MARITIME ELECTRIC
A FORTIS COMPANY

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The Island Regulatory and Appeals Commission

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June 3, 2015

Island Regulatory & Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Commissioners:

Please find enclosed 10 copies of Maritime Electric's Demand Side Management and Energy Conservation Plan 2015 - 2020.

If you require further information, please do not hesitate to contact me at (902) 629-3668.

Yours truly,

MARITIME ELECTRIC

A. S. Orford
Vice President, Customer Service

ASO08
Encl. as noted

PO Box 1328, 180 Kent Street, Charlottetown, PE C1A 7N2
Tel. 1-800-670-1012, Fax 902-629-3665, Web Site www.maritimeelectric.com

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY AND APPEALS COMMISSION

IN THE MATTER of Section 16.1 of the Electric Power Act (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for an order of the Commission approving an Energy Efficiency and Demand Side Management Plan for the years 2015 to 2020 and for certain approvals incidental to such an order.

APPLICATION AND EVIDENCE OF MARITIME ELECTRIC COMPANY, LIMITED

Date: June 3, 2015

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1.0 APPLICATION

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Introduction

1. Maritime Electric Company, Limited ("Maritime Electric" or the "Company") is a Corporation incorporated under the laws of Canada with its head or registered office at Charlottetown and carries on a business as a public utility within the scope of the Electric Power Act ("EPA" or the "Act") engaged in the production, purchase, transmission, distribution and sale of electricity within Prince Edward Island.

Application

2. Maritime Electric hereby applies for an order of the Island Regulatory and Appeals Commission ("IRAC" or the "Commission") approving the Energy Efficiency and Demand Side Management Plan ("the Plan") for the years 2015 to 2020 as outlined in the attached evidence. Maritime Electric proposes to launch the Plan in late 2015

and recover the costs of each program, in a manner similar to previous programs, through the Energy Cost Adjustment Mechanism.

3. The proposals contained in this Application represent a just and reasonable balance of the interests of Maritime Electric and those of its customers and will, if approved, allow the Company to deliver an effective Plan at a cost that is, in all circumstances, reasonable.

Procedure

4. Filed hereto is the Affidavit of Frederick J. O'Brien, Angus S. Orford and Robert O. Younker which contains the evidence in which Maritime Electric relies in this Application.

Dated this 3rd day of June, 2015.

D. Spencer Campbell
Counsel for the Applicant
Whose address for service is:

STEWART MCKELVEY
65 Grafton Street, PO Box 2140
Charlottetown PE C1A 8B9
Telephone: (902) 629-4549
Facsimile: (902) 892-2485
Email: scampbell@smss.com

2.0 AFFIDAVIT

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY AND APPEALS COMMISSION

IN THE MATTER of Section 16.1 of the Electric Power Act (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for an order of the Commission approving an Energy Efficiency and Demand Side Management Plan for the years 2015 to 2020 and for certain approvals incidental to such an order.

AFFIDAVIT

We, Frederick James O'Brien, of Alberton, in Prince County, and Angus Sumner Orford of Charlottetown, and Robert Owen Younker of Cornwall, in Queens County, Province of Prince Edward Island, MAKE OATH AND SAY AS FOLLOWS:

1. THAT we are respectively, the President and Chief Executive Officer and Vice President, Customer Service and Director, Corporate Planning for Maritime Electric Company, Limited ("Maritime Electric" or the "Company") and as such have personal knowledge of the matters deposed to herein, except where noted, in which

case we rely upon the information of others and in which case we verily believe such information to be true.

2. Maritime Electric is a public utility subject to the provisions of the Electric Power Act engaged in the production, purchase, transmission, distribution and sale of electricity within Prince Edward Island.

3. We prepared or supervised the preparation of the evidence and to the best of our knowledge and belief the evidence is true in substance and in fact. A copy of the evidence is attached to this our Affidavit, and is collectively known as Exhibit "A", contained in Tab 3 inclusive.

4. The evidence found at Tab 3 (the "Evidence") contains the evidence with respect to the proposed Plan.

5. The evidence found at Tab 3 (the "Appendices") contains Appendices 1 through 16 inclusive which are referred to in the evidence.

6. Tab 4 contains a proposed Order of the Commission based on the Company's Application.

SWORN SEVERALLY at
Charlottetown, County of Queens,
Province of Prince Edward Island,
The 3rd day of June, 2015.
Before me:

Frederick J. O'Brien

Angus S. Orford

Robert O. Younker

A Commissioner for taking Affidavits
in the Supreme Court of Prince Edward Island.

3.0 EVIDENCE

3.1 EXECUTIVE SUMMARY

This document describes Maritime Electric Company, Limited's ("Maritime Electric" or the "Company") proposed Energy Efficiency and Demand Side Management ("DSM") Plan ("the Plan") for the years 2015 to 2020.

Maritime Electric's proposed plan is summarized in the following table. It lists the measures that the Company is proposing, the reduction in energy and peak load expected to be realized through each measure, and the estimated implementation cost for each measure. The energy and peak load reductions are estimated annual values for year 5 (i.e. 2020), while the costs are the total estimated expenditures for the five year period 2016 to 2020. (Most of 2015 is expected to be taken up with obtaining approvals and subsequent planning and preparations leading up to launch of programs in late 2015.)

TABLE 1
SUMMARY OF 2015 – 2020 PROPOSED ENERGY EFFICIENCY AND DSM MEASURES

Proposed Measure	Expected annual energy saving in year five (GWh)	Expected peak load reduction in year five (MW)	Estimated cost for the five years ($ millions)	Estimated cost for after 2020 ($ millions)
$ 5.00 rebate coupon for LED light bulbs	12.2	5.9	$ 6.0	
Grants for heat pumps that operate down to -25 C in electric resistance heated homes	0.3	1.5	$ 1.0	
Incentives for thermostat shut off below -15 C of heat pumps in oil heated homes (1)	1.0	2.3	$ 3.1	$ 4.2
Customer Outreach Activities			$ 0.8	
TOTAL	**13.5**	**9.7**	**$ 10.9**	**$ 4.2**

(1) Based on a successful pilot phase in 2016 and full implementation for 2017 to 2020

The Company's proposed Plan is based on the following approach to cost effectiveness:

- Cost effectiveness is determined at the individual measure level using the California tests
- The Total Resource Cost test is the primary test of cost effectiveness
- The cost of lost space heating is taken into account

The proposed Plan is also based on the following considerations:

- It is cost effective to incent consumers to use Light Emitting Diode (LED) products. The objective is to advance the adoption of LED lighting by 10 years.

- No incentives are proposed for the purchase of compact fluorescent lighting (CFL) products. It is expected that there is limited consumer appetite for increased use of CFLs. Although CFLs are currently a more cost effective replacement for incandescent lighting than LEDs, CFLs are viewed as a transitional technology and have drawbacks such as warm-up time and mercury content requiring hazardous waste disposal. LEDs do not have these drawbacks, and Maritime Electric expects that there will be a much greater uptake of incentives for LED lighting products.

- It is cost effective to incent the installation of "cold climate" air-source heat pumps (units that will operate down to -25 C) in households and businesses with electric resistance space heating. The objective is to have heat pumps installed that will be operating at time of system peak, and thus achieve a reduction in peak load by displacing electric resistance heating.

- It is cost effective to incent the installation of thermostat controls for air-source heat pumps in oil heated households and businesses. The objective is to have these heat pumps turned off during the coldest weather and the oil-fired heating systems operating instead, and thus minimize the impact on system peak. The Company is proposing that a pilot phase of approximately 100 installations be carried out in 2016 to confirm the overall investment required per location and the performance of available control equipment. Assuming a successful pilot phase, full implementation would follow for 2017 to 2020.

- It is not cost effective to incent consumers to purchase ENERGY STAR appliances because 1) manufacturers have already built in most of the cost effective efficiency improvements in order to comply with minimum efficiency performance standards, 2) the additional energy savings offered by ENERGY STAR appliances are relatively small, and 3) for most appliances ENERGY STAR models already dominate the marketplace.

- No incentives are proposed for the purchase of LED holiday lighting. The increase in electric space heating in the past several years is causing the system peak to move from December to January or February. When the system peak occurs in January or February, the reduction in load due to a conversion from incandescent holiday lighting to LED holiday lighting does not result in a corresponding reduction in annual system peak load.

Maritime Electric proposes to recover the costs of the Plan through the Energy Cost Adjustment Mechanism, as was done for DSM programs during 2006 to 2010.

The Company also proposes to recover these costs over periods of up to 15 years in order to match the time period during which the benefits will be realized. Costs incurred prior to the end of the Energy Accord on February 29, 2016 are proposed to be accrued for recovery under revised rates starting March 2016.

The maximum annual amount to be recovered through rates is estimated as $ 1.3 million, which corresponds to 0.65 % of the Company's annual revenue requirement. However, based on the Rate Impact Measure benefit cost analyses for the proposed measures, it is expected that the impact on rates will be minimal.

3.2 INTRODUCTION

During the November 2013 session of the Legislative Assembly of the Province of PEI, the Electric Power Act (the "Act") was amended to require that "… public utilities should utilize energy efficiency and demand-side resource measures whenever it is cost-effective to do so". Energy efficiency and demand-side resource measures are defined in the Act as "any activities, techniques, standards or programs that are or may be used by the public utility to reduce the consumption of electric energy or modify when electric energy is consumed".[1]

According to the Act, the only requirement of energy efficiency and demand-side resource measures proposed for implementation by a public utility is that they be cost effective. However, there can be considerable variation in the assumptions and philosophies that go into determining what is cost effective in the area of energy efficiency and demand side management (DSM). Thus the main body of this report begins with a description of the approach that Maritime Electric uses in doing cost effectiveness analysis of potential energy efficiency and DSM measures.

A description of the California tests for cost effectiveness is included next, along with an example of their application.

Subsequent sections describe the benefit cost analyses of potential energy efficiency measures and potential DSM measures that were considered, along with a summary of the results. Details of the analyses are included in appendices at the end of the report.

The third last section describes customer outreach and public education initiatives, which are proposed as continuation of a number of the Company's current ongoing programs.

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[1] Electric Power Act (2014), Preamble and Definitions 1.(1) (b.1): Retrieved from http://www.irac.pe.ca/document.aspx?file=legislation/ElectricPowerAct.asp

The second last section contains the proposed method of recovery of costs through rates.

The final section of the report provides a summary of conclusions and the proposed Plan.

3.3 MARITIME ELECTRIC APPROACH TO COST EFFECTIVENESS ANALYSIS

Cost Effectiveness Evaluated at the Individual Measure Level

In keeping with the Act's requirement that "public utilities should utilize energy efficiency and demand-side resource measures whenever it is cost-effective to do so," Maritime Electric's view is that only measures that are cost effective on a stand-alone basis should be implemented. This approach ensures the cost effectiveness of each potential measure is evaluated on its own merit. Measures are not bundled into programs and then the benefit-cost analysis done at the program level.

In some jurisdictions cost effectiveness tests are applied to a bundle or a portfolio of measures rather than on a stand-alone basis. The result of evaluating potential measures as a bundle is that measures that are not cost effective on their own can end up being recommended for implementation. This is because a bundle of efficiency measures can be deemed to be cost effective (benefit cost ratio of greater than one for the bundle as a whole), with the bundle consisting of some measures that are cost effective on their own (benefit cost ratio of greater than one) and some measures that are not cost effective on their own (benefit cost ratio of less than one).

Various reasons are given in support of the bundle or portfolio approach. These reasons are largely public policy in nature and appear intended to maximize the amount of energy efficiency that is implemented at the expense of some level of cost effectiveness. Maritime Electric's view is that the mandate to provide reliable service at lowest cost requires the Company to implement only measures that are cost effective on their own merit, because it is the Company's customers who will pay for the costs incurred by the Company in implementing energy efficiency measures.

Total Resource Cost Test is the Primary Test of Cost Effectiveness

The benefit-cost analysis done by Maritime Electric on potential energy efficiency and DSM measures is based on the five cost effectiveness tests (sometimes referred to as the "California tests") that were developed in California during the 1980's.

These tests look at cost effectiveness from the perspectives of 1) the participant, 2) the utility, 3) the non-participant, 4) the utility's service area and 5) society as a whole. The use of the California tests is in keeping with industry practice in North America.

The National Action Plan for Energy Efficiency (2008)[2] advises that the Total Resource Cost test and Societal Cost test are used to determine whether energy efficiency is cost-effective overall. In Maritime Electric's analysis the only difference between the Total Resource Cost test and the Societal Cost test is the inclusion of the estimated value of avoided CO2 emissions. Maritime Electric uses the Total Resource Cost test as the primary test of cost effectiveness because the Company is not mandated to internalize and recover the cost of CO2 emissions through rates. In this context the Societal Cost test serves to provide policymakers with an indication of the potential impact of including externalities.

The Participant Cost test, the Utility Cost test and the Rate Impact test indicate how the benefits and costs of energy efficiency and DSM measures are shared between the participant, the utility and the non-participant, respectively. The five benefit-cost tests are further described in section 4.0, including an example of their application.

Cost of Lost Space Heating Taken into Account

Increasing the efficiency of electrical appliances and lighting within a building envelope results in an increase in the amount of energy needed for space heating. This is because most of the electricity used by appliances and lighting ends up as heat inside the building, and thus contributes to space heating. Reducing this contribution to space heating provided by less efficient electricity usage means that more furnace oil must be burned for space heating (in PEI most space heating is done with oil-fired furnaces).

[2] DOE/EPA (2008). *The National Action Plan for Energy Efficiency Vision for 2025: A Framework for Change*: http://www.epa.gov/cleanenergy/documents/suca/vision.pdf

This additional space heating requirement is included as a cost in the cost effectiveness analysis of incenting the purchase of more efficient appliances or lighting.

In some jurisdictions the benefit-cost analysis of efficiency programs does not include the cost to make up for lost space heating. This may be seen as being acceptable in regions outside Atlantic Canada where the heating season is shorter, residential air conditioning is widespread and natural gas is often available for space heating, typically at a lower cost than furnace oil or electricity. However, conditions in Atlantic Canada are different and should be accounted for. The heating season is longer, in the order of eight months, there is relatively little residential air conditioning, and natural gas is generally not available for space heating, making the cost of replacing lost space heating higher.

To estimate the additional furnace oil needed to make up for lost space heating, a factor of 8.5 kWh = 1 litre of furnace oil is used (i.e., 8.5 kWh used by appliances and lighting in the heated space during the heating season will provide the same amount of space heating as 1 litre of furnace oil at 80% conversion efficiency).

In doing cost effectiveness analysis, Maritime Electric uses an 8 month heating season for PEI, which means that two thirds of the electricity saved by using more efficient appliances and lighting in the heated space needs to be replaced with an equivalent amount of additional space heating. Support for using an 8 month heating season for PEI can be found in research done by Canada Mortgage and Housing Corporation (CMHC). In the table below the numbers in the middle two columns are taken from the January 2008 CMHC Research Highlight (Benchmarking Home Energy Savings from Energy-Efficient Lighting – Technical Series 08-101).

TABLE 2 LENGTH OF HEATING SEASON			
Location	**Annual electricity saving due to more efficient lighting (kWh)**	**Space heating increase (litres of furnace oil)**	**Estimated length of heating season (months)**
St. John's, NL	318	30	9.6
Saint John, NB	318	25	8.0
Halifax, NS	318	22	7.1

The numbers in the far right hand column are the result of calculations done by Maritime Electric. Using St. John's as an example, the calculations were done as follows:

- 318 kWh/8.5 kWh per litre = 37 litres of additional furnace oil needed if the heating season were 12 months long; i.e. if all of the electricity saving due to more efficient lighting needed to be replaced with additional space heating

- 12 months x 30 litres/37 litres = 9.6 months estimated length of heating season

PEI is taken to be between the 9.6 months heating season for St. John's and the 7.1 months heating season for Halifax, which leads to using an 8 month heating season for PEI.

3.4 EXPLANATION OF THE CALIFORNIA TESTS FOR COST EFFECTIVENESS

The benefit cost analysis performed for potential DSM programs is based on the five cost effectiveness tests that were developed in California during the 1980's. These tests look at the cost effectiveness of energy efficiency programs from the perspectives of 1) the participant, 2) the utility, 3) the non-participant, 4) the utility's service area or region and 5) society as a whole.

The use of the California tests is in keeping with industry practice in North America. Quoting from the *National Action Plan for Energy Efficiency* (2008), "Currently, five key tests are used to compare the costs and benefits of energy efficiency and demand response programs. These tests all originated in California. … In 1983, California's *Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs* manual developed five cost-effectiveness tests for evaluating energy efficiency programs. These approaches, with minor updates, continue to be used today and are the principal approaches used for evaluating energy efficiency programs across the United States."[3]

These tests are briefly described below.

- The Participant Cost Test looks at cost effectiveness from the perspective of a utility customer who participates in the energy efficiency program. This test takes into account the following benefits and costs to the participating customer:
  - Benefits – the reduction in electricity bills and the incentive rebate received.
  - Costs – the cost to implement the efficiency measure (does not take into account the incentive rebate) and the cost to replace lost space heating.

[3] *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers.* Energy and Environmental Economics, Inc. and Regulatory Assistance project (2008): http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html

- The Utility Cost Test looks at cost effectiveness from the perspective of the utility that undertakes the energy efficiency program. This test takes into account the following benefits and costs to the utility:
  - Benefits – avoided capacity costs and avoided energy supply costs.
  - Costs – the cost to develop and administer the energy efficiency program, and the cost of incentive rebates to customers.
- The Rate Impact Measure Test looks at cost effectiveness from the perspective of a utility customer who does not participate in the energy efficiency program by examining the effect of the program on the utility's rates. This test takes into account the following benefits and costs to the utility:
  - Benefits – avoided capacity costs and avoided energy supply costs.
  - Costs – the cost to develop and administer the energy efficiency program, the cost of incentive rebates to customers and the reduction in revenue due to reduced energy sales.

- The Total Resource Cost Test looks at cost effectiveness from the perspective of the entire area or region that the utility serves. This test takes into account the following benefits and costs to the region as a whole:
  - Benefits – avoided capacity costs and avoided energy supply costs by the utility.
  - Costs – the utility's cost to develop and administer the energy efficiency program (not including the incentive rebates), the cost to customers to implement the energy efficiency measure and the cost to customers to replace lost space heating.

- The Societal Cost Test looks at cost effectiveness from a broader perspective than the Total Resource Cost Test. In addition to all the benefits and costs included in the Total Resource Cost Test, the Societal Cost Test takes into account societal benefits such as avoided emissions to the environment that result from the energy efficiency program.

As an example of the use of the tests, the following table shows the application of the five tests to a potential rebate coupon that would incent consumers to purchase an ENERGY STAR refrigerator instead of a unit that just meets the minimum efficiency performance standards. Except for the increment in price to purchase the ENERGY STAR refrigerator and the amount of the incentive rebate, all the benefits and costs are present value amounts that are estimated to accrue over the service life of the appliance.

TABLE 3 BENEFIT COST ANALYSIS FOR POTENTIAL ENERGY STAR REFRIGERATOR REBATE					
	Participant Cost test ($)	**Utility Cost test ($)**	**Rate Impact test ($)**	**Total Resource test ($)**	**Societal Cost test ($)**
Benefits:					
Utility avoided generating capacity cost		8	8	8	8
Utility avoided T&D capacity cost		9	9	9	9
Utility avoided energy supply cost		43	43	43	43
Reduction in participant utility bills	71				
Incentive rebate to participant	30				
Value of avoided CO2 emissions					9
Total	101	60	60	60	69
Costs:					
Utility DSM program admin. costs		10	10	10	10
Utility DSM program rebate costs		30	30		
Revenue reduction to utility			62		
Higher price for ENERGY STAR refrigerator	50			50	50
Cost to replace lost space heating	39			39	39
Total	89	40	102	99	99
Net benefit (cost)	12	20	(42)	(39)	(30)
Benefit / cost ratio	1.13	1.50	0.58	0.60	0.69

Based on the analysis in the above table, the benefit-cost ratio for the Total Resource Cost Test is less than 1.0 (equal to 0.60), which means that the benefits do not outweigh the costs for the potential refrigerator rebate coupon measure, and thus it would not be recommended for implementation.

3.5 ANALYSIS OF POTENTIAL ENERGY EFFICIENCY MEASURES

3.5.1 Lighting

Maritime Electric is proposing a rebate coupon measure aimed at incenting consumers to choose Light Emitting Diode (LED) products. The coupon will be for $ 5.00, and it will apply to all LED light bulbs.

The rationale for this initiative is based in part on benefit cost analyses done for:

- LED replacement for the 43 Watt incandescent halogen standard light bulb
- LED replacement for the BR30 incandescent reflector bulb typically used in ceiling pot-light fixtures

The expectation is that by partially offsetting the higher price for LEDs with the rebate coupon, LEDs will gain widespread acceptance sooner than would be the case without the rebate. The benefit cost analyses that support these measures is based on an expected advancement in consumer uptake of LED lighting by 10 years.

Phase out of Standard Incandescent Light Bulbs

On January 1, 2014 new federal minimum efficiency regulations for general service incandescent lighting came into effect. These regulations are intended to result in the phase out of standard incandescent light bulbs in 75 and 100 Watt sizes. Similar regulations for standard incandescent light bulbs in 40 and 60 Watt sizes came into effect on December 31, 2014.

These regulations require at least a 28% reduction in electricity usage to provide the same amount of general service lighting. In the absence of incentives to purchase LED lighting, Maritime Electric expects that consumers will respond as follows:

- By 2008 consumers were purchasing one compact fluorescent (CFL) bulb for every three standard incandescent bulbs, according to the National Electrical Manufacturers Association's quarterly reports on shipments of general service light bulbs in the United States. However, the penetration of CFLs has not increased above the 25 % level since 2008, presumably due to their drawbacks. Maritime Electric expects that this will continue to be the case, with CFLs eventually being replaced by LED bulbs in the longer term as the price of LEDs decreases over time.

- Due to the drawbacks of CFLs and the higher price of LEDs, consumers will purchase incandescent halogen bulbs to replace standard incandescent bulbs as they are removed from the marketplace. The incandescent halogen bulb is identical in appearance to the standard incandescent bulb but lasts three times as long (3,000 hours instead of 1,000 hours) and just meets the 28 % required improvement in efficiency (e.g. 72 Watts instead of 100 Watts and 43 Watts instead of 60 Watts).

Replacement for 43 Watt incandescent halogen

To assess the possibility of achieving additional savings in household energy usage for lighting, two energy saving alternatives to the 43 Watt incandescent halogen light bulb are compared in the following two tables.

TABLE 4
ENERGY SAVING ALTERNATIVES TO THE 43 WATT INCANDESCENT HALOGEN LIGHT BULB

	Incandescent Halogen	**Compact Fluorescent (CFL)**	**Light Emitting Diode (LED)**
Power used (Watts)	43	13	11
Operating life (hours)	3,000	6,000	25,000
Indicative retail price	$ 2.50	$ 3.50	$ 10.50

TABLE 5 BENEFIT COST ANALYSIS RESULTS FOR REBATE COUPON FOR 11 WATT LED	
Potential Measure	**Benefit cost ratio for Total Resource Cost test**
Replace 43 Watt incandescent halogen with 13 Watt CFL	2.67
Replace 43 Watt incandescent halogen with 11 Watt LED	1.53
Replace 13 Watt CFL with 11 Watt LED	0.41
Replace one 43 Watt incandescent halogen and one 13 Watt CFL with two 11 Watt LEDs	1.17

Based on the above two tables, it appears that the best choice from a least cost perspective is the 13 Watt CFL. However, CFLs have some drawbacks that have limited consumer acceptance of them. These are:

- Typically CFLs take one to two minutes to reach full brightness
- Some are not dimmable
- They contain mercury, and thus should not be disposed of in the normal household waste stream

To achieve energy savings in excess of the 28 % that incandescent halogens will provide in replacing standard incandescent bulbs, Maritime Electric is proposing to offer a $ 5.00 rebate coupon for general service LEDs. A $ 5.00 rebate is in line with other jurisdictions and offers a significant reduction in the cost of an LED bulb to the consumer. It is expected that some people will use the coupon to purchase an LED to replace a CFL instead of an incandescent halogen. However the benefit cost analysis shows a benefit cost ratio of 1.17 for the Total Resource Cost test even if one 13 Watt CFL is replaced for every 43 Watt incandescent halogen that is replaced. If customer uptake is greater than expected, the cost of the program can be controlled by limiting the number of rebate coupons made available.

Replacement for BR30 Incandescent Reflector Light

Reflector type light bulbs have not been made subject to minimum efficiency performance standards. Therefore the 65 Watt incandescent reflector bulb used in pot lights will continue to be available to consumers. Two energy saving alternatives to the 65 Watt incandescent reflector bulb are compared in the following table.

TABLE 6
ENERGY SAVING ALTERNATIVES TO THE
65 WATT BR30 INCANDESCENT REFLECTOR BULB

	BR30 incandescent reflector bulb	CFL reflector bulb	LED reflector bulb
Power usage (Watts)	65	16	13
Operating life (hours)	2,000	6,000	25,000
Indicative retail price	$2.50	$ 7.50	$ 17.00

Similar to the case for replacement of the 43 Watt incandescent halogen, the benefit cost ratio for the Total Resource Cost test is greater than 1.0 for a $ 5.00 rebate coupon for the LED reflector bulb, even if the number of 16 Watt CFL reflector bulbs replaced is the same as the number of 65 Watt incandescent reflector bulbs replaced.

TABLE 7
BENEFIT COST ANALYSIS RESULTS FOR
REBATE COUPON FOR 13 WATT LED REFLECTOR BULB

Potential Measure	Benefit cost ratio for Total Resource Cost test
Replace 65 Watt BR30 incandescent reflector with 16 Watt CFL reflector bulb	2.04
Replace 65 Watt BR30 incandescent reflector with 13 Watt LED reflector bulb	1.67
Replace 16 Watt CFL reflector with 13 Watt LED reflector	0.62
Replace one 65 Watt BR30 incandescent reflector and one 16 Watt CFL reflector with two 13 Watt LED reflectors	1.38

The results of the above benefit cost analyses are assumed to be indicative for LED light bulbs generally, and thus for simplicity of program delivery Maritime Electric is proposing that the $ 5.00 rebate coupon will apply to all LED light bulbs.

Estimated Energy and Demand Savings and Cost of LED Rebate Coupon Program

The table below shows the estimated reduction in system energy and peak load as a direct result of the LED rebate coupon program, based on an average of eight incandescent halogen bulbs per household replaced with LEDs over five years (an annual saving of 187 kWh per household at the end of five years).

TABLE 8 ESTIMATED ENERGY AND DEMAND SAVINGS AT END OF FIVE YEARS DUE TO LED REBATE COUPON	
Number of halogen bulbs replaced per household	8
Number of MECL Residential customers	58,000
Total number of halogen bulbs replaced	464,000
Estimated reduction in annual energy supply (GWh)	12.2
(based on (43 – 11) Watts x 2 hours per day and 11.5 % losses)	
Estimated reduction in system peak load (MW)	5.9
(based on (43 – 11) Watts x 1/3 on at peak and 15.7 % losses)	

The estimated cost of the five year LED rebate coupon program is shown in the table below. A 50 % free ridership is assumed; i.e. one CFL is replaced for each incandescent halogen that is replaced. The administration cost of $ 1.50 per coupon is based on discussions with a company that does rebate coupon processing.

TABLE 9 ESTIMATED COSTS FOR FIVE YEAR LED REBATE COUPON PROGRAM	
Number of halogen bulbs replaced per household	8
Number of MECL Residential customers	58,000
Total number of halogen bulbs replaced	464,000
Cost of coupons that replace halogens (at $ 5.00 each)	$ 2,320,000
Cost of coupons that replace CFLs (at $ 5.00 each)	$ 2,320,000
Administration cost (at $ 1.50 per coupon)	$ 1,392,000
Total Program Cost	$ 6,032,000

LED Holiday Lighting

In 2010 Maritime Electric proposed a rebate coupon program for LED holiday lighting as a measure to reduce the system peak load. The program was based on the expectation that the conversion to LED holiday lighting would be advanced by 10 years. A similar program has not been included in the current proposed Plan because of the increase in electric space heating during the past several years, as the increase in electric space heating is causing the system peak load to shift from December to January or February. When the system peak occurs in January or February, the reduction in load due to a conversion from incandescent holiday lighting to LED holiday lighting does not result in a corresponding reduction in annual system peak load.

3.5.2 Household Appliances

Introduction

Maritime Electric is not proposing any measures to incent consumers to purchase more efficient household appliances. The reasons for this are:

- Manufacturers have already incorporated most cost-effective efficiency improvements into the major household appliances in order to comply with government minimum efficiency regulations.

- The energy efficiency program opportunity lies in incenting consumers to purchase appliances that are more efficient than the minimum standards, and in particular those appliances that meet the ENERGY STAR criteria. However, the results of benefit cost analyses show that it would not be cost effective for the Company to do so, largely because the additional savings are relatively small.

- The ENERGY STAR program has been a success – the majority of consumers are already purchasing ENERGY STAR qualified appliances.

Impact of Minimum Efficiency Performance Standards

To illustrate the limited opportunity for efficiency programs with respect to household appliances, the following table summarizes the annual average electricity usage of major new appliances for selected years of manufacture, starting with 1990. An examination of the table shows that large improvements in energy efficiency have been achieved over the years, driven in large part by government minimum efficiency performance standards and the ENERGY STAR program.

TABLE 10
AVERAGE ANNUAL ENERGY CONSUMPTION (kWh/year) OF NEW MAJOR APPLIANCES

	1990	1997	2001	2010
Refrigerators (16.5 – 18.4 cu. ft.)				
▪ Standard Top-Mounted Freezer	1044	664	572	427
▪ ENERGY STAR qualified	-	-	440	369
Freezers (Standard size Chest)	658	342	337	295
Kitchen ranges (30 inch)				
▪ Self-Cleaning	727	759	741	530
▪ Non-Self-Cleaning	786	780	786	499
Dishwashers (includes water heating)				
▪ Standard size	1026	649	634	310
▪ ENERGY STAR qualified	-	-	534	309
Clothes Washers (includes water heating)				
Standard size (Top-Loading)	1218	930	905	319
▪ ENERGY STAR qualified	-	-	304	148
Clothes Dryers (Standard size)	1103	887	916	928

Source: Natural Resources Canada (2013). *Choosing and Using Appliances with Energuide*: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/energystar/EnerGuideappliances.pdf

Table 10 suggests that refrigerators and clothes washers are the two appliances with potential for energy savings through purchase of Energy Star qualified models. However, revised minimum efficiency performance standards that came into effect on September 15, 2014 for refrigerators and on March 7, 2015 for clothes washers will further reduce the potential for energy savings. The benefit cost analysis of potential rebate coupon measures to incent consumers to purchase ENERGY STAR refrigerators and clothes washers shows benefit cost ratios of less than 1.0 for the Total Resource Cost test, and thus such measures have not been proposed.

ENERGY STAR Market Share

ENERGY STAR® is a U.S. Environmental Protection Agency (EPA) voluntary program that helps businesses and individuals improve comfort, save money, and reduce both energy usage and emissions of greenhouse gases (GHGs) through superior energy efficiency.

Canada is an international partner in the U.S. Energy Star program since 2001. Natural Resources Canada (NRCan) administers and monitors use of the ENERGY STAR name and symbol in Canada under an agreement with the U.S. EPA. NRCan works with the EPA to develop ENERGY STAR technical specifications for products. It also develops Canadian specifications for certain ENERGY STAR qualified products. Typically, an ENERGY STAR qualified product is in the top 15 to 30 percent of its class for energy performance.

The following table shows historical U.S. ENERGY STAR market share growth for selected major appliances. An examination of this table indicates that the North American major appliance market has been largely transformed by the ENERGY STAR program, given the high levels of market share attained by ENERGY STAR models.

TABLE 11
U.S. ENERGY STAR APPLIANCES: MARKET SHARE

	2008	2009	2010	2011	2012	2013	Revision Status
Refrigerators	31 %	35 %	50 %	56 %	76 %	74 %	V5.0
Freezers			25 %	21 %	44 %	29 %	V5.0
Room ACs	43 %	36 %	33 %	62 %	58 %	-	V3.0
Clothes Washers	24 %	48 %	64 %	60 %	66 %	66 %	V6.1 V7.0 (Mar 2015)
Dishwashers	67 %	68 %	100 %	96 %	89 %	90 %	V6.0

Source: Environmental Protection Agency (2014). *ENERGY STAR Appliance Specification Updates* http://www.energystar.gov/ia/partners/downloads/ENERGY_STAR_Appliance_Specification_Updates_Webinar.pdf?0b55-1475

Source: U.S. ENERGY STAR Program (2014). *ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2013 Summary.* *https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2013_USD_Summary_Report.pdf?e143-f3e4*

Refrigerator Roundup

Some households have two refrigerators, often as a result of keeping the old refrigerator when a new one is purchased. The old refrigerator is moved to another part of the house, and often kept plugged in. In some jurisdictions there is a program under which homeowners are offered a nominal payment for their second refrigerator, and it is removed from the home.

Maritime Electric's benefit cost analysis for such a program gave a benefit cost ratio of 0.76 for the Total Resource Cost test, and thus it has not been proposed.

3.6. ANALYSIS OF DEMAND SIDE MANAGEMENT MEASURES

3.6.1 Air-Source Heat Pumps - General

Currently the PEI Office of Energy Efficiency ("OEE") incents the installation of "most efficient" heat pumps by providing a $425 grant for units with a Heating Season Performance Factor ("HSPF") of 8.35 or better for Region 5. Maritime Electric is proposing two measures for heat pumps that will tie in with OEE's grant program. By partnering with OEE, Maritime Electric expects to reduce administration costs and leverage its grant by having it and the OEE grant coupled together.

1. For homes with electric resistance heating, Maritime Electric proposes to offer a matching grant for the installation of heat pumps that meet OEE's efficiency criterion <u>and</u> are rated to operate down to temperatures as low as -25 C. The objective is to have heat pumps installed that will be operating at system peak, and thus reduce system peak load by displacing some of the electric resistance heating that would otherwise be on.

2. For homes with oil-fired heating, Maritime Electric proposes to offer an annual rebate on customers' bills or similar incentive for the installation of heat pumps that meet OEE's efficiency criterion <u>and</u> that will turn off at temperatures below -15 C. The objective is to have these heat pumps off at system peak, and the oil-fired furnaces supplying all the space heating requirements. Approximately half of the annual rebate on customers' bills would be to compensate homeowners for the extra cost incurred by having the heat pumps turned off at temperatures below -15 C.

The benefit cost analyses that support the recommendation of these two measures are shown in Appendix 13 and Appendix 14.

For homes with oil heat, the turning off of heat pumps at temperatures below -15 C would be done by a thermostat switch installed inside the heat pump. MECL is proposing a pilot phase of approximately 100 installations for 2016. The purpose of the pilot phase is to confirm the technical viability of turning off the heat pumps, and to confirm that the expected benefits will be realized. Assuming a successful pilot phase, full implementation for the program would follow for 2017 to 2020.

Approximately 3,600 heat pumps were installed in PEI in 2013. The estimated resulting impact on system peak load is shown in the following table.

TABLE 12
ESTIMATED ADDITION TO PEAK LOAD BY HEAT PUMPS INSTALLED IN 2013

	Units Rebated by OEE	Units not Rebated	Total
Estimated number of units installed in 2013	900	2,700	3,600
Estimated percentage that are on at system peak	75	50	56
Number of units on at system peak	675	1,350	2,025
Estimated usage by each unit at peak (kW)	1.6	1.6	1.6
Total load at peak (including 15.7 % losses) (MW)	1.3	2.5	3.8
Less electric resistance heating displaced (MW)	0.3	0.5	0.8
Net addition to system peak load (MW)	**1.0**	**2.0**	**3.0**

The 0.8 MW of electric resistance heating displaced was estimated as follows:

- An estimated 10 % of Island households have electric resistance heating. Thus 10 % of the heat pump load at peak (i.e. 3.8 MW x 0.1 = 0.38 MW) was displacing electric resistance heating.
- Assuming a Coefficient Of Performance (COP) of 2.0 at time of system peak for the heat pumps, the 0.38 MW of heat pump load was displacing 0.38 MW x 2.0 = 0.76 MW (rounded to 0.8 MW in above table) of electric resistance heating.

3.6.2 "Cold Climate" Heat Pumps for Homes with Electric Resistance Heating

An estimated 10% of Island households have electric resistance heating. This means that of the 3,600 heat pumps installed in 2013, 10%, or 360, were installed in homes with electric resistance heating. Of these, an estimated 56%, or approximately 200, were on at system peak and thus displacing the 0.8 MW (0.76 MW rounded) of electric resistance heating shown in the Table 12 above, for an overall net reduction of 0.38 MW (the 0.76 MW reduction in resistance heating minus the 0.38 MW used by the heat pumps – this assumes a COP of 2.0 at system peak).

If all 360 units installed in electric resistance heated homes in 2013 were on at system peak (instead of the estimated 200 units), there would be an additional 0.76 MW x 160/200 = 0.6 MW of electric resistance heating displaced, for an additional net reduction of 0.3 MW. This represents an opportunity to mitigate the impact on system peak load of electric resistive heating.

There will also be an associated reduction in energy usage. The heat pumps not on at peak are assumed to turn off at -15 C. On average, it is estimated that each unit that turns off at -15 C would have displaced an additional 722 kWh of electric resistance heating had it kept operating down to -25 C, for a net reduction of 361 kWh (722 kWh/COP of 2.0).

In partnership with the OEE, MECL proposes to provide a matching grant of $425 for cold climate heat pumps installed in electric resistance heated households and businesses. This would be in addition to the $425 grant currently provided by the OEE. In addition to a sharing of administration costs, the tie in with the OEE grant program would be the OEE revising its grant criteria to include the requirement that the heat pump must be rated to operate down to -25 C.

<u>Measure Criteria</u>

1. Cold climate heat pump must operate down to -25 C.

2. Cold climate heat pump must meet the OEE's efficiency criterion – based on NRCan's "most efficient" HSPF designation of greater than 8.35 HSPF for climate zone Region 5.

<u>Annual Cost</u>

Cost of grants	360 units/y x $ 425 =	$ 153,000
Shared admin cost with OEE	360 units/y x $ 150 =	$ 54,000
Total annual cost (MECL)		$ 207,000

<u>Estimated Energy Saving and Peak Load reduction in Year 5</u>

0.3 GWh of energy: (361 kWh/unit x 160 units / year x 5 years and 11.5% losses)

1.5 MW of peak load: (0.3 MW/year x 5 years)

3.6.3 Thermostat Shutoff of Heat Pumps for Homes with Oil Furnaces

Of the 900 units given grants by OEE in 2013, an estimated 90 %, or 810, were installed in homes or businesses with oil or some other fuel heat. Of these, an estimated 608 units, or 75 %, were on at system peak, representing a load of 1.15 MW (1.6 kW x 608 units and 15.7 % losses). The ability to shut these units off below a certain temperature (proposed at - 15 C and below) would represent an opportunity to mitigate the impact on system peak load of heat pump installations.

Based on turning off the units at -15 C and below, a typical homeowner would see an annual reduction in electricity usage of 361 kWh, but would also see a corresponding increase in furnace oil usage of 85 litres (361 kWh x COP of 2.0/8.5 kWh per litre = 85 litres), for an overall increase in their energy costs. Approximately half of a proposed annual electricity bill credit is intended to compensate the homeowner for this increase in energy costs (the other half of the bill credit would serve as an additional incentive for customers to participate in the program).

Another issue to consider is that in some years the reduction in peak load achieved will be less than the full amount of the heat pump load. An example would be a year in which the system peak occurs at a temperature of -14 C, when the heat pumps would still be running. To account for this, a factor of 0.5 is applied to the amount of heat pump load under thermostat control in estimating the expected reduction in system peak load.

If the thermostats were set to turn the heat pumps off at -12 C and below, then the resulting reduction in peak load would be larger than for a -15 C shut off temperature. However, the overall increase in the homeowner's energy costs would be larger, because the heat pump would be shut off for more hours and more furnace oil would be used.

To better assess what is the optimal shut off temperature, and to confirm the technical viability of the proposed thermostat control, Maritime Electric is proposing a pilot phase of approximately 100 installations for 2016. Assuming a successful pilot phase, full implementation of the program would follow for 2017 to 2020.

In partnership with the OEE, MECL proposes to provide an annual bill credit of $100 or a similar incentive for cold climate heat pumps installed in oil heated households and businesses. This would be in addition to the $425 grant currently provided by the OEE. In addition to a sharing of administration costs, the tie in with the OEE grant program would be the OEE making the availability of its grant subject to the homeowner agreeing to thermostat control of the heat pump. Existing installations would be eligible for the program (but not for the OEE $425 grant).

Measure Criteria

1. Cold climate heat pump must be rated to operate down to -25 C.
2. Cold climate heat pump must meet the OEE's efficiency criterion – based on NRCan's "most efficient" HSPF designation of greater than 8.35 HSPF for climate zone Region 5.
3. Cold climate heat pump must have thermostat controlled shut off (installed at Maritime Electric's expense, and a Maritime Electric installed meter to monitor heat pump operation).

Annual Cost (after first year pilot phase)

Cost for meter and thermostat	810 units/y x $500 =	$ 405,000
Annual bill credit	810 units/y x $100 =	$ 81,000
Shared admin cost with OEE	810 units/y x $150 =	$ 121,500
Total annual cost (MECL)		$ 607,500

In addition to the above costs, the annual bill credits would continue past 2020 for the service life of the heat pumps, estimated to be 15 years. The total for bill credits post 2020 is estimated as $ 4.2 million.

Estimated Energy Saving and Peak Load reduction in Year 5

1.0 GWh of energy: (361 kWh/unit x 608 units/year x 4 years and 11.5% losses)

2.3 MW of peak load: (1.6 kW unit x 608 units/year x 0.5 x 4 years and 15.7% losses)

3.7 SUMMARY OF BENEFIT COST ANALYSES

The following table summarizes the results of the benefit cost analyses for all potential measures analyzed.

TABLE 13
BENEFIT COST RATIOS FOR POTENTIAL ENERGY EFFICIENCY AND DSM MEASURES

Potential Measure	Appendix	Participant Cost Test	Utility Cost Test	Rate Impact Test	Total Resource Cost Test	Societal Cost Test
Replace 43 W halogen with 13 W CFL	2	1.95	n/a	1.63	2.67	2.88
Replace 43 W halogen with 11 W LED	3	1.58	3.86	1.14	1.53	1.65
Replace 13 W CFL with 11 W LED	4	1.21	0.24	0.21	0.41	0.43
Replace 43 W halogen and 13 W CFL with two 11 W LEDs	5	1.49	2.05	0.90	1.17	1.26
Replace 65 W BR30 with 16 W CFL	6	1.90	7.28	1.33	2.04	2.19
Replace 65 W BR30 with 13 W LED	7	1.53	6.27	1.29	1.67	1.80
Replace 16 W CFL BR30 with 13 W LED	8	1.26	0.36	0.30	0.62	0.64
Replace 65 W BR30 and 16 W CFL BR30 with two 13 W LEDs	9	1.47	3.32	1.09	1.38	1.48
Rebate for ENERGY STAR refrigerator	10	1.13	1.49	0.58	0.60	0.69
Rebate for ENERGY STAR clothes washer	11	1.51	1.54	0.60	0.93	1.10
Refrigerator Roundup program	12	1.93	1.42	0.56	0.76	0.88
Heat pumps that operate to -25 C for homes with electric resistance heat	13	1.42	3.68	2.66	3.66	3.74
Thermostat shut off for heat pumps in homes with oil heat	14	1.58	1.63	1.24	1.78	1.78

3.8 CUSTOMER OUTREACH ACTIVITIES

Working with the community through outreach programs is an ongoing part of the Company's energy conservation strategy. These programs are intended to enhance energy conservation and awareness to help customers better understand their energy use. These activities also provide opportunities to promote the Company`s incentive rebate programs.

Participation in tradeshows, presentations, promotions and lighting exchanges will continue to be an integral component of the DSM plan. A series of promotions and events will occur annually to help consumers understand more about energy efficiency and conservation. Marketing of proposed DSM programs will include newspaper and radio. Additional training about energy efficiency and conservation will be provided for Customer Service staff.

Over the next five years further modifications will be made to the Company's customer information and website in order to provide updated energy conversation information, tools and program information for customers.

Maritime Electric plans to partner with the OEE to develop energy efficiency communications and information programming for the commercial sector, including seminars and workshops. These initiatives will focus on demand management as well as energy efficiency.

The Company proposes to spend $ 167,500 annually on customer outreach activities.

3.9 PROPOSED RECOVERY OF COSTS THROUGH RATES

Table 14 lists the proposed incentive measures and the estimated implementation cost for each measure.

TABLE 14
SUMMARY OF PROPOSED EXPENDITURES

Proposed Measure	Estimated cost for years 2015 - 2020 ($ millions)	Estimated ongoing costs after 2020 ($ millions)
$ 5.00 rebate coupon for LED light bulbs	$ 6.0	
Grants for heat pumps that operate down to -25 C in electric resistance heated homes	$ 1.0	
Incentives for thermostat controlled heat pumps in oil heated homes	$ 3.1	$ 4.2
Community Outreach Activities	$ 0.8	
TOTAL	$ 10.9	$ 4.2

Appendix 15 shows the estimated annual expenditures for 2016 to 2020, and for post 2020. The annual bill credits or similar incentives for thermostat controlled heat pumps would continue for the service life of the heat pumps, estimated to be 15 years.

The Company proposes to recover these costs through the Energy Cost Adjustment Mechanism, as follows:

- Over 10 years for the LED rebate coupons, based on an assumed advancement of LED purchases by 10 years
- Over 15 years for the heat pump measures, based on an assumed 15 years life for a mini-split heat pump (Except for bill credits, which would be expensed as incurred.)
- Expensed as incurred for Community Outreach Activities

Appendix 16 shows the proposed annual recovery of costs through rates. Appendix 16 shows that the maximum annual amount to be recovered through rates is $ 1.3

million, which corresponds to approximately 0.65 % of the Company's annual revenue requirement. However, based on the benefit cost ratios for the Rate Impact Measure (RIM) tests for the proposed measures being close to or greater than 1.0, it is expected that the impact on rates will be minimal. (A RIM benefit cost ratio of 1.0 or greater for a measure indicates that implementation of the measure will not result in an increase in electricity rates, and thus it will not negatively impact customers who do not participate in the measure.)

It is proposed that costs incurred prior to the end of the Energy Accord on February 29, 2016 will be accrued for recovery under revised rates starting March 1, 2016.

3.10 CONCLUSIONS AND PROPOSED PLAN

The Company's proposed Plan is based on the following observations and conclusions:

- It is cost effective to incent consumers to use LED lighting products, primarily because the LEDs are longer life and more efficient than incandescent lighting.

- No incentives will be offered for the purchase of CFL lighting products because it is expected that there is limited consumer appetite for increased use of CFLs. Even though CFLs are currently a more cost effective replacement for incandescent lighting than LEDs, CFLs are viewed as a transitional technology because of drawbacks such as warm-up time and mercury content. LEDs do not have these drawbacks, and Maritime Electric expects that there will be a much greater uptake of incentives for LED lighting products.

- It is cost effective to incent the installation of "cold climate" air-source heat pumps in households and businesses with electric resistance space heating. The objective is to have only heat pumps installed that will be operating at time of system peak, and thus achieve a reduction in peak load by displacing electric resistance heating.

- It is cost effective to incent the installation of thermostat controls for air-source heat pumps in oil heated households and businesses. Here the objective is to have the heat pumps shut off during the coldest weather. By having the oil furnace supplying all the space heating for the building during the coldest weather, the impact on system peak load will be minimized. It is proposed that a pilot phase of approximately 100 installations be carried in 2016 out to confirm the overall investment required per location and the performance of available control equipment. Assuming a successful pilot phase, full implementation of the program would follow for 2017 to 2020.

- It is not cost effective to incent consumers to purchase ENERGY STAR appliances because 1) manufacturers have already built in most of the cost effective efficiency improvements in order to comply with minimum efficiency performance standards, 2) the additional energy savings offered by ENERGY STAR appliances are relatively small, and 3) for most appliances ENERGY STAR models already dominant the marketplace.

- No incentives are proposed for the purchase of LED holiday lighting. The increase in electric space heating in the past several years is causing the system peak to move from December to January or February. When the system peak occurs in January or February, the reduction in load due to a conversion from incandescent holiday lighting to LED holiday lighting does not result in a corresponding reduction in annual system peak load.

Table 15 below lists the proposed incentive measures, the reduction in energy and peak load expected to be realized through each measure, and the estimated implementation cost for each program. The energy and peak load reductions are estimated annual values for year 5 (i.e. 2020), while the costs are the total estimated expenditures for the five year period 2016 to 2020.

The Company expects that the proposed Plan will satisfy Section 16.1(5)(d) of the Electric Power Act, which requires that the Plan submitted "shall be designed so that it is reasonably likely, on implementation, to achieve the results expected by the order".

TABLE 15 SUMMARY OF 2015 – 2020 PROPOSED ENERGY EFFICIENCY AND DSM MEASURES				
Proposed Measure	**Expected annual energy saving in year five (GWh)**	**Expected peak load reduction in year five (MW)**	**Estimated cost for the five years ($ millions)**	**Estimated cost for after 2020 ($ millions)**
$ 5.00 rebate coupon for LED light bulbs	12.2	5.9	$ 6.0	
Grants for heat pumps that operate down to -25 C in electric resistance heated homes	0.3	1.5	$ 1.0	
Incentives for thermostat controlled heat pumps in oil heated homes (1)	1.0	2.3	$ 3.1	$ 4.2
Customer Outreach Activities			$ 0.8	
TOTAL	**13.5**	**9.7**	**$ 10.9**	**$ 4.2**

(1)Based on a successful pilot phase in 2016 and full implementation for 2017 to 2020

The Company proposes to recover these costs through the Energy Cost Adjustment Mechanism, as was done for DSM programs during 2006 to 2010.

The Company also proposes to recover these costs over a period of up to 15 years in order to match the time period during which the benefits will be realized. Costs incurred prior to the end of the Energy Accord on February 29, 2016 are proposed to be accrued for recovery under revised rates starting March 1, 2016.

The maximum annual amount to be recovered through rates is estimated as $ 1.3 million, which corresponds to 0.65 % of the Company's annual revenue requirement. However, based on the benefit cost ratios for the Rate Impact Measure (RIM) tests for the proposed measures being close to or greater than 1.0, it is expected that the impact on rates will be minimal. (A RIM benefit cost ratio of 1.0 or greater for a measure indicates that implementation of the measure will not result in an increase in electricity rates, and thus it will not negatively impact customers who do not participate in the measure.)

4.0 PROPOSED ORDER

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY AND APPEALS COMMISSION

IN THE MATTER of Section 16.1 of the Electric Power Act (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for an order of the Commission approving an Energy Efficiency and Demand Side Management Plan for the years 2015 to 2020 and for certain approvals incidental to such an Order.

UPON receiving an Application by Maritime Electric Company, Limited (the "Company") for approval of an Energy Efficiency and Demand Side Management Plan (the "Plan") for the years 2015 to 2020 and certain approvals incidental to such an order;

AND UPON considering the Application as well as the Evidence of the Company;

NOW THEREFORE for the reasons given in the annexed Reasons for Order;
IT IS ORDERED THAT

1. The Energy Efficiency and Demand Side Management Plan as detailed in the evidence for the years 2015 to 2020 is approved;
2. The inclusion of the Plan costs in the ECAM account is approved;

3. Commencing in 2017, and until otherwise directed, the Company shall file, no later than April 30th each year, an annual progress report on the status of the Plan; and
4. The Company shall seek Commission approval for any additional programs or initiatives affecting the Plan.

DATED at Charlottetown this ____ day of ____, 2015

BY THE COMMISSION:

____

____________________, Chair

____

____________________, Commissioner

____

____________________, Commissioner

Appendix 1
INPUTS AND ASSUMPTIONS FOR BENEFIT COST ANALYSIS

1. The following life expectancies for the major household appliances have been used. They are from the 2010 EnerGuide Appliance Directory.

Dishwashers -	13 years	Electric ranges -	16 years
Clothes washers -	14 years	Refrigerators -	18 years
Clothes dryers -	16 years	Freezers -	19 years

2. An annual escalation rate of 2.0% has been assumed.

3. Maritime Electric's weighted average cost of capital has been used as the discount rate in all the cost effectiveness tests. This is equal to 7.0%, based on 41.5% equity at 9.75% return and 58.5% long term debt at 5.0% interest rate.

4. Maritime Electric's average annual transmission and distribution system losses are 7.5%. However, on an incremental basis, the energy losses are estimated to be 11.5%. This means that 100 kWh saved at the customer's premises will result in a 100 kWh/(1 - 0.115) = 113 kWh reduction in the amount of energy that the utility must generate or purchase. The present worth of the utility's avoided energy supply cost is then (kWh saved by customer/(1 - 0.115)) x $/kWh x PV factor.

5. The estimated incremental transmission and distribution system losses at the time of system peak are 15.7%. This means that 1.0 kW saved at the customer's premises at the time of system peak will result in a 1.0 kW/(1 - 0.157) = 1.19 kW reduction in system peak load. Also, Maritime Electric must maintain a planning reserve capacity equal to 15% of firm peak load. Thus the present worth of the utility's avoided capacity cost is then (kW saved by customer/(1 - 0.15)) x 1.15 x $/kW-year x PV factor.

6. An CO2 emissions rate of 0.60 kg/kWh has been assumed as an indicative value. Natural gas fired combined cycle generation is lower than 0.60 kg/kWh, while coal and oil fired generation are higher. Maritime Electric' marginal source of energy supply is normally purchases from the mainland, which typically are priced based on natural gas fired generation. The Company's on-Island oil fired generating units normally only run in the order of 100 to 200 hours in a year.

7. An value of $40/tonne has been used in the Societal Cost test as an indicative value for the cost of CO2 emissions. This is based on the May 2103 revision by the U.S. Office of Management and Budget (OMB) of its estimate of the social cost of CO2 emissions. The revised OMB value was based on the results of updated climate change modeling.

9. The Residential rate first block energy charge was used in all cost effectiveness analyses. With a first block size of 2,000 kWh per month, it is expected that most usage for lighting, appliances and mini-split heat pumps is billed at the first block energy charge.

Appendix 2

BENEFIT COST ANALYSIS OF REPLACING 43 WATT INCANDESCENT HALOGEN WITH 13 WATT CFL

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		8	8	8	8
	- Utility avoided T&D capacity cost		10	10	10	10
	- Utility avoided energy supply cost		13	13	13	13
	- Reduction in participants' bills	22				
	- Avoided cost of incandescent halogen lamps	3			3	3
	- Incentive rebate to participants	0				
	- Value of avoided CO2 emissions					3
	Total	25	31	31	35	37
Costs:	- Utility DSM program admin. costs		0	0	0	0
	- Utility DSM program rebate costs		0	0		
	- Revenue reduction to utility			19		
	- Participant's incremental capital cost	1			1	1
	- Cost to replace lost space heating	12			12	12
	Total	13	0	19	13	13
	Net benefit (cost)	12	31	12	22	24
	Benefit/cost ratio	1.95	??	1.63	2.67	2.88

Inputs and Assumptions

Equipment life (6,000 hours effective life)	years	8.2	
Escalation rate	%	2.0	
Present value factor for 8.2 yrs at 7.0 % discount rate is		6.6	or escalating items
		6.1	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.010	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	8	(+ 15 % planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	10	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	22	
- price of purchased energy	$/kWh	0.08	
- present value is	$	13	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	22	(HST at 14 % applied)
Rebate to participant:			
- higher price for bare CFL ($3.50 - $2.50)	$	1.00	
- portion rebated to participant	%	-	
- participants rebate	$	-	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	3	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	12	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to 13 W CFL	kg	15	
- annual CO2 emissions from replacement space htg	kg	5	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	3	

Annual saving with bare CFL is	22	kWh	((43 W - 13 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.030	kW	(43 W - 13 W)
Assume average reduction at system peak is	0.010	kW	(33 % on at time of system peak)

Appendix 3

BENEFIT COST ANALYSIS OF REBATE FOR REPLACING 43 WATT INCANDESCENT HALOGEN WITH 11 WATT LED

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		10	10	10	10
	- Utility avoided T&D capacity cost		12	12	12	12
	- Utility avoided energy supply cost		16	16	16	16
	- Reduction in participants' bills	27				
	- Avoided cost of incandescent halogen lamps	4			4	4
	- Incentive rebate to participants	5				
	- Value of avoided CO2 emissions					3
	Total	36	39	39	43	46
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			24		
	- Participant’s incremental capital cost	8			8	8
	- Cost to replace lost space heating	15			15	15
	Total	23	10	34	28	28
	Net benefit (cost)	13	29	5	15	18
	Benefit/cost ratio	1.58	3.86	1.14	1.53	1.65

Inputs and Assumptions

Advance replacement of incandescent with LED by	years	10.0	
Escalation rate	%	2.0	
Present value factor for 10 yrs at 7.0 % discount rate is		7.8	or escalating items
		7.0	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.011	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	10	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	12	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	23	
- price of purchased energy	$/kWh	0.08	
- present value is	$	16	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	27	(HST at 14 % applied)
Rebate to participant:			
- higher price for LED ($10.50 - $2.50)	$	8.00	
- portion rebated to participant	%	62.5	
- participants rebate	$	5.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	3	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	15	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to 13 W CFL	kg	16	
- annual CO2 emissions from replacement space htg	kg	5	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	3	

Annual saving with LED is	23	kWh	((43 W - 11 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.032	kW	(43 W - 11 W)
Assume average reduction at system peak is	0.011	kW	(33 % on at time of system peak)

Appendix 4

BENEFIT COST ANALYSIS OF REBATE FOR REPLACING 13 WATT CFL WITH 11 WATT LED

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		1	1	1	1
	- Utility avoided T&D capacity cost		1	1	1	1
	- Utility avoided energy supply cost		1	1	1	1
	- Reduction in participants' bills	2				
	- Avoided cost of CFL lamps	3			3	3
	- Incentive rebate to participants	5				
	- Value of avoided CO2 emissions					0
	Total	10	2	2	5	6
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			1		
	- Participant's incremental capital cost	7			7	7
	- Cost to replace lost space heating	1			1	1
	Total	8	10	11	13	13
	Net benefit (cost)	2	(8)	(9)	(8)	(7)
	Benefit/cost ratio	1.21	0.24	0.21	0.41	0.43

<u>Inputs and Assumptions</u>

Advance replacement of CFL with LED by	years	10.0	
Escalation rate	%	2.0	
Present value factor for 10 yrs at 7.0 % discount rate is		7.8	or escalating items
		7.0	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.001	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	1	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	1	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	1	
- price of purchased energy	$/kWh	0.08	
- present value is	$	1	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	2	(HST at 14 % applied)
Rebate to participant:			
- higher price for LED ($10.50 - $3.50)	$	7.00	
- portion rebated to participant	%	71.4	
- participants rebate	$	5.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	0	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	1	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to 13 W CFL	kg	1	
- annual CO2 emissions from replacement space htg	kg	0	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	0	

Annual saving with LED is	1	kWh	((13 W - 11 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.002	kW	(13 W - 11 W)
Assume average reduction at system peak is	0.001	kW	(33 % on at time of system peak)

Appendix 5

BENEFIT COST ANALYSIS OF REBATES FOR REPLACING ONE 43 WATT INCANDESCENT HALOGEN AND ONE 13 WATT CFL WITH TWO 11 WATT LEDS

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		5	5	5	5
	- Utility avoided T&D capacity cost		6	6	6	6
	- Utility avoided energy supply cost		9	9	9	9
	- Reduction in participants' bills	14				
	- Avoided cost of incandescent halogen and CFL lamps	3			3	3
	- Incentive rebate to participants	5				
	- Value of avoided CO2 emissions					2
	Total	23	21	21	24	26
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			13		
	- Participant's incremental capital cost	8			8	8
	- Cost to replace lost space heating	8			8	8
	Total	15	10	23	20	20
	Net benefit (cost)	8	11	(2)	4	5
	Benefit/cost ratio	1.49	2.05	0.90	1.17	1.26

The dollar amounts in the above table are the average of the corresponding dollar amount in Appendix 3 (11 Watt LED replacing 43 Watt incandescent halogen) and Appendix 4 (11 Watt LED replacing 13 Watt CFL).

Appendix 6

BENEFIT COST ANALYSIS OF REBATE FOR REPLACING 65 WATT BR30 INCANDESCENT REFLECTOR WITH 16 WATT CFL BR30 REFLECTOR

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		14	14	14	14
	- Utility avoided T&D capacity cost		16	16	16	16
	- Utility avoided energy supply cost		21	21	21	21
	- Reduction in participants' bills	36				
	- Avoided cost of BR30 incandescent lamps	7			7	7
	- Incentive rebate to participants	2				
	- Value of avoided CO2 emissions					4
	Total	45	51	51	58	63
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		2	2		
	- Revenue reduction to utility			31		
	- Participant’s incremental capital cost	4			4	4
	- Cost to replace lost space heating	20			20	20
	Total	24	7	38	29	29
	Net benefit (cost)	21	44	13	30	34
	Benefit/cost ratio	1.90	7.28	1.33	2.04	2.19

Inputs and Assumptions

Equipment life (6,000 hours effective life)	years	8.2	
Escalation rate	%	2.0	
Present value factor for 8.2 yrs at 7.0 % discount rate is		6.6	or escalating items
		6.1	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.016	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	14	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	16	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	36	
- price of purchased energy	$/kWh	0.08	
- present value is	$	21	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	36	(HST at 14 % applied)
Rebate to participant:			
- higher price for BR30 CFL ($7.50 - $3.50)	$	4.00	
- portion rebated to participant	%	50	
- participants rebate	$	2.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	4	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	20	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to BR30 CFL	kg	24	
- annual CO2 emissions from replacement space htg	kg	7	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	4	

Annual saving with BR30 CFL is	36	kWh	((65 W - 13 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.049	kW	(65 W - 16 W)
Assume average reduction at system peak is	0.016	kW	(33 % on at time of system peak)

Appendix 7

BENEFIT COST ANALYSIS OF REBATE FOR REPLACING 65 WATT BR30 INCANDESCENT REFLECTOR WITH 13 WATT LED BR30 REFLECTOR

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		17	17	17	17
	- Utility avoided T&D capacity cost		19	19	19	19
	- Utility avoided energy supply cost		27	27	27	27
	- Reduction in participants' bills	44				
	- Avoided cost of BR30 incandescent lamps	9			9	9
	- Incentive rebate to participants	5				
	- Value of avoided CO2 emissions					6
	Total	58	63	63	71	77
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			39		
	- Participant’s incremental capital cost	14			14	14
	- Cost to replace lost space heating	24			24	24
	Total	38	10	49	43	43
	Net benefit (cost)	20	53	14	29	34
	Benefit/cost ratio	1.53	6.27	1.29	1.67	1.80

Inputs and Assumptions

Advance replacement of incandescent with LED by	years	10	
Escalation rate	%	2.0	
Present value factor for 10 yrs at 7.0 % discount rate is		7.8	or escalating items
		7.0	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.017	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	17	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	19	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	38	
- price of purchased energy	$/kWh	0.08	
- present value is	$	27	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	44	(HST at 14 % applied)
Rebate to participant:			
- higher price for LED reflector light ($17.00 - $3.50)	$	13.50	
- portion rebated to participant	%	37.0	
- participants rebate	$	5.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	4	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	24	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to LED pot light	kg	26	
- annual CO2 emissions from replacement space htg	kg	8	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	6	

Annual saving with LED reflector light is	38	kWh	((65 W - 13 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.052	kW	(65 W - 13 W)
Assume average reduction at system peak is	0.017	kW	(33 % on at time of system peak)

Appendix 8

BENEFIT COST ANALYSIS OF REBATE FOR REPLACING 16 WATT CFL BR30 REFLECTOR WITH 13 WATT LED BR30 REFLECTOR

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		1	1	1	1
	- Utility avoided T&D capacity cost		1	1	1	1
	- Utility avoided energy supply cost		2	2	2	2
	- Reduction in participants' bills	3				
	- Avoided cost of BR30 CFLs	6			6	6
	- Incentive rebate to participants	5				
	- Value of avoided CO2 emissions					0
	Subtotal	14	4	4	10	10
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			2		
	- Participant’s incremental capital cost	10			10	10
	- Cost to replace lost space heating	1			1	1
	Subtotal	11	10	12	16	16
	Net benefit (cost)	3	(6)	(9)	(6)	(6)
	Benefit/cost ratio	1.26	0.36	0.30	0.62	0.64

Inputs and Assumptions

Advance replacement of incandescent with LED by	years	10	
Escalation rate	%	2.0	
Present value factor for 10 yrs at 7.0 % discount rate is		7.8	or escalating items
		7.0	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.001	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	1	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	1	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	2	
- price of purchased energy	$/kWh	0.08	
- present value is	$	2	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	3	(HST at 14 % applied)
Rebate to participant:			
- higher price for LED reflector light ($17.00 - $7.50)	$	9.50	
- portion rebated to participant	%	52.6	
- customer rebate	$	5.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	0	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	1	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to LED pot light	kg	1	
- annual CO2 emissions from replacement space htg	kg	0	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	0	

Annual saving with LED reflector light is	2	kWh	((16 W - 13 W) x 2 h/day x 365 days)
Reduction in customer load for one unit is	0.003	kW	(16 W - 13 W)
Assume average reduction at system peak is	0.001	kW	(33 % on at time of system peak)

Appendix 9

BENEFIT COST ANALYSIS OF REBATES FOR REPLACING ONE 65 WATT BR30 INCANDESCENT REFLECTOR AND ONE 16 WATT CFL BR30 REFLECTOR WITH TWO 13 WATT LED BR30 REFLECTORS

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		9	9	9	9
	- Utility avoided T&D capacity cost		10	10	10	10
	- Utility avoided energy supply cost		14	14	14	14
	- Reduction in participants' bills	23				
	- Avoided cost of incandescent halogen and CFL lamps	7			7	7
	- Incentive rebate to participants	5				
	- Value of avoided CO_2 emissions					3
	Total	36	33	33	41	44
Costs:	- Utility DSM program admin. costs		5	5	5	5
	- Utility DSM program rebate costs		5	5		
	- Revenue reduction to utility			20		
	- Participant's incremental capital cost	12			12	12
	- Cost to replace lost space heating	13			13	13
	Total	24	10	30	29	29
	Net benefit (cost)	11	23	3	11	14
	Benefit/cost ratio	1.47	3.32	1.09	1.38	1.48

The dollar amounts in the above table are the average of the corresponding dollar amount in Appendix 7 (13 Watt LED replacing 65 Watt incandescent reflector) and Appendix 8 (13 Watt LED replacing 16 Watt CFL).

Appendix 10
BENEFIT COST ANALYSIS OF ENERGY STAR REFRIGERATOR REBATE

Free riders have been taken into account		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		8	8	8	8
	- Utility avoided T&D capacity cost		9	9	9	9
	- Utility avoided energy supply cost		43	43	43	43
	- Reduction in participants' bills	71				
	- Incentive rebate to participants	30				
	- Value of avoided CO2 emissions					9
	Total	101	60	60	60	68
Costs:	- Utility DSM program admin. costs		10	10	10	10
	- Utility DSM program rebate costs		30	30		
	- Revenue reduction to utility			62		
	- Participant's incremental capital cost	50			50	50
	- Cost to replace lost space heating	39			39	39
	Total	89	40	102	99	99
	Net benefit (cost)	12	20	(42)	(39)	(30)
	Benefit/cost ratio	1.13	1.49	0.58	0.60	0.69

Inputs and Assumptions

Equipment life	years	18	
Escalation rate	%	2.0	
Present value factor for 18 yrs at 7.0 % discount rate is		11.8	or escalating items
		10.1	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.057	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	8	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	9	
Utility avoided energy supply cost:			
- annual energy saving by participant	kWh	40	
- price of purchased energy	$/kWh	0.08	
- present value is	$	43	
Reduction in participant's bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	71	(HST at 14 % applied)
Rebate to participant:			
- higher price for ENERGY STAR refrigerator	$	50.00	
- portion rebated to participant	%	60	
- participant rebate	$	30.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	5	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	39	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	indicative value
- avoided annual CO2 emissions due to refrigerator	kg	27	
- annual CO2 emissions from replacement space htg	kg	8	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	9	

Annual saving with Energy Star refrigerator is	40	kWh	(difference for 16.5 – 18.4 cu ft units)
Average reduction in customer load is	0.046	kW	(40 kWh/8,760 hours in year)
Assume average reduction at system peak is	0.057	kW	(1.25 times average load)

Appendix 11

BENEFIT COST ANALYSIS OF ENERGY STAR CLOTHES WASHER REBATE
(ENERGY STAR front loading versus non-ENERGY STAR front loading)

Free riders have been taken into account

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		13	13	13	13
	- Utility avoided T&D capacity cost		15	15	15	15
	- Utility avoided energy supply cost		64	64	64	64
	- Reduction in participant electric bills	106				
	- Reduction in participant fce oil bills	33			33	33
	- Incentive rebate to participants	50				
	- Avoided CO2 emissions: electricity					19
	- Avoided CO2 emissions: furnace oil					3
	Total	189	92	92	126	148
Costs:	- Utility DSM program admin. costs		10	10	10	10
	- Utility DSM program rebate costs		50	50		
	- Revenue reduction to utility			93		
	- Participants incremental capital cost	125			125	125
	- Cost to replace lost space heating	0			0	0
	Total	125	60	153	135	135
	Net benefit (cost)	64	32	(61)	(9)	13
	Benefit/cost ratio	1.51	1.54	0.60	0.93	1.10

Inputs and Assumptions

Equipment life	years	14	
Escalation rate	%	2.0	
Present value factor for 14 yrs at 7.0 % discount rate is		10.0	or escalating items
		8.7	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.011	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	13	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	15	
Utility avoided energy supply cost:			
- annual energy saving by participants	kWh	71	
- price of purchased energy	$/kWh	0.08	
- present value is	$	64	
Reduction in participant's electricity bill:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	106	(HST at 14 % applied)
Rebate to participant:			
- higher price for ENERGY STAR clothes washer	$	125.00	
- portion rebated to participants	%	40	
- participants rebate	$	50.00	
Reduction in participant's furnace oil bill:			
- annual reduction in furnace oil for water heating	litres	3	(1 litre = 8.5 kWh)
- assumed furnace oil price	$/litre	1.00	
- present value of reduction in furnace oil	$	33	(GST at 5 % applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate for electricity	kg/kWh	0.60	
- assumed price of CO2 emissions	$/tonne	40	
- present value for reduction in electricity is	$	19	
- present value for reduction in furnace oil is	$	3	

Annual saving with ENERGY STAR unit:	12	kWh for mechanical (25% of EnerGuide usage)
	36	kWh for water heating (75% of EnerGuide usage)
	50	kWh for dryer energy
Average reduction in customer load is	0.0081	kW (25% of water heating is by electricity)
Assume average reduction at system peak is	0.0109	kW (1.35 times average load)

Appendix 12
BENEFIT COST ANALYSIS OF A REFRIGERATOR ROUNDUP PROGRAM

		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Utility avoided generating capacity cost		53	53	53	53
	- Utility avoided T&D capacity cost		63	63	63	63
	- Utility avoided energy supply cost		342	342	342	342
	- Reduction in participant's bills	567				
	- Incentive rebate to participants	35				
	- Value of avoided CO2 emissions					71
	Total	602	458	458	458	529
Costs:	- Utility DSM program admin. costs		287	287	287	287
	- Utility DSM program rebate costs		35	35		
	- Revenue reduction to utility			498		
	- Participant's incremental capital cost	0			0	0
	- Cost to replace lost space heating	311			311	311
	Total	311	322	820	598	598
	Net benefit (cost)	291	136	(362)	(141)	(69)
	Benefit/cost ratio	1.93	1.42	0.56	0.76	0.88

Inputs and Assumptions

Remaining equipment life	years	10	
Escalation rate	%	2.0	
Present value factor for 10 yrs at 7.0 % discount rate is		7.8	or escalating items
		7.0	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- participant load reduction at time of system peak	kW	0.056	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	53	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	63	
Utility avoided energy supply cost:			
- annual energy saving by participants	kWh	488	
- price of purchased energy	$/kWh	0.08	
- present value is	$	342	
Reduction in participant's electric bills:			
- retail energy charge for electricity	$/kWh	0.1316	Residential first block
- present value is	$	567	(HST at 14 % applied)
Rebate to participants	$	35.00	
Cost to replace lost space heating:			
- furnace oil equivalent of annual energy savings	litres	57	(1 litre = 8.5 kWh)
- portion of energy savings that provided space heating	%	67	(8 month htg season)
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	311	(GST at 5% applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate	kg/kWh	0.60	
- avoided annual CO2 emissions due to refrigerator	kg	331	
- annual CO2 emissions from replacement space htg	kg	101	
- assumed price of CO2 emissions	$/tonne	40	
- present value is		71	

Annual usage by second refrigerator is	650	kWh (assume 2004 vintage)
Potential ave. reduction in customer load is	0.074	kW (650 kWh/8,760 hours in year)
Percentage assumed to be plugged in	75	%
Assume average reduction at system peak is	0.056	kW

Appendix 13
BENEFIT COST ANALYSIS OF MATCHING GRANT FOR COLD CLIMATE HEAT PUMP (OPERATION DOWN TO -25C) IN HOMES WITH ELECTRIC RESISTANCE HEATING

OEE grant is factored in – the assumption is that the OEE grant of $425 plus a matching grant from Maritime Electric is needed to increase the number of "most efficient" units purchased.		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Reduction in utility generating capacity purchase		2,031	2,031	2,031	2,031
	- Reduction in utility demand related T&D capacity cost		2,383	2,383	2,383	2,383
	- Reduction in utility energy supply cost		341	341	341	341
	- Net Reduction in participant's electricity bill	566				
	- OEE grant for "most efficient" heat pump	425				
	- Marching grant from utility	425				
	- Value of avoided CO2 emissions					102
	Total	1,416	4,755	4,755	4,755	4,857
Costs:	- Utility share of OEE admin. costs		338	338	150	150
	- OEE share of admin. costs				150	150
	- Matching grant from utility		956	956		
	- Revenue decrease for utility			496		
	- Extra cost for "most efficient" heat pump	1,000			1,000	1,000
	Total	1,000	1,294	1,790	1,300	1,300
	Net benefit (cost)	416	3,461	2,965	3,455	3,557
	Benefit/cost ratio	1.42	3.68	2.66	3.66	3.74

Note: Under the Utility Cost test and the Rate Impact test the utility share of OEE admin costs and the matching grant from utility have been scaled up by 360/160 to account for free riders; i.e. currently 200 per year are incented by just the OEE grant, and the goal of the utility matching grant is to increase that number to 360.

Inputs and Assumptions

Mini-split heat pump life	years	15	
Escalation rate	%	2.0	
Present value factor for 15 yrs at 7.0 % discount rate is		10.4	or escalating items
		9.1	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost: (assumes not "most efficient" unit turns itself off at -15C)			
- electric resistance load displaced by heat pump at peak	kW	3.27	
- heat pump load at system peak	kW	1.64	assume COP of 2.0
- net reduction in heating load at system peak	kW	1.64	
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	2,031	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	2,383	
Reduction in utility energy supply cost:			
- participant's usage below -14C for electric resistance	kWh	722	
- participant's usage below -14C for "most efficient" heat pump	kWh	361	Assume COP of 2.0
- net reduction in participant's electricity usage below -14C	kWh	361	
- energy supply cost	$/kWh	80	
- present value is	$	341	
Reduction in participant's electricity bill:			
- net reduction electricity usage below -14C	kWh	361	
- retail price for electricity	$/kW	0.1316	residential first block
- present value is	$	566	(HST at 14% applied)
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate for electricity supply	kg/kWh	0.60	
- net reduction in annual CO2 emissions from electricity supply	tonne	0.24	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	102	

Appendix 14
BENEFIT COST ANALYSIS OF INCENTIVE FOR THERMOSTAT CONTROL OF HEAT PUMP IN HOMES WITH OIL-FIRED HEATING

OEE grant is factored in – the assumption is that the homeowner has already chosen to purchase a "most efficient" unit based on just the OEE $425 grant.		Participant Cost Test ($)	Utility Cost Test ($)	Rate Impact Test ($)	Total Resource Cost Test ($)	Societal Cost Test ($)
Benefits:	- Reduction in utility generating capacity purchase		1,016	1,016	1,016	1,016
	- Reduction in utility demand related T&D capacity cost		1,191	1,191	1,191	1,191
	- Reduction in utility energy supply cost		341	341	341	341
	- Reduction in participant's electricity bill	566				
	- Annual credit on participant's electricity bill	911				
	- Value of avoided CO2 emissions					9
	Total	1,477	2,548	2,548	2,548	2,557
Costs:	- Utility share of OEE admin. costs		150	150		
	- Annual credit on participant's electricity bill		911	911		
	- Cost of thermostat controlled shutoff		500	500	500	50
	- Revenue decrease for utility			497		
	- Increase in participant furnace oil bill	933			933	933
	Total	933	1,561	2,058	1,433	1,433
	Net benefit (cost)	545	987	491	1,116	1,125
	Benefit/cost ratio	1.58	1.63	1.24	1.78	1.78

Inputs and Assumptions

Mini-split heat pump life	years	15	
Escalation rate	%	2.0	
Present value factor for 15 yrs at 7.0 % discount rate is		10.4	or escalating items
		9.1	for non-escalating items
Estimated annual average incremental T&D losses	%	11.5	
Estimated incremental T&D losses at system peak	%	15.7	
Utility avoided generating capacity cost:			
- net reduction in heating load at system peak	kW	0.82	50% for shut off at -15C
- cost of generating capacity	$/kW - year	100	(purchases on the margin)
- present value is	$	1,016	(+15% planning reserve)
Utility avoided T&D capacity cost:			
- demand related T&D capacity cost	$/kW - year	160	(adjusted for losses)
- present value is	$	1,191	
Reduction in utility energy supply cost:			
- reduction in participant's electricity usage below -14C	kWh	361	Assume COP of 2.0
- energy supply cost	$/kWh	80	
- present value is	$	341	
Reduction in participant's electricity bill:			
- electricity for heat pump below -14C	kWh	361	
- retail price for electricity	$/kW	0.1316	residential first block
- present value is	$	566	(HST at 14% applied)
Increase in participant's furnace oil bill:			
- increase in furnace oil used below -14C	litres	85	
- assumed furnace oil price	$/litre	1.00	
- present value of cost for additional furnace oil	$	933	(GST at 5% applied)
Annual credit on participant's electricity bill	$	100	
Benefit of avoided CO2 emissions:			
- assumed CO2 emissions rate for electricity supply	kg/kWh	0.60	indicative value
- reduction in annual CO2 emissions from electricity supply	tonne	0.24	
- annual CO2 emissions from increase in furnace oil	tonne	0.22	
- assumed price of CO2 emissions	$/tonne	40	
- present value is	$	9	

Appendix 15
SCHEULE OF PROPOSED YEARLY EXPENDITURES

			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	3033	2034
Annual number of units for each measure:																						
- LED lighting rebates (x 1,000)				185.6	185.6	185.6	185.6	185.6	8 over 5 years for each of 58,000 residential customers + an equal number of free riders													
- Heat pumps in electric resistance heated homes				360	360	360	360	360	10% of the estimated 3,600 units installed in 2013 assumed to be in electric resistance heated homes													
- Heat pumps in oil heated homes				100	810	810	810	810	90% of the 900 units rebated by OEE in 2013 assumed to be in oil heated homes													
Expenditures ($ x 1,000)																						
LED lighting rebate coupon:																						
- rebate coupons at $	5.00	each		928	928	928	928	928														
- administration costs	1.50	each		278	278	278	278	278														
- program development			50																			
			50	1,206	1,206	1,206	1,206	1,206														
Heat pumps in electric resistance heated homes:																						
- matching grant at $	425	each		153	153	153	153	153														
- MECL share of OEE admin $	150	each		54	54	54	54	54														
- program development			10																			
			10	207	207	207	207	207														
Thermostat-controlled heat pumps in oil heated home:																						
- electric bill credits at $	100	each/yr		10	91	172	253	334	334	334	334	334	334	334	334	334	334	334	324	243	162	81
- MECL share of OEE admin $	150	each		15	122	122	122	122														
- meter and thermostat at $	500	for both		50	405	405	405	405														
- program development			40																			
			40	75	618	699	780	861	334	334	334	334	334	334	334	334	334	334	324	243	162	81
Community outreach activities				168	168	168	168	168														
Total			100	1,656	2,198	2,279	2,360	2,441	334	334	334	334	334	334	334	34	334	334	324	243	162	81

Appendix 16
SCHEULE OF PROPOSED YEARLY RECOVERY OF COSTS THROUGH RATES

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	3033	2034	2035
Assumed recovery period for each measure:																				
- LED lighting rebates		10	years, based on assumed advancement of LED purchases by 10 years																	
- Heat pumps in electric resistance heated homes		15	years, based on assumed life of mini-split heat pump																	
- Heat pumps in oil heated homes		15	years, based on assumed life of mini-split heat pump (except for bill credits)																	
- Community outreach activities		1	year - fully recover in the year following when expense incurred																	
Recovery through rates ($ x 1,000)																				
LED lighting rebate coupon:																				
- rebate coupon		93	186	278	371	464	464	464	464	464	464	371	278	186	93					
- couponing processing		28	56	84	111	139	139	139	139	139	139	111	84	56	28					
- program development		4	4	4	4	4	4	4	4	4	4	4	4	4	4					
		124	245	365	486	607	607	607	607	607	607	486	365	245	124					
Heat pumps in electric resistance heated homes:																				
- matching grant		10	20	31	41	51	51	51	51	51	51	51	51	51	51	51	41	31	20	10
- MECL share of OEE admin costs		4	7	11	14	18	18	18	18	18	18	18	18	18	18	18	14	11	7	4
- program development		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		14	28	42	56	70	70	70	70	70	70	70	70	70	70	70	56	42	28	14
Thermostat-controlled heat pumps in oil heated home:																				
- electric bill credits		10	91	172	253	334	334	334	334	334	334	334	334	334	334	334	324	243	162	81
- MECL share of OEE admin costs		1	9	17	25	33	33	33	33	33	33	33	33	33	33	33	32	24	16	8
- cost of meters and thermostats		3	30	57	84	111	111	111	111	111	111	111	111	111	111	111	108	81	54	27
- program development		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		16	133	249	365	481	481	481	481	481	481	481	481	481	481	481	467	350	234	118
Community outreach activities		168	168	168	168	168														
Total		322	573	824	1,074	1,325	1,157	1,157	1,157	1,157	1,157	1,036	916	795	675	550	522	392	262	133