BC hydro

POWER SMART

THE POWER IS YOURS

Electrical Design Guidelines

for

Power Smart Energy Studies and Projects

Prepared for:

BC Hydro Technical Solutions

and

Electrical Design Consultants / Contractors

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INTRODUCTION

These electrical guidelines have as a goal the following purposes:

1. For the Energy Study Reports and incentive applications, establish a common base for:
   - reports prepared by the BC Hydro Alliance Consultants / Contractors and
   - review undertaken by BC Hydro Technical Solutions Team;
2. Indicate the typical lighting retrofits and default accepted energy savings;
3. Identify typical default burning hours for lighting systems for various commercial buildings;
4. Indicate typical energy intensities to provide a baseline for the building electrical energy usage;
5. Provide a summary of design lighting levels for various applications to confirm that the appropriate standards are being applied;
6. Provide standard energy conservation measures to be examined for commercial buildings – these standard recommendations include mechanical measures as well;
7. Establish a performance specification for the acceptable lighting retrofits.

The intended audience for these guidelines is:
- Electrical consultants / contractors preparing energy studies for BC Hydro;
- BC Hydro Technical Solutions team.

This document has been based on information gathered by BC Hydro over the past 15 years of Power Smart Programs. It is the culmination of monitoring and evaluation of many hundreds of energy efficiency projects. This learning has resulted in guidelines for approval of Power Smart projects that may seem conservative, but represent BC Hydro's comfort level in purchasing firm energy from these projects given the technical and financial risks. Every effort must still be made by the consultant to identify creative conservation measures and point out the maximum savings potential that can be achieved if the customer is diligent in maintaining their systems. However along with this, the consultant must show the level of savings that are likely to be approved for incentives based on BC Hydro's criteria.

These guidelines will evolve as the program moves forward, and suggestions and comments to improve the document are encouraged.

ACCEPTANCE CRITERIA FOR ENERGY STUDIES

Energy studies prepared by Consultants for BC Hydro must meet the following basic criteria:
- Contain the information requested in Appendix 'A';
- When an energy study is requesting an incentive from BC Hydro, the following are the minimum acceptable energy savings levels:

All Sectors
▪ >= 300,000kWh annually ▪ Bundled projects must meet a minimum facility threshold of 100,000kWh annually ▪ >= 3,000,000kWh over ten years based on persistency of technology installed.

- If the customer has a number of smaller sites such as a chain store, or a number of small schools, these can be aggregated to meet the minimum requirement for an incentive application provided each facility has a minimum of 100,000kWh savings annually;

- All study recommendations should be economically sound, i.e. have a payback of less than 10 years. Any identified measure with longer paybacks should be presented, but not recommended, unless specifically requested by the Client.

- Consultants shall submit a read / write Excel (or equivalent) electronic copy of the lighting spreadsheets with the application.

TYPICAL HOURS OF USE FOR VARIOUS INSTALLATIONS

The following maximum hours of use for lighting applications will be used in calculating the approved savings for incentive applications unless the Consultant can document higher hours of use to the satisfaction of BC Hydro.

TYPICAL ANNUAL HOURS OF OPERATION			
Facility	**Hours of Use / Yr**	**Facility**	**Hours of Use /Yr**
Elementary School		Secondary School	
Classroom	2200	*Classroom*	2500
Corridors / Gymnasiums	2800	*Corridors / Gymnasiums*	3200
Storage Rooms	600	*Storage Rooms*	600
College / University		Strata Units / Hotels	
Classrooms / Offices	3000	*Common areas*	8760
Parking Garages	8760	*Parking garages*	8760
Storage Rooms	600	*Offices*	2600
Gymnasium	3200	*Guest room*	1500
Hospitals	8760	*Storage Rooms*	600
Warehouses	3600	Restaurants	4000
Shopping Mall	4800	Convenience Stores	6500
Office Buildings		Retail (food)	5800
Low rise	3800	Retail (non food)	4500
High rise	4000	Industrial	Confirm site by site

ENERGY INTENSITY

A general rule of thumb for comparing energy usage in different facilities is the energy intensity, measured in kWh/m^2 . Typical values before retrofit for various facilities are shown below:

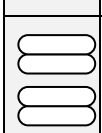
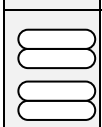
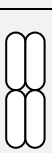
Facility	Energy Intensity (kWh/m^2)[1]	Load Factor
Primary Schools	83.60	31.4
Secondary Schools	110.89	37.0
Large Grocery	561.67	80.4
Large Hotel	224.45	68.2
Motel / Small Hotel	176.03	61.2
Extended Care Homes	130.20	54.6
High Rise Office	217.67	53.9
Low Rise Office	189.05	48.7
Libraries	182.06	52.4
Ice Arenas	258.13	61.1
Swimming Pools	408.23	68.7
Large Retail	273.73	61.6
Restaurants	644.74	52.2
Wholesale / Warehouse	148.81	44.6

1. Taken from BC Hydro Building Check-up data base

STANDARD FLUORESCENT LIGHTING RETROFITS

Figure 1 details standard fluorescent lighting retrofits and energy savings based on typical lamp and ballast combinations. The Consultant or BC Hydro may revise the default value based on site audit details. The Consultant shall provide sufficient information and details to enable BC Hydro to determine the potential energy savings and the impact to lighting levels.

The default energy savings value used for BC Hydro is shown in bold.

Existing		Retrofit		Energy Savings (W)
	2', 1 T12 lamp, magnetic ballast, 25W		2', 1 lamp T8, elec, 20W	5W
	2', 2 T12 lamp, magnetic ballast, 50W		2', 1 lamp T8, elec, 33W	17W
	2', 2 T12 lamp, magnetic ballast, 50W		2', 1 lamp T8, elec, low ballast factor, 29W	21W
	3', 1 T12 lamp, magnetic ballast, 42W		3', 1 lamp T8, elec, 26W	16W
	3', 2 T12 lamp, magnetic ballast, 73W		3', 2 lamp T8, elec, 46W **3', 2 lamp T8, elec, low ballast factor, 42W**	27W **31W**
	4', 1 T12 lamp, magnetic ballast, 41W		4', 1 lamp T8, elec, 31W	10W
	4', 2 T12 lamp, magnetic ballast, 74 W		4', 1 lamp T8, reflector, elec, 31W	43W
	4', 2 T12 lamp, magnetic ballast, 74 W		4', 2 lamp T8, elec, low ballast factor, 51W	23W
	4', 4 T12 lamp, magnetic ballast, 148 W		4', 2 lamp T8, reflector, elec, 59W	89W
	4', 4 T12 lamp, magnetic ballast, 148 W		4', 3 lamp T8, optional reflector, elec, 89W	59W
	8', 1 T12 lamp, magnetic ballast, 69W		4', 2 T8 lamp, elec, low ballast factor, 51W	18W
	8', 2 T12 lamp, magnetic ballast, 128W		4', 2 T8 lamp, elec, low power ballast, 102W	26W

	8’, 2 T12 lamp, magnetic ballast, 128W		4’, 3 T8 lamp, optional reflector, elec, 89W	39W
	8’, 1 T12 HO lamp, magnetic ballast, 113W		4’, 2 T8 lamp, reflector, elec, 59W	54W
	8’, 2 T12 HO lamp, magn. ballast, 227W **8’, 2 T12 HO ES lamp, magn-ES, 207W**		4’, 4 T8 lamp, reflector, elec, 112W	115W **95W**
	8’, 2 T12 HO lamp, magn. ballast, 227W **8’, 2 T12 HO ES lamp, magn-ES, 207W**		4’, 3 T8 lamp, reflector, elec, 89W	138W **118W**
2 U lamps in 2’x 2’ fixture	2’, 2 U lamps, 72W		2’, 3 – F17 T8 lamp, reflector, elec, 47W	25W
	2’, 4 F20 lamps, mag-std, 112W		2’, 2- F17 T8 lamp, reflector, elec, 33W	79W

Figure 1

- 2', T12 lamp, magnetic ballast refers to any combination of a 2-ft, 20W T12 lamp with standard or energy saving magnetic ballast
- 3', T12 lamp, magnetic ballast refers to any combination of a 3-ft, 25W or 30W T12 lamp with standard or energy saving magnetic ballast
- 4', T12 lamp, magnetic ballast refers to any combination of a 4-ft, 34W or 40W T12 lamp with standard or energy saving magnetic ballast
- 8', T12 lamp, magnetic ballast refers to any combination of a 8-ft, 60W or 75W T12 lamp with standard or energy saving magnetic ballast.
- 8', T12 HO lamp, magnetic ballast refers to any combination of a 8-ft, 113W or 95W T12 HO lamp with standard magnetic ballast.
- T12 HO ES lamp, magn-ES refers to a 8-ft, 95W T12 HO lamp with energy saving magnetic ballast.
- The normal ballast wattage is based on instant start ballast with normal ballast factor 0.85 – 1.0.
- The low power ballast wattage is based on a ballast with low ballast factor < 0.85.

INCANDESCENT / MERCURY VAPOUR LAMP REPLACEMENT GUIDE

The following table is intended to illustrate the expected wattages for lamp changes from incandescent / mercury vapour lamps to either compact fluorescent, metal halide pulse start or high pressure sodium lamps.

Lamp Replacement Guideline

Existing Lamp			Potential Replacement Lamp								
			Compact Fluorescent			Metal Halide Pulse Start			High Pressure Sodium		
Lamp Wattage	Fixture Wattage	Mean Lumen Output	Lamp Wattage	Fixture Wattage	Mean Lumen Output	Lamp Wattage	Fixture Wattage	Mean Lumen Output	Lamp Wattage	Fixture Wattage	Mean Lumen Output
Standard Incandescent											
40 watt	25	415	9 watt	10	500						
50 watt	40	545	11 watt	12	680						
60 watt	60	900	15 watt	20	980						
75 watt	75	1,200	20 watt	23	1,200						
100 watt	100	1,600	25 watt	33	1,530				35 watt	46	2,000
150 watt	150	2,400	34 watt	41	2,100	39 watt	57	2,800			
200 watt	200	3,600	42 watt	48	2,720	50 watt	68	3,200	50 watt	66	3,600
250 watt	250	3,750	50 watt	60	3,870						
300 watt	300	6,000	80 watt	90	5,400	70 watt	90	5,400	70 watt	95	5,450
500 watt	500	9,500				150 watt	190	10,000	100 watt	138	8,500
620 watt	620	11,000				175 watt	208	11,200			
750 watt	750	15,000				250 watt	288	16,600	150 watt	188	14,000
1000 watt	1000	24,000				350 watt	400	27,000	250 watt	295	27,000
1500 watt	1500	31,000				400 watt	456	30,000	310 watt	365	33,000
Typical Rated Avg. Lamp Life 1,000 to 2,000hrs											
Mercury Vapour											
50 watt	63	1,260	20 watt	23	1,200						
75 watt	95	2,250	34 watt	41	2,100				35 watt	46	2,000
100 watt	125	3,400	50 watt	60	3,870	50 watt	68	3,200	50 watt	66	3,600
175 watt	210	7,400	105 watt	115	6,900	100 watt	125	7,000	100 watt	138	8,500
250 watt	290	10,500				150 watt	190	10,000	150 watt	188	14,000
400 watt	450	19,000				320 watt	365	22,000	200 watt	250	19,800
700 watt	775	33,600				400 watt	456	30,000	310 watt	365	33,000
1000 watt	1100	45,000							400 watt	465	45,000
Typical Rated Avg. Lamp Life 24,000hrs											

Notes:

1. The lumen output values shown in table are intended as a guideline only. These values are an average of various manufactures published data. It is not to be relied on for detail design.

2. The lumen output of all the lamps will vary depending on the exact lamp selected.

3. A lighting designer should be consulted to ensure the correct application of lamps is selected to meet the required lighting levels,

4. The lighting output values shown are **mean** not initial lumens.

Standard Wattage and Lumen Output for Various Lamp Styles

Compact Fluorescent			Metal Halide Pulse Start			High Pressure Sodium		
Lamp Wattage	Fixture Wattage	Mean Lumen Output	Lamp Wattage	Fixture Wattage	Mean Lumen Output	Lamp Wattage	Fixture Wattage	Mean Lumen Output
9 watt	10	500	39 watt	57	2,800	35 watt	46	2,000
11 watt	13	680	50 watt	68	3,200	50 watt	66	3,600
15 watt	20	900	70 watt	90	5,400	70 watt	95	5,450
18 watt	26	1,100	100 watt	125	7,000	100 watt	138	8,500
20 watt	23	1,200	150 watt	190	10,000	150 watt	188	14,000
25 watt	33	1,530	175 watt	208	11,200	200 watt	250	19,800
34 watt	41	2,100	250 watt	288	16,600	250 watt	295	25,000
42 watt	48	2,720	320 watt	365	22,000	310 watt	365	33,000
50 watt	60	3,870	350 watt	400	27,000	360 watt	414	42,800
65 watt	75	4,200	400 watt	456	30,000	400 watt	465	45,000
80 watt	90	5,400	750 watt	810	60,000	600 watt	660	81,000
105 watt	115	6,900	1000 watt	1075	96,000	750 watt	810	99,000
						1000 watt	1100	112,000
Typical Rated Avg. Lamp Life 6,000 to 10,000hrs			Typical Rated Avg. Lamp Life: <= 150 W: 9,000 to 12,000hrs > 150W : 15,000 to 20,000 hrs			Typical Rated Avg. Lamp Life 24,000hrs		

INSTALLATION STANDARDS FOR DESIGN BUILD CONTRACTORS

With the retrofit of luminaires under the Power Smart programs, the following guidelines must be adhered to by contractors:

1. Magnetic ballasts that are removed during a retrofit are to have all leads snipped off at the case (so they cannot be re-used) and disposed of in a safe manner.

2. Ballasts that are disconnected and left in existing luminaires or luminaires removed during a retrofit shall also have the ballast leads snipped at the case. This ensures the inefficient ballast can not be reused.

3. In most cases it is acceptable for luminaires to be re-used with electronic ballasts and T8 lamps.

4. Contractors shall arrange orderly storage of removed ballasts on-site until the final inspection so that BCH inspectors can easily verify quantities removed. For larger projects, contractors can call for interim inspections before removal. The contractor shall leave the ballasts on-site for 20 working days after contacting BC Hydro.

5. Luminaires that have been modified during a retrofit shall be re-certified by an approved contractor or certification agency. New labels shall be installed confirming the re-certification (Warnock Hersey / CSA) according to Electrical Safety Branch Directive. Master/Slave luminaires shall be identified - luminaires containing the ballast shall be identified by a uniform mark visible from below the luminaire.

6. Disposal of ballasts must be done in a safe manner in accordance with codes and bylaws. PCB ballasts must be separated and dealt with according to Environmental Protection Act.

IES RECOMMENDED LIGHTING LEVELS TABLE

The following table is an extract from the Illuminating Engineering Society North American (IESNA) Handbook, 9th Edition. It is intended to provide a *guide only* to the illuminance levels required for areas. Specifically the recommended illuminance provided are based on the Society's judgement of best practise for 'typical' applications. A professional engineer or certified lighting designer should be consulted for particular spaces to ensure the space is properly designed to IESNA and WCB regulations.

Location and Tasks	**VI** – Very Important ; **I** – Important ; **SI** – Somewhat Important ; Blank – Not Applicable			
	Horizontal Illuminance		**Vertical Illuminance**	
	Importance	Lux	Importance	Lux
Interior				
Auditoriums				
Assembly	I	100		
Social activity	SI	50	SI	30
Banks				
General lobby	SI	100	SI	30
Lobby – writing area	VI	300	SI	30
Tellers station	VI	500	SI	30
Conference Rooms				
Meeting	SI	300	SI	50
Video Conference	SI	500	VI	300
Correctional Facility				
Cells	VI	300	SI	50
Day Rooms	SI	300	SI	50
Educational Facilities				
Classrooms (depending on use)	VI	300 - 500	VI	100 – 500
Gymnasiums	VI	500	VI	300
Food Courts	I	300	SI	30
Health Care Facilities				
Nursing areas, day	I	100	SI	30
Nursing areas, night	I	50	SI	30
General Recovery Room	VI	100	VI	30
Local postanesthetic recovery	VI	3000-10000	VI	500
Libraries				
Card files	VI	300	VI	50
Offices				
Open plan office (intensive VDT)	SI	300	VI	50
Open plan office (intermittent VDT)	SI	500	SI	50
Private office	SI	500	SI	50
Industrial				
Raw Material Processing				
Coarse	VI	100		
Fine	VI	500		
Assembly				
Simple	VI	300		
Difficult	VI	1000		
Inspection				
Simple	VI	300		
Difficult	VI	1000		
Exacting	VI	3000		
Warehousing				
Inactive	SI	50		
Active: bulky items; large labels	I	100		

LIGHTING LOAD CONSUMPTION TABLE

The lighting load for commercial and institutional facilities is a significant component of the total electrical consumption, hence there are normally good opportunities for energy savings. The typical lighting load consumption is shown in the table below:

Commercial / Institutional Facilities	
Building Type	**Typical Lighting Load %**
Large office building / small office building	43 / 45
Hospitals	36
Hotel	46
Non-food retail	60
Large grocery retail	20
Elementary / Secondary schools	51 / 52
Universities and colleges	35
Warehouse and wholesale	42
Restaurant and tavern	28
Nursing homes	42
Recreation	30
Library	52
Industrial Facilities	
Facility Type	**Typical Lighting Load %**
Sawmills and wood products	5
Pulp and paper mill	5
Paper and allied products	11
Fabricated metal products	3
Petroleum and coal products	16
Transportation equipment	8
Plastic materials	13
Printing and publishing	15
Furniture and fixtures	13
Instrument machinery and equipment	15
Electronic and other equipment	24
Instruments and related products	24

PERSISTENCY OF SAVINGS

BC Hydro evaluates project incentives based on persistency. This is technical life expectancy of the retrofit tempered by market forces that result in a persistency that is usually less than life expectancy. The main categories for persistency of savings is shown below:

1. Hardwired retrofit measures such as T8 conversions have a persistency of 10 years.

2. Energy savings resulting from upgrading lighting controls is given 5 years.

3. Energy savings resulting from rescheduling existing control systems is given 2 years.

4. Screw in lamp technology is normally considered for a lifetime of 2 years. HID screw in lamps will be considered for 5 years.

5. Some screw in technology will be considered for a 5 year life duration if the ballast is non-removable and has anti-theft protection, or is otherwise designed to be a permanent installation.

All control savings shall be shown separately on the incentive application.

Area Lighting Control Upgrades

1. For interior retrofits that use timers and occupancy and/or photocell sensors, BC Hydro will review the opportunity for these measures. For sustainability and financial accountability, BC Hydro will approve savings up to a **maximum of 30%** of the controlled load. The savings shall be calculated area-by-area, based on the post-retrofit lighting load times the estimated controlled usage hours (the difference between the usage hours before and after the lighting control upgrade).

2. For exterior, dawn to dusk photocell and/or timer upgrade applications, BC Hydro will approve savings up to a **maximum of 50%** of controlled load. Timer controls shall have an astronomical/ electronic time clock feature to adjust for seasonal changes.

3. For upgrades involving multiple-switched luminaires (using multiple ballasts, Hi-Lo mechanisms, etc), BC Hydro will consider 10 years persistence. Upon review, BC Hydro will approve savings up to a **maximum of 30%** where load is controlled by occupancy sensors and to a **maximum of 50%** for dawn to dusk photocells. The savings shall be calculated as mentioned previously.

4. We recognise that the savings may be greater than the limits approved by BCH above, and the savings identified can be greater than the limits in this document and should be pointed out; however, the incentive amounts will be calculated on the limits identified.

Building Automated Lighting Control Upgrades

1. BC Hydro will approve savings up to a **maximum of 30%** for loads controlled by DDC/automated building controls. Applications will be evaluated on a building-by-building case, upon submitting the following mandatory documents:

    - Assessment of existing usage hours on an area-by-area basis. To correctly estimate the potential of the DDC upgrade, define the type of work/ seeing task performed (per area). For commercial/ office buildings estimate in percentages the main type of business with their specific usage hours (ex: law firms work long hours, brokerage firms start early in the morning, etc).
    - Estimated post-retrofit hours, following the same rationale as above.
    - Pre-retrofit (if is the case) and post-retrofit lighting load data on an area-by area basis.

- Calculations of the energy savings in the same manner as described above for the area controls.

2. BC Hydro reserves the right to install energy monitoring equipment to verify hours of operation pre- and post- retrofit.

APPENDIX A

Study Report Requirements

ENERGY STUDY PROPOSAL REQUIREMENTS

These items must be included in a proposal to conduct an energy study. The requirements of the Energy Study itself are set out in the section after this.

1. Indicate the size and type of project, including floor area of the building and annual energy use of all fuels.

2. List the building lighting and mechanical systems, including any known problem areas, e.g. under- or over-lit areas, air quality problems, etc.

3. Indicate which energy conservation measures have potential and will be studied as a result of the preliminary review of the building, e.g. conversion of existing T12 lighting to T8 technology.

4. Include fee schedule, listing all tasks along with hours and hourly rate.

MINIMUM REQUIREMENTS FOR A BUILDING RETROFIT ENERGY STUDY

The following minimum requirements for a Building Retrofit Energy Study are to be viewed as a set of core elements that BC Hydro expects to be addressed by the Consultant performing the study, and not a step-by-step protocol for the consultant to follow.

The consultant who performs the study must be registered with BC Hydro as a "Qualified Consultant".

1. Customer Information:
- Name and address
- Contact person (Building Owner/Manager)
- Name, telephone, fax, email
- Building type
- Date of Energy Study completion

2. Executive Summary
This summary is important, as it is used to provide the customer and BC Hydro with an outline of the Energy Study's recommendations.
- List of energy-saving options.
- Overall electricity savings anticipated (kWh), demand reduction (kW)
- Dollars saved and estimated costs to implement options
- Other fuel savings

3. Building(s) Description
- Age
- Total floor area and number of floors
- Sketches (optional)
- Physical condition
- Types of doors, windows
- Shading, glazing levels (% wall area), type of glazing
- Occupancy pattern

4. Mechanical, Water, and Process System Description
- Types of systems, areas served
- Inventory of equipment
- Usage schedules and sequences of operation
- Maintenance schedules
- Baseline
- Equipment efficiencies

5. Electrical System Description
- Service, size and description
- Estimate or inventory of plug loads

6. Lighting System Description
- Types of systems
- Lamp inventory
- Lighting levels
- Maintenance schedules
- Baseline equipment efficiencies/consumption
- Provide electronic copy of lighting spreadsheet

7. Control Equipment Description
- Equipment inventory
- Equipment application
- DDC system points
- Control system 5-year maintenance contract

8. Energy Supply
- Copy of rate schedules
- Annual energy consumption account histories (all fuels)
- Annual peak demand
- Baseline energy consumption by equipment type
- Baseline energy consumption by end use

9. Recommended Energy Conservation Measures (ECMs)
- Description of ECM and work required to accomplish implementation
- Number of units affected
- Estimated service life
- Annual kWh and kW savings/system savings (include other fuel savings, such as natural gas)
- Capital cost to accomplish implementation, including design
- Material, labour and commissioning
- Annual dollar savings
- Simple payback
- Type of energy analysis performed (please describe)

10.Recommended Maintenance and Scheduling Measures
- Description of the measure
- Work required to accomplish the measure
- Assessment of in-house capability to install measure

11.Project Definition
- Description of the preferred measures
- Reason for selection of measures
- Total investment required
- Annual energy savings and project simple payback

APPENDIX B

Specifications for Standard Lighting Equipment Retrofit

Specifications for Standard Lighting Equipment Retrofit

The following specification outlines the minimum acceptable requirements for lighting equipment retrofits that will be suitable for incentive rebates from BC Hydro :

General Specifications for all Eligible Products

1. All products shall be new, of current manufacture and CSA approved or certified by an accredited independent organisation to conform to CSA Standards for the intended application.

2. Minimum product warranty (excluding lamps) must be three years from date of installation.

3. Average lighting levels and measurements of same shall comply with IES (Illuminating Engineering Society) recommended practices. BC Hydro will **not** monitor lighting levels but reserves the right to occasionally check levels and design quality. Lighting levels must meet the requirements of the end user and be to the satisfaction of all approving authorities having jurisdiction for specific applications.

4. All retrofitted luminaires shall be suitably identified with appropriate labelling, listing the re-rated parameters.

5. In any installation, in the event of abnormally high product failure rates within the first year of operation (in excess of 5%) BC Hydro reserves the right to reject specific products from the Program.

6. All products shall be constructed of individually replaceable compatible lighting components, such as ballasts, starters, capacitors, sockets and lamps so as not to invalidate any of these component warranties.

7. Lighting retrofits shall be designed for optimum energy efficiency without depreciating the quality of light.

8. All eligible products should be represented by an authorised local representative or distributor, including after sales service.

9. Products must meet Energy Star ratings where applicable.

T8 Lighting System

1. It is the responsibility of the customer and/or installing contractor to ensure that the luminaires are CSA approved for the specific application, and in full compliance with the building codes.

2. If requested by BC Hydro, the contractor shall make available photometric test results, based on IES testing procedure and report format prepared by a recognised independent testing laboratory. BC Hydro may consider a mock up demonstration of the lighting installation appropriate.

3. Colour rendering index (CRI) shall be 82 minimum. There is no restriction on lamp colour temperature.

4. Ballasts shall be dedicated only for T8 systems and be the electronic type. Based upon a two lamp ballast, input wattage shall not exceed 60 watts for standard electronic type.

5. Power factor for the ballast shall be 0.95 minimum (lead or lag).

6. Total harmonic distortion (THD) limits for the electronic T8 ballast shall not exceed 20% at either rated, 5% above and 5% below nominal primary voltage, for the standard ballast.

Compact Fluorescent Systems

1. This measure applies to all retrofit kits and integral lamp / ballast replacement compact fluorescent lamps with one or more lamps per luminaire.

2. Life rating of lamps shall be 10,000 hours minimum at three hours per start.

3. Lamps shall start and operate reliably at temperatures down to +10°C throughout their rated lives. Low temperature ballasts to be suitably rated for cool temperature applications.

4. There is no restriction on the lamp colour temperature, but the colour rendering index (CRI) shall be 82 minimum.

5. Permanent or “hard-wired” types of luminaries shall be complete with an integral replaceable ballast, thermally protected, high power factor. Where multiple lamps are used, ballasts may be the multi-lamp type. It shall be possible to reconnect multiple ballasts individually to achieve multi-level switching within individual fixtures.

6. Retrofit kits for the conversion of existing incandescent luminaries shall have permanent mounting features, with thermally protected high power factor ballasts. All attachment shall be by mechanical means and not dependent upon tape or adhesives. All displaced incandescent lamps sockets shall be permanently removed. Major hardware shall identify this kit as a retrofit type, with make/model number and nominal lamp rating. Kit components are not to be modified in a manner so as to invalidate CSA approval for the intended function.

T5 Fluorescent Systems

1. This measure will apply to T5 systems with lamps rated 18 watts to 80 watts inclusive, using electronic ballasts.

2. All ballasts must be dedicated to T5 technology. Multi-lamp ballasts will be eligible.

3. Total harmonic distortion (THD) limits for input current shall not exceed 17% at either rated, 5% above, and 5% below nominal primary voltage.

High Intensity Discharge Lamp Retrofit

1. This incentive applies to both interior and exterior lighting systems for new and retrofitted luminaires. Pulse-start metal halide and high-pressure sodium lamps are eligible for rebates when displacing incandescent, halogen or mercury vapor lamps

2. Lamps and ballasts must be of the current commercial production.

3. Metal Halide fixtures installed under the Lighting Program must be totally enclosed on interior installations. This requirement also includes the new pulse-start and ceramic metal halide source.

4. All HID ballasts shall have a ballast factor of 0.95 minimum and a high power factor (0.90 minimum).

LED Exit Sign Options

Retrofits that are applicable for incentives under the Power Smart Program include:

- New LED Exit Signs
- LED Conversion Kits and lens for existing signs
- LED screw-in lamps complete with lens

To be eligible for a rebate, the retrofit must meet the minimum requirements:
- Must comply with CSA standards C22.2 No. 9.0 and C860;
- Maximum input watts per lamp or strip of 1.4 Watts.
- For new exit sign, maximum input watts of 2.0 Watts.
- For new self powered exit sign, maximum input watts of 3.5 Watts.

LED conversion kits shall be permanently mounted within the housing with the displaced incandescent lamp sockets and any diodes removed, with the exception of any necessary standby DC lamps. Retrofit kits shall be identified as such, including lamp wattage. Retrofit kits and lamp only changes shall include a replacement lens for the exit sign to ensure correct luminance levels are maintained.

Occupancy Sensor Switches

1. Principle of operation shall be on the basis of passive infra-red energy or ultrasonic energy response or a combination of both, and be of commercial quality only.

2. Switch format to be either a wall-mounted type for the replacement of conventional wall switches, or a ceiling mounted version. Switch contacts to be suitable for application on fluorescent and HID lighting systems. Switching shall be via parting/making of mechanical contacts and not solely with electronic components. Sensor switches to be used in conjunction with approved low voltage relay systems will also be permitted. Switch to have no minimum loading requirement to stay activated.

3. Sensor switches shall have OFF-AUTOMATIC selector modes with no “ON” position.

4. Sensor switches can have an optional ambient light sensing feature with an adjustment range to result in a lighting system not being turned “ON” during occupancy with generous daylight contribution.

5. An adjustable “ON” time feature shall be provided with a continuous range of one to 15 minutes. Occupancy “scan” frequency shall be at least once every two seconds, with automatic timing function reset. LED indicator to show activity detection.

6. All sensors shall have a sensitivity adjustment feature to “tune in” for proper operation for a variation of room or area geometric.

7. This measure accepts the use of two or more sensor switches suitably interconnected as a system for situation such as highly irregular areas, partitioned work station areas, very large areas, etc.

8. Occupancy sensor layout and arrangement to be in accordance with individual manufacturer’s recommendations.

9. For situation where an “OFF” option is required during room occupancy where ceiling-type sensors are used, a wall switch is suggested to electrically switch off the occupancy sensor.

10. Switch to have humidity resistant circuitry and components.

11. It is important that the sensor have adequate inrush current capability for the subjected application, particularly electronic ballasts.