



Manitoba Energy Code for Buildings 2011 Part 4: Lighting

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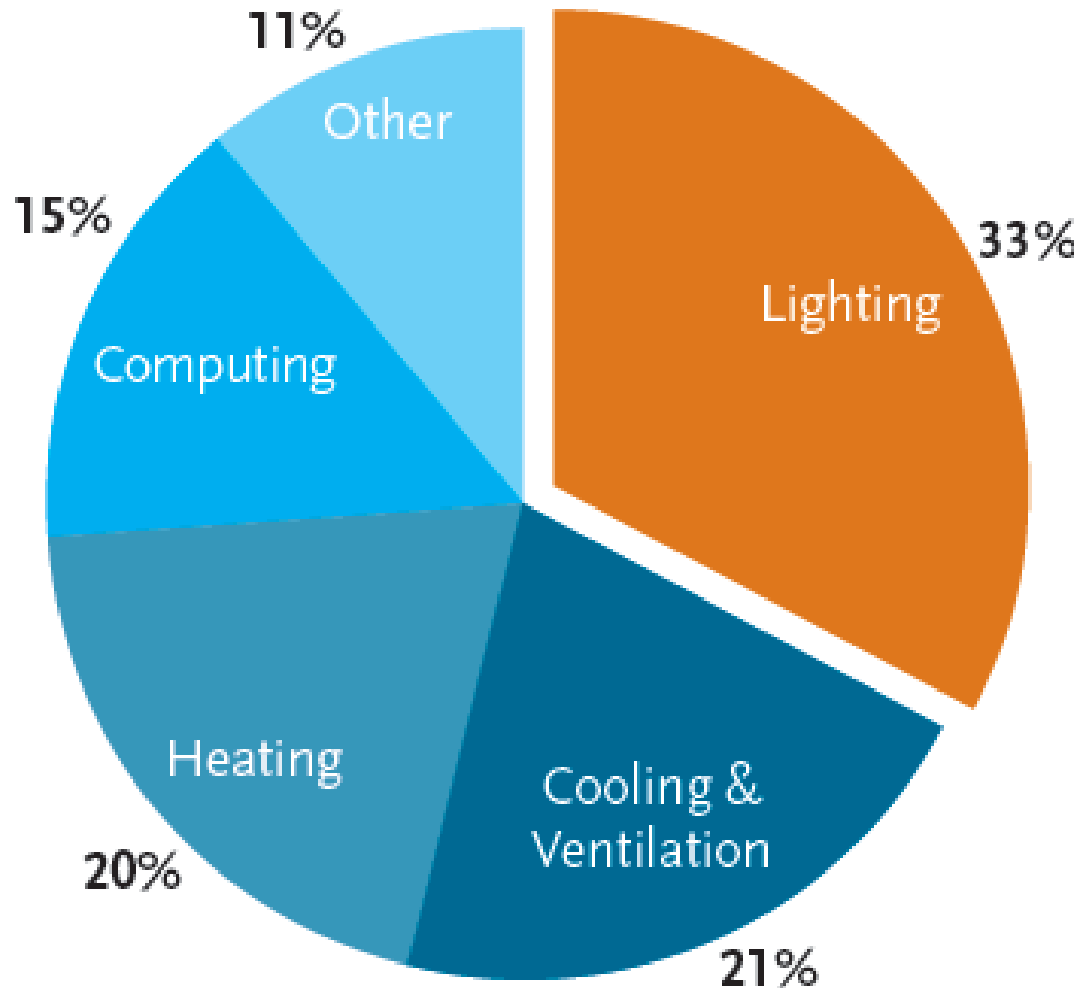


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Lighting – A Significant Load Component



Outline

- Scope of Part 4 – Lighting
- Methods of compliance
- Exterior lighting – prescriptive path
- Interior lighting – prescriptive path
- Interior lighting trade-off path
- Performance compliance path
- Traditional vs New Technology:
A Brief Case Study Brandon

Outline

- **Scope of Part 4 – Lighting**
- Methods of compliance
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- Traditional vs New Technology:
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Scope of Part 4 – Lighting

- Applies to lighting components and systems connected to building's electrical service
- Exemptions:
 - emergency lighting automatically off during normal building operation
 - lighting in dwelling units
 - where impractical due to nature of occupancy
- Similar to ASHRAE 90.1 2010 in content

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3 Methods of compliance

1. Prescriptive path

2. Tradeoff path (interior lighting)

3. Performance path

Outline

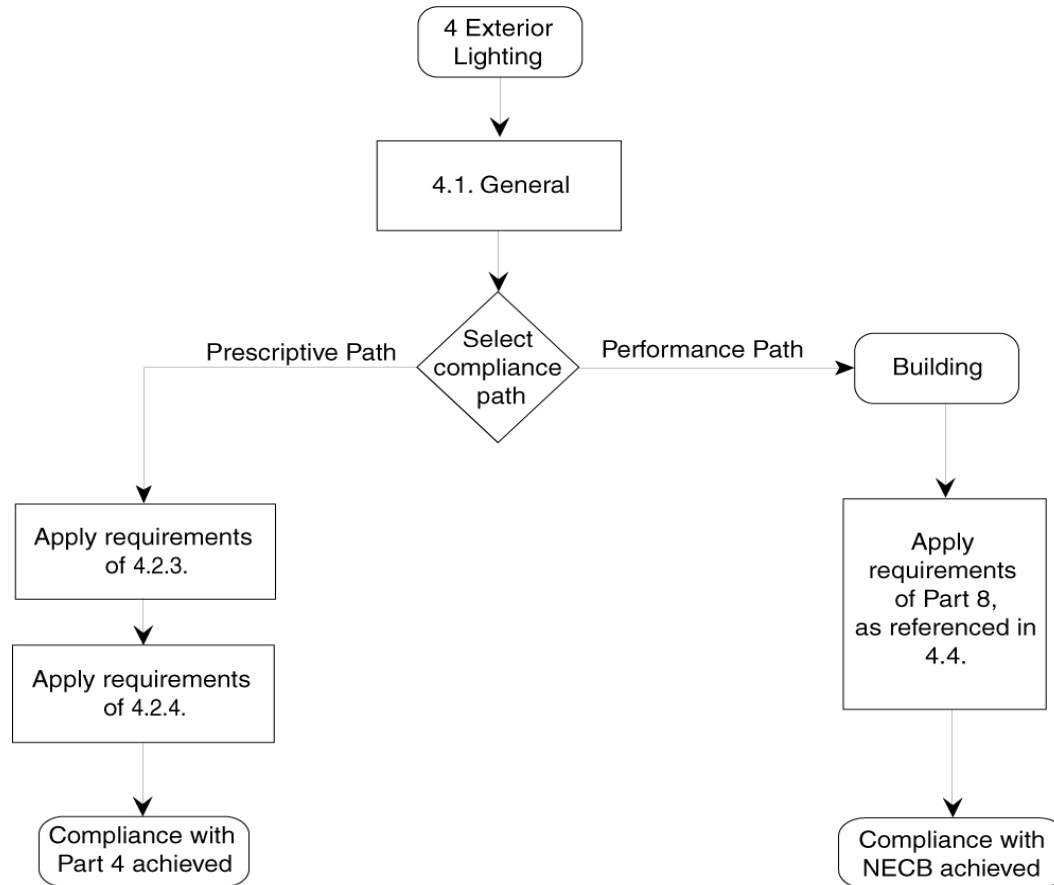
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Exterior lighting – options

- Compliance:
 - Prescriptive or
 - Performance
 - **No option** for tradeoff path
- For exterior lighting systems that are connected to the building's electrical service



Exterior lighting – options



EG00751A



Exterior lighting power – Prescriptive Path

3 Parts of Exterior Lighting Power Allowance:

1. Base site allowance
2. Specific building power allowance
3. General building power allowance

Exterior lighting power – Prescriptive Path

Step 1: Base site allowance

- Determine “Lighting zone”
- **Lighting zone** classification will determine **base** power allowance

Exterior lighting power – Prescriptive Path

Table 4.2.3.1.A.
Lighting Zones Used to Determine Exterior Lighting Allowances
Forming Part of Sentence 4.2.3.1.(1)

Lighting Zone	Description
0	Undeveloped areas within national, provincial or territorial parks, forest land, and rural areas, and other undeveloped areas
1	Developed areas within national, provincial or territorial parks, and rural areas
2	Areas predominantly consisting of residential zoning, neighbourhood business districts, light industrial areas with limited nighttime use, and residential mixed-use areas
3	All other areas
4	High-activity commercial districts

Exterior lighting power – Prescriptive Path

Step 2: Specific building power allowance

Lighting power for each **specific exterior**
application

≤

Specific exterior application allowance

Exterior lighting power – Prescriptive Path

Exterior Application	Lighting Power Allowances According to Lighting Zone				
	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
<i>Building facades (facade lighting)</i>		No allowance	1.1 W/m ² for each illuminated wall or surface, or 8.2 W/m for each illuminated wall or surface length	1.6 W/m ² for each illuminated wall or surface, or 12.3 W/m for each illuminated wall or surface length	2.2 W/m ² for each illuminated wall or surface, or 16.4 W/m for each illuminated wall or surface length
Automated teller machines (ATM) and night depositories	A single luminaire of 60 W or less may be installed for each roadway or parking entry, trail head, and toilet facility, or other locations approved by the <i>authority having jurisdiction</i>	270 W per location plus 90 W per additional ATM per location			
Entrances and gatehouse inspection stations at guarded facilities		8.1 W/m ² of covered and uncovered area			
Loading areas for law enforcement, fire, ambulance and other emergency service vehicles		5.4 W/m ² of covered and uncovered area			
Drive-up windows and doors		400 W per drive-through			
Parking near 24-hour retail entrances		800 W per main entry			

Table 4.2.3.1.C

Exterior lighting power – Prescriptive Path

Step 2 (cont):

- The base site allowance can be drawn down to compensate for applications that are greater than the **specific** allowance.
- ‘Unused’ or ‘underbudget’ allowances **CANNOT** be transferred to other **specific** areas

Exterior lighting power – Prescriptive Path

Step 3: General building power allowance

Lighting power for each **general exterior**
application

≤

General exterior application allowance

Exterior lighting power – Prescriptive Path

Exterior Application	Lighting Power Allowances According to Lighting Zone				
	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Uncovered Parking Areas Parking areas and drives	No allowances	0.4 W/m ²	0.7 W/m ²	1.1 W/m ²	1.4 W/m ²
<i>Building Grounds</i>	No allowances				
Walkways less than 3 m wide		2.3 W/m	2.3 W/m	2.6 W/m	3.3 W/m
Walkways 3 m wide or greater, plaza areas, special feature areas		1.5 W/m ²	1.5 W/m ²	1.7 W/m ²	2.2 W/m ²
Stairways		8.1 W/m ²	11.0 W/m ²	11.0 W/m ²	11.0 W/m ²
Pedestrian tunnels		1.6 W/m ²	1.6 W/m ²	2.2 W/m ²	3.2 W/m ²
<i>Landscape lighting</i>		0.4 W/m ²	0.5 W/m ²	0.5 W/m ²	0.5 W/m ²
<i>Exterior Entrances and Exterior Exits</i>	No allowances				
Main entries		66 W/m of door width	66 W/m of door width	98 W/m of door width	98 W/m of door width
Other doors		66 W/m of door width	66 W/m of door width	66 W/m of door width	66 W/m of door width
Entry canopies		2.7 W/m ²	2.7 W/m ²	4.3 W/m ²	4.3 W/m ²
Sales Canopies Free-standing and attached	No allowances	6.5 W/m ²	6.5 W/m ²	8.6 W/m ²	11.0 W/m ²
Outdoor Sales	No allowances				
Open areas (including vehicle sales lots)		2.7 W/m ²	2.7 W/m ²	5.4 W/m ²	7.5 W/m ²
Street frontage for vehicle sales lots in addition to "open area" allowance		No allowance	33 W/m	33 W/m	98 W/m

Table 4.2.3.1.C



Exterior lighting power – Prescriptive Path

Step 3 (cont):

- The base site allowance can be drawn down to compensate for applications that are greater than the **general** allowance.
- ‘Unused’ or ‘underbudget’ allowances can be transferred to *other* **general** areas
 - Cannot be transferred to **specific** areas

Exterior lighting power – Prescriptive Path – exemptions

specialized signal, directional, and marker lighting associated with transportation	lighting for production, material handling, transportation sites, and associated storage areas for industrial sites
advertising signage or directional signage	temporary lighting
lighting integral to equipment or instrumentation and installed by its manufacturer	theme elements in theme/amusement parks
lighting for theatrical purposes, including performance, stage, film production, and video production	lighting used to highlight features of recognized art objects, public monuments and designated national or provincial historic sites
lighting for athletic playing areas	

Exterior lighting controls – Prescriptive Path

Requirements - Exterior Lighting Controls

1. Astronomical time controls
2. Photosensors
3. Photosensors and timer shutoff switch
4. An equivalent control system equivalent in operation to those above
5. Controllers must retain programming and time setting for a 10 hour power outage

Exterior lighting controls – Prescriptive Path

Exemptions

1. Covered vehicle exterior entrances;
2. Exterior exits from buildings;
3. Parking structures

“Where needed for safety, security or eye adaptation”

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Interior Lighting

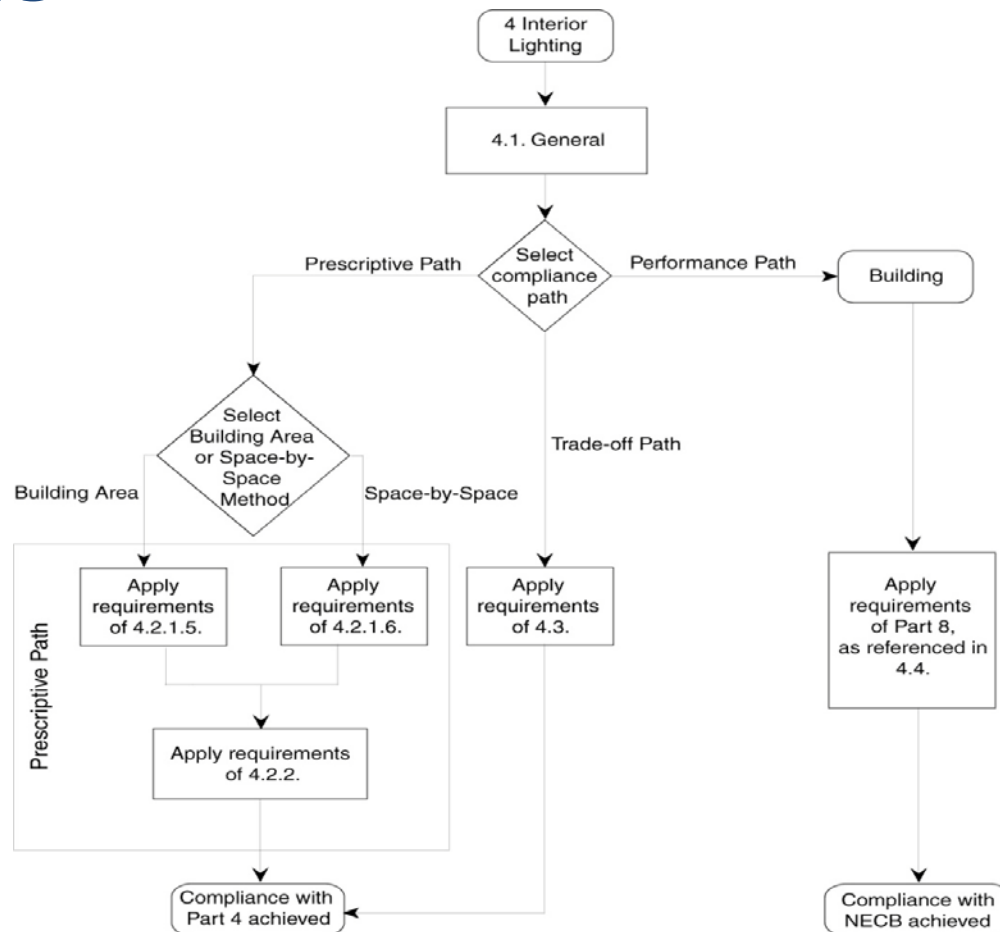
3 Methods of compliance

1. Prescriptive path

2. Tradeoff path

3. Performance path

Interior lighting – compliance options



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1. Prescriptive path

Installed interior lighting power

- Installed interior lighting power cannot exceed interior lighting power allowance as determined by either:
 - I. Building area method
 - II. Space-by-space method
- **Cannot** be mixed



1. Prescriptive path

Installed interior lighting power

- Includes
 - All power used by luminaires, both permanent and supplemental or task-related provided by movable or plug-in luminaires
 - ‘Maximum’ rated power consumption
 - Doesn’t include EE lamp usage
 - Higher wattage when more than one system provides lighting but not simultaneously



1. Prescriptive path

Installed interior lighting power

- Exemptions

lighting for TV broadcasting in sporting activities	lighting for retail or educational demonstration
lighting integral to equipment	casinos
lighting used during medical or dental procedures	lighting in retail displays in fully enclosed spaces
lighting integral to refrigerator and freezer cases	special lighting for visually impaired and other conditions
lighting integral to food warming and food preparation	lighting integral to advertising or directional signs
lighting for plants	exit signs
lighting in historic landmarks	lighting for theatrical purposes
mirror lighting in dressing rooms	accent lighting in religious areas
display or accent lighting essential for galleries, museums, monuments	where it can be shown that the inclusion will adversely affect the intended function or use

1. Prescriptive path

Installed interior lighting power

I. Building area method:

- Select building type or equivalent from table based on primary use
- Multiply lighting power density by gross lighted area to obtain interior lighting power allowance
- If 10% or more of gross lighted area can be classified as another type or if no equivalent building, must use space-by-space method

1. Prescriptive path

Installed interior lighting power

II. Interior Lighting Power Allowance – space-by-space method:

- For each enclosed space:
 - Find lighting power density from table based on intended use of space
 - Multiply lighting power density by gross interior floor area
- Sum results for all spaces
- Ensure **total** interior lighting power is less than **total** allowance

1. Prescriptive path Controls

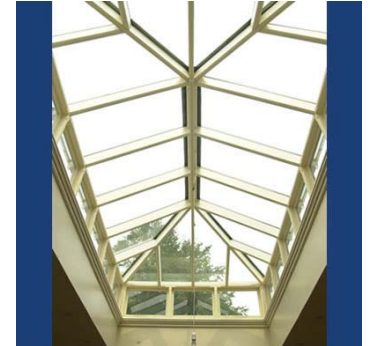
- Automatic shut off
 - Time-of-day operation
 - Occupant sensor
 - Control system
- Exemptions
 - 24-hour operation
 - Patient care is rendered
 - Safety or security issues

1. Prescriptive path Controls for spaces

- At least one control for general lighting in enclosed spaces
- Space types listed below must use automatic controls based on space occupancy:
 - Offices up to 25 m²
 - Classrooms and lecture halls, excl. shop and laboratory classrooms
 - Conference, meeting and training rooms
 - Employee lunch and break rooms
 - Storage and supply rooms up to 100 m²
 - Copying and printing rooms
 - Dressing, locker and fitting rooms
 - Washrooms

1. Prescriptive path Controls for spaces - Toplighting

- Daylight area $> 400 \text{ m}^2 \rightarrow$
photocontrol to reduce general lighting
- Exemptions
 - light blocked
 - insufficient skylight aperture
 - small enclosed space above 55°N latitude
- Provisions on how to calculate
daylighted area



1. Prescriptive path Controls for spaces - Sidelighting

- Sidelighted area $> 100 \text{ m}^2 \rightarrow$
photocontrol to reduce general lighting
- Exemptions
 - light blocked by adjacent building
 - insufficient sidelight aperture
 - retail spaces
- Provisions on how to calculate
sidelighted area



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2. Trade-off path

- Applies to interior lighting only
- More detailed calculations required
- Used when prescriptive path (building area and/or space-by-space method) power limits are exceeded
- Building owner requires higher light levels, yet doesn't qualify for exemptions

2. Trade-off path

- Compliance is based primarily on energy (kWh) as opposed to demand (W)
- Compliance achieved when:

Installed Interior Lighting Energy (IILE)

≤

Interior Lighting Energy Allowance (ILEA)

2. Trade-off path

Installed Interior Lighting Energy (IILE)

- Sum of the annual energy consumption of the proposed interior lighting designs
- Includes:
 - Daylighting Controls
 - Time of operation
 - Occupancy Sensor
 - Personal controls
 - Dimming

2. Trade-off path

Interior Lighting Energy Allowance (ILEA)

- Sum of the annual energy consumption allowances for interior lighting in the spaces under consideration using the space by space prescriptive path

2. Trade-off path

- Compliance:

Installed Interior Lighting Energy (IILE)

≤

Interior Lighting Energy Allowance (ILEA)

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3. Performance compliance path

- Whole building energy modeling
- NECB Part 4 Lighting → no limitations
- Criteria found in Part 8 “Building Energy Performance Compliance Path”
- Somewhat complicated

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Traditional vs New Technology: A Brief Case Study Brandon

HPS shoebox → LED

- Motivation
 - Energy savings
 - Maintenance savings
 - Improve light ‘quality’
- IES RP-20 for parking facilities
 - (They make an RP for nearly everything...)

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HPS Design (circa 1971)

- HPS overall fixture efficiency approx 70%
- Amber light
- Prone to hot spots directly under lamps
- 2x 290W per point, roughly 600W

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LED Proposed Design

- High fixtures efficiency, “delivered lumens”
- White light high CRI
- Extremely uniform, less than 2:1 contrast ratio
- Approximately 130W per point (one head)
- Used only 25% of the power of the original design, yet superior



Questions?

http://www.firecomm.gov.mb.ca/codes_energy.html



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Thanks!

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