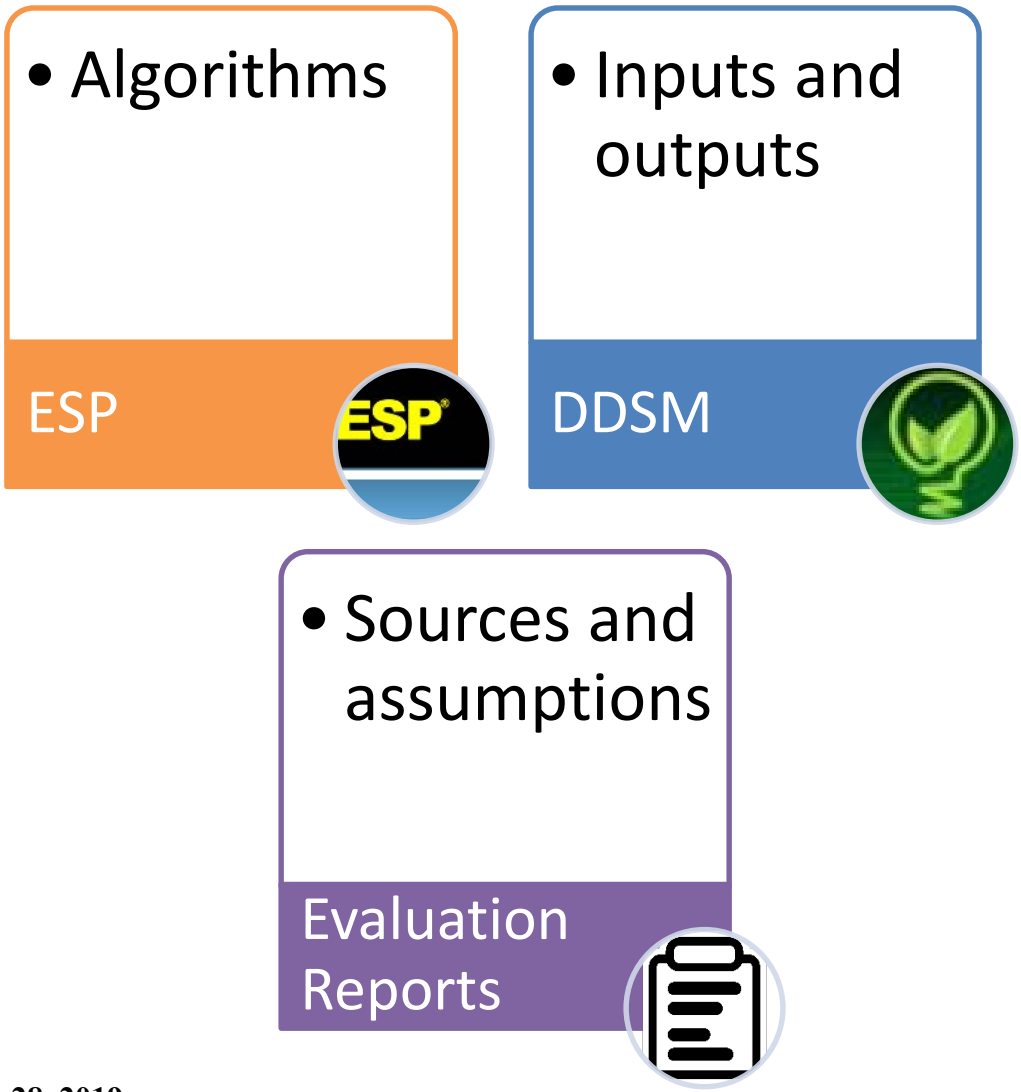
Lighting Calculator

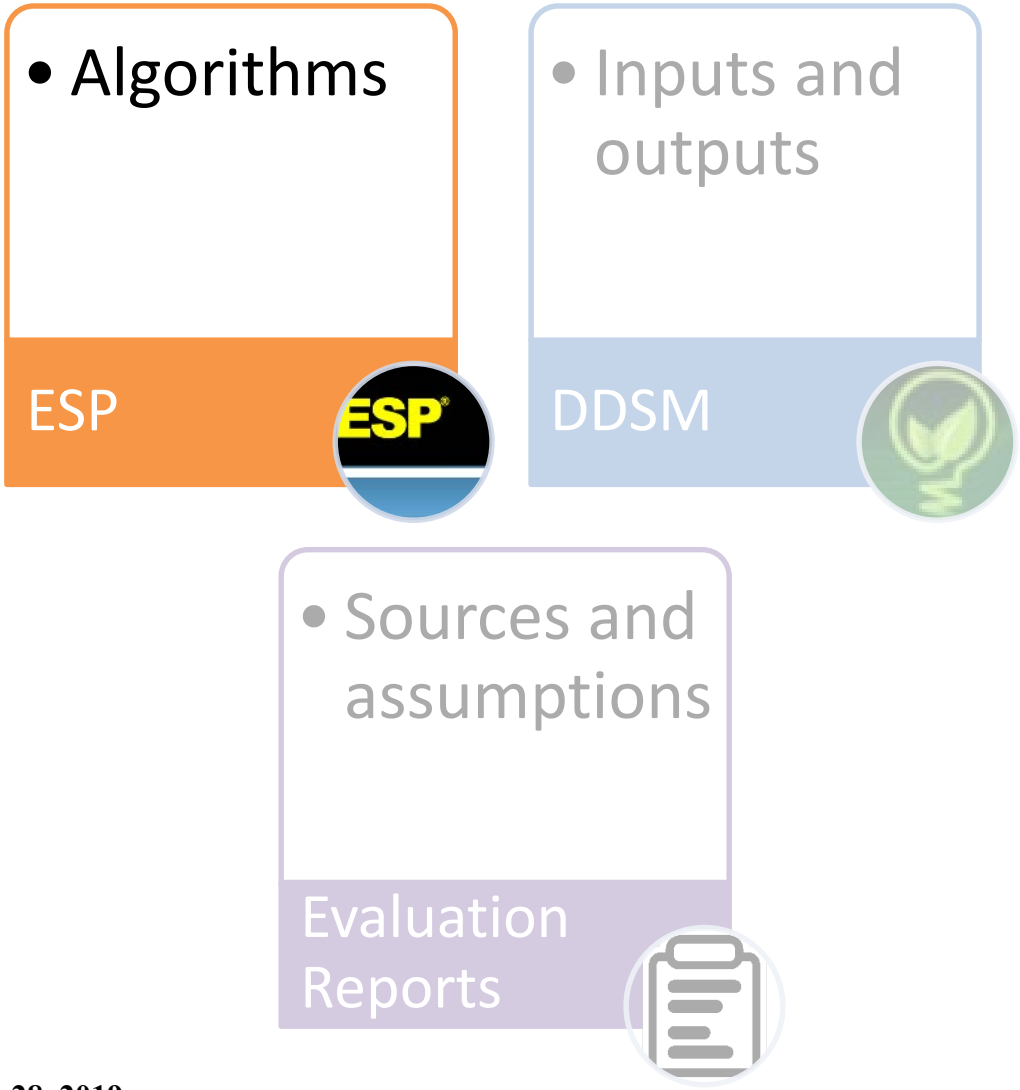
$$\Delta kWh = (W_b - W_e)\ x\ HRS\ x\ QTY$$
$$\Delta kW = (W_b - W_e)\ x\ QTY$$

Heat Pump Calculator

$$\Delta kWh = \left(HC * \left[\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}} \right] * FLH_h + CC * \left[\frac{1}{SEER_{base}} * AC - \frac{1}{SEER_{ee}} \right] * FLH_c \right) * QTY$$

$$\Delta kW = \frac{HC_{min}}{3.412} * \left[1 - \frac{1}{COP_{ee_min}} \right] * QTY$$


• Algorithms
ESP
• Inputs and outputs
DDSM
• Sources and assumptions
Evaluation Reports


• Algorithms
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DDSM
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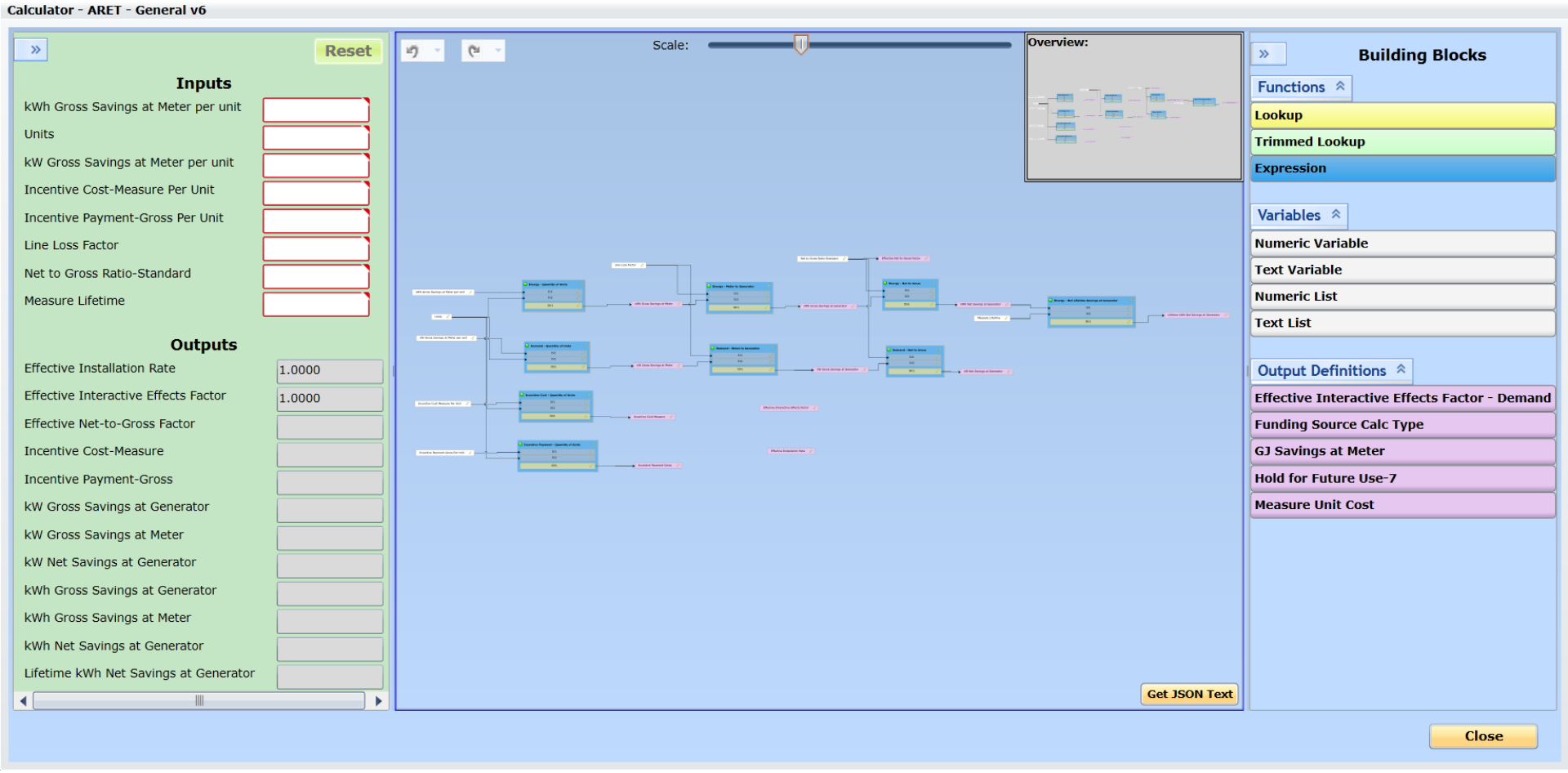
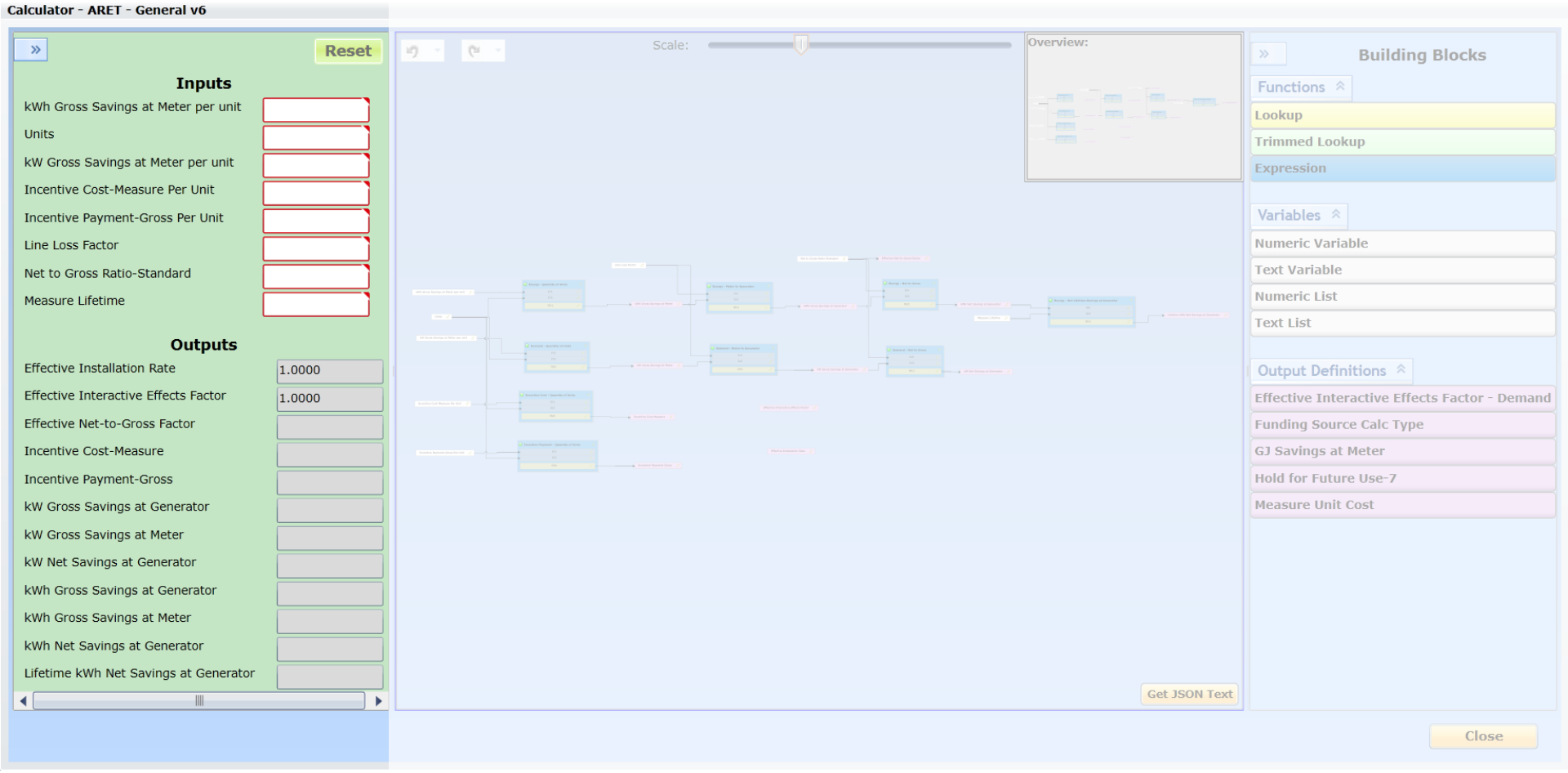
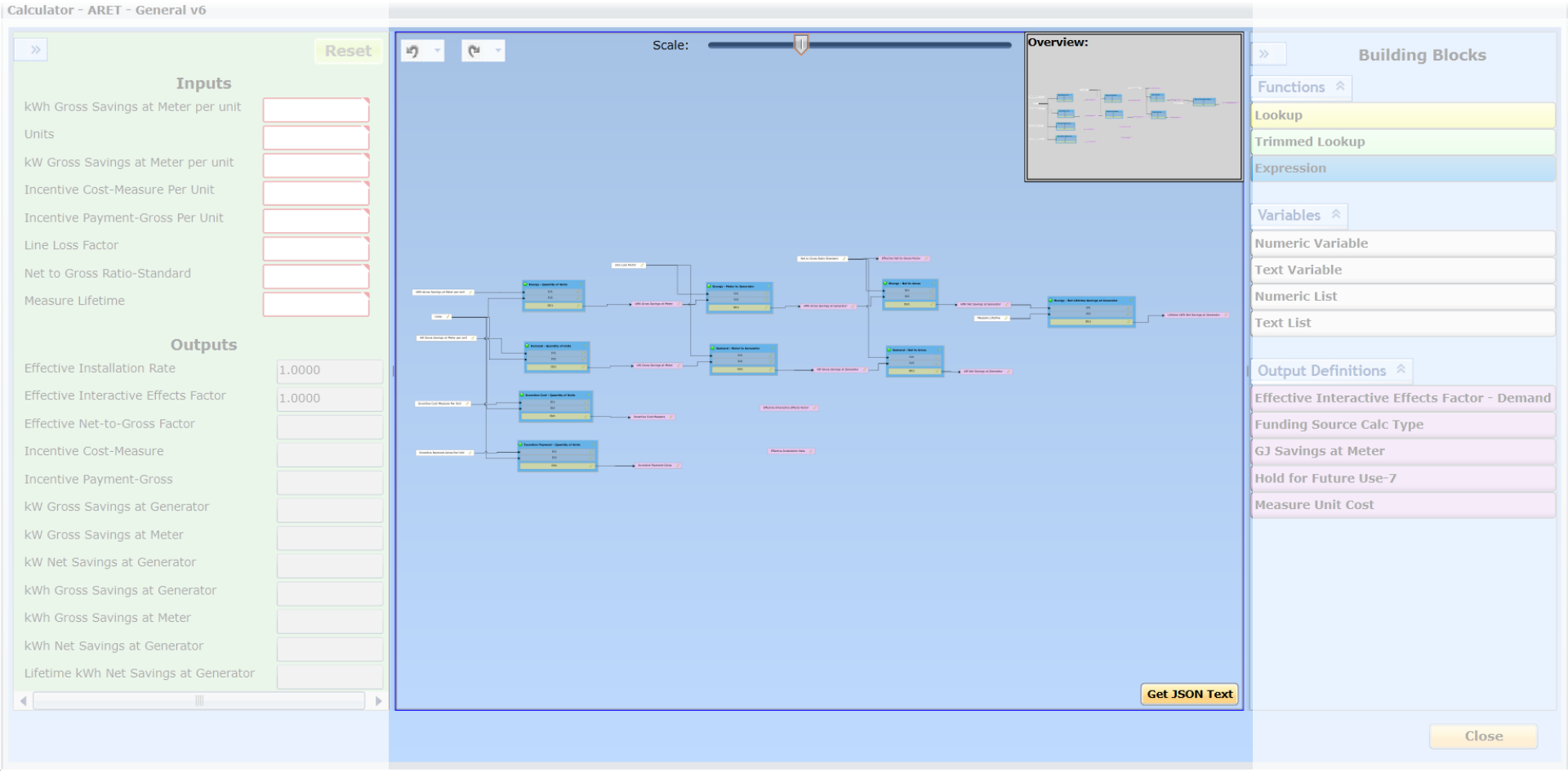
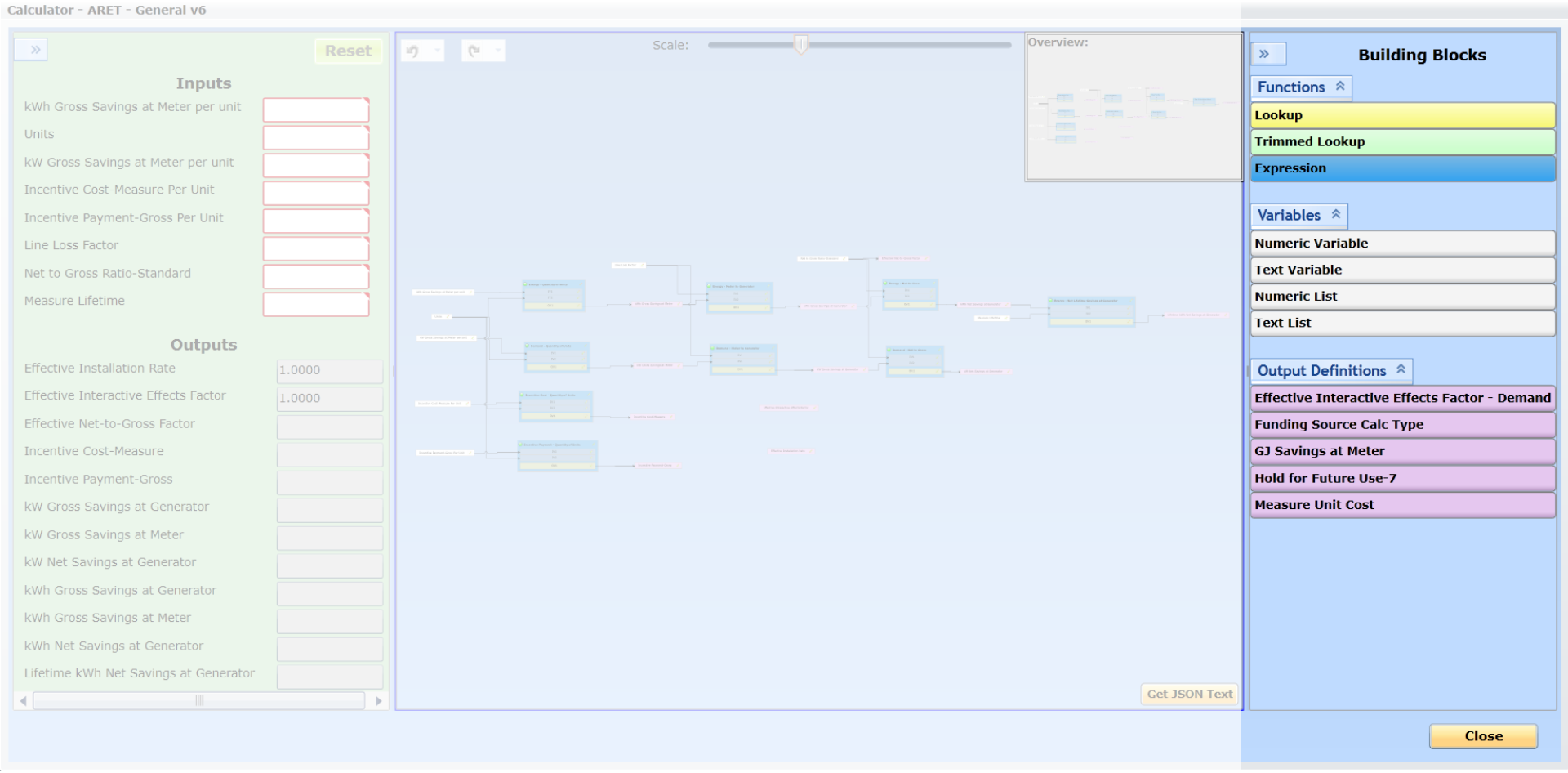
Evaluation Reports


Calculator - ARET - General v6
Reset
Inputs
kWh Gross Savings at Meter per unit
Units
kW Gross Savings at Meter per unit
Incentive Cost-Measure Per Unit
Incentive Payment-Gross Per Unit
Line Loss Factor
Net to Gross Ratio-Standard
Measure Lifetime
Outputs
Effective Installation Rate
1.0000
Effective Interactive Effects Factor
1.0000
Effective Net-to-Gross Factor
Incentive Cost-Measure
Incentive Payment-Gross
kW Gross Savings at Generator
kW Gross Savings at Meter
kW Net Savings at Generator
kWh Gross Savings at Generator
kWh Gross Savings at Meter
kWh Net Savings at Generator
Lifetime kWh Net Savings at Generator
Scale:
Overview:
Get JSON Text
Building Blocks
Functions
Lookup
Trimmed Lookup
Expression
Variables
Numeric Variable
Text Variable
Numeric List
Text List
Output Definitions
Effective Interactive Effects Factor - Demand
Funding Source Calc Type
GJ Savings at Meter
Hold for Future Use-7
Measure Unit Cost
Close

E1 approach – Example measure




Calculator - ARET - General v6
Reset
Inputs
kWh Gross Savings at Meter per unit
Units
kW Gross Savings at Meter per unit
Incentive Cost-Measure Per Unit
Incentive Payment-Gross Per Unit
Line Loss Factor
Net to Gross Ratio-Standard
Measure Lifetime
Outputs
Effective Installation Rate
1.0000
Effective Interactive Effects Factor
1.0000
Effective Net-to-Gross Factor
Incentive Cost-Measure
Incentive Payment-Gross
kW Gross Savings at Generator
kW Gross Savings at Meter
kW Net Savings at Generator
kWh Gross Savings at Generator
kWh Gross Savings at Meter
kWh Net Savings at Generator
Lifetime kWh Net Savings at Generator
Scale:
Overview:
Get JSON Text
Building Blocks
Functions
Lookup
Trimmed Lookup
Expression
Variables
Numeric Variable
Text Variable
Numeric List
Text List
Output Definitions
Effective Interactive Effects Factor - Demand
Funding Source Calc Type
GJ Savings at Meter
Hold for Future Use-7
Measure Unit Cost
Close


Calculator - ARET - General v6
Reset
Inputs
kWh Gross Savings at Meter per unit
Units
kW Gross Savings at Meter per unit
Incentive Cost-Measure Per Unit
Incentive Payment-Gross Per Unit
Line Loss Factor
Net to Gross Ratio-Standard
Measure Lifetime
Outputs
Effective Installation Rate
1.0000
Effective Interactive Effects Factor
1.0000
Effective Net-to-Gross Factor
Incentive Cost-Measure
Incentive Payment-Gross
kW Gross Savings at Generator
kW Gross Savings at Meter
kW Net Savings at Generator
kWh Gross Savings at Generator
kWh Gross Savings at Meter
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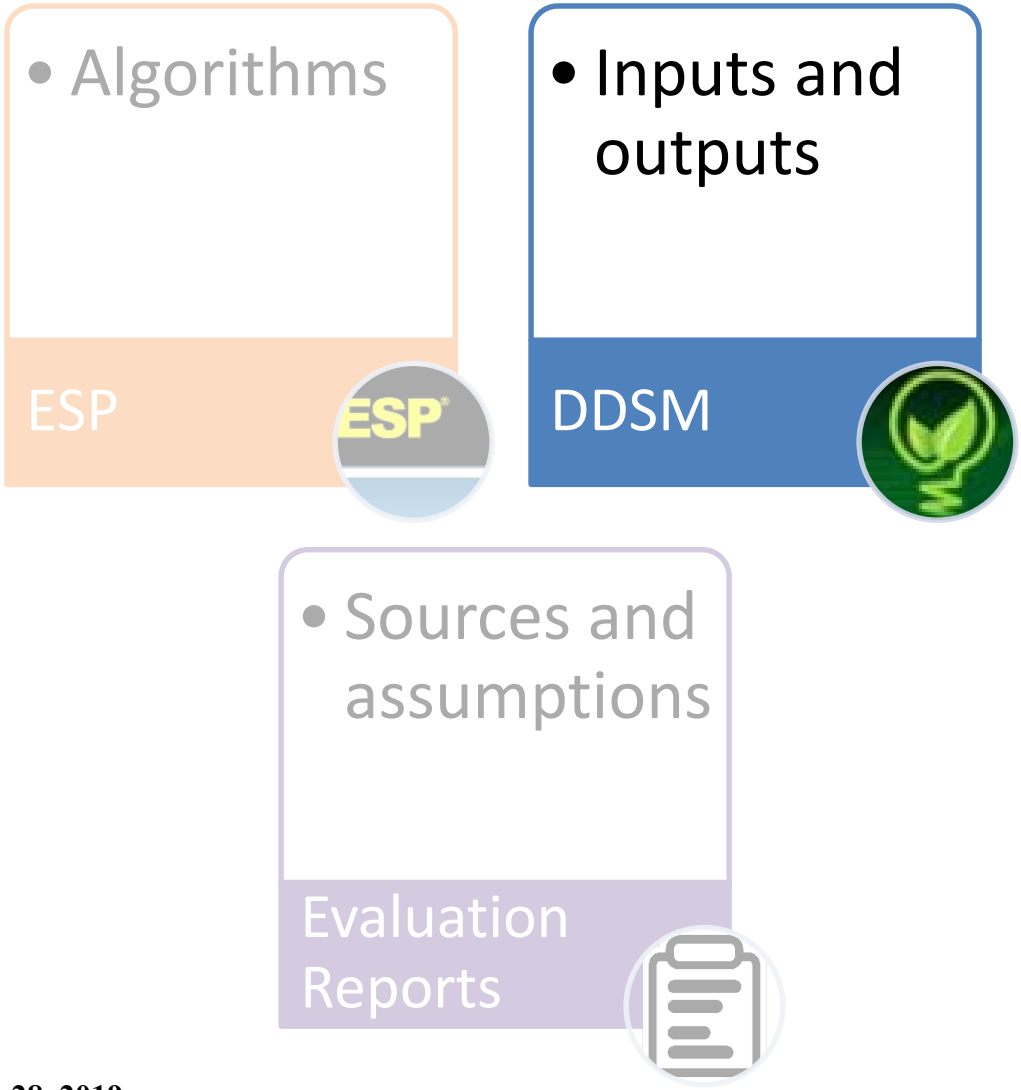
Effective Interactive Effects Factor - Demand
Funding Source Calc Type
GJ Savings at Meter
Hold for Future Use-7
Measure Unit Cost
Close


• Algorithms
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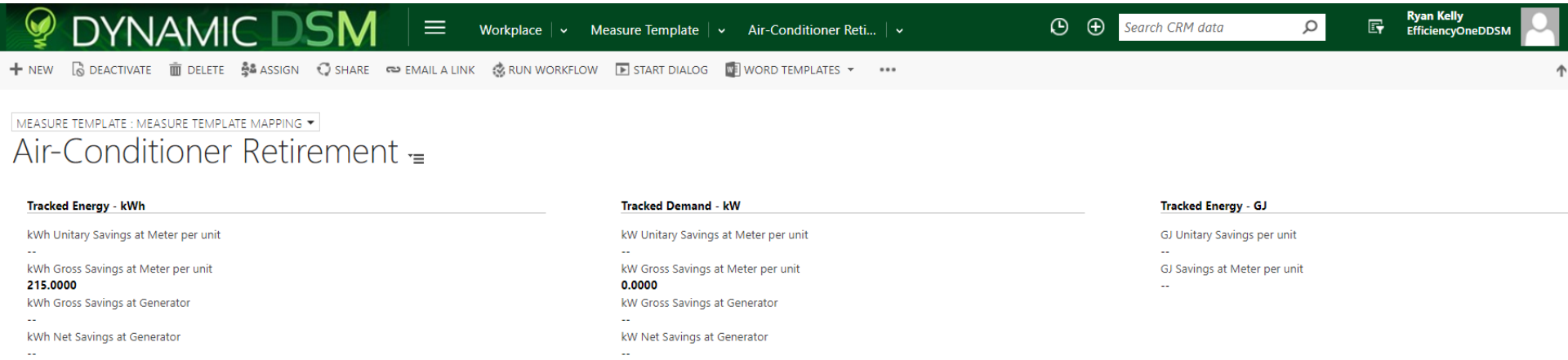
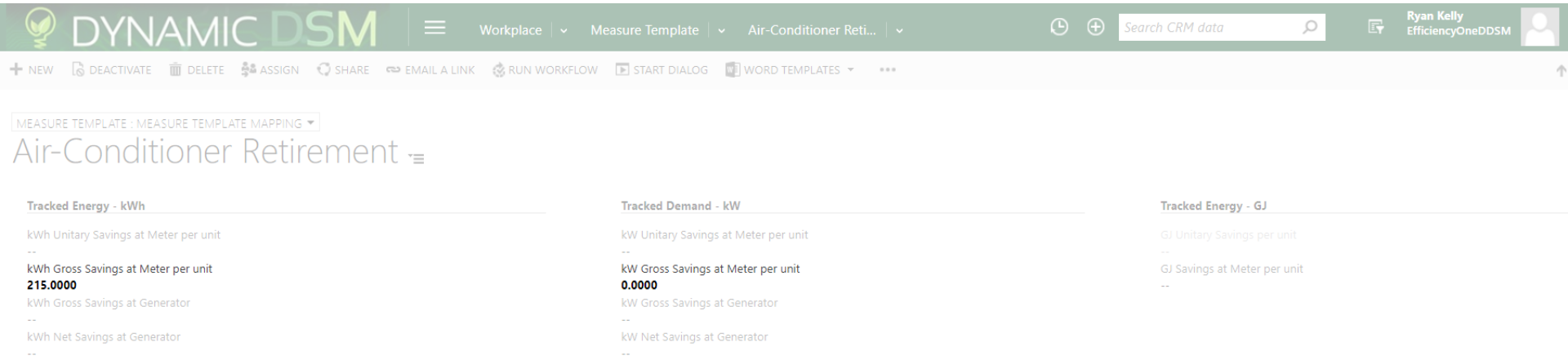
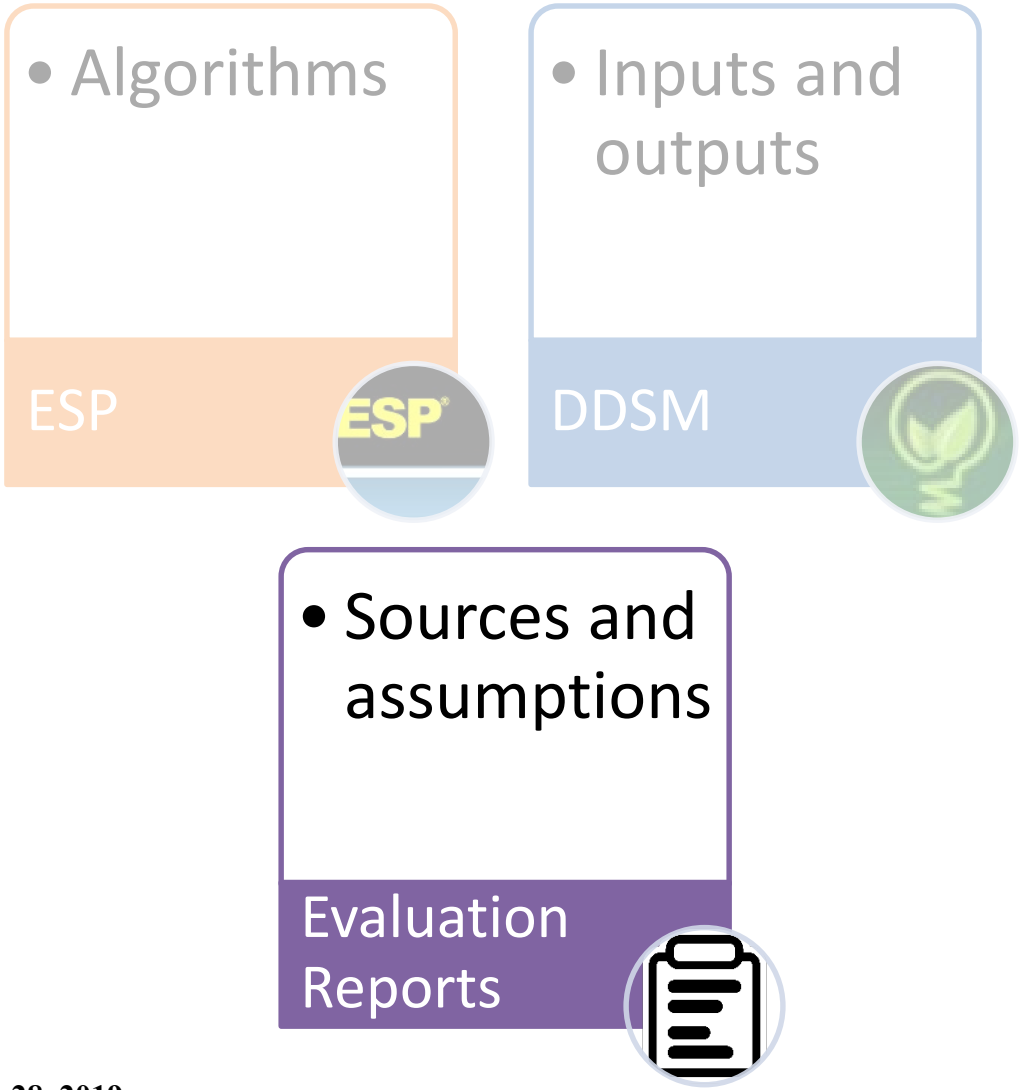

DYNAMIC DSM
Workplace
Measure Template
Air-Conditioner Reti...
Search CRM data
Ryan Kelly
EfficiencyOneDDSM
NEW
DEACTIVATE
DELETE
ASSIGN
SHARE
EMAIL A LINK
RUN WORKFLOW
START DIALOG
WORD TEMPLATES
MEASURE TEMPLATE : MEASURE TEMPLATE MAPPING
Air-Conditioner Retirement
Tracked Energy - kWh
kWh Unitary Savings at Meter per unit
--
kWh Gross Savings at Meter per unit
215.0000
kWh Gross Savings at Generator
--
kWh Net Savings at Generator
--
Tracked Demand - kW
kW Unitary Savings at Meter per unit
--
kW Gross Savings at Meter per unit
0.0000
kW Gross Savings at Generator
--
kW Net Savings at Generator
--
Tracked Energy - GJ
GJ Unitary Savings per unit
--
GJ Savings at Meter per unit
--

E1 approach – Example measure




• Algorithms
ESP
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DDSM
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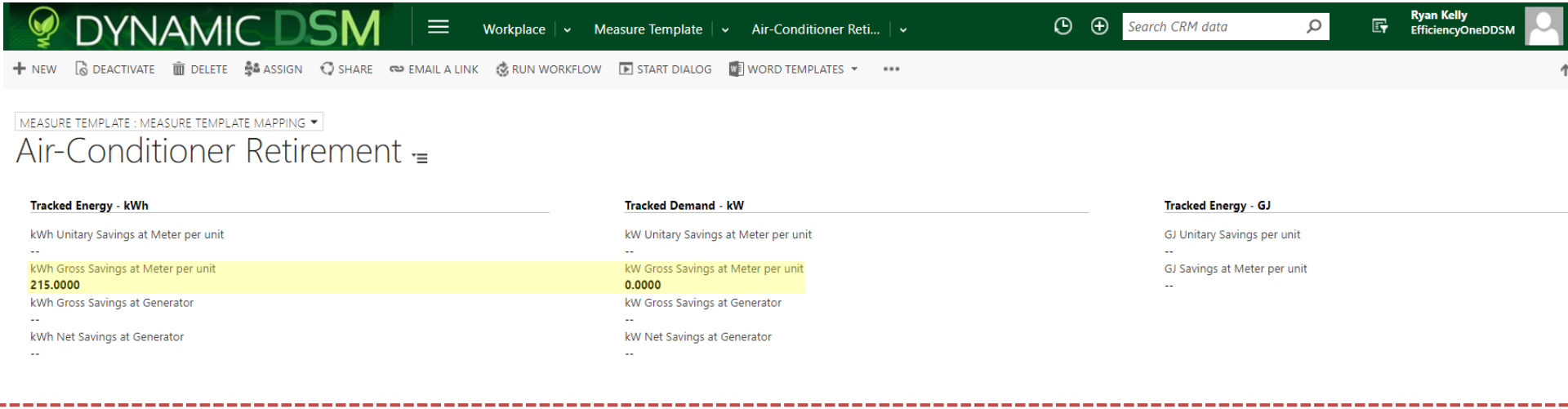
Evaluation Reports

E1 approach – Example measure



3.9 Summary of Unitary Savings Values

Table 34 presents the tracked and revised savings values for each type of product retired through ARet and the pilot, and replaced under HomeWarming in 2017.

Table 34: Tracked and Revised Unitary Savings by Appliance Type

	Tracked Unitary Savings (kWh/yr)		Revised Unitary Savings (kWh/yr)	
	Gross	Net	Gross	Net
Refrigerator (ARet)	745	406	751	410
Freezer (ARet)	756	398	863	465
Room Air Conditioner (ARet)	251	77	215	66
Small Refrigerator (ARet)	194	95	209	103
Small Freezer (ARet)	296	145	327	162
Refrigerator (Pilot)	745	406	814	814
Freezer (Pilot)	756	398	674	674
Small Refrigerator (Pilot)	194	95	295	295
Refrigerator (HomeWarming)	938	938	705	705
Freezer (HomeWarming)	492	492	1,399	1,399
Dehumidifier (HomeWarming)	633	633	660	660

Table 35: Peak-demand-to-energy Ratios by Appliance Type

Type of Appliance	Peak-demand-to-energy Ratio	Peak-demand-to-energy Ratio Category
Refrigerator	0.138	RES-Appliance-Fridge
Freezer	0.138	RES-Appliance-Fridge
Air conditioner	0.000	Calculated by the Evaluator
Dehumidifier	0.335	RES-Appliance-Dehumidifier

Questions before demonstration?