

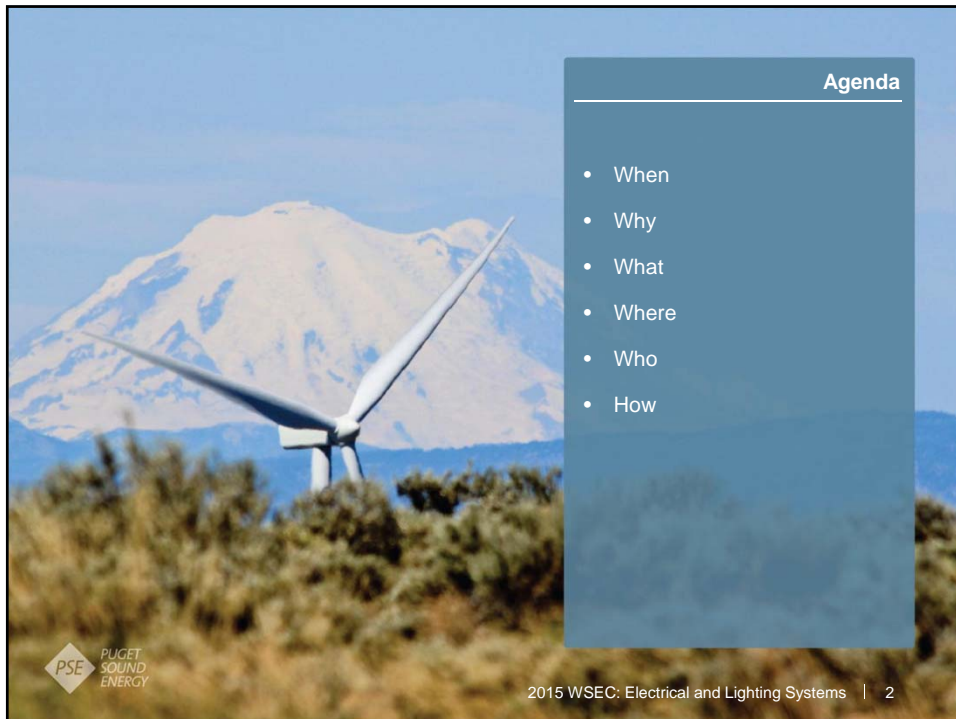
2015 WSEC: Electrical and Lighting Systems



in collaboration with...



Presented by: Andrew Pultorak, LC, MIES
Senior Energy Management Engineer
Puget Sound Energy

A photograph of a white wind turbine in the foreground, with a large, snow-capped mountain in the background under a clear blue sky. The foreground is filled with dry, scrubby vegetation.

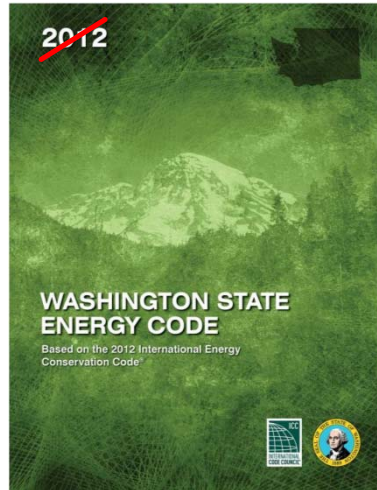
Agenda

- When
- Why
- What
- Where
- Who
- How



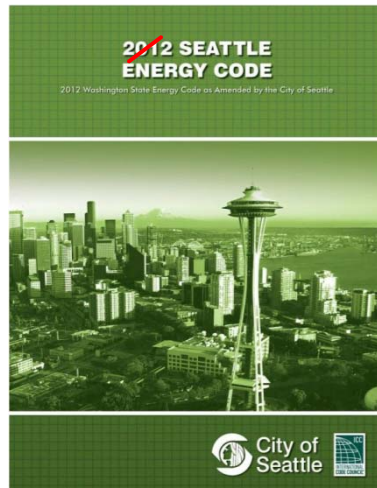
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July 1, 2016

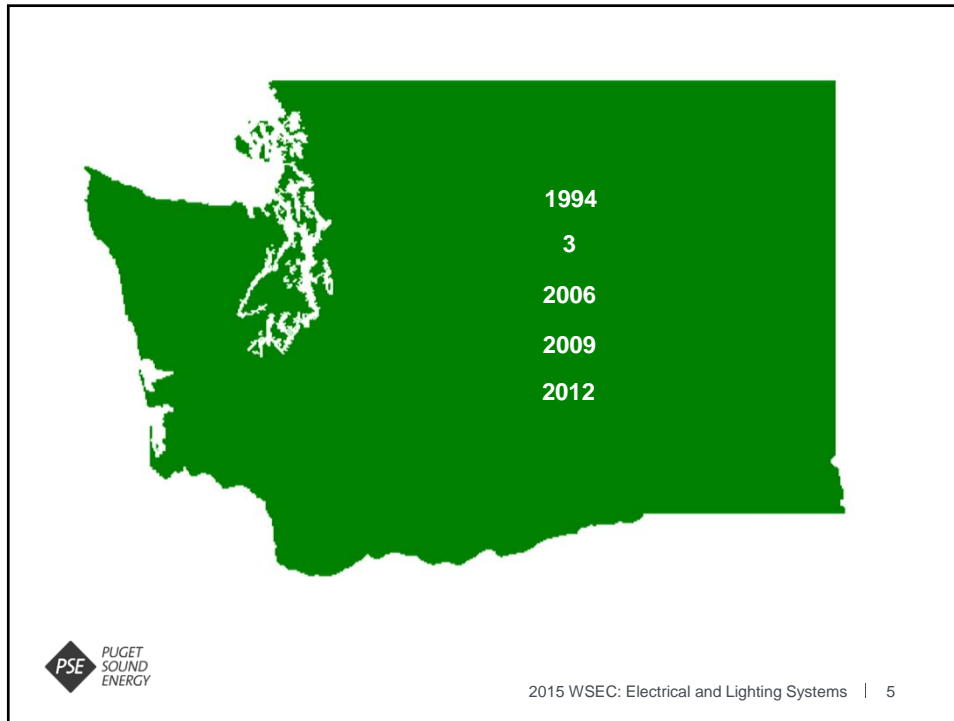


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January 1, 2017



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2015 WSEC: Washington State Energy Code

IECC – 2015 International Energy Conservation Code

WAC – Washington Administrative Code

SBCC – State Building Code Council

NEEC – Northwest Energy Efficiency Council

2015 WSEC

- Residential WAC 51-11R
- Commercial WAC 51-11C
 - Chapter 1 Scope and Administration
 - Chapter 2 Definitions
 - Chapter 3 General Requirements
 - Chapter 4 Commercial Energy Efficiency
 - Chapter 5 Existing Buildings
 - Chapter 6 Referenced Standards

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2015 WSEC

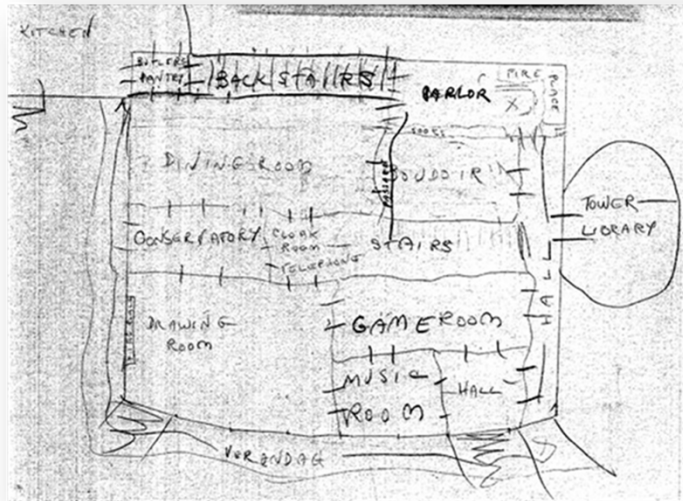
Commercial / Residential (C505)

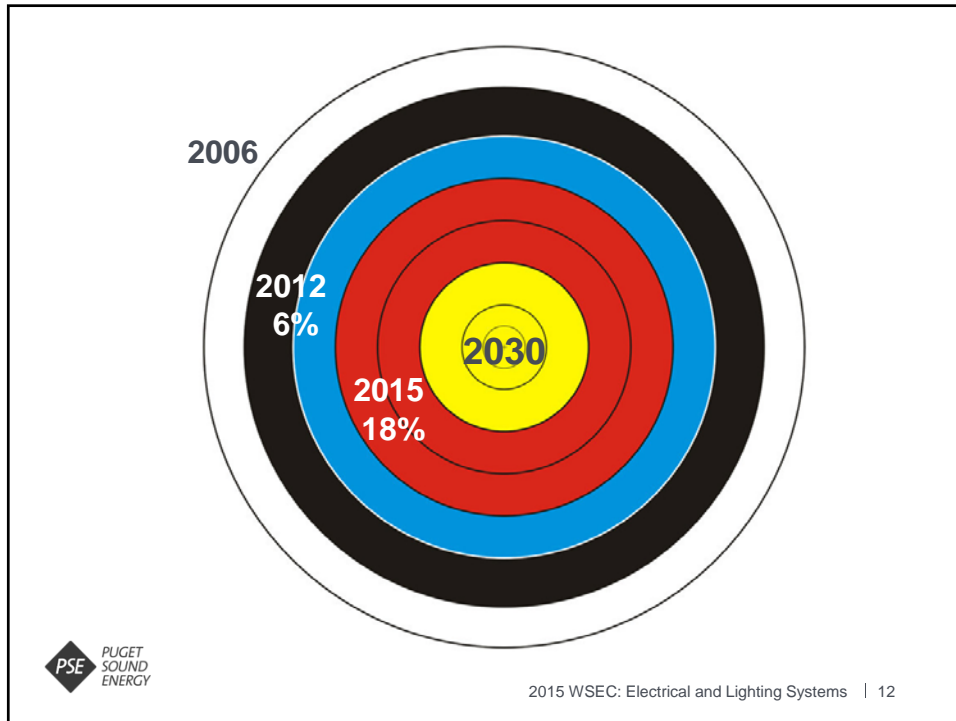
Section
Chapter
C - Commercial
R - Residential

Residential includes detached one and two-family dwellings (townhouses) as well as R-2, R-3, and R-4 buildings three stories or less in height above grade plane.

- R1** = single family
- R2** = single family and duplex
- R3** = single family thru duplex
- R4** = multi-family developments

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Proposals

- 146 submitted proposals
- 26 specific to electrical or lighting
- Most controversial?
 - DOAS: Dedicated Outside Air Systems - effective July 1, 2017
- Second most?
 - Interior LPA – Lighting Power Allowances

WASHINGTON STATE LEGISLATURE

WACs > Title 51 > Chapter 51-11C > Section 51-11C-10140

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51-11C-10100 << 51-11C-10140 >> 51-11C-10143

Effective until July 1, 2016.

WAC 51-11C-10140

Section C101.4—Applicability.

C101.4 Applicability. Where, in any specific case, different sections of this code shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

C101.4.1 Existing buildings. Except as specified in this chapter, this code shall not apply to the construction, alteration, and maintenance of, an existing building or building system lawfully in existence at the time of the adoption of this code.

C101.4.2 Historic buildings. The building official may modify the specific requirements of this code to allow for a reasonable degree of energy efficiency. This modification may be allowed for those buildings designated as historic properties under local or state designation laws or codes.

(Effective July 1, 2016.)

WAC 51-11C-10140

Section C101.4—Applicability.

C101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods, or standards, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

C101.4.1 Mixed occupancy. Where a building includes both residential and commercial occupancies, each provision of WSEC—Commercial Provisions or WSEC—Residential Provisions shall apply.

[Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-10140, filed 1/19/16, effective 1/19/16. WSR 14-24-122, § 51-11C-10140, filed 12/3/14, effective 1/3/15. Statutory Authority: RCW 19.27A.025, effective 11/1/13. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-0

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Chapter 1 Scope and Administration

C101.2 Scope

This code applies to commercial buildings and the buildings sites and associated systems and equipment.

- EXCEPTION: The provisions of this code do not apply to temporary growing structures used solely for the commercial production of horticultural plants including ornamental plants, flowers, vegetables, and fruits. A temporary growing structure is not considered a building for the purposes of this code. However, the installation of other than listed, portable mechanical equipment or listed, portable lighting fixtures is not allowed.

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C101 Scope and general requirements

C101.3 Intent

This code shall regulate the design and construction of buildings for the use and conservation of energy over the life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

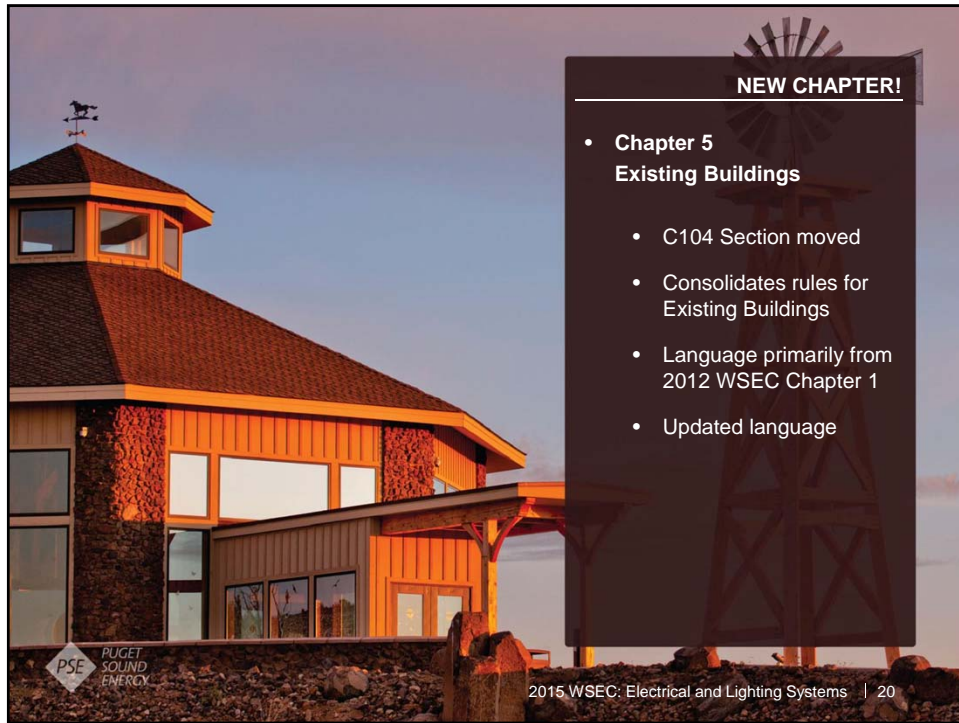


C101 Scope and general requirements

C101.4 Applicability

Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.





C503 Alterations

C503.6 Lighting and motors

- Alterations that replace 50 percent or more of the luminaires shall comply with the Code
 - 1) in a space enclosed by walls or ceiling-height partitions
 - 2) parking garage luminaires
 - 3) exterior luminaires
 - 4) shall comply...
- Where less than 50 percent of the fixtures in an interior space enclosed by walls or ceiling-height partitions or parking garage are new, or 50 percent or more of the installed exterior wattage is altered, the installed lighting wattage shall be *maintained or reduced*.

C503 Alterations



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C503 Alterations

C503.6 Lighting and motors (cont.)

Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit, controls (manual/occupancy/daylight) shall comply....

NOTE: Occupancy controls must be installed and commissioned for:

- o Office areas less than 300 sq ft enclosed by walls or ceiling-height partitions
- o Meeting and conference rooms
- o School classrooms

Where a new lighting panel (or a moved lighting panel) with all new raceway and conductor wiring from the panel to the fixtures is being installed, controls and commissioning shall also comply.



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C503 Alterations

C503.6 Lighting and motors (cont.)

Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall comply and have either:

- Occupancy controls (C405.2.1)
- Time switch controls (C405.2.2)
- Daylight responsive controls (C405.2.4)

and...

- Lighting system commissioning (C408.3)



C505 Change of Occupancy and Use

C505.1 General

Spaces undergoing a change in occupancy shall be brought up to full compliance...

- Non-residential to residential
- Unheated to conditioned space
- Storage, factory or utility occupancy to anything else





Chapter 4 Commercial Energy Efficiency

C405.1 General

This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, minimum acceptable lighting equipment for exterior applications, and minimum efficiencies for motors and transformers.

EXCEPTION: Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that a minimum of 75 percent of the lamps in permanently installed light fixtures shall be high efficacy lamps.

Walk-in coolers and walk-in freezers (C405.10)

Refrigerated warehouse coolers warehouse freezers (C405.11)

C405 Controls Overview

C405.2 Lighting controls (mandatory)

Lighting systems controls required in all areas (manual control minimum).

EXCEPTION:

- Security/emergency areas
- Interior stairways, ramps, and exits
- Industrial/manufacturing processes
- LLLC – luminaire level lighting fixtures



C405.2 Controls *Exception* for LLLC

Luminaire Level Light Controls are exempt from other control requirements if:

- 1) Monitor occupant activity to brighten or dim its lighting when occupied or unoccupied, respectively.
- 2) Monitor ambient light (both electric light and daylight) and brighten or dim electric light to maintain desired light level.
- 3) Configuration and reconfiguration of performance parameters, including bright and dim setpoints, time-outs, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations, for each control strategy.
- 4) Meet the operational and commissioning requirements



PSE Lighting Upgrade

East Side



- Philips DualLED with SpaceWise
- 43 watts at 3900 lumens
- 4000K and 80 CRI
- 50,000 hours life L70
- Dimming: 66% or 77% or 88%

West Side



- Cree ZR Series with SmartCast
- 35 watts at 3200 lumens
- 4000K and 90 CRI
- 70,000 hours life L70
- Dimming: 5% to 100%



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C405 Controls Overview

C405.2.1. Occupant sensor controls

Occupant sensor controls shall be installed to control lights in the following space types:

- 1) Classrooms/lecture/training rooms.
- 2) Conference/meeting/multipurpose rooms.
- 3) Copy/print rooms.
- 4) Lounges.
- 5) Employee lunch and break rooms.
- 6) Private offices.
- 7) Restrooms.
- 8) Storage rooms.
- 9) Janitorial closets.
- 10) Locker rooms.
- 11) Other spaces 300 square feet or less that are enclosed by floor-to-ceiling height partitions.
- 12) Warehouses.



C405 Controls Overview

C405.2.1.1 Occupant sensor control function

- 1) Automatically turn off lights within 30 minutes of all occupants leaving the space.
- 2) Be ~~manual on (vacancy sensors) or controlled to automatically~~ turn the lighting on to not more than 50 percent power.
EXCEPTION: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrances areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.
- 3) Shall incorporate a manual control to allow occupants to turn lights off.



C405 Controls Overview

C405.2.1.2 Occupant sensor control function in warehouses

Aisleways and open areas shall have occupancy sensors controlled:

- o automatically to reduce lighting power by not less than 50 percent when the areas are unoccupied.
- o Separately and independently in each aisleway.
- o Not control lighting beyond the aisleway being controlled by the sensor.



C405 Controls Overview

C405.2.2 Time switch controls

Each area NOT provided with occupant sensor or digital timer switch shall have a time switch control.

EXCEPTION:

- 1) Sleeping Units
- 2) Spaces where patient care directly provided
- 3) Safety/security
- 4) Lighting intended for continuous operation
- 5) Shop/Laboratory classrooms



C405 Controls Overview

C405.2.2.1 Time switch control function

- Have 7 day clock programmable for each day
- Holiday function
- 10 hour backup
- Manual override switch with maximum of 2 hours, controlling area not larger than 5,000 sq ft

EXCEPTIONS:

- Malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas
 - If captive key, can be longer than 2 hour override
 - 20,000 sq ft maximum
- If manual control, then exempt from light reduction controls
 - Spaces with 1 fixture and less than 100W
 - Spaces with less than .6W / ft
 - Corridors, equipment rooms, lobbies, elect/mech rooms



C405 Controls Overview

C405.2.2.2 Light Reduction Controls

Spaces required to have light-reduction controls shall have a manual control that allows the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50 percent.

Lighting reductions shall be achieved by one of the following approved methods:

1. Controlling all lamps or luminaires.
2. Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps.
3. Switching the middle lamp luminaires independently of the outer lamps.
4. Switching each luminaire or each lamp.

EXCEPTION: Light reduction controls are not required in daylight zones with daylight responsive controls



C405 Controls Overview

C405.2 Light Reduction Controls

EXCEPTIONS:

- Occupancy sensor installed
- Daylight sensor installed
- Space with .6w / sq ft or less
- Room with one fixture and less than 100W
- Corridors
- Equipment rooms
- Storerooms
- Restrooms
- Public Lobbies
- Electrical or mechanical rooms



C405 Controls Overview

C405.2.4 Daylight responsive controls

Daylight zone controls required in Sidelight and Toplight daylight zones with more than 2 general lighting fixtures in the primary and secondary daylight zones.

EXCEPTION:

- 1) Health care facilities where patient care directly provided
- 2) Dwelling units and sleeping units
- 3) Specific application control spaces
- 4) Sidelight daylight zones above 1st floor in certain occupancies
- 5) Daylight zones where proposed LPD is less than 35% of LPD



C405 Controls Overview

- Primary & secondary zones (& skylight zones) separately controlled
- Continuous dimming or stepped dimming:
 - Continuous now required for office, classroom, laboratory and library reading room (step dimming not allowed)
 - Continuous dims at least down to 15%
 - Stepped: 2 roughly equal steps between zero & 100%



C405 Controls Overview

C405.2 Stair and Garage Lighting Controls

- Stair lights turn down at least 50% when empty for 30 min, turn back up when someone enters the stairwell
- Minimum 1 fc for all walking surfaces at all times
- Garage area lights turn down min 50% when empty for 30 min, turn back up when someone approaches the garage area:
 - 30 foot pedestrian approach, 60-foot vehicle approach
 - 7,200 SF maximum for each separate controlled area



C405.2.5 Additional Lighting Controls

Formerly “*Specific Lighting Applications*”

- Display & accent lighting, lighted display cases, grow lights, and food warming lights must be controlled separately from area lighting
- Under-cabinet & task lights require:
 - auto shut-off when space unoccupied
 - and local manual-on switch
- Dual-function fixtures (standard area light and egress light) within exit access turn off when space unoccupied (so, not in exit stairs)
- EXCEPTION: means of egress lighting that does not exceed 0.02 watts/ft can stay on 24/7



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C405.6 Digital timer switch controls

Spaces under 300 sq ft may use digital timer in lieu of occupancy sensor in the following areas:

- Copy/print rooms
- Storage rooms
- Janitorial closets



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Daylight Zones Defined

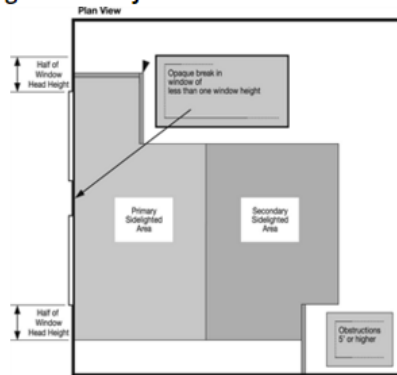
- **Sidelight daylight zone**
 - Adjacent to fenestration
 - Under rooftop monitor
 - Under sloped rooftop monitor
 - Adjacent to clerestory
 - Parking garage
- **Toplight daylight zone**
 - Under rooftop
 - Under atrium

PSE PUGET SOUND ENERGY

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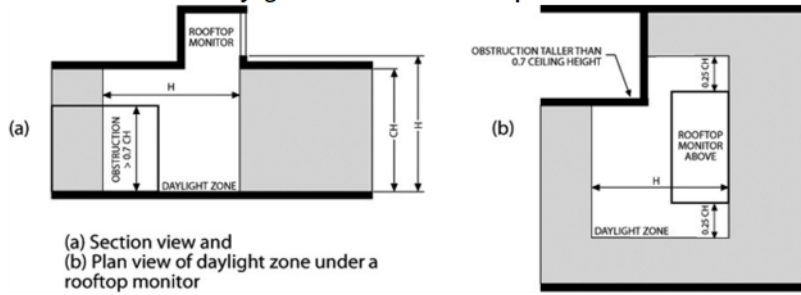
Daylight Zones

Figure C405.2.4.2(1)
Daylight Zone Adjacent to Fenestration in a Wall



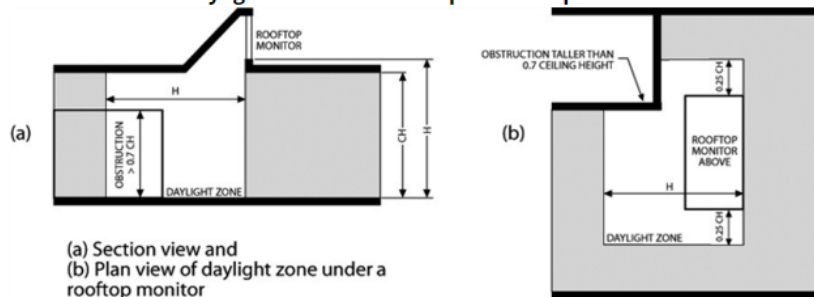
Daylight Zones

Figure C405.2.4.2(2)
Daylight Zone Under a Rooftop Monitor



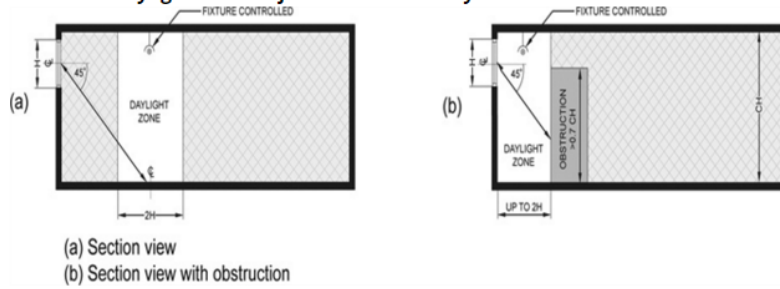
Daylight Zones

Figure C405.2.4.2(3)
Daylight Zone Under a Sloped Rooftop Monitor



Daylight Zones

Figure C405.2.4.2(4)
Daylight Zone Adjacent to Clerestory Fenestration in a Wall

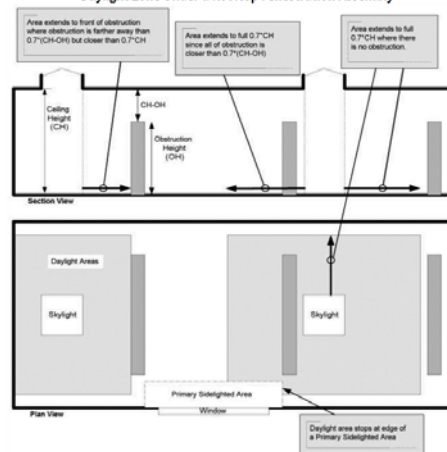


If the rough opening area of a vertical fenestration assembly is less than 10% of the calculated primary daylight zone area for this fenestration, it does not qualify as a daylight zone.

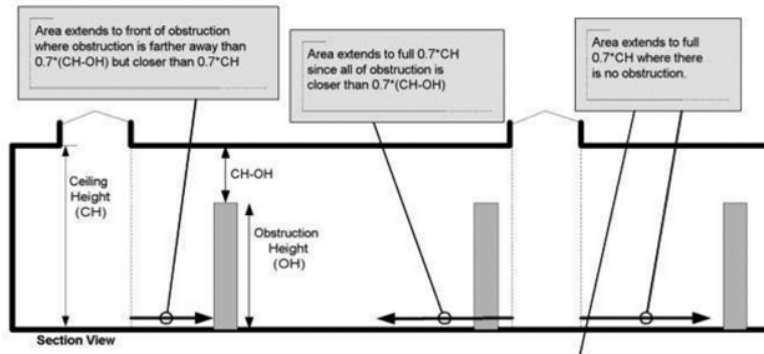


Daylight Zones

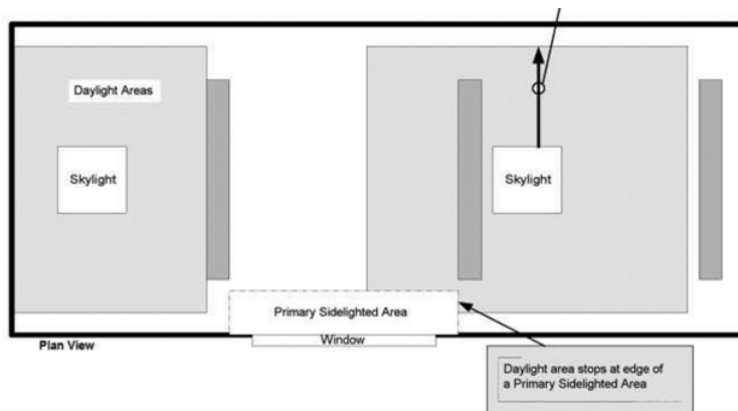
Figure C405.2.4.3(1)
Daylight Zone Under a Rooftop Fenestration Assembly



Daylight Zones

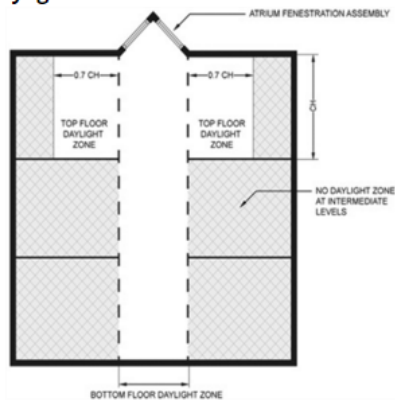


Daylight Zones



Daylight Zones

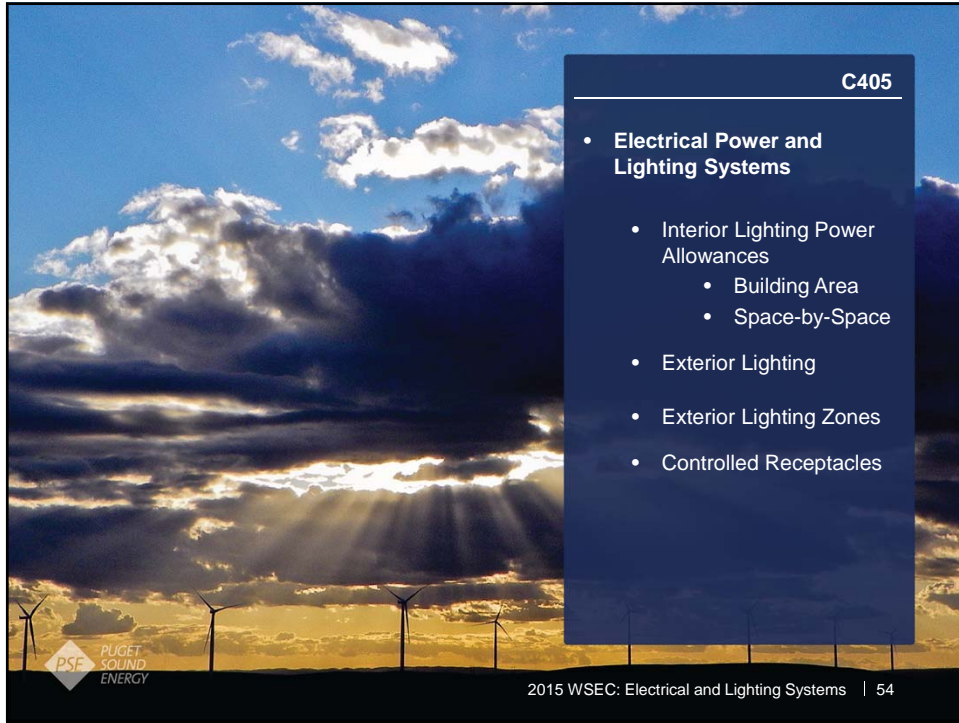
Figure C405.2.4.3(2)
Daylight Zone Under Atrium Fenestration



Daylight Zones

In parking garages with floor area adjacent to perimeter wall openings, the daylight zone shall include the area within 20 feet of any portion of a perimeter wall that has a net opening to wall ratio of at least 40 percent.





Total Connected Interior Lighting Power

C405.5.1 Total Connected Interior Lighting Power

The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment...

EXCEPTIONS:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.
 - 1.1. Professional sports arena playing field lighting.
 - 1.2. Emergency lighting automatically off during normal building operation.
 - 1.3. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired and other medical and age-related issues.
 - 1.4. Casino gaming areas.
 - 1.5. General area lighting power in industrial and manufacturing occupancies dedicated to the inspection or quality control of goods and products.
 - 1.6. Lighting in sleeping units, provided that the lighting complies with Section R404.1.
 - 1.7. Mirror lighting in dressing rooms.
2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:
 - 2.1. Task lighting for medical and dental purposes.
 - 2.2. Display lighting for exhibits in galleries, museums and monuments.

Total Connected Interior Lighting Power

Cont.

EXCEPTIONS:

3. Lighting for theatrical purposes, including performance, stage, film production and video production.
4. Lighting for photographic processes.
5. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
6. Task lighting for plant growth or maintenance *where the lamp efficacy is not less than 90 lumens per watt*.
7. Advertising signage or directional signage.
8. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
9. Lighting equipment that is for sale.
10. Lighting demonstration equipment in lighting education facilities.
11. Lighting approved because of safety or emergency considerations, inclusive of exit lights.
12. Lighting integral to both open and glass enclosed refrigerator and freezer cases.
13. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.
15. Lighting used for aircraft painting.



Lighting Power Allowances

- Lighting Power Allowances (LPA) reduced *about 25%*
 - Building Area Method
 - Space by Space Method
- Ceiling height adjustments are back! (*Unless otherwise specified*)
 - Office and library – 2% per foot over 9' CH
 - Other spaces - 2% per foot over 20' CH



Lighting Power Allowances

C405.4.2(1) Interior Lighting Power-Building Area Method

2012

Building Area Type	LPD (w/ft ²)
Automotive facility	0.82
Convention center	1.08
Court house	1.05
Dining: Bar lounge/leisure	0.99
Dining: Cafeteria/fast food	0.90
Dining: Family	0.89
Dormitory	0.61
Exercise center	0.88
Fire station	0.71
Gymnasium	0.95
Health care clinic	0.87
Hospital	1.20
Hotel	1.00
Library	1.18
Manufacturing facility	1.11

2015

Building Area Type	LPD (w/ft ²)
Automotive facility	0.64
Convention center	0.81
Court house	0.81
Dining: Bar lounge/leisure	0.79
Dining: Cafeteria/fast food	0.72
Dining: Family	0.71
Dormitory	0.46
Exercise center	0.67
Fire station	0.54
Gymnasium	0.75
Health care clinic	0.70
Hospital	0.84
Hotel/motel	0.70
Library	0.94
Manufacturing facility	0.89



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Lighting Power Allowances

C405.4.2(1) Interior Lighting Power-Building Area Method

2012

Motel	0.88
Motion picture theater	0.83
Multifamily	0.60
Museum	1.00
Office	0.90
Parking garage	0.20
Penitentiary	0.90
Performing arts theater	1.25
Police station	0.90
Post office	0.87
Religious building	1.05
Retail	1.33
School/university	0.99
Sports arena	0.78
Town hall	0.92
Transportation	0.77
Warehouse	0.50
Workshop	1.20

2015

Hotel/motel	0.70
Library	0.94
Manufacturing facility	0.89
Motion picture theater	0.61
Multifamily	0.41
Museum	0.80
Office	0.66
Parking garage	0.16
Penitentiary	0.65
Performing arts theater	1.00
Police station	0.70
Post office	0.70
Religious building	0.80
Retail	1.01
School/university	0.70
Sports arena	0.62
Town hall	0.71
Transportation	0.56
Warehouse	0.40
Workshop	0.95



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Lighting Power Allowances

C405.4.2(2) Interior Lighting Power-Space by Space Method

2012

Common Space-by-Space Types	LPD ^d (w/ft ²)
Atrium - First 40 feet in height	0.03 per ft. ht.
Atrium - Above 40 feet in height	0.02 per ft. ht.
Audience/seating area - Permanent	
For auditorium	0.79
For performing arts theater	2.43
For motion picture theater	1.14
Classroom/lecture/training	1.24
Conference/meeting/multipurpose	1.23
Corridor/transition	0.66
Dining area	
Bar/lounge/leisure dining	1.31
Family dining area	0.89
Dressing/fitting room performing arts theater	0.40



2015

Common Space-by-Space Types ^a	LPD ^d (w/ft ²)
Atrium - First 40 feet in height ^e	0.02 per ft. ht.
Atrium - Above 40 feet in height ^e	0.03 + 0.02 per ft. in total height
Audience/seating area - Permanent	
In an auditorium	0.50
In a convention center	0.66
In a gymnasium	0.34
In a motion picture theater	0.91
In a penitentiary	0.22
In a performing arts theater	1.94
In a religious building	1.22
In a sports arena	0.34
Otherwise	0.34
Banking activity area	0.81
Breakroom (see Lounge/breakroom)	

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Lighting Power Allowances

C405.4.2(2) Interior Lighting Power-Space by Space Method

2012

Building Specific Space-by-space Types	LPD ^d (w/ft ²)
Automotive - Service/repair	0.67
Bank/office - Banking activity area	1.38
Convention center	
Exhibit space	1.45
Audience/seating area	0.82
Courthouse/police station/penitentiary	
Courtroom	1.72
Confinement cells	1.10
Judge chambers	1.17
Penitentiary audience seating	0.43
Penitentiary classroom	1.34
Penitentiary dining	1.07
Dormitory living quarters	0.38
Fire stations	
Engine rooms	0.56
Sleeping quarters	0.25



2015

Building Specific Space-by-Space Types ^a	LPD ^d (w/ft ²)
Automotive - (See Vehicular maintenance, above)	
Convention center - Exhibit space	1.16
Dormitory living quarters	0.30
Facility for the visually impaired ^b	
In a chapel (and not used primarily by the staff) ^b	1.77
In a recreation room (and not used primarily by the staff) ^b	1.93
Fire stations - Sleeping quarters	0.18
Engine rooms	0.45

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Exterior Lighting

C405.5.1 Exterior building grounds lighting

All exterior building grounds luminaires that operate at greater than 100 watts shall have a minimum efficacy of 80 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section C405.5.2.



Exterior Lighting

C405.5.2 Exterior building lighting power

The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated...for the applicable lighting zone.

EXCEPTIONS:

1. Specialized signal, directional and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Integral to equipment or instrumentation and is installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production and video production;
5. Athletic playing areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites and associated storage areas;
8. Theme elements in theme/amusement parks; and
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.



Exterior Lighting Zones

Table C405.5.2(1)
Exterior Lighting Zones

Lighting Zone	Description
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas not classified as lighting zone 1, 2, or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority



Exterior Lighting Power Allowances

Table C405.6.2(2)
Individual Lighting Power Allowances for Building Exteriors

		Lighting Zones			
		Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (Base allowance is usable in tradable or nontradable surfaces.)		500 W	600 W	750 W	1300 W
Tradable Surfaces	Uncovered Parking Areas				
(Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas are tradable.)	Parking areas and drives	0.04 W/ft ²	0.06 W/ft ²	0.10 W/ft ²	0.13 W/ft ²



Exterior Lighting Power Allowances

Nontradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)	Building facades	No allowance	0.1 W/ft ² for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft ² for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length	0.2 W/ft ² for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length
Automated teller machines and night depositories		270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location



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C405.10 Controlled Receptacles

Change from offices and classrooms *only* to:

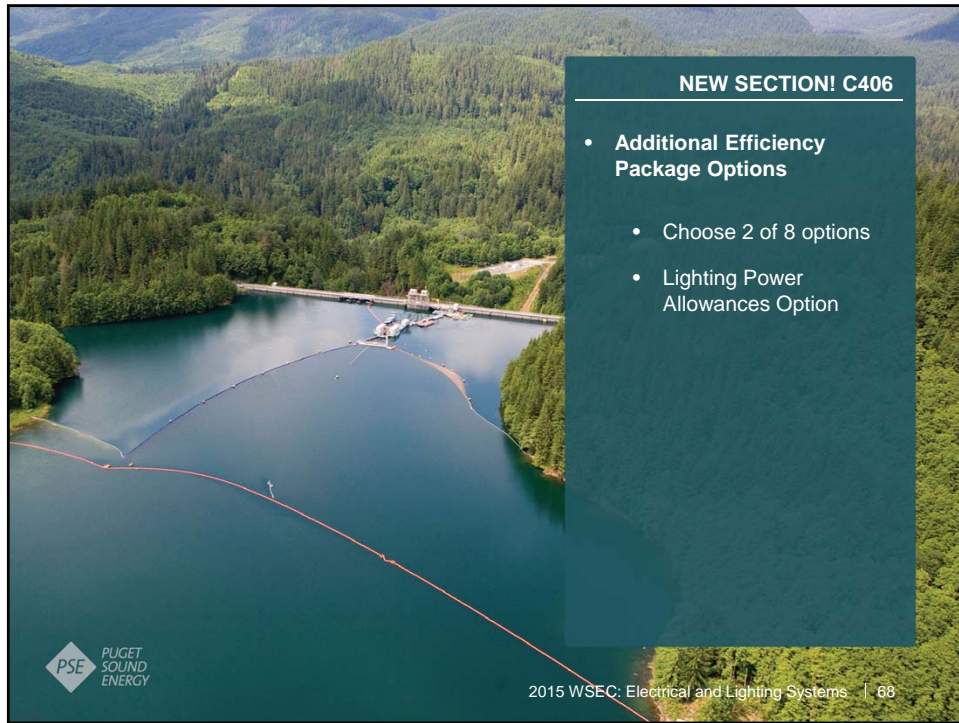
- Offices
- Classrooms
- Conference rooms, break rooms
- Print/copy rooms

- At least 50% of receptacles controlled by occupancy sensor or time clock
- Rooms larger than 200 sq ft need to be every 72" apart
- Visibly differentiated from standard receptacles
- Must control with occupancy sensor or time clock with 2-hour override switch

- EXCEPTION:
 - Outlets for specific purposes, safety & security, maintenance



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C406 Additional efficiency package

Pick 2 (from 8 choices):

- High-efficiency HVAC
- Reduced lighting power
- Enhanced lighting controls
- On-site renewable
- Enhanced building envelope
- Reduced air infiltration
- High-efficiency water heating
- DOAS (where not otherwise required)

C406 Additional efficiency package

C406.3.1 Reduced lighting power density

The total interior lighting power (watts) of the building shall be 75 percent or less of the lighting power values in Building Area Method times the floor area for the building types, or by using 75 percent of the interior lighting power allowance calculated by the Space-by-Space Method.

C406.3.2 Lamp fraction.

Not less than 95 percent of the interior lighting power (watts) from lamps in permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 60 lumens per watt.



C406 Additional efficiency package

C406.4 Enhanced digital lighting controls

Interior lighting shall be located, scheduled and operated in accordance with Section C405.2 and no less than 90 percent of the total installed interior lighting power shall be configured with the following enhanced control functions.

- 1) Luminaires shall be configured for continuous dimming.
- 2) Each luminaire shall be individually addressed.

EXCEPTIONS:

- 1) Multiple luminaires mounted on no more than 12 linear feet of a single lighting track and addressed as a single luminaire.
- 2) Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and addressed as a single luminaire, where the total length of the combined luminaires is not more than 12 feet.



C406 Additional efficiency package

Cont.

EXCEPTIONS:

- 3) Not more than eight luminaires within a daylight zone are permitted to be controlled by a single daylight responsive control.
- 4) Luminaires shall be controlled by a digital control system configured with the following capabilities:
 - a) Scheduling and illumination levels of individual luminaires and groups of luminaires are capable of being configured through the system.
 - b) Load shedding.
 - c) In open and enclosed offices, the illumination level of overhead general illumination luminaires are configured to be individually adjusted by occupants.



C406 Additional efficiency package

Cont.

EXCEPTIONS:

- d) Occupancy sensors and daylight responsive controls are capable of being reconfigured through the system.
- 5) Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions required by this section.





C408 System Commissioning

Section C408.3 Lighting System Commissioning

The commissioning process shall minimally include all energy code requirements for which the code requires specific daylight responsive controls, "control functions," and where the code states that equipment shall be "configured to" perform specific functions.

EXCEPTION: Lighting control systems are *exempt* from the commissioning process in buildings where:

- 1) The total installed lighting load is less than 20 kW.
- 2) Where the lighting load controlled by occupancy sensors or automatic daylighting controls is less than 10 kW.

C408 System Commissioning

Section C408.3 Lighting System Commissioning

Section reorganized, most requirements same as 2012

- *Required:* Preliminary and Final Commissioning Plans
- Required: Preliminary Cx Report before Cert of Occupancy
- Record doc's, manuals & training requirements moved to C103.6
- Now requires "Certified Commissioning Professional"
 - Defined as Registered Design Professional
- Added instructions

The slide features a background image of a sunset over a wind farm. The sun is partially obscured by dark, dramatic clouds, with bright rays of light breaking through. In the foreground, several wind turbines are silhouetted against the horizon. A dark blue rectangular box is overlaid on the right side of the image, containing white text.

Compliance Forms

- Northwest Energy Efficiency Council
 - www.neec.net
 - June 2016
 - Recorded webinar!
 - Choose your section



More Education: LDL

Lighting Design Lab
Seattle, WA
www.lightingdesignlab.com



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Questions?

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