DSM STANDARD

Effective Measure Life and Persistence – Revision 11

For External and Internal Use

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Conservation and Energy Management
Quality Management

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	Name	Date (yyyy-mm-dd)
Prepared by:	Doina Balea, Quality Management	2019-03-13
Reviewed by:	Ira Rowland, Engineering	Reviewed on ongoing basis.
	Greg Lehoux, Industrial Marketing	Reviewed on ongoing basis.
	Carmelina Sorace, Commercial Marketing	Reviewed on ongoing basis.
	Pat Mathot, Residential Marketing	Reviewed on ongoing basis.
	Paul Seo, Commercial Marketing	Reviewed on ongoing basis.
	Cynthia Lee, Strategic Planning	Reviewed on ongoing basis.
	Lyle McClelland, Strategic Planning	2018-06-04
	Kala O'Riordain, Strategic Planning	2019-02-28
	Arvindh Gupta, Quality Management	Reviewed on ongoing basis.
Approved by:	Steve Hobson, Director, Conservation & Energy Management	2019-03-20
	Dave Warner, Sr. Manager, Operations, Engineering & QM	2019-03-20
	Dave Hargreaves, Sr. Manager Industrial Marketing	2019-03-20
	Jim Nelson, Sr. Manager, Commercial Marketing	2019-03-20
	John Duffy, Sr. Manager, Evaluation and M&V	2019-03-20
	Kristin Hanlon, Sr. Manager, Strategic Planning	2019-03-20

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	ISSUED TO	TITLE	REVISION NO.	DATE ISSUED (yyyy-mm-dd)
1	Dave Warner	Sr. Manager, Operations, Engineering, and Quality Management	11	2019-03-20
2	Dave Hargreaves	Sr. Manager, Industrial Marketing	11	2019-03-20
3	Jim Nelson	Sr. Manager, Commercial Marketing	11	2019-03-20
4	Kristin Hanlon	Sr. Manager, Strategic Planning	11	2019-03-20
5	John Duffy	Sr. Manager, Evaluation & M&V	11	2019-03-20

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This document was prepared by CEM Quality Management, in consultation with CEM Engineering, Marketing and Strategic Planning

A.1. Purpose

Demand-side management (DSM) programs and initiatives result in impacts on energy consumption and other non-energy impacts (e.g., greenhouse gas emission reduction). The effective measure life (EML) and persistence (years) of the energy management measures determine how long the energy impacts and relevant non-energy impacts are attributed to the program or initiative.

The purpose of this document is to standardize the EML for estimating the impacts on energy consumption and relevant non-energy impacts from a DSM activity.

DSM activity envelopes the full range of energy management initiatives, and includes, but is not limited to, "traditional DSM" targeting energy conservation and capacity focused measures, and also low-carbon electrification (LCE) initiatives that support the provincial government's greenhouse gas reduction goals.

The standardization is intended to ensure uniform application of the effective measure life/persistence of impacts from a DSM activity; consistency in planning, estimating, reporting, evaluation of DSM impacts, calculation of cost effectiveness of DSM projects and programs; and for effective & efficient quality assurance. The standard has been prepared by BCH, Conservation and Energy Management, Quality Management team after due consultation, studies, verification, or in consideration of sources of information of the effective life measures from sources listed under references in this standard. The standard is revised from time to time to improve the efficacy and effectiveness. The revisions may include new Energy Conservation measures (ECM), as well as new Low Carbon Electrification (LCE) measures, and their effective measure life; and/or updates to the effective measure life of existing measures based on new/improved quality of information. Exceptions/Deviations from the standard should be dealt with individually on a case-by-case basis.

A.2. Scope

The scope of the Standard for Effective Measure Life and Persistence covers the effective measure life/persistence of the following industrial (Transmission and Distribution), commercial, residential, lighting and rate structure measures:

- Energy conservation measures (ECM)
  A measure employed for a specific end use in a demand side management project to improve energy efficiency (1) relative to the baseline alternative within the same fuel type.
- Low carbon electrification (LCE) measures
  A measure enabling the customers to reduce the greenhouse gas emissions by switching from fossil fuels to clean, low-carbon electricity.

The application and scope of this standard extends to but is not limited to BCH Corporation and their subsidiaries, energy managers, Alliance partners, contractors, consultants, and other energy management professionals who are associated in planning, initiating, implementing or promoting any DSM activity under the BC Hydro Conservation and Energy Management portfolio.

A.3. Introduction

The term ***effective measure life*** *(EML)*, with respect to demand-side management (DSM), is one method to measure how long an energy management measure is expected to last. EML is defined as the estimate of the median number of years that the measure installed is still in place and operable. In effect, the median age is the number of years that pass until 50% of the installed measures are no

longer in place and operable. EML considers field conditions, obsolescence, building remodelling, renovation, demolition and occupancy changes.

Commercial and some industrial and residential EMLs defined by credible third party research, including the Public Service Commission of Wisconsin (2), California Public Utilities Commission, 2014 Database for Energy Efficiency Resources (DEER) (3) and Skumatz Economic Research Associates Inc. (SERA) (4), have largely been adopted in this standard as recommended in *Persistence of Energy Savings: Review of Estimates of Measure Life* (5). Where there is no existing reference to EML, BC Hydro staff recommended a value based on their professional judgement and experience, as referenced in Section F.

The term ***persistence,*** with respect to demand-side management (DSM), refers to how long the impact on energy consumption is expected to be attributable to the DSM activity. Persistence of selected energy saving/LCE measures has been estimated by BC Hydro staff based on EML estimates and consideration of natural conservation and market research.

Other factors to consider:

- ***Relative technical degradation*** is not considered for the purpose of determining effective measure life. Degradation is considered when estimating the impact on energy consumption for some specific projects, as the performance of an energy management measure may degrade at a different rate than that of the baseline alternative, resulting in either a loss or increase of the estimated impact. Studies (6) and (7) prepared for the California DSM Measurement Advisory Committee (CADMAC) have indicated that the relative technical degradation for the vast majority of measures is 1.0 (no net loss or increase of DSM impacts).
- ***Replacement issues*** such as market transformation and customer transformation are not taken into account in the EML values. Replacement issues must be addressed separately when programs are designed and evaluated.
- ***Natural conservation*** refers to improvements in energy efficiency that occurs in the absence of utility DSM activities.
- ***Codes and standards with legislation effective date*** are considered when the measures are impacted by legislation, and the assigned standard persistence value of all measures installed before the end of the delay period is maintained, typically three months after the legislation is effective. The delay period is assigned for the purpose of clearing existing stock of phased out or eliminated technologies/products. No DSM impacts will be claimed under programs from measures installed after the delay period.
- ***Future potential codes and standards*** are not considered when setting measure persistence because of uncertainty regarding implementation date.

A.4. Previous Versions of the Standard

Power Smart, QA Standard Persistence of Savings	November 30, 2004
Power Smart, QA Standard Technology: Effective Measure Life	November 1, 2005
Power Smart, QA Standard Technology: Effective Measure Life	September 11, 2006
Power Smart, QA Effective Measure Life and Persistence, For Internal Use only	August 1, 2008
Power Smart Standard - Effective Measure Life and Persistence, For Internal Use Only	October 28, 2009
Power Smart Standard - F11 Effective Measure Life and Persistence, For Internal Use Only	February 22, 2011
Power Smart Standard - F12 Effective Measure Life and Persistence, For External and Internal Use	January 2012
Power Smart Standard - F13 Effective Measure Life and Persistence, For External and Internal Use	August 2012
Power Smart Standard - F13 Effective Measure Life and Persistence, For External and Internal Use	December 2012
Power Smart Standard - Effective Measure Life and Persistence, Revision 9, For External and Internal Use	May 2014
DSM Standard - Effective Measure Life and Persistence, Revision 10, For External and Internal Use	June 2016

B. ENERGY CONSERVATION MEASURES

B.1. Commercial Measures

B.1.1. HVAC Hard Wired Controls		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.1.1.1	Heating or cooling control upgrade	15	15	N/A	Reference (2)	N/A
B.1.1.2	Ventilation control upgrade	10	10	N/A	Reference (2)	N/A
B.1.1.3	CO based parkade ventilation control	5	5	N/A	Reference (2)	N/A
B.1.1.4	CO_2 based demand control ventilation	5	5	N/A	Reference (2)	N/A
B.1.1.5	HVAC time clock control	11	11	N/A	Reference (3)	N/A
B.1.1.6	Occupancy, temperature sensors	8	8	N/A	Reference (3)	N/A
B.1.1.7	Programmable/Smart Thermostats	11	11	N/A	Reference (3)	N/A
B.1.1.8	Advanced Rooftop Unit Controls	10	10	N/A	Reference (8)	N/A

B.1.2. HVAC Operational Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.1.2.1	Commercial operational and procedural measures including: Control resets and rescheduling; Heating, cooling, hot water, air handling, and refrigeration systems optimization; Fan motor and pump rescheduling; Supply air temperature reset; Unoccupied setback; System lockout	N/A	2	N/A	Reference (2)	Note B.1.2.1
B.1.2.2	Heating/cooling systems: recommissioning with sustainment initiative	N/A	5	N/A	Reference (9)	Note B.1.2.2
B.1.2.3	Operational and procedural measures (including equipment shut down when not in use, set point adjustment, maintenance and tuning for improved performance) not supported by a formal sustainment plan	N/A	2	2	Reference (2)	Note B.1.2.3
B.1.2.4	Operational and procedural measures supported by a formal sustainment plan to maintain savings	N/A	5	5	Reference (10)	Note B.1.2.4
B.1.2.5	Impeller trim	N/A	5	5	Reference (2)	N/A
B.1.3. HVAC Components		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards; Effective Date for PS**	**References**	**Notes**
B.1.3.1	Cooling equipment upgrades including high efficiency air conditioners	15	15	N/A	Reference (3)	N/A
B.1.3.2	Adjustable speed drive with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) - Pumps	10	10	N/A	Reference (2)	N/A

B.1.3.3	High Efficiency Boiler	20	20	N/A	Reference (3)	N/A
B.1.3.4	Cooling tower/evaporating condenser	15	15	N/A	Reference (2)	N/A
B.1.3.5	Furnace - high efficiency	20	20	N/A	Reference (3)	Note B.1.3.5
B.1.3.6	Heating/cooling equipment upgrade including heat pumps and packaged HVAC	15	15	N/A	Reference (3)	N/A
B.1.3.7	Heat recovery upgrade/retrofit	15	15	N/A	Reference (11)	Note B.1.3.7
B.1.3.8	Adjustable speed drive with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) - Fans	10	10	N/A	Reference (2)	N/A
B.1.3.9	Air distribution system retrofit (ductwork)	18	18	N/A	Reference (4)	N/A
B.1.3.10	Water distribution piping retrofit	18	18	N/A	Reference (12)	Note B.1.3.10
B.1.3.11	Fan and pump upgrade	15	15	N/A	Reference (2) and (3)	N/A
B.1.3.12	Free cooling retrofit airside economizer/water side economizer	10	10	N/A	Reference (3)	N/A
B.1.3.13	Induction Motors, 51-500 hp, Replacement with Premium Efficiency Motor instead of rewinding (per repair/replace policy)	15	15	C&S #2, 4; April 1, 2011	Reference (3)	Note B.1.3.13
B.1.3.14	Premium Efficiency induction motor $\leq$ 50 hp	15	Savings attributed to C&S	C&S #2, 4; April 1, 2011	Reference (3)	Note B.1.3.14
B.1.3.15	Natural ventilation	15	15	N/A	Reference (3)	Note B.1.3.15

B.1.3.16	Renewable energy (solar thermal)	15	15	N/A	Reference (3)	N/A
B.1.3.17	CNC Only – High Efficiency HVAC System/Plant, Central Heat Pumps	17	17	N/A	Reference (13)	Note B.1.3.17
B.1.3.18	CNC Only – High Efficiency HVAC System/Plant, Distributed Heat Pumps	18	18	N/A	Reference (13)	Note B.1.3.18
B.1.3.19	Induction motors ≤ 50 hp, Efficiency increase beyond Premium	15	15	N/A	Reference (3)	Note B.1.3.19
B.1.3.20	Induction motors up to 500 hp, New Construction, Efficiency increase beyond Premium	15	15	N/A	Reference (3)	Note B.1.3.20
B.1.3.21	High efficiency chiller, chiller/cooler upgrade	22	22	N/A	Reference (13)	Note B.1.3.21
B.1.4. Domestic Hot Water		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.4.1	Water heater controls	15	15	N/A	Reference (14)	N/A
B.1.4.2	Domestic hot water recirculation pump demand control	10	10	N/A	Reference (2)	Note B.1.4.2
B.1.4.3	Domestic hot water boiler upgrade; Efficient boiler	15	15	N/A	Reference (2)	N/A
B.1.4.4	Domestic hot water distribution system retrofit (piping insulation)	10	10	N/A	Reference (2)	N/A
B.1.4.5	Adjustable speed drive with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) - Pumps	10	10	N/A	Reference (2)	N/A

B.1.4.6	Electronically commutated motor pumps	15	15	N/A	Reference (2)	Note B.1.4.6
B.1.4.7	Low flow fixtures (faucet aerators, shower heads)	10	10	N/A	Reference (3)	N/A
B.1.4.8	Heat recovery for domestic hot water pre-heat	15	15	N/A	Reference (11)	Note B.1.4.8
B.1.5. Commercial Refrigeration		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards; Effective Date for PS**	**References**	**Notes**
B.1.5.1	Adjustable speed drive with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) - Fans	10	10	N/A	Reference (2)	N/A
B.1.5.2	Adjustable speed drive with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) - Pumps	10	10	N/A	Reference (2)	N/A
B.1.5.3	Efficient compressor	15	15	N/A	Reference (3)	N/A
B.1.5.4	Floating head pressure control	15	15	N/A	Reference (3)	N/A
B.1.5.5	Insulation on refrigeration suction line	11	11	N/A	Reference (3)	N/A
B.1.5.6	Electronically commutated fan motor system	15	15	N/A	Reference (2)	Note B.1.5.6
B.1.5.7	Anti-sweat heater humidistat control	12	12	N/A	Reference (3)	N/A
B.1.5.8	Glass/acrylic case doors; zero heat reach in glass door	10	10	N/A	Reference (2)	N/A
B.1.5.9	Night covers, air curtain	5	5	N/A	Reference (2)	N/A

B.1.5.10	Strip curtains	4	4	N/A	Reference (3)	Note B.1.5.10
B.1.5.11	Refrigerator display case with doors, low/medium temp	12	12	N/A	Reference (3)	N/A
B.1.5.12	Refrigerators	12	12	N/A	Reference (3)	N/A
B.1.5.13	Induction Motors, 51-500 hp, Replacement with Premium Efficiency Motor instead of rewinding (per repair/replace policy)	15	15	C&S #2, 4; April 1, 2011	Reference (3)	Note B.1.5.13
B.1.5.14	Premium Efficiency induction motor ≤ 50 hp	15	Savings attributed to C&S	C&S #2, 4; April 1, 2011	Reference (3)	Note B.1.5.14
B.1.5.15	Ice machine	10	10	N/A	Reference (3)	N/A
B.1.5.16	Energy Star Freezers	12	12	N/A	Reference (3)	N/A
B.1.5.17	Brine Pump: Install Pony Motor	15	15	N/A	Reference (3)	N/A
B.1.5.18	Booster Pump	15	15	N/A	Reference (3)	N/A
B.1.5.19	Induction motors ≤ 50 hp, Efficiency increase beyond Premium	15	15	N/A	Reference (3)	Note B.1.5.19
B.1.5.20	Induction motors up to 500 hp in New Construction, Efficiency increase beyond Premium	15	15	N/A	Reference (3)	Note B.1.5.20
B.1.6. Commercial Kitchens		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.6.1	Efficient food preparation equipment	12	12	N/A	Reference (3)	N/A

B.1.6.2	Efficient door type dishwashing	15	15	N/A	Reference (15)	N/A
B.1.6.3	Efficient conveyor dishwasher	20	20	N/A	Reference (15)	N/A
B.1.6.4	Exhaust hood demand ventilation controls	8	8	N/A	Reference (16)	Note B.1.6.4
B.1.6.5	Pre-rinse spray valve	5	5	N/A	Reference (2)	N/A
B.1.6.6	Insulated Hot Food Holding Cabinet	12	12	N/A	Reference (3)	N/A
B.1.7. Commercial Building Envelope		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.7.1	Parkade ceiling insulation	Indefinite	25	N/A	Reference (17)	Note B.1.7.1
B.1.7.2	Roof insulation increase	25	25	N/A	Reference (17)	N/A
B.1.7.3	Wall insulation increase	30	30	N/A	Reference (18)	Note B.1.7.3
B.1.7.4	Efficient windows	25	25	N/A	Reference (17)	Note B.1.7.4
B.1.7.5	Shading (motorized)	15	15	N/A	Reference (3)	Note B.1.7.5
B.1.7.6	Shading (concrete)	25	25	N/A	Reference (17)	Note B.1.7.6
B.1.8. Commercial Data Centre Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.8.1	Server virtualization	Indefinite	8	N/A	Reference (19)	N/A

B.1.8.2	Data centre servers	4	4	N/A	Reference (19)	N/A
B.1.8.3	Energy efficient data storage	4	4	N/A	Reference (19)	N/A
B.1.8.4	Uninterruptible power supply	16	16	N/A	Reference (19)	N/A
B.1.8.5	Energy Efficient Rectifiers	16	16	N/A	Reference (20)	Note B.1.8.5
B.1.9. Other Commercial Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.9.1	Reduced standby losses for plug load	5	5	N/A	Reference (21)	N/A
B.1.9.2	Energy efficient livestock waterer	10	10	N/A	Reference (2)	N/A
B.1.9.3	New transformers, 15 to 7,500 kVA, dry or liquid filled	30	30	N/A	Reference (22)	Note B.1.9.3
B.1.9.4	Refrigeration low emissivity ceiling	20	20	N/A	Reference (23)	N/A
B.1.9.5	Energy Efficient Elevator Systems	15	15	N/A	Reference (24)	Note B.1.9.5
B.1.9.6	Generator Coolant Heat Pump	15	15	N/A	Reference (3)	Note B.1.9.6
B.1.10. Process		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.1.10.1	Process HVAC	15	15	N/A	Reference (3)	Note B.1.10.1
B.1.10.2	Process load reduction	15	15	N/A	Reference (3)	Note B.1.10.2

B.2. Industrial Measures

B.2.1. Industrial Operational and Procedural Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.2.1.1	Industrial operational and procedural measures (including: compressed air leak repair, equipment shut down when not in use, set point adjustment, maintenance and tuning for improved performance) not supported by a formal sustainment plan.	N/A	2	N/A	Reference (2) (p. 5, Table 1-3)	N/A
B.2.1.2	Industrial operational and procedural measures supported by a formal program to maintain savings	N/A	5	N/A	Reference (10)	Note B.2.1.2
B.2.2. Industrial Air Displacement Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.2.1	High efficiency fans	10	10	N/A	Reference (2)	Note B.2.2.1
B.2.2.2	Low friction ducts	10	10	N/A	Reference (25)	Note B.2.2.2
B.2.2.3	Smaller fans and blowers	10	10	N/A	Reference (2)	Note B.2.2.3
B.2.2.4	Impeller trim	5	5	N/A	Reference (2)	Note B.2.2.4
B.2.3. Industrial Pumping Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.3.1	High efficiency pumps	13	13	N/A	Reference (2)	Note B.2.3.1
B.2.3.2	Low friction piping networks	15	15	N/A	Reference (26)	N/A

B.2.3.3	Impeller trim	5	5	N/A	Reference (2)	Note B.2.3.3
B.2.3.4	Smaller pumps	13	13	N/A	Reference (2)	Note B.2.3.4
B.2.3.5	Network redesign including holding tanks	15	15	N/A	Reference (26)	Note B.2.3.5
B.2.4. Industrial Compressed Air Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.4.1	Efficient compressed air dryers	10	10	N/A	Reference (26)	Note B.2.4.1
B.2.4.2	Efficient air compressors	10	10	N/A	Reference (26)	Note B.2.4.2
B.2.4.3	Compressed air piping and storage	10	10	N/A	Reference (26)	Note B.2.4.3
B.2.4.4	Efficient nozzles	15	15	N/A	Reference (2)	N/A
B.2.4.5	Switch from compressed air to a more efficient end use	15	15	N/A	Reference (26)	Note B.2.4.5
B.2.4.6	Compressed air leak repair	N/A	2	N/A	Reference (2)	N/A
B.2.4.7	Reduced header pressure	10	10	N/A	Reference (26)	Note B.2.4.7
B.2.4.8	Improved Controls	5	5	N/A	Reference (2)	Note B.2.4.8
B.2.4.9	Flow sequencer	5	5	N/A	Reference (27)	N/A
B.2.4.10	Waste heat reclaim	10	10	N/A	Reference (2)	Note B.2.4.10
B.2.4.11	Process control affecting operating time by using secured (locked) hardwired devices/PLCs	8	8	N/A	Reference (28)	Note B.2.4.11

B.2.5. Industrial Conveyance Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.2.5.1	Conveyor retrofit	10	10	N/A	Reference (25)	Note B.2.5.1
B.2.5.2	Conversion of pneumatic systems to mechanical systems	15	15	N/A	Reference (26)	Note B.2.5.2
B.2.5.3	Improved control	10	10	N/A	Reference (26)	Note B.2.5.3
B.2.6. Industrial Refrigeration Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.6.1	Process cooling	15	15	N/A	Reference (4)	N/A
B.2.6.2	Refrigerated space envelope retrofit	15	15	N/A	Reference (4)	N/A
B.2.6.3	Efficient refrigerant compressor	15	15	N/A	Reference (4)	N/A
B.2.6.4	Efficient refrigerant condenser	15	15	N/A	Reference (4)	N/A
B.2.6.5	Floating head pressure control	15	15	N/A	Reference (4)	N/A
B.2.6.6	Other high efficiency industrial refrigeration measure	15	15	N/A	Reference (4)	N/A

B.2.7. Motors and Drives		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
B.2.7.1	Drive conversion	10	10	N/A	Reference (26)	Note B.2.7.1
B.2.7.2	Efficient gear reducers	20	20	N/A	Reference (26)	Note B.2.7.2
B.2.7.3	Synchronous belts	3	10	N/A	Reference (26)	Note B.2.7.3
B.2.7.4	Retrofit - Premium Efficiency induction motor > 50 hp, up to 500 hp (per repair/replace policy)	15	15	C&S #2 April 1, 2011	Reference (3)	Note B.2.7.4
B.2.7.5	Premium Efficiency induction motor ≤ 50 hp	15	Savings attributed to C&S	C&S #2 April 1, 2011	Reference (3)	Note B.2.7.5
B.2.7.6	Induction motors ≤ 50 hp, Efficiency increase beyond Premium	15	15	C&S #2 April 1, 2011	Reference (3)	Note B.2.7.6
B.2.7.7	Induction motors > 500 hp, Efficiency increase relative to valid baseline	15	15	N/A	Reference (3)	Note B.2.7.7
B.2.7.8	Induction motors up to 500 hp in New plant, Efficiency increase beyond Premium	15	15	N/A	Reference (3)	Note B.2.7.8
B.2.7.9	Large Synchronous Motor (≥ 1,000 hp)	20	20	N/A	Reference (29)	Note B.2.7.9
B.2.7.10	Green motor rewinds	8	8	N/A	Reference (30)	Note B.2.7.10

B.2.8. Other Industrial Process Measures		Effective Measure Life (Years)	Persistence (Years)	Codes and Standards	References	Notes
B.2.8.1	Extrusion equipment	15	15	N/A	Reference (4)	N/A
B.2.8.2	Improved process control	5	5	N/A	Reference (2)	Note B.2.8.2
B.2.8.3	Injection moulding equipment	15	15	N/A	Reference (4)	Note B.2.8.3
B.2.8.4	Efficient kiln, oven or furnace	25	25	N/A	Reference (14)	N/A
B.2.8.5	Heat recovery for kiln, oven, or furnace	15	15	N/A	Reference (2)	Note B.2.8.5
B.2.8.6	Process equipment insulation	15	15	N/A	Reference (4)	N/A
B.2.8.7	Process heat recovery	10	10	N/A	Reference (2)	N/A
B.2.8.8	Efficient crushing or grinding circuit	25	25	N/A	Reference (25)	Note B.2.8.8
B.2.8.9	Steam traps	6	6	N/A	Reference (3)	N/A
B.2.9. Other Industrial Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.9.1	Regenerative devices	10	10	N/A	Reference (26)	Note B.2.9.1
B.2.9.2	Hardwired voltage optimization	16	16	N/A	Reference (26)	Note B.2.9.2
B.2.9.3	Capacitor and Reactor installation to reduce line losses	16	16	N/A	Reference (31)	Note B.2.9.3

B.2.9.4	Variable speed drives with a programmed set point or controlled by a feedback signal from a process variable (not operator adjustable) – air displacement, pumping, conveyance, refrigeration, grinding mill, flotation cells agitators, natural gas compression.	10	10	N/A	Reference (2)	N/A
B.2.9.5	Energy Efficient Transformers	30	30	N/A	Reference (22)	N/A
B.2.9.6	Reduction of power losses in Transmission or Distribution Lines (by voltage increase and/or conductor upgrade)	30	30	N/A	Reference (32)	Note B.2.9.6
B.2.9.7	Energy Efficient Rectifier	16	16	N/A	Reference (33)	Note B.2.9.7
B.2.9.8	Generator Coolant Heat Pump	15	15	N/A	Reference (3)	Note B.2.9.8
B.2.10. Pulp and Paper		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.10.1	Mechanical pulp refiner modernization	Indefinite	15	N/A	Reference (18)	Note B.2.10.1
B.2.10.2	Refiner plate segments	<1yr	2	N/A	Reference (2)	Note B.2.10.2
B.2.10.3	Advanced quality control	5	5	N/A	Reference (25)	Note B.2.10.3
B.2.10.4	Refiner heat recovery	10	10	N/A	Reference (2)	N/A
B.2.10.5	Production rate effect for time of day pulping	N/A	2	N/A	Reference (2)	Note B.2.10.5
B.2.10.6	Efficient rotors for pulp screening	13	13	N/A	Reference (2)	N/A
B.2.10.7	Repulper rotors	13	13	N/A	Reference (2)	N/A

B.2.10.8	High efficiency aerator	13	13	N/A	Reference (34)	Note B.2.10.8
B.2.10.9	Efficient Mixers and Agitators	10	10	N/A	Reference (27)	N/A
B.2.10.10	Permanent Equipment Removal/Decommissioning	15	15	N/A	Reference (35)	Note B.2.10.10
B.2.10.11	Lumber Kiln Fan VFD Optimization	10	10	N/A	Reference (36)	Note B.2.10.11
B.2.10.12	Hammermill Efficiency Improvement	10	10	N/A	Reference (37)	Note B.2.10.12
B.2.11. Mining		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.11.1	Tailings piping modification	10	10	N/A	Reference (38)	Note B.2.11.1
B.2.11.2	Vertical axis grinder	15	15	N/A	Reference (38)	Note B.2.11.2
B.2.11.3	Grinding optimization	5	5	N/A	Reference (39)	Note B.2.11.3
B.2.11.4	High Efficiency Flotation Cells	30	30	N/A	Reference (39)	Note B.2.11.4
B.2.12. Municipal Operations (waste water treatment)		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.12.1	High efficiency aerator	13	13	N/A	Reference (34)	Note B.2.12.1

B.2.13. Electro-chemical process		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.2.13.1	Gap reduction between cathode and anode	10	10	N/A	Reference (27)	N/A
B.2.13.2	Premium efficiency electro-chemical process (excluding membrane cell electrochemical technology due to natural conservation)	10	10	N/A	Reference (27)	Note B.2.13.2
B.2.14. Load Displacement		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.14.1	Power Generation including various technologies (Internal Combustion Engine, Organic Rankin Cycle, Combined Cycle, Boiler/Steam Turbo-Generator, Combined Heat and Power, Combined Cycle/Combined Heat and Power, Fuel Cell, Solar Panel PV, Solar Panel Thermal)	20	20	N/A	Reference (40)	Note B.2.14.1
B.2.14.2	Rebuilt Turbo Generator	15	15	N/A	Reference (26)	Note B.2.14.2
B.2.15. Domestic Hot Water		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.15.1	Heat recovery for domestic hot water pre-heat	15	15	N/A	Reference (11)	Note B.2.15.1
B.2.15.2	Adjustable speed drive on pump	10	10	N/A	Reference (2)	N/A
B.2.15.3	Domestic hot water distribution system retrofit (piping insulation)	10	10	N/A	Reference (2)	N/A

B.2.15.4	Domestic hot water recirculation pump demand control	10	10	N/A	Reference (2)	Note B.2.15.4
B.2.15.5	Electronically commutated motor pumps	15	15	N/A	Reference (2)	Note B.2.15.5
B.2.15.6	Water heater controls	15	15	N/A	Reference (14)	N/A
B.2.15.7	Low flow fixtures (faucet aerators, shower heads)	10	10	N/A	Reference (3)	N/A
B.2.16. HVAC		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.16.1	High Efficiency Boiler	20	20	N/A	Reference (3)	N/A
B.2.16.2	High efficiency chiller, chiller/cooler upgrade	22	22	N/A	Reference (13)	Note B.2.16.2
B.2.16.3	Heat recovery upgrade/retrofit	15	15	N/A	Reference (11)	Note B.2.16.3
B.2.16.4	Adjustable speed drive on pump	10	10	N/A	Reference (2)	N/A
B.2.16.5	Adjustable speed drive on fan	10	10	N/A	Reference (2)	N/A
B.2.16.6	Air distribution system retrofit (ductwork)	18	18	N/A	Reference (4)	N/A
B.2.16.7	CO_2 based demand control ventilation	5	5	N/A	Reference (2)	N/A
B.2.16.8	Cooling equipment upgrades including high efficiency air conditioners	15	15	N/A	Reference (3)	N/A
B.2.16.9	Cooling tower/evaporating condenser	15	15	N/A	Reference (2)	N/A

B.2.16.10	Free cooling retrofit/airside economizer/water side economizer	10	10	N/A	Reference (3)	N/A
B.2.16.11	Heating/cooling equipment upgrade including heat pumps and packaged HVAC	15	15	N/A	Reference (3)	N/A
B.2.16.12	Heating or cooling control upgrade	15	15	N/A	Reference (2)	N/A
B.2.16.13	HVAC time clock control	11	11	N/A	Reference (3)	N/A
B.2.16.14	Occupancy, temperature sensors	8	8	N/A	Reference (3)	N/A
B.2.16.15	Ventilation control upgrade	10	10	N/A	Reference (2)	N/A
B.2.16.16	Water distribution piping retrofit	18	18	N/A	Reference (12)	Note B.2.16.16
B.2.17. Strategic Energy Management (SEM) Cohort		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.17.1	SEM Cohort Model - Operational/Behavioural Measures without Sustainment Plan	1	1	N/A	Reference (41)	Note B.2.17.1
B.2.17.2	SEM Cohort Model - Operational/Behavioural Measures Supported by Formal Sustainment Plan	5	5	N/A	Reference (41)	Note B.2.17.2
B.2.18. Strategic Energy Management (SEM) Industrial Energy Manager		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.2.18.1	SEM - Deemed Modelled Savings	1	1	N/A	Reference (41)	Note B.2.18.1

B.2.19. Industrial Natural Gas Compression Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.2.19.1	Low friction piping networks	15	15	N/A	Reference (26)	N/A
B.2.19.2	Network redesign including holding tanks	15	15	N/A	Reference (26)	Note B.19.2

B.3. Residential Measures

3.1. Residential Comfort Heating, Cooling and Building Envelope Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
B.3.1.1	Weather stripping including caulking and draft proofing (performed by the home occupant)	6	6	N/A	Reference (42)	Note B.3.1.1
B.3.1.2	Ceiling, wall or floor insulation	30	30	N/A	Reference (28)	Note B.3.1.2
B.3.1.3	Energy efficient windows	25	25	C&S #3; April 1, 2011	Reference (21)	Note B.3.1.3
B.3.1.4	Electrical outlet gasket	15	15	N/A	Reference (21)	Note B.3.1.4
B.3.1.5	Window film	1	1	N/A	Reference (43)	Note B.3.1.5
B.3.1.6	Variable speed drive furnace motor	18	18	N/A	Reference (21)	Note B.3.1.6
B.3.1.7	Efficient ventilation fan	9	9	N/A	Reference (15)	Note B.3.1.7
B.3.1.8	Weatherization, air sealing (performed by a professional builder)	11	11	N/A	Reference (3)	Note B.3.1.8
B.3.1.9	Air-source heat pumps	18	18	N/A	Reference (28)	Note B.3.1.9
B.3.1.10	Electronic thermostats	11	11	N/A	Reference (3)	N/A

B.3.1.11	Heat recovery ventilator	16	16	N/A	Reference (44)	Note B.3.1.11
B.3.1.12	Attic Insulation	30	30	N/A	Reference (28)	Note B.3.1.12
B.3.2. Residential Domestic Hot Water Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.3.2.1	Faucet aerators	10	10	N/A	Reference (3)	N/A
B.3.2.2	Low flow showerhead	10	10	N/A	Reference (3)	N/A
B.3.2.3	Hot water pipe wrap	8	8	N/A	Reference (43)	Note B.3.2.3
B.3.2.4	Energy efficient hot water heater	13	13	N/A	Reference (3)	Note B.3.2.4
B.3.2.5	Heat pump hot water heater	10	10	N/A	Reference (3)	N/A
B.3.3. Residential Appliances Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.3.3.1	Efficient refrigerator	17	17	N/A	Reference (45)	Note B.3.3.1
B.3.3.2	Efficient freezer	18	18	N/A	Reference (2)	N/A
B.3.3.3	Refrigerator buyback	7	7	N/A	Reference (46)	N/A
B.3.3.4	Horizontal axis clothes washer	14	14	N/A	Reference (47)	N/A
B.3.3.5	Advanced Power Strip	5	5	N/A	Reference (21)	N/A

B.3.4. Residential Behavioural Measures		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.3.4.1	Residential behavioural measures	N/A	1	N/A	Reference (48)	Note B.3.4.1
B.3.4.2	Low income behavioural measures	1	1	N/A	Reference (49)	Note B.3.4.2

B.4. Lighting Measures

B.4.1. Hardwired Luminaires, Lamps, and Ballast		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.4.1.1	Energy Star fixture in residential setting	20	20	N/A	Reference (15)	Note B.4.1.1
B.4.1.2	LED light fixture in residential setting	20	20	N/A	Reference (50)	Note B.4.1.2
B.4.1.3	LED light bulbs in residential setting	20	20	N/A	Reference (21)	Note B.4.1.3
B.4.1.4	Exterior LED signage	12	12	N/A	Reference (51)	Note B.4.1.4
B.4.1.5	Non-LED lighting redesign for lower power density	16	16	N/A	Reference (52)	Note B.4.1.5
B.4.1.6	Luminaire Removal	16	16	N/A	Reference (52)	Note B.4.1.6
B.4.1.7	LED Refrigerated Lighting System per Door	16	16	N/A	Reference (3)	N/A
B.4.1.8	LED luminaire and retrofit kit in non-residential setting	15	15	N/A	Reference (2)	N/A
B.4.1.9	LED Street Lighting	16	16	N/A	Reference (51)	Note B.4.1.9
B.4.1.10	LED Nightlight	16	16	N/A	Reference (3)	N/A

B.4.2. Screw or Snap in Lamps		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
B.4.2.1	Screw or snap in HID lamps	4	4	N/A	Reference (50)	Note B.4.2.1
B.4.2.2	LED replaceable reflector lamp in non-residential setting (screw-in/snap-in)	12	12	N/A	Reference (51)	Note B.4.2.2
B.4.2.3	Tubular LED Lamps	12	12	N/A	Reference (51)	Note B.4.2.3
B.4.2.4	LED Mogul screw-base replacement for HID lamps	12	12	N/A	Reference (51)	Note B.4.2.4
B.4.3. Lighting Controls Measures		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
B.4.3.1	New lighting controls including time clocks, occupancy sensors or photocells	8	8	N/A	Reference (3)	N/A
B.4.3.2	Adjustments to lighting control operations without commissioning	N/A	2	N/A	Reference (2)	Note B.4.3.2
B.4.3.3	Adjustment to lighting control operations with sustainment plan	N/A	5	N/A	Reference (9)	Note B.4.3.3
B.4.3.4	Adaptable street lighting	10	10	N/A	Reference (53)	N/A
B.4.3.5	NLC Level 1- Bi-level Controls	10	10	N/A	Reference (54)	Note B.4.3.5.
B.4.3.6	NLC Level 2 - Networked Controls without Energy Management	15	15	N/A	Reference (54)	Note B.4.3.6.

B.4.3.7	NLC Level 3 - Networked Controls with Energy Management	20	20	N/A	Reference (54)	Note B.4.3.7.

B.5. Rate Structure

B.5.1. Rate Structure Initiatives		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
B.5.1.1	Distribution Voltage Rates (RIB, LGS, MGS and SGS):	Indefinite	Indefinite	N/A	Reference (55)	Note B.5.1.1
B.5.1.2	Transmission Service Rates - Customer self-generation	1	1	N/A	Reference (55)	Note B.5.1.2
B.5.1.3	Transmission Service Rates - Unreported DSM	3	3	N/A	Reference (55)	Note B.5.1.3
B.5.1.4	Transmission Service Rates - Reported DSM	3	3	N/A	Reference (56)	Note B.5.1.4

C. LOW CARBON ELECTRIFICATION MEASURES (LCE)

C.1. Commercial LCE Measures

C.1.1. LCE - HVAC Components		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
C.1.1.1	Heat Recovery Chiller	22	22	N/A	Reference (13)	Note C.1.1.1
C.1.1.2	Air-to-Water Heat Pump	15	15	N/A	Reference (11)	Note C.1.1.2
C.1.1.3	Air-to-Air Heat Pump (ductless or minisplit)	18	18	N/A	Reference (21)	Note C.1.1.3
C.1.1.4	Water-to-Water Heat Pump	15	15	N/A	Reference (21)	Note C.1.1.4
C.1.1.5	Ground Source Heat Pump	15	15	N/A	Reference (21)	Note C.1.1.5
C.1.1.6	Air-to-Air Rooftop Heat Pump	15	15	N/A	Reference (57)	Note C.1.1.6
C.1.1.7	Air-to-Water Rooftop Heat Pump	15	15	N/A	Reference (57)	Note C.1.1.7
C.1.1.8	Exhaust Air Heat Recovery Heat Pump	15	15	N/A	Reference (11)	Note C.1.1.8
C.1.1.9	Electric Boiler	20	20	N/A	Reference (3)	N/A
C.1.1.10	Electric Water Heater	15	15	N/A	Reference (28)	Note C.1.1.10
C.1.1.11	Air Source VRF Distributed Heat Pumps	18	18	N/A	Reference (58)	Note C.1.1.11

C.1.1.12	Water Source VRF Distributed Heat Pumps	22	22	N/A	Reference (58)	Note C.1.1.12
C.1.1.13	High-efficiency (>75%) HRV	15	15	N/A	Reference (59)	Note C.1.1.13
C.1.2. LCE - Domestic Hot Water		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
C.1.2.1	Heat Recovery Chiller	22	22	N/A	Reference (13)	Note C.1.2.1
C.1.2.2	Air-to-Water Heat Pump (central plant)	15	15	N/A	Reference (11)	Note C.1.2.2
C.1.2.3	Air-to-Water Heat Pump Water Heater	15	15	N/A	Reference (18)	Note C.1.2.3
C.1.2.4	Ground Source Heat Pump	15	15	N/A	Reference (21)	Note C.1.2.4
C.1.2.5	Water-to-Water Heat Pump	15	15	N/A	Reference (21)	Note C.1.2.5
C.1.2.6	Sewage Heat Recovery Heat Pump	15	15	N/A	Reference (21)	Note C.1.2.6
C.1.2.7	Electric Boiler	20	20	N/A	Reference (3)	N/A
C.1.2.8	Electric Water Heater	15	15	N/A	Reference (28)	Note C.1.2.8
C.1.3. LCE - Electric Supply		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
C.1.3.1	Connection to BC Hydro Grid via T/D line	30	30	N/A	Reference (32)	Note C.1.3.1

C.1.4. LCE - Transportation		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
C.1.4.1	Electric Vehicle Supply Equipment – Level 2 *	10	10*	N/A	Reference (60)	Note C.1.4.1
C.1.4.2	Electric Vehicle Supply Equipment – DC Fast Charging *	10	10*	N/A	Reference (60)	Note C.1.4.2

*) *The recommended persistence is based on limited information currently available. The persistence value and references will be firmed up going forward, as better/more relevant information on industry practice becomes available.*

C.2. Industrial LCE Measures

C.2.1. LCE - HVAC Components		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
C.2.1.1	Heat Recovery Chiller	22	22	N/A	Reference (13)	Note C.2.1.1
C.2.1.2	Air-to-Water Heat Pump	15	15	N/A	Reference (11)	Note C.2.1.2
C.2.1.3	Air-to-Air Heat Pump (ductless or minisplit)	18	18	N/A	Reference (21)	Note C.2.1.3
C.2.1.4	Water-to-Water Heat Pump	15	15	N/A	Reference (21)	Note C.2.1.4
C.2.1.5	Ground Source Heat Pump	15	15	N/A	Reference (21)	Note C.2.1.5
C.2.1.6	Air-to-Air Rooftop Heat Pump	15	15	N/A	Reference (57)	Note C.2.1.6
C.2.1.7	Air-to-Water Rooftop Heat Pump	15	15	N/A	Reference (57)	Note C.2.1.7
C.2.1.8	Exhaust Air Heat Recovery Heat Pump	15	15	N/A	Reference (11)	Note C.2.1.8
C.2.1.9	Electric Boiler	20	20	N/A	Reference (3)	N/A
C.2.1.10	Electric Water Heater	15	15	N/A	Reference (28)	Note C.2.1.10

C.2.2. LCE - Domestic Hot Water		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
C.2.2.1	Heat Recovery Chiller	22	22	N/A	Reference (13)	Note C.2.2.1
C.2.2.2	Air-to-Water Heat Pump (central plant)	15	15	N/A	Reference (11)	Note C.2.2.2
C.2.2.3	Air-to-Water Heat Pump Water Heater	15	15	N/A	Reference (18)	Note C.2.2.3
C.2.2.4	Ground Source Heat Pump	15	15	N/A	Reference (21)	Note C.2.2.4
C.2.2.5	Water-to-Water Heat Pump	15	15	N/A	Reference (21)	Note C.2.2.5
C.2.2.6	Sewage Heat Recovery Heat Pump	15	15	N/A	Reference (21)	Note C.2.2.6
C.2.2.7	Electric Boiler	20	20	N/A	Reference (3)	N/A
C.2.2.8	Electric Water Heater	15	15	N/A	Reference (28)	Note C.2.2.8
C.2.3. LCE - Electric Supply		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
C.2.3.1	Connection to BC Hydro Grid via T/D line	30	30	N/A	Reference (32)	Note C.2.3.1

C.2.4. LCE - Process		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards	References	Notes
C.2.4.1	Electric Crusher or Grinding *	10	10*	N/A	Reference (61)	Note C.2.4.1
C.2.4.2	Electric Chipper *	10	10*	N/A	Reference (61)	Note C.2.4.2
C.2.4.3	Electric Boiler	20	20	N/A	Reference (3)	N/A
C.2.4.4	Electric Dryer *	10	10*	N/A	Reference (61)	Note C.2.4.4
C.2.5. LCE - Transportation		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
C.2.5.1	Electric Vehicle Supply Equipment – Level 2 *	10	10*	N/A	Reference (60)	Note C.2.5.1
C.2.5.2	Electric Vehicle Supply Equipment – DC Fast Charging *	10	10*	N/A	Reference (60)	Note C.2.5.2
C.2.5.3	Electric Conveyance	10	10	N/A	Reference (25)	Note C.2.5.3
C.2.6. LCE - Aircraft Ground Support		**Effective Measure Life (Years)**	**Persistence (Years)**	**Codes & Standards**	**References**	**Notes**
C.2.6.1	Electric Preconditioned Air (PCA) Unit	13	13	N/A	Reference (62)	Note C.2.6.1
C.2.6.2	Electric Ground Power Unit (GPU)	20	20	N/A	Reference (62)	Note C.2.6.2

*) *The recommended persistence for these measures is based on limited information currently available. The persistence value and references will be firmed up going forward, as better/more relevant information on industry practice becomes available.*

C.3. Residential LCE Measures

C.3.1. LCE – Garden Equipment		Effective Measure Life (Years)	Persistence (Years)	Codes & Standards; Effective Date for PS	References	Notes
C.3.1.1	Electric Lawnmower *	9	9	N/A	Reference (61)	Note C.3.1.1

**) The recommended persistence is based on limited information currently available. The persistence value and reference will be firmed up going forward, as better/more relevant information on industry practice becomes available.*

D. Repeat Project

A **Repeat Project** is a project that repeats the implementation of a previously implemented energy conservation/LCE measure at a customer site when the previous measure has reached the end of its persistence. Repeat Projects are assigned the current Standard Persistence Value. In all circumstances, Repeat Projects are assessed and processed in the same manner as new projects, and are not considered to be extensions of the previous project.

E. Persistence Adjustments

A **Project-Specific Persistence Adjustment** is the assignment of a persistence value to a project that does not match the Standard Persistence Value. Project-Specific Persistence Adjustments are made for:

a) Energy conservation/LCE measures installed at customer sites with a remaining life that is known to be shorter than the Standard Persistence value.
   - The persistence is adjusted at the time of project submission, based on the best information that is available at that time about the anticipated life of the customer site.
   - Except for the large customer sites, a further persistence adjustment would not be applied if subsequently the life of the customer site proves to be different than anticipated at the time of application submission.
   - For large Commercial and Industrial customer sites:
     - if the site life outlasts the adjusted persistence, the project can be re-submitted and the persistence for the new submission will be assessed through an engineering review.
     - If the site life is shorter than anticipated, the persistence should be adjusted in compliance with the procedure defined for the permanent closure of customer sites, described below and in Appendix C.

b) Energy conservation/LCE measures installed at large Commercial or Industrial sites (Transmission and Distribution) that are impacted by the permanent closure/shutdown of the site/operations occurring within the persistence period.
   - The reporting from the DSM projects impacted by the permanent shutdown/closure should be discontinued.
     (Appendix_C shows the process for persistence adjustment and the projects excepted from this requirement).

   This is a conservative approach for projects installed at large industrial or commercial sites, since the permanent, early closure of the customer site is not considered in the determination of the Standard Persistence Values.

A **Global Persistence Adjustment** is an update to the Standard Persistence Value based on new and more accurate information. Global Persistence Adjustments are assessed and approved through the Persistence Standard maintenance process administered by Quality Management. Where possible, sources with the best quality ranking are used as reference for the updated persistence value (e.g., sources basing the EML recommendation on primary research). In cases of multiple values resulting from the review of various sources, the persistence is established as the weighted average of all values, after excluding outliers.
Global Persistence Adjustments are applied to new projects.

F. References

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G. Codes and Standards References

	Legislation	Effective Date (yyyy-mm-dd)	PS Incentive last eligible date (yyyy-mm-dd)
1	Provincial Amendment 3, General Service Lighting Regulation, British Columbia Energy Efficiency Act	2011-01-01	2011-03-31
2	Provincial Amendment 3, Premium Efficiency Electric Motors, British Columbia Energy Efficiency Act	2011-01-01	2011-03-31
3	Provincial Amendment 2, Windows, Glazing, Doors, Skylights, British Columbia Energy Efficiency Act	2011-01-01	2011-03-31
4	Federal Amendment 11, Premium Efficiency Electric Motors, Government of Canada Energy Efficiency Act	2011-01-01	2011-03-31
5	Federal and Provincial Amendment 12B, General Service Lighting Regulation, British Columbia Energy Efficiency Act	2014-12-31	2015-03-31
6	Amendment 13 to Canada's Energy Efficiency Regulations	2018-01-26	2018-04-26

H. Notes

B.1.2.1 KEMA 2009 recommends five years for HVAC operational type measures. Building operators can easily change schedules and resets at no cost.
Two-year persistence was chosen for HVAC operational type measures without a formal sustainment plan, consistent with the value recommended for the Industrial sector, which is supported by KEMA 2009 (two years recommended for the "service" type measures, based on primary research conducted for several Industrial End Uses). Service Measures "include, but are not limited to, boiler tune-ups, chiller tune-ups, compressed air leakage repair and steam trap maintenance".
Five years is only used for measures with a formal sustainment initiative in place.

B.1.2.2 The recommendation is also supported by KEMA 2009 (five years for HVAC operational type measures including measures with a formal sustainment initiative in place: "Tune-up/repairs, establish regular Preventive Maintenance").

B.1.2.3 This operational and procedural measure without sustainment plan, typically relevant for Industrial sector, has been included in Commercial sector for customers having equipment and processes that are similar to those in industrial environment (e.g., municipal sites/waste water treatment plant).

B.1.2.4 Operational and procedural measure with formal sustainment plan, typically relevant for Industrial sector, has been included in Commercial sector for customers having equipment and processes that are similar to those in industrial environment.

B.1.3.5 Twenty-year persistence for "Furnace - High Efficiency" is supported by DEER 2014.

B.1.3.7 Fifteen-year persistence for "Heat recovery upgrade/retrofit" is supported by "Connecticut Light & Power, United Illuminating Company. *Connecticut Energy Efficiency Fund for 2008*. September 25, 2007". Various measures (heat pump or heat exchanger based technologies) can be implemented.

B.1.3.10 EML and persistence for water distribution piping retrofit are assumed to match the values recommended for air distribution ductwork retrofit.

B.1.3.13 NEMA Premium Efficiency is the minimum requirement for new induction motors up to 500 hp. Savings from DSM retrofit projects involving Premium Efficiency motors > 50 hp and up to 500 hp are eligible only as possible exceptions where the standard industry practice is to rewind a failed motor instead of replacing it (based on the policy that the motor would be repaired only if the repair cost does not exceed 65% of the cost for a new motor). In this case, if the customer elects to replace the motor, the savings relative to rewound motor can be recognized.

B.1.3.14 Premium Efficiency induction motors ≤ 50 hp are not eligible as DSM projects. The savings from these motors are reported under Codes & Standards.

B.1.3.15 EML and persistence of natural ventilation (consisting of controlled motorized windows or dampers) are assumed to match the values recommended for motors.
The Natural Ventilation Engineering Guide (http://www.price-hvac.com/Catalog/Section_K/html/K_pdf/Engineering_Guide.pdf) shows that, in contrast to mechanical ventilation, which requires significant overhaul, refurbishment or replacement in a 15-20 year timescale, "natural ventilation equipment typically lasts longer" and "the weatherproof louvers, control system, ducts and shafts are extremely unlikely to need replacement".

B.1.3.17 Specifically defined for the Commercial New Construction program, this measure refers to the entire HVAC system/plant as a whole, as opposed to specific components and equipment. The EML and persistence for High Efficiency Commercial "HVAC System/Plant including Central Heat Pump" is based on the average EML value of the HVAC equipment and components (i.e., large heat pumps; back-up boiler for heating; back-up boiler for domestic hot water; air handling units/heating and cooling coils and fan; chiller; terminal units; heat recovery).

B.1.3.18 Specifically defined for the Commercial New Construction program, this measure refers to the entire HVAC system/plant as a whole, as opposed to specific components and equipment. The EML and persistence for "High Efficiency Commercial HVAC System/Plant including .Distributed Heat Pumps" is based on the average EML value of the HVAC equipment and components (i.e., small heat pumps; back-up boiler for heating; back-up boiler for domestic hot water; fluid cooler).

B.1.3.19 Savings from induction motors ≤ 50 hp can be claimed only for motors above Premium Efficiency.

B.1.3.20 For new construction, savings from induction motors up to 500 hp can be claimed only for motors that exceed NEMA Premium Efficiency minimum requirements.

B.1.3.21 Persistence for "High efficiency chiller, chiller/cooler upgrade" (22 years) was determined as the weighted average of multiple values (between 20 and 25 years) recommended by third party studies.

B.1.4.2 EML and persistence for demand control on domestic hot water recirculation pumps are assumed to match the values recommended for domestic hot water circulation pump time clock control, as per KEMA 2009. EML for thermostat base control is assumed to match that of time clock control.

B.1.4.6 EML and persistence are assumed to match those recommended by KEMA 2009 for the ECM fan motor systems (15 years for "ECM replacing single pole evaporator or condenser fan motors" and for "ECM motors replacing shaded pole motor in refrigerated case").

B.1.4.8 The persistence of Heat Recovery for Domestic Hot Water Preheat matches that of heat recovery measures used for HVAC systems. Various measures (heat pump or heat exchanger based technologies) can be implemented.

B.1.5.6 KEMA 2009 recommends 15 years for Electronically Commutated Fan Motors in commercial refrigeration setting.

B.1.5.10 KEMA 2009 recommends six years for strip curtains. The more conservative value (four years) recommended by DEER 2014 and CALMAC 2000 was selected.

B.1.5.13 NEMA Premium Efficiency is the minimum requirement for new induction motors up to 500 hp. Savings from DSM retrofit projects involving Premium Efficiency motors > 50 hp and up to 500 hp are eligible only as possible exceptions where the standard industry practice is to rewind a failed motor instead of replacing it (based on the policy that the motor would be repaired only if the repair cost does not exceed 65% of the cost for a new motor). In this case, if the customer elects to replace the motor, the savings relative to rewound motor can be recognized.

B.1.5.14 Premium Efficiency induction motors ≤ 50 hp are not eligible as DSM projects. The savings from these motors are reported under Codes & Standards.

B.1.5.19 Savings from induction motors ≤ 50 hp can be claimed only for motors above Premium Efficiency.

B.1.5.20 For new construction, savings from induction motors up to 500 hp can be claimed only for motors that exceed NEMA Premium Efficiency minimum requirements.

B.1.6.4 KEMA 2009 recommends 10 years for exhaust hood demand ventilation controls. Eight-year conservative value was selected because the smoke detectors and temperature sensors will likely fail after eight years.

B.1.7.1 Persistence for parkade ceiling insulation is assumed to match that of envelope upgrade measures (including ceiling insulation).

B.1.7.3 Thirty-year persistence for "Wall Insulation Increase" was determined as the weighted average of the values recommended by third party studies, ranging between 20 and 40 years. Thirty years is supported by Energy Trust of Oregon, 2009 and BPA Portland, 2005.

B.1.7.4 This measure is relevant to Commercial New Construction program. EML of twenty-five years is recommended by several studies including: GDS 2007, Massachusetts 2010, Northeast Energy Efficiency Partnership (NEEP 2010) and "KEMA. DSM Market Potential Assessment. Austin Energy, July 12, 2012".

B.1.7.5 Persistence of windows shading (motorized blinds) is assumed to match that of motors.

B.1.7.6 Persistence of windows shading (concrete overhang) is assumed to match that of building envelope.

B.1.8.5 Persistence recommendation is based on the value used in previous projects implementing energy efficient rectifiers.

B.1.9.3 Thirty-year persistence for transformers is supported by "Vermont Electric Energy Efficiency Potential Study, GDS Associates, January 2007".
Study for the USDOE by Oakridge National Laboratory (ORNL-6925) "Determination Analysis and Analysis of the NEMA Efficiency Standard for Distribution Transformers states average life spans over 30 years. Study by NR Can states that the actual life of transformers is 40-50 years for new transformers independent of size (15-7,500 kVA) or type (dry-type and liquid-filled).

B.1.9.5 There is relatively little information available on elevator energy efficiency and life, due to the custom nature of elevator installations. Several sources (American Council for an Energy Efficient Economy, January 2015: Advancing Elevator Energy Efficiency; California Energy Commission, June 2014: ASHRAE Electricity Savings – Elevator Lighting and Ventilation; ACEEE, April 2005: Opportunities for Elevator Efficiencies Improvement) indicate an expected useful life of 20 years for elevator efficiency measures, or a retrofit cycle of 20-30 years.
The 15-year persistence for Energy Efficient Elevator Systems is based on the EML of the typical systems being upgraded (e.g., motors, LED lighting).

B.1.9.6 Used for emergency diesel generators, this ECM involves installation of air source heat pumps instead of electric resistance heaters, for the purpose of maintaining the engine coolant at the optimum temperature enabling reliable and quick start of generator in case of power failure.
The persistence matches that of heat pumps.

B.1.10.1 This measure refers to the HVAC equipment that will service the process activities (laundry, data centre, kitchen, labs, pools). Persistence is assumed to be 15 years, matching that of the HVAC system for the rest of the building.

B.1.10.2 Persistence of measures reducing the process loads (e.g., high efficiency elevators) is assumed to match that of motors.

B.2.1.2 To obtain five year persistence, industrial operational type savings must be supported by a sustainment initiative documented in the customer's Sustainable Energy Management Plan or equivalent.

B.2.2.1 EML and persistence estimate of 10 years for high efficiency fans is based on published reference value of 15 years for fans in commercial sector (See KEMA 2009), shortened to 10 years for industrial applications because wear and hours of use are both likely higher in an industrial setting than they would be in a commercial setting.

B.2.2.2 Based on engineering judgement, typical EML and persistence for "low friction ducts" in an industrial setting is 10 years, but can range from seven to 12 years. Ducting measure in commercial and residential setting typically last longer (e.g., 18 years as per SERA 2007), however wear and hours of use are expected to be higher in an industrial setting than they would be in a commercial setting.

B.2.2.3 Replacement of oversized fans and blowers is assumed to have the same EML and persistence as measure "High Efficiency Fans".

B.2.2.4 Persistence of impeller trim for fans and blowers is assumed to match the persistence recommended by KEMA 2009 for impeller trim for pumps.

B.2.3.1 Persistence of 13 years is based on KEMA 2009, Line item 5.4020.325.

B.2.3.3 KEMA 2009 recommends five years for the EML and persistence of pump impeller trim.

B.2.3.4 Replacement of oversized pumps is assumed to have the same EML and persistence as measure "High efficiency pumps".

B.2.3.5 EML and persistence of "Network redesign including holding tanks" are assumed to match those recommended for "Low friction piping networks".

B.2.4.1 KEMA 2009 recommends between 10 and 15 years for compressed air dryers. Ten-year persistence was chosen because, although efficient air dryers have a long technical life, savings persistence can be limited by operating practices.

B.2.4.2 KEMA 2009 recommends 15 years for efficient compressor. Ten-year persistence was chosen because of the ongoing maintenance and machinery operation practices required for the savings to persist.

B.2.4.3 KEMA 2009 recommends 15 years for compressed air storage tanks. Ten-year persistence was chosen because optimization of compressed air systems by installing receivers and associated piping has a long technical life, but EML and persistence are limited by the system maintenance and operational component of the savings.

B.2.4.5 KEMA 2009 recommends 20 years for reducing process needs for compressed air. Eliminating poor uses of compressed air requires a significant investment to provide a replacement for that poor use; typically small blowers. EML and persistence are limited to 15 years by potential maintenance issues with blowers (i.e., cleaning requirements and motor failures).

B.2.4.7 KEMA 2009 recommends 20 years for reducing the operating pressure of compressed air systems. Ten-year persistence was chosen for reduced header pressure because savings persistence can be limited by operating practices.

B.2.4.8 The five-year persistence for "improved controls" for industrial compressed air is based on KEMA 2009 recommendation for boiler controls.

B.2.4.10 KEMA 2009 recommends 13 years for measure "Compressed Air Heat Recovery". Ten-year persistence was selected, consistent with the value recommended by this standard for air compressors.

B.2.4.11 Study "KEMA, DSM Market Potential Assessment, Austin Energy, July 2012" recommends 10 years for "Compressed Air – Controls". A conservative value of eight-year was selected in order to account for situations where the projects will not perform over the entire persistence period in the same manner and conditions as at BC Hydro project completion date, due to operation changes and that might result in decrease in energy savings.

B.2.5.1 No third party studies were found to support persistence determination for industrial conveyor estimate. EML and persistence were estimated based on internal staff expertise.

B.2.5.2 No third party studies were found to support persistence determination for conversion of

pneumatic conveyor systems to mechanical systems. Conveyance systems are an integral part of the associated industrial process, so once conversion occurs, the value for EML and persistence is assumed to match that of motors at 15 years.

B.2.5.3 No third parties studies were found to support persistence determination for improved conveyor controls. Persistence was set to match that of variable speed drives.

B.2.7.1 No third party studies were found to support persistence determination for drive conversion (e.g., from hydraulic to electrical drives). Persistence recommendation was based on internal staff expertise.

B.2.7.2 No third party studies were found to support persistence determination for efficient gear reducers. Persistence recommendation was based on internal staff expertise.

B.2.7.3 No third party studies were found to support persistence determination for synchronous belts. The technical life of a synchronous belt is only about three years, while the cog pulleys required to use the sync belt have a much longer lifetime. It is assumed that customers will revert or reconfigure the system after replacing the sync belt three times in 10 years.

B.2.7.4 NEMA Premium Efficiency is the minimum requirement for new induction motors up to 500 hp. Savings from DSM retrofit projects involving Premium Efficiency motors > 50 hp and up to 500 hp are eligible only as possible exceptions where the standard industry practice is to rewind a failed motor instead of replacing it (based on the policy that the motor would be repaired only if the repair cost does not exceed 65% of the cost for a new motor). In this case, if the customer elects to replace the motor, the savings relative to rewound motor can be recognized.

B.2.7.5 Premium Efficiency induction motors ≤ 50 hp are not eligible as DSM projects. The savings from these motors are reported under Codes & Standards.

B.2.7.6 Savings from induction motors ≤ 50 hp can be claimed only for motors above Premium Efficiency.

B.2.7.7 NEMA Premium Efficiency requirements do not apply to induction motors >500 hp. Savings are claimed relative to a valid alternative/baseline.

B.2.7.8 For New Plant, savings from induction motors up to 500 hp can be claimed only for motors that exceed NEMA Premium Efficiency minimum requirements.

B.2.7.9 The information found on EML for large synchronous motors (ESource, ABB Brazil – Life Expectancy Analysis Program) indicates that the effective life of large synchronous motors is indefinite due to repairs and proper maintenance and good housekeeping, which extend the life between major refurbishings.

An analysis of life expectancy based on the equivalent operating hours until the stresses leading to the motor degradation (e.g., thermal, mechanical, electrical, ambient) exceeds the motor strength and reach the point of imminent failure, shows that the motor life can exceed 30 years.

Factors contributing to the extended life and persistence of savings include:

- enhanced monitoring (e.g., temperature and vibration sensors, monitoring closely two of the main factors contributing to motor degradation) and preventive maintenance (leading to an increase of the mean-time-between failures) - motivated by the large capital investment associated with these motors.
- comprehensive CSA standard, which provides guidance to the electric machine service centers, to assist in verifying that the refurbishing process has maintained or enhanced the synchronous machine efficiency.

Twenty-year, conservative value is recommended in this standard, to account for variances introduced by: different manufacturers, motor sizes, load profile and number of motor starts, environment conditions, maintenance.

B.2.7.10 Persistence for green motor rewinds varies between 7 and 12 years depending on the motor size. Eight-year persistence is the weighted average of the persistence of savings resulting from the motors typically included in BC Hydro program offer.

B.2.8.2 Process control persistence of five years is based on KEMA 2009 recommendation for boiler control life of five years.

B.2.8.3 Injection moulding persistence of 15 years is based on SERA 2007 recommendation for process extrusion equipment.

B.2.8.5 Fifteen-year EML and persistence value for heat recovery on kilns, furnaces, and industrial ovens is based on KEMA 2009 recommendation for preheating combustion air on industrial ovens and furnaces. Note that ten years is recommended for process heat recovery, as per KEMA 2009.

B.2.8.8 No third party studies were found to support persistence determination for efficient crushing and grinding. Persistence is assumed to match that of process equipment improvement, as supported by "Process Overhaul" measure, recommended by CALMAC 2000.

B.2.9.1 No third party studies were found to support persistence determination for regenerative devices. Persistence estimate is based on internal staff expertise.

B.2.9.2 No third party studies were found to support persistence determination for hardwired voltage optimization. Persistence estimate is based on internal staff expertise.

B.2.9.3 No third party studies were found to support persistence determination for the equipment installed to reduce power losses due to harmonics. Persistence estimate is based on internal BCH staff expertise.

B.2.9.6 No third party studies were found to include energy conservation measures for reducing the transmission and distribution line losses by increasing the voltage and/or upgrading the conductor. The 30-year persistence is based on internal staff expertise and is supported by assumptions of expected asset life used by BC Hydro for T&D Planning and Finance, Investment Evaluation.

B.2.9.7 Persistence recommendation is based on the value used in previous projects implementing energy efficient rectifiers. The persistence is within the design lifetime indicated by manufacturer (> 30 years specified by AEG).

B.2.9.8 Used for emergency diesel generators, this ECM involves installation of air source heat pumps instead of electric resistance heaters, for the purpose of maintaining the engine coolant at the optimum temperature enabling reliable and quick start of generator in case of power failure. The persistence matches that of heat pumps.

B.2.10.1 No third party studies were found to support persistence determination for refiner modernization. Persistence estimate is based on internal staff knowledge of the average age of refiners in the BC Hydro service area.

B.2.10.2 Persistence estimate for refiner plate segments is based on KEMA 2009 recommended value for operational measures, as well as internal staff knowledge that, while refiner segments have a short life and are frequently replaced, their specifications are usually constant for at least two years.

B.2.10.3 No third party studies were found to support persistence determination for advanced quality control in the pulp and paper sector. Persistence estimate is based on internal staff expertise, and is assumed to match that of process control.

B.2.10.5 No third party studies were found to support persistence determination for production rate effect for time of day pulping. Persistence is assumed to match that of operational measures.

B.2.10.8 KEMA 2009 recommends 15 years for aerator technologies in waste water treatment facilities. Thirteen-year persistence was chosen based on internal staff expertise.

B.2.10.10 Permanent removal of equipment in the pulp and paper process (e.g., cleaners removal) is like creating a lower friction piping network or redesigning a piping network, which have 15-year persistence.

B.2.10.11 The kiln fan VFD control is a control system fully integrated with the kiln controller and not easily by-passed by the operator. Unlike a compressed air auto-sequencer control, where the operator can easily change the set points, this kiln fan VFD control algorithm is locked in and only the controls company can make the changes. In this sense, the fan VFD controller is more like a refrigeration floating header pressure control, which has 10 years EML and persistence.

B.2.10.12 No third party studies were found to support persistence for "Hammermill Efficiency Improvement". Persistence estimate is based on internal staff expertise and information provided by manufacturers and customers who installed this equipment.

B.2.11.1 No third party studies were found to support persistence determination for tailings piping modifications. Persistence estimate is based on internal staff expertise.

B.2.11.2 No third party studies were found to support persistence determination for vertical axis grinders. Persistence estimate is based on internal staff expertise.

B.2.11.3 BC Hydro Conservation Potential Review 2007 recommends 10 years for EML and persistence. Five-year persistence was selected because this control measure associated with the optimum size of the grind can be overridden or no longer valid for a different ore extracted.

B.2.11.4 EML and persistence were estimated based on internal staff expertise and are assumed to match the values recommended for the new industrial plant (capped to the life time of mine).

B.2.12.1 KEMA 2009 recommends 15 years for aerator technologies in waste water treatment facilities. Thirteen-year persistence was chosen based on internal staff expertise.

B.2.13.2 BC Hydro, CPR 2007 recommends 12 years for Premium Efficiency Electro-chemical Process. Ten-year persistence was selected based on BC Hydro internal staff expertise.
Due to natural conservation, the "Membrane cell electro-chemical technology" is no longer eligible as DSM measure. With the exception of small applications, this technology was adopted as industry standard practice.

B.2.14.1 The 20-year default persistence for load displacement due to power self-generation projects should be overwritten on a project-by-project basis, to match the contract terms.

B.2.14.2 Depending on the age and condition of the used turbo generator (TG), a lower persistence of savings is given to a rebuilt TG (15 years) compared to a new TG (20 years). The turbine casing, turbine blades, turbine shaft, etc., may be prone to structural failure even if the non-destructive testing conducted at time of purchase shows no evidence of fatigue, etc.

B.2.15.1 The persistence of Heat Recovery for Domestic Hot Water Preheat matches that of heat recovery measures used for HVAC systems. Various measures (heat pump or heat exchanger based technologies) can be implemented.

B.2.15.4 EML and persistence for demand control on domestic hot water recirculation pumps are assumed to match the values recommended for domestic hot water circulation pump time clock control, as per KEMA 2009. EML for thermostat base control is assumed to match that of time clock control.

B.2.15.5 EML and persistence are assumed to match those recommended by KEMA 2009 for the electronically commutated fan motor systems (15 years for "ECM replacing single pole evaporator or condenser fan motors" and for "ECM motors replacing shaded pole motor in refrigerated case").

B.2.16.2 Persistence for "High efficiency chiller, chiller/cooler upgrade" was determined as the weighted average of multiple values (between 20 and 25 years) recommended by third party studies.

B.2.16.3 Fifteen-year persistence for "Heat recovery upgrade/retrofit" is supported by "Connecticut Light & Power, United Illuminating Company. *Connecticut Energy Efficiency Fund for 2008*. September 25, 2007". Various measures (heat pump or heat exchanger based technologies) can be implemented.

B.2.16.16 EML and persistence for water distribution piping retrofit are assumed to match the values recommended for air distribution ductwork retrofit.

B.2.17.1 By program design, the persistence for new ECM "SEM Cohort Model - Operational/Behavioural ECMs without Sustainment Plan" was set to 1 year, even though the existing ECMs of operational and procedural types have 2-year persistence.

The SEM Cohort Program is a 2-year curriculum where a facility model is developed and used to capture savings from operational/behavioural ECMs. The savings claims are made in two separate Program Enabled claims, at the end of year 1 and at end of year 2. In order to simplify the savings claim process and avoid double counting, the first year claim has one-year persistence allowing the 2nd year claim to capture the savings from all ECMs implemented in the program.

B.2.17.2 ECM "SEM Cohort Model - Operational/Behavioural Measures Supported by Formal Sustainment Plan" is providing support for the energy savings projects implemented through the SEM Cohort program. This ECM is supporting the savings claim made at the end of year 2 of the Cohort agreement, and has a 5-year assigned persistence, ensured by the formal sustainment plan.

B.2.18.1 ECM "SEM-Deemed Modelled Savings" is providing support for the operational/behavioural energy savings claimed by SEM Industrial Energy Manager participants with EM&T Level 1 model. The 1-year persistence is consistent with that recommended for "SEM Cohort Model - Operational/Behavioural ECMs without Sustainment Plan".

B.2.19.2 EML and persistence of "Network redesign including holding tanks" are assumed to match those recommended for "Low friction piping networks".

B.3.1.1 Persistence estimate for weather stripping was based on internal staff expertise. Persistence is limited by the fact that in this application of weather stripping, installation is typically not made by a professional builder, and the weather stripping degrades over time because of wear and tear.

B.3.1.2 Persistence for "Ceiling, wall or floor insulation" (30 years) is supported by KEMA, Austin 2012.

B.3.1.3 Persistence for "Energy efficient windows" (25 years) is supported Massachusetts Electric and Gas Energy Program Administrators. October 2010.

B.3.1.4 Electrical outlet gaskets are unlikely to be removed once installed. Fifteen-year EML is recommended by Massachusetts 2010 for air sealing measures.

B.3.1.5 Window film is of the disposable variety typically removed in summer months.

B.3.1.6 Massachusetts 2010 recommends 18-year EML and persistence for measure "Warm Air furnace ECM (installation of an electronically commutated variable speed air supply motor)" in residential sector.

B.3.1.7 NR Canada Energy Star Calculator recommends nine years for the EML and persistence of "Energy Star Ventilation Fan" in residential sector.

B.3.1.8 Eleven-year persistence is recommended for Weatherization (air sealing), supported by DEER 2014.

B.3.1.9 Eighteen-year persistence for residential Air-Source Heat Pumps is supported by KEMA Austin, 2012.

B.3.1.11 Persistence for Heat Recovery Ventilator (16 years) was estimated as the weighted average of the values recommended by various third party studies.

B.3.1.12 The ECM for "Attic Insulation" is supporting Home Renovation Rebate program. Thirty-year persistence is recommended by KEMA, Austin 2012.

B.3.2.3 Recommendation is based on BC Hydro internal staff expertise and represents the median value of the persistence recommendations made by different third party studies.

B.3.2.4 Thirteen-year persistence for "Energy Efficient Hot Water Heater" is supported by DEER 2014.

B.3.3.1 Persistence recommendation for refrigerators (17 years) is supported by NEEP 2010 and BCH CPR 2007.

B.3.4.1 A default one-year persistence is assigned for behavioural measures without ongoing support. However, a longer persistence (up to a maximum of 24 years) is possible with ongoing customer engagement based on the program design, including the level of support provided by the program and the participation level available to the customer.

B.3.4.2 SERA 2009 indicates that the retention of energy efficient behaviours is low to modest for low income programs. The one-year persistence is applicable with or without ongoing support.

B.4.1.1 The recommendation of 20 years for the EML and persistence for Energy Star Fixture in Residential Setting is also supported by "Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, October 2010".

B.4.1.2 Not many third party studies were found to support persistence determination of LED light fixtures and bulbs in a residential setting. OPA, December 2010 is indicating 50,000 hours for the EUL of "Energy Star® LED Recessed Downlights" and an OPA study on prescriptive input assumptions performed by Navigant Consulting suggests the average hours of operation per day in Residential setting is 2.7 hrs./day. Conservatively selected 20 years.

B.4.1.3 Persistence recommendation is supported by Massachusetts: 20 years for "Light-Emitting Diode Lights (LED) screw-in bulbs, Residential". Other third party study, OPA, March 2011 is conservatively recommending 30 years for "Lights – 6 W LED Screw-in", based on the useful life of 35,000 hours and 2.7 average hours of operation per day, which translates to a 35-year effective useful life" (based on "data from manufacturers and the US Department of Energy, the effective useful life of LED light bulbs falls between 35,000 and 50,000 hours").

B.4.1.4 Measure life for exterior signage is based on 50,000 hours life time and an average annual use of 4,000 hours years.

B.4.1.5 Measure life for "Non-LED Lighting Redesign for Lower Power Density" is 16 years, consistent with the recommended EML for typical non-LED lighting technology in non-residential setting (e.g., High Output T5 Luminaires, and New or Retrofit T8 Lamps, both supported by KEMA 2011; Induction luminaires, supported by CALMAC 2000; and HID Luminaires supported by SERA 2007).

B.1.1.6 Measure life for "Luminaire Removal" is 16 years, consistent with the recommended EML for "Non-LED Lighting Redesign for Lower Power Density".

B.4.1.9 Persistence is assumed to be 16 years, based on an average rated life of 70,000 hours and 4,380 hours of use/year.

B.4.2.1 EML of HID lamp is based on 20,000 rated hours and 5,000 operating hours/year.

B.4.2.2 Measure life for "LED replaceable reflector lamp in non-residential setting (screw-in/snap-in" is based on 50,000-hour life time (supported by OPA, December 2010) and an average annual use of 4,000 hours/year.

B.4.2.3 "Tubular LED Lamps" are a sub-category of "LED replaceable lamps in non-residential setting, screw-in/snap-in" (12-year persistence), which was removed from this revision due to lighting regulations impact. Lamps not affected by regulations, such as "Tubular LED Lamps" and "LED Mogul screw-base replacement for HID lamps", were added as separate measures.

B.4.2.4 Similar to "Tubular LED Lamps", the "LED Mogul screw-base replacement for HID lamps" (12-years), was included as a separate ECM/sub-category of the generic measure "LED replaceable lamps in non-residential setting, screw-in/snap-in the ECM " previously contained in the standard.

B.4.3.2 Persistence of lighting control resets is assumed to match that of industrial operational type measures.

B.4.3.3 Persistence of lighting control optimization with sustainment is assumed to match that of operational type measures with sustainment.

B.4.3.5 Persistence of NLC Level 1- Bi-level Controls (10 years) is the same as that of existing ECM "Adaptable Street Lighting", as they both involve a demand reduction (step dimming) as a result of a control event (occupancy sensor and/or schedule).

B.4.3.6 Fifteen-year persistence for "NLC Level 2 - Networked Controls without Energy Management" is supported by various third party studies (e.g., KEMA 2009 - Public Service Commission of Wisconsin, Measure Life Study; "Energy Trust of Oregon, Energy Efficiency and Conservation Measure Resources Assessment for the Years 2010-2030, January 25, 2011; NYSERDA, Energy Efficiency and Renewable Energy Potential Study of New York State, April 2014), which recommend 15 years for similar control components: daylighting controls, automatic dimming ballasts; lighting scheduling and control capabilities".

B.4.3.7 Twenty-year persistence for "NLC Level 3 - Networked Controls with Energy Management" is supported by "NYSERDA, Energy Efficiency and Renewable Energy Potential Study of New York State, April 2014", which recommends 20 years for similar control components: "location, controls, targeted for room and task, including accommodation for daylighting for integrated design".

B.5.1.1 RIB/LGS/MGS/SGS rates have indefinite persistence as long as the marginal price does not decline in real dollars.

B.5.1.2 Persistence remains subject to change in future.

B.5.1.3 Persistence value remains subject to change in future.

B.5.1.4 Persistence value remains subject to change in future.

C.1.1.1 Same persistence as the existing ECM "High efficiency chiller, chiller/cooler upgrade" (B.1.3.21)

C.1.1.2 Persistence for "Air-to-Water Heat Pump" is by supported several third party studies recommending 15-years for "Air-source Heat Pumps".

C.1.1.3 Several studies, including *Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Plan, October 2010*, recommend 18-year persistence for "Ductless/Minisplit Heat Pump".

C.1.1.4 Fifteen-year persistence for "Water-to-Water Heat Pump" is supported by several third party studies, including *Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Plan, October 2010.*

C.1.1.5 Fifteen-year persistence for "Ground-Source Heat Pump" is supported by several third party studies, including *Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Plan, October 2010.*

C.1.1.6 Fifteen-year persistence for "Air-to-Air Rooftop Heat Pump" is supported by *"NAVIGANT, Energy Information Administration, Technology Forecast updates- Res and Comm Building Technologies, September 2011"*, recommending 15 years for Commercial Rooftop Heat Pumps.

C.1.1.7 Same as C.1.1.6, the 15-year persistence for "Air-to-Water Rooftop Heat Pump" is supported by *NAVIGANT, Energy Information Administration, Technology Forecast updates- Res and Comm Building Technologies, September 2011.*

C.1.1.8 Persistence for "Exhaust Air Heat Recovery Heat Pump" is supported by several studies, including *Connecticut Energy Efficiency Fund for 2008, September 25, 2007*, which recommends 15-year for Air-Source Heat Pumps.

C.1.1.10 Persistence for "Electric Water Heater" is supported by *KEMA, Austin, July 2012, DSM Market Potential Assessment*, recommending 15 years for "High Efficiency Water Heater (electric)".

C.1.1.11 Persistence for "Air Source VRF Distributed Heat Pump" is supported by "*2016 ASHRAE Handbook for HVAC Systems and Equipment" - Chapter 18, Page 18.3* , which shows that "most VRF systems manufacturers list 15 to 20 years for air-source systems as the average life expectancy range ". The 18-year recommended persistence for this LCE measure represents the midpoint value of the life expectancy range.

C.1.1.12 Persistence for "Water Source VRF Distributed Heat Pump" is supported by "*2016 ASHRAE Handbook for HVAC Systems and Equipment" - Chapter 18, Page 18.3* , which shows that "most VRF systems manufacturers list 20 to 25 years for water-source systems as the average life expectancy range". The 22-year recommended persistence for this LCE measure is the midpoint value of the life expectancy range.

C.1.1.13 Persistence of "High-efficiency (>75%) HRV" is supported by *State of Minnesota, Technical Reference Manual for Energy Conservation Improvement Programs, 2014,* which recommends 15 years for commercial Energy Recovery Ventilator.

C.1.2.1 Same persistence as the existing ECM "High efficiency chiller, chiller/cooler upgrade" (B.1.3.21)

C.1.2.2 Same measure as "Air-to-Water Heat pump" included as C.1.1.2, in section "LCE - HVAC Components".

C.1.2.3 Persistence for "Air-to-Water Heat Pump Water Heater" is supported *by Energy Trust of Oregon Energy Efficiency and Conservation, Measure Resource Assessment for the years 2008-2027*, *Inc., February 26, 2009,* which recommends 15 years for Heat Pump Water Heater.

C.1.2.4 Same measure as the "Ground-Source Heat Pump" included at C.1.1.5, in section "LCE - HVAC Components".

C.1.2.5 Same measure as "Water-to-Water Heat Pump" as included at C.1.1.4, in section "LCE - HVAC Components".

C.1.2.6 Persistence for "Sewage Heat Recovery Heat Pump" is the same as for Water-to-Water Heat Pump", described at C.1.1.4, section "LCE - HVAC Components".

C.1.2.8 Same measure as "Electric Water Heater" included at C.1.1.10, in section "LCE - HVAC Components".

C.1.3.1 Thirty-year persistence for "Connection to BC Hydro Grid via T/D line" is consistent with the persistence value assigned to existing ECM "Reduction of power losses in Transmission or Distribution Lines (by voltage increase and/or conductor upgrade)". The persistence should be capped to the life of site, as applicable.

C.1.4.1 Persistence recommendation for "Electric Vehicle Supply Equipment – Level 2" is based on limited information currently available on the market, and on BC Hydro internal staff expertise. The persistence will be firmed up as more relevant information regarding the lifespan of EV charging equipment becomes available.

C.1.4.2 Persistence value for "Electric Vehicle Supply Equipment – DC Fast Charging" is based on limited information currently available on the market, and on BC Hydro internal staff expertise. The persistence will be firmed up as more relevant information regarding the lifespan of EV charging equipment becomes available.

C.2.1.1 Same persistence as the existing ECM "High efficiency chiller, chiller/cooler upgrade" (B.1.3.21)

C.2.1.2 Persistence for "Air-to-Water Heat Pump" is supported by several third party studies, including *Connecticut Energy Efficiency Fund for 2008,* September 25, 2007, which recommend 15-year persistence for "Air-Source Heat Pumps"

C.2.1.3 Persistence for "Air-to-Air Heat Pump (ductless or minisplit)" is supported by several studies recommending 18-year persistence for "Ductless/Minisplit Heat Pump".

C.2.1.4 Fifteen-year persistence for "Water-to-Water Heat Pump" is supported by several third party studies, including *Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Plan, October 2010.*

C.2.1.5 Recommended persistence for "Ground-Source Heat Pump" (15 years) is supported by multiple studies.

C.2.1.6 Persistence for "Air-to-Air Rooftop Heat Pump" is supported by *"NAVIGANT, Energy Information Administration, Technology Forecast updates- Res and Comm Building Technologies, September 2011"*, recommending 15 years for "Commercial Rooftop Heat Pumps".

C.2.1.7 Same as C.2.1.6, the 15-year persistence for "Air-to-Water Rooftop Heat Pump" is supported by *NAVIGANT.*

C.2.1.8 Persistence for "Exhaust Air Heat Recovery Heat Pump" is supported by several studies recommending 15-year for Air-Source Heat Pumps.

C.2.1.10 Persistence for "Electric Water Heater" is supported by *KEMA, Austin, July 2012, DSM Market Potential Assessment*, recommending 15 years for "High Efficiency Water Heater (electric)".

C.2.2.1 Same persistence as the existing ECM "High efficiency chiller, chiller/cooler upgrade" (B.1.3.21)

C.2.2.2 Persistence for "Air-to-Water Heat Pump" is consistent with the third party studies recommending 15-year for "Air-Source Heat Pumps"

C.2.2.3 Persistence for "Air-to-Water Heat Pump Water Heater" is supported third party studies recommending 15 years for *"*Heat Pump Water Heater".

C.2.2.4 Fifteen -year persistence for "Ground-Source Heat Pump" is supported by several third party studies.

C.2.2.5 Fifteen-year persistence for "Water-to-Water Heat Pump" is supported by several third party studies.

C.2.2.6 Persistence for "Sewage Heat Recovery Heat Pump" is the same as for Water-to-Water Heat Pump", described at C.2.1.4.

C.2.2.8 Persistence for "Electric Water Heater" is supported by *KEMA, Austin, July 2012, DSM Market Potential Assessment*, recommending 15 years for "High Efficiency Water Heater (electric)".

C.2.3.1 Thirty-year persistence for "Connection to BC Hydro Grid via T/D Line" is consistent with the persistence assigned to existing ECM for "Reduction of power losses in Transmission or Distribution Lines (by voltage increase and/or conductor upgrade)". The persistence should be capped to the life of customer site, as applicable.

C.2.4.1 Ten-year persistence for "Electric Crusher Chipper" is based on BC Hydro internal staff expertise and on limited information available on the market at the time of publishing the standard. The persistence and reference will be firmed up as better information becomes available.

C.2.4.2 Ten-year persistence for "Electric Crusher or Grinding" is based on BC Hydro internal staff expertise and on limited information available on the market at the time of publishing the standard. The persistence and reference will be firmed up as better information becomes available.

C.2.4.4 Ten-year persistence for “Electric Dryer” is based on BC Hydro internal staff expertise and on limited information available on the market at the time of publishing the standard. The persistence and reference will be firmed up as better information becomes available.

C.2.5.1 Recommended persistence for “Electric Vehicle Supply Equipment – Level 2” is based on BC Hydro internal staff expertise and on limited information available on the market at the time of publishing this document. The persistence and reference will be firmed up as better information becomes available.

C.2.5.2 Recommended persistence for “Electric Vehicle Supply Equipment – DC Fast Charging” is based on BC Hydro internal staff expertise and on limited information available on the market at the time of publishing this document. The persistence and reference will be firmed up as better information becomes available.

C.2.5.3 Measure for “Electric Conveyance” has the same persistence of the existing ECM “Conveyance Retrofit” (B.2.5.1) linked to “Industrial Conveyance” end use.

C.2.6.1 Preconditioned Air (PCA) Units ensure heating and cooling for the aircraft while it is on the ground. These units will replace the mobile Air Conditioning units powered by Diesel engines.

C.2.6.2 Ground Power Units (GPUs) power the electrical systems on the aircraft, including lighting and navigational equipment while the plane is parked on the ground, replacing the mobile Diesel generators.

C.3.1.1 Recommended persistence (9 years) for “Electric Lawnmower” is based on limited information available on the market at the time of publishing this document. The persistence and reference will be firmed up as better information becomes available.

I. Appendices

I.1. Appendix A. Acronyms

CADMAC	California DSM Measurement Advisory Committee
CALMAC	California Measurement Advisory Committee
C&S	Codes and Standards
CFL	Compact Fluorescent Lamp
DEER	Database for Energy Efficiency Resources
DSM	Demand Side Management
ECM	Energy Conservation Measure
EML	Effective Measure Life
ECAP	Energy Conservation Assistance Program
ESK	Energy Saving Kit
EUL	Effective Useful Life
HID	High Intensity Discharge
HIR	Halogen Infrared
HVAC	Heating, Ventilation, Air Conditioning
LCE	Low Carbon Electrification
LED	Light Emitting Diode
LGS	Large General Service
MGS	Medium General Service
NEMA	National Electrical Manufacturers Association
OPA	Ontario Power Authority
PS	Power Smart
RIB	Residential Inclining Block
SEM	Strategic Energy Management
SERA	Skumatz Economic Research Associates Inc.
SGS	Small General Service

I.2. Appendix B. Previously Supported Measures

The following measures have been removed from the current version of the standard as they are no longer offered by BC Hydro energy conservation programs. However, these measures and their savings are still persisting in some projects.

	Measure	Effective Measure Life	Persistence	Removed from Standard
1	Computer power management software	2 to 5 years	2 to 5 years	F2011
2	Energy efficient power bar[1]	4	4	F2011
3	Compact fluorescent luminaires in non-residential setting	16	16	F2011
4	Screw or snap in compact fluorescent lamp and induction lamp in non-residential setting	2	2	F2011
5	LED strings (seasonal LED or SLED program)	16	16	F2009
6	Vending machine controller	5	5	F2013
7	Energy Star vending machine	14	14	F2013
8	Parking lot block heater timer control	10	10	F2013
9	Industrial New Plant	30	30	F2015
10	Coil Cleaning	2	2	F2016
11	Envelope Upgrade	Indefinite	25	F2016
12	Transmission Service Rates - Retail Access	1	1	F2016
13	Screw or snap in compact fluorescent lamp (applicable to Residential New Home Program)	8	2	F2016
14	Energy Star Torchiere CFL Fixture	16	16	F2016
15	High grade district energy system (biomass, natural gas, waste heat recovery)	Indefinite	30	F2016
16	Low grade district energy system (heat pumps)	Indefinite	30	F2016
17	Workplace Conservation Awareness Participants	2	2	F2018
18	Specialty CFL in residential setting	10	10	F2019
19	LED Parkade Lighting	16	16	F2019
20	Non-LED Parkade Lighting	16	16	F2019
21	Screw or snap in compact fluorescent lamp and induction lamp outdoor residential setting (applicable to Residential Low Income - ESK)	7	7	F2019

[1] Removed from Commercial Programs.

22	Screw or snap in compact fluorescent lamp and induction lamp indoor residential setting (applicable to Residential Low Income - ESK)	12	12	F2019
23	Screw or snap in compact fluorescent lamp and induction lamp outdoor residential setting (applicable to Residential Low Income - ECAP)	6	6	F2019
24	Screw or snap in compact fluorescent lamp and induction lamp indoor residential setting (applicable to Residential Low Income - ECAP)	11	11	F2019
25	Snap in LED exit signs	16	16	F2019
26	Photoluminescent Exit Signs	16	16	F2019
27	LED replaceable lamp in non-residential setting (screw-in/snap-in)	12	12	F2019
28	LED Lighting with Adaptive/Bi-Level Control	14	14	F2019
29	Non-LED Lighting with Adaptive/Bi-Level Control	14	14	F2019
30	Server Power Management Software	4	4	F2019
31	Virtual Desktops – Thin Clients	4	4	F2019
32	Energy Efficient Laptops and/or Mini Computers	4	4	F2019
33	Energy Efficient Mobile Computers	4	4	F2019
34	4 Top Tier Energy Star IT Equipment	4	4	F2019
35	Wood Stove	25	25	F2019
36	Water Heater Blanket	7	7	F2019
37	Drain Water Heat Recovery	15	15	F2019
38	Solar Water Heater	15	15	F2019
39	Efficient Television	7	7	F2019
40	Television Recycling	7	7	F2019
41	Television Set Top Box	5	5	F2019
42	Efficient Dishwasher	11	11	F2019
43	Energy Efficient New Home	Indefinite	25	F2019
44	Transmission Service Rates – Load Aggregation Across Sites	1	1	F2019

I.3. Appendix C. Persistence Adjustment in Cases of Permanent Shutdown of Customer Sites

1. Treatment of savings reporting and relevant DSM impacts from projects affected by permanent closure/shutdown of a customer site/process.

1.1. Procedure for the permanent closure/shut down of SMALL/MEDIUM customer sites (Commercial or Industrial) or a permanent shutdown of an operation line installed at a Small/Medium customer site:

- **DO NOT** make any adjustments to the prescribed EML/persistence values for the DSM impacts from projects installed at these sites.
- Continue to report energy savings and other DSM impacts for the assigned persistence value, because the prescribed EML/persistence values and the program design are based on the assumption that some DSM projects will over-perform their effective measure life and some will under-perform, due to a change in field conditions, obsolescence, building remodeling, renovation, demolition, occupancy changes, etc.
- In order to maintain the sanctity and integrity of the prescribed persistence values, persistence adjustments should not be made on a project to project basis, based on the performance of the ECM/LCE measure. The impact on energy consumption should continue to be reported if the facility/operations are permanently closed/shut down before the end of the ECM expected life.

1.2. Procedure for the permanent closure shut down of a LARGE customer sites (Commercial or Industrial) or a permanent shutdown/closure of an operations line installed at a large customer site:

- **ADJUST** the persistence of all ECMs/LCE measures/End Uses and discontinue the reporting for all installed DSM projects impacted by the permanent shutdown of the site or operation. The following factors support this recommendation:
  - DSM projects installed at large commercial and industrial sites (transmission and distribution service) are typically associated with large impacts on energy consumption.
  - DSM projects are fewer in number, unique in specification, complex and more process oriented, rather than a targeted end use.
  - Due to these reasons, an unexpected change in the project performance, like the unanticipated early facility/operation shut down, may not get offset by other similar projects that would operate longer than the expected measure life. Not adjusting the persistence would affect the rationale/assumption of prescribed EML values and the DSM impact on energy consumption at portfolio level.
- A large site may have multiple processes and this policy will apply when one or more processes are permanently closed/shut down.
- Exceptions from persistence adjustments apply for the following end uses, program offerings or events associated with the site:
  - all Lighting projects as well as the Compressed Air projects offered through Self-serve Incentive Program (SIP).
    These projects will continue to report energy savings after the permanent shut-down because they are more generic, with relatively small energy savings, and the overall impact of unanticipated early facility/operation shut down is absorbed by the large DSM portfolio for lighting and SIP compressed air.

- Persistence adjustment described in this section does not apply to projects installed at sites undergoing production curtailment or temporary shutdown/closure.

- A permanent shutdown must be publicly announced by the customer, in order for the DSM impacts from the affected projects to be discontinued.
- In some cases, the business at a permanently closed down site may subsequently be reopened or undertaken by a new customer who may act on bringing the DSM projects back into operation. The impacts on energy consumption from these projects may be claimed under a new file submission, following a site inspection and engineering review to assess the remaining life/persistence of the ECM/LCE measure.

2. Definitions

Definitions and thresholds included in this section should be used only in the context described in Appendix C regarding discontinuation of energy savings and relevant DSM impacts from LARGE customer sites that permanently closed down.

Large Customer Site:
Customer site that has an annual electrical energy consumption over 50 GWh/year.
The consumption will be based on rolling one year consumption before the permanent closure/shutdown announcement.

Small/Medium Customer Site
In this context, customer sites with an annual electricity consumption of 50 GWh/year or less are considered Small and Medium.

Site Closure
Companies, including those that operate at multiple locations, may choose to close one or more sites. Site closures may be the first step toward a permanent shutdown, or it can be a move toward consolidation and reinforcing the core business model.

Permanent Shutdown/Closure of Customer Site or Process
A permanent shutdown means closing the door on the operations for good.
Permanent shutdown/closure of a site or process is usually anticipated to be final, without immediate plans of being brought back into operation under the same or different ownership. Based on the information available at the time of site/process closure, it is assumed that the DSM projects installed at this site will no longer achieve savings/LCE impacts.

A site will be considered permanently closed/shut down only if there is a public announcement of the event.

Temporary Shutdown/Closure of Customer Site/Process
A temporary shutdown may occur as a measure to prevent further spending on company expenses and to give the company time to reorganize and re-open.

I.4 Appendix D: Maintenance/Update Process for the Standard for Effective Measure Life and Persistence

Purpose

The purpose is to document a standard process for maintenance and update of the "Effective Measure Life and Persistence" standard, and the methodology for selecting the persistence value.

Background

The Standard for Effective Measure Life and Persistence contains standardized values of effective life of the energy conservation measures (ECMs)/Low Carbon Electrification (LCE) measures in order to ensure:

- Uniform application of the persistence of impact from a DSM activity on energy consumption.
- Consistency in planning, estimating, reporting, evaluation of impact on energy consumption, calculation of incentives and cost effectiveness of DSM projects and programs.
- Effective and efficient quality assurance.

The standard is revised every two years or as required by CEM Quality Management, to remain consistent with standard industry practices. The revision may include new energy conservation/LCE measures or updates of the existing ECMs/LCE measures, based on improved quality of information available from reliable sources.

Maintenance & Update Process

The maintenance and update of the EML standard in essence is as per the Operations, Engineering and QM Document Management Process at the link below:

CEM Operations, Engineering and Quality Management - Document Management Process

The need for revision may emanate because of various reasons and from various sources such as:

- Research and review of literature in the industry, including third party studies, recommendations made for similar measures by other utilities/jurisdictions/consultants or organizations working with energy management programs.
- Requests from CEM Engineering/Marketing for addition of new technologies or removal of obsolete technologies.

Methodology of selecting the proposed values of persistence

The methodology includes:

- Collecting information on measure life/persistence from the studies reviewed.
- Assess the quality of information based on the source (e.g., primary research, secondary research, manufacturer specification/personal judgment).
- In the case of multiple values resulting from the review of all third party studies, calculate the weighted average of all values, after excluding any outliers.

Exception from this approach may be dealt on a case-by-case basis.

Consultation, Approval, & Communication

- Discuss proposed persistence values and rationale with CEM Engineering and Marketing and agree on the recommended update.
- Communicate proposed update to CEM Strategic Planning and obtain feedback and comments if any.
- Incorporate/address concerns of any stakeholders and finalize updates.
- Obtain approval of CEM Leadership Team/MSC on proposed updates if there is any material effect on energy consumption or other relevant DSM impacts.
- Update the changes in xRM to facilitate the DSM Operations process. The new persistence is applied for new projects only. In case there is no material effect to energy consumption or other relevant DSM impacts as a result of the updates, the changes in xRM can be applied as required without approval from CEM LT/MSC.
- Update the standard when the approved updates have substantially accumulated.
- Publish updated standard on CEM SharePoint Site and Hydroweb and notify all relevant users.
- Provide awareness and training to all stakeholders/users on the updates in the standard.
- Repeat the above update process as required.

Roles & Responsibilities

The maintenance and update of this standard is administered by CEM Quality Management and the updates are approved by CEM Leadership Team/Management Steering Committee (MSC) prior to implementation.

J. Revision Log

Revision No.	Revision Date	Revised by	Description of Revision	Item Changed (ECM/LCE Measures/Code/End Use Name/Section)
11.0	March 2019	Doina Balea, Quality Management	Addition of 7 brand new ECMs, with corresponding References and Notes:	• Commercial (Hard Wired Controls): B.1.1.8 • Industrial: B.2.10.12; B.2.17.1; B.2.17.2; B.2.18.1. • Lighting: B.4.3.6; B.4.3.7
			Removal of 37 ECM: [2]	• Commercial (Data Centre): 2.8.3; 2.8.6; 2.8.7; 2.8.8; 2.8.9. Commercial (WCA): 2.10.1 (WCA Participants) • Residential (Heating, Cooling and Envelope): 4.1.10 • Residential (DHW): 4.2.4; 4.2.7; 4.2.8. • Residential (Appliances): 4.3.5; 4.3.6; 4.3.7; 4.3.8. • Residential (New Home): 4.4.1. • Lighting (Hardwired Luminaires/lamps Ballasts): 5.1.1 to 5.1.5; 5.1.9; 5.1.10; 5.1.13; 5.1.18; 5.1.19 • Lighting (Screw/Snap-in Lamps): 5.2.1 to 5.2.4; 5.2.6; 5.2.7; 5.2.8; 5.2.9; 5.2.10 • Lighting Controls: Two existing ECMs (5.3.5 and 5.3.6) were removed and replaced by one updated ECM. Persistence was updated from 14 to 10 years. • Rates Structure: One ECM (6.1.3 TSR - Load Aggregation across Sites) is no longer a component of TSR Savings.
			Addition of two Lighting ECMs as sub-categories of an existing ECM:	Two ECMs were added, to increase clarity regarding regulatory impacts on specific technology: • B.4.2.3 Tubular LED Lamps; • B.4.2.4 (LED Mogul screw-base replacement for HID lamps).
			Addition of one separate ECM, resulted from splitting an existing ECM in two components:	The Luminaire Removal component of an existing ECM (5.1.12 – "Lighting Redesign for Lower Power Density, including luminaire removal or delamping with luminaire removal") is identified as a separate ECM (B.4.1.6) to improve clarity.
			One ECM update, replacing two existing ECMs.	Updated ECM "B.4.3.7 "NLC Level 1- Bi-level Controls" (10 years) replaced two existing ECMs (5.3.5 and 5.3.6)

[2] The code for the removed ECM is corresponding to the previous revision (Rev.10, June 2016). For other changes (additions, name/reference/persistence changes/notes changes) the codes are corresponding to the updated version.

Revision No.	Revision Date	Revised by	Description of Revision	Item Changed (ECM/LCE Measures/Code/End Use Name/Section)
			Addition (duplication) of two ECMs from Pumps to Natural Gas Compression	Industrial: B.2.19.1; B.2.19.2 - ECMs duplicate from end use "Pumps to new end use "Natural Gas Compression"
			Addition (duplication) of one existing ECM from Residential to Commercial Sector.	Commercial: B.1.1.7 Programmable/Smart Thermostat (duplication to another sector is also supported by literature review indicating the same persistence for applications in Commercial sector)
			Addition of 3 End Uses in ECM section:	Industrial: B.2.17 (SEM Cohort); B.2.18 (SEM – IEM); B.2.19 (Industrial Natural Gas Compression Measures)
			Removal of two End Uses	• Commercial: 2.10 (Commercial Behavioural Measures) • Residential: 4.4 (Residential New Home)
			Name change for 10 ECMs to improve clarity:	• Commercial: B.1.2.4; B.1.3.2.; B.1.3.8; B.1.4.5; B.1.5.1; B1.5.2. • Industrial: B.2.1.1; B.2.9.4. • Residential: B.3.1.9 • Lighting: B.4.1.5: Name was updated, as one component of the existing measure became separate ECM (B.4.1- Luminaire Removal) and other component "delamping" was removed (obsolete).
			Reference update:	• Reference changed for one ECM (B.1.3.3): from KEMA 2009 to DEER 2014. • Addition of 11 new References (supporting new ECMs). • Removal of 3 Reference sources. • Referencing updated version of study California Public Utilities Commission. *Database for Energy Efficiency Resources - DEER Update for 2014 Codes.* February 4, 2014 (DEER 2014 version replaces DEER 2011).
			Notes update for 20 existing ECMs:	• Commercial: B.1.3.5; B.1.3.7; B.1.3.21; B.1.7.3; B.1.9.3 • Industrial: B.2.2.3; B.2.3.1; B.2.7.10; B.2.8.8; B.2.16.2; B.2.16.3. • Residential: B.3.1.2; B.3.1.3; B.3.1.4; B.3.1.9; B.3.1.11; B.3.1.12; B.3.2.4; B.3.3.1 • Lighting: B.4.1.5

Revision No.	Revision Date	Revised by	Description of Revision	Item Changed (ECM/LCE Measures/Code/End Use Name/Section)
			Addition of an entire section for LCE:	C – Low Carbon Electrification Measures
			Addition of 11 LCE End Uses:	• Commercial: 4 End Uses (C.1.1 to C.1.4) • Industrial: 6 End Uses (C.2.1 to C.2.6) • Residential: 1 End Use (C.3.1)
			Addition of 53 LCE Measures, with References and Notes.	• Commercial: 24 LCE Measures • Industrial: 28 LCE Measures • Residential: 1 LCE Measure
			Other Updates:	Rename all sections to identify the Low Carbon Electrification Measures separately from Energy Conservation Measures: • ECMs section, end uses/ECMs, and corresponding notes have the prefix "B". • Entire section and notes corresponding to LCE measures have the prefix "C".
				Updated all relevant sections, to ensure the document applicability to LCE measures (A.1 Purpose; A.2 Scope; A.3 Introduction; I.3 Appendix C; I.4 Appendix D).
				Updated Section A.1. Introduction, to integrate the Persistence policy requirement.
				Updated other sections as necessary: Document Authorization; Document Control; A.4 Previous Versions of the Standard; G – Codes and Standard References; Appendix A – Acronyms; Appendix B – Previously Supported Measures; J- Revision Log.