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2009 Washington State Non-Residential Energy Code

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Christian Haas, PE – Sparling
Lisa Rosenow, CSBA, LEED® AP – NEEC

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Lighting and Energy Metering

Agenda

- Changes in NREC Chapter 15
- Review of new Chapter 12 on Energy Metering
- Q&A

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NREC: 101.3

Multi-Family Residential

- **101.3 Scope**
  - Spaces within the scope of Section R101.2 of the International Residential Code shall comply with Chapters 1 through 10 of this Code. All other spaces, including other Group R Occupancies, shall comply with Chapters 11 through 20 of this Code. Chapter 2, 7 and 10 are applicable to all building types.

- ***Refer to new definition of Multi-Family Residential under Section 201 General Definitions.***

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Lighting Requirements

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NREC: 1512

Exempt Lighting

"The use of these exemptions is at the applicant's option."

The following lighting equipment and tasks are exempt from the lighting requirements of Section 1520 through 1522 and need not be included when calculating the installed lighting power under Sections 1530 through 1532 but shall comply with all other requirements of this chapter.

- **1512.1 Exempt Spaces**
- **1512.2 Exempt Lighting Equipment**

See also

- **1521 Prescriptive Interior Lighting Requirements**
- **1532 Exterior Lighting Power Allowance**

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NREC: 1512.1

Exempt Lighting

- **1512.1 Exempt Spaces**
  - **Areas that are no longer exempt (moved to 1512.2 Exempt Equipment) include:**
    - » Areas in which medical or dental tasks are performed.
    - » Food prep areas.
    - » Inspection and restoration areas in galleries and museums.
  - **Areas that are still exempt with clarification**
    - » Spaces designed for primary use by the visually impaired or hard of hearing. Specific wording for spaces occupied by senior citizens has been removed.

NREC: 1512.2

Exempt Lighting

- **1512.2 Exempt Lighting Equipment**
  - "However, such lighting shall not be exempt unless it is in addition to general area lighting, is located in a separate fixture, and is controlled by an independent control device."

    This applies to lighting equipment for:
    - » Use during medical or dental procedures and lighting integral to medical equipment…
    - » Food warming equipment or specifically for food preparation…
    - » Theatrical productions, television broadcasting (including sports facilities) and special effects lighting for stage areas and dance floors in entertainment facilities…
    - » Lighting that is used solely for indoor plant growth…
    - » Lighting in galleries, museums and in building entry lobbies for exhibits…

NREC: 1512.2

Exempt Lighting

- **1512.2 Exempt Lighting Equipment**
  - **Undershelf or Undercabinet Lighting** (new)
    - » Permanently installed undershelf or undercabinet lighting that has an automatic shutoff control device…
    - » Other permanently installed undershelf or undercabinet lighting that is not automatically controlled is not exempt and other partition-mounted lighting that is providing general illumination is not exempt…
  - **Lighting used for aircraft painting** (new)

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NREC: 1513.3

Lighting Controls

- **1513.3 Daylight Zone Control**
  - Automatic daylight sensing controls are required in all areas with skylights, monitors or other fenestration at or above ceiling level and in all areas with windows.
  - Primary and secondary daylight zones shall be controlled separately.
  - **Daylight sensing controls shall:**
    - » Reduce the light output of the controlled luminaires while maintaining a uniform level of illuminance.
    - » Have time-delay circuits to prevent cycling of light level changes.
    - » Only control daylight area fixtures.

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NREC: 1513.3

Lighting Controls

- **1513.3 Daylight Zone Control**
  - **Light output control may be accomplished by:**
    - » Continuous dimming to at least 20% light output.
    - » Step switching of each lamp in individual luminaires.
    - » Step dimming by reducing the output of all of the lamps in individual luminaires by at least 50%.
  - **A daylight zone adjacent to vertical glazing is no longer defined as being more than 15-feet deep!**

NREC: 201

Daylighted Zone

- **201 General Definitions – Under overhead glazing**
  - The area under overhead glazing whose horizontal dimension, in each direction, is equal to the overhead glazing dimension in that direction plus either ***70 percent of*** the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent overhead or vertical glazing, whichever is least.

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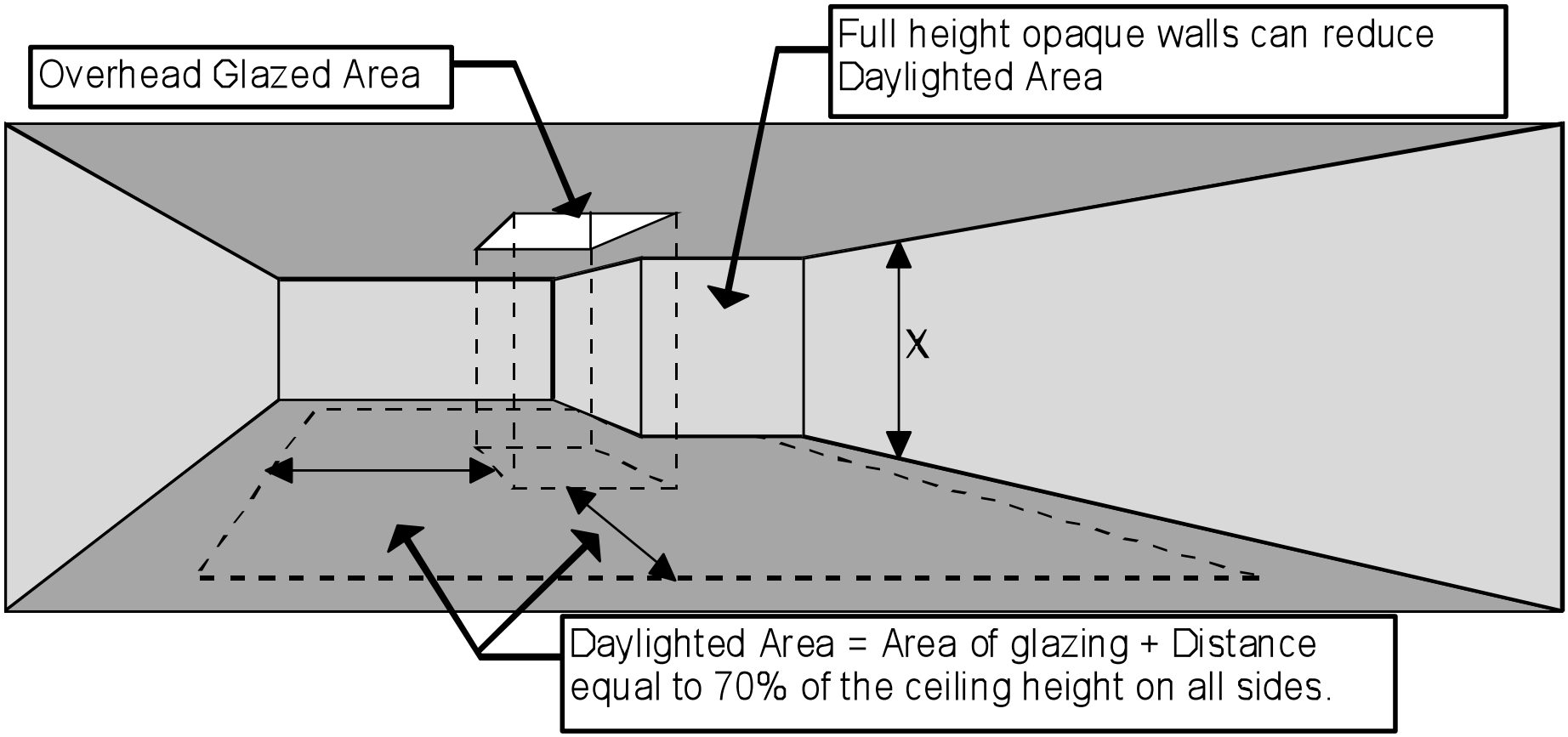
Daylight Zone - Overhead Glazing



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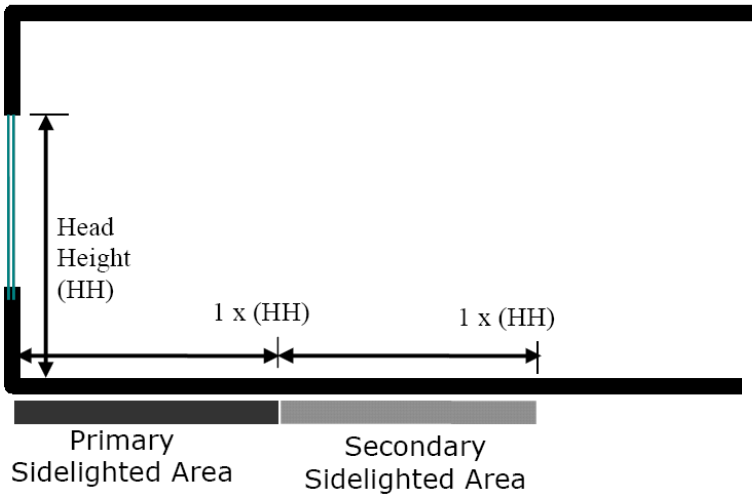
NREC: 201

Daylighted Zone

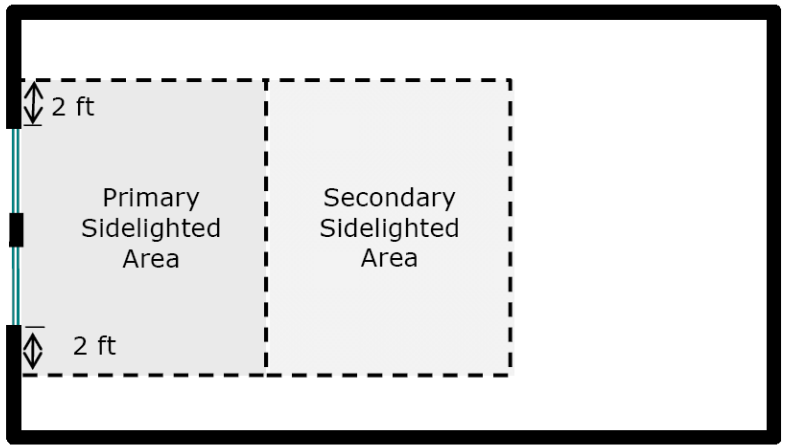
- **201 General Definitions – At vertical glazing**
  - Primary daylighted zone depth - Extends into the space a distance equal to the window head height.
  - Secondary daylighted zone depth - Extends from the edge of the primary zone to a distance equal to two times the window head height, or to the nearest ceiling height opaque partition, whichever is less.
  - Daylighting zone width - The width of the window plus either two feet on each side (the distance to an opaque partition) or one-half the distance to adjacent overhead or vertical glazing, whichever is least.

Daylight Zone – Vertical Glazing

a) Section View



b) Plan View



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NREC: 1513.3

Lighting Controls

- **1513.3 Daylight Zone Control Exemptions**
  - **Exempt from requirement for automatic daylighting control:**
    - » Retail spaces adjacent to vertical glazing (retail spaces under overhead glazing are not exempt).
    - » Display, exhibition and specialty lighting that are controlled independently of general area lighting. (Section 1513.4)

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NREC: 1513.3

Lighting Controls

- **1513.3 Daylight Zone Control Exemptions**
  - **Exempt from requirement for automatic daylighting control provided they have occupancy sensor controls:**
    - » Small spaces in the daylighted zone that are normally unoccupied (such as a storage room or restroom with a window).
    - » Rooms less than 300 square feet.
    - » Conference rooms 300 square feet and larger that have a lighting control system with at least four scene options and occupancy sensor control.
    - » HID lamps with automatic controls that are capable of reducing the power consumption by at least 50%.
    - » HID lamps 100 watts or less.

NREC: 1513.6

Lighting Controls

- **1513.6 Automatic Shut-off Controls, Interior**
  - **All** buildings shall be equipped with separate automatic controls to shut off the lighting in all spaces during unoccupied hours.
  - **Occupancy sensors are required in:**
    - » Office areas less than 300 square feet enclosed by walls or ceiling-height partitions
    - » Meeting and conference rooms
    - » School classrooms
    - » **Warehouse and storage spaces** (new)
    - » For other spaces, automatic controls may be an occupancy sensor, time switch, or other device capable of automatically shutting off lighting.

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NREC: 1513.6

Lighting Controls

- **1513.6 Automatic Shut-off Controls, Interior**
  - **Exceptions to the requirements of this section:**
    - » Areas that must be continuously illuminated or illuminated in a manner requiring manual operation of the lighting (such as 24-hour operation facilities).
    - » **Emergency lighting and means of egress illumination as required by code that are normally OFF during normal building operation.** (new)
    - » Switching for industrial or manufacturing process facilities as may be required for production.
    - » **24-hour occupancy areas in hospitals and laboratory spaces.** (new)
    - » Areas in which medical or dental tasks are performed.
    - » **Dwelling units.** (new)

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NREC: 1513.7

Lighting Controls

- **1513.7 Lighting Controls (Hotel/Motel)**
  - Hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles. In addition, a minimum of one of the following control technologies shall be required in hotel/motel guest rooms with over 50 guest rooms such that all the power to the lights and switched outlets in a hotel or motel guest room would be turned off when the occupant is not in the room:
    - » Controls that are activated by the room occupant via the primary room access method - key, card, deadbolt, etc.
    - » Occupancy sensor controls that are activated by the occupant's presence in the room.

NREC: 1520/1530

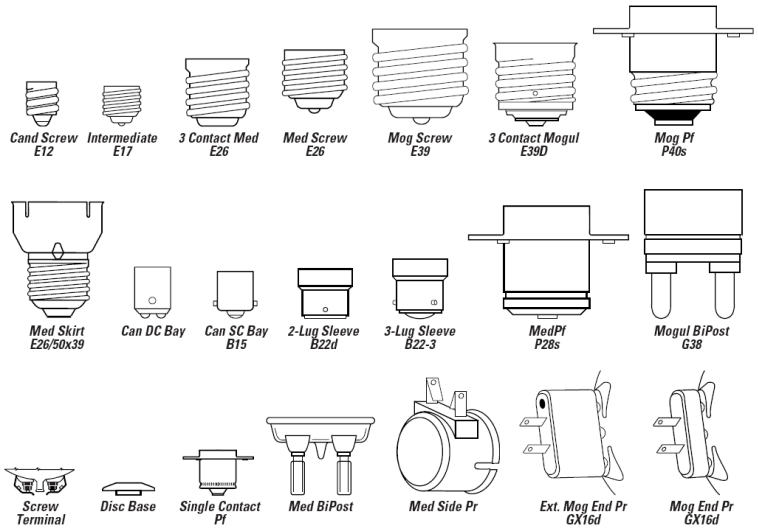
Lighting Power

- **1520 & 1530 Lighting Wattage**
  - There are two methods of identifying the maximum allowable lighting wattage:
    - » Section 1520 – Prescriptive Lighting Option
      - There are no 2009 changes to this section of the code.
    - » 1530 – Lighting Power Allowance Option
      - 1531 – Interior Lighting Power Allowance
      - 1532 – Exterior Lighting Power Allowance
      - 2009 changes in both sections.

NREC: 1530

Lighting Power

- **1530 Lighting Power Allowance Option**
  - The wattage of ***all*** line-voltage incandescent or tungsten-halogen luminaires not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.
  - "with medium screw base sockets" was deleted



GE Lighting

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Table 15-1

Unit Lighting Power Allowance (LPA)

TABLE 15-1
Unit Lighting Power Allowance (LPA)

Use[1]	LPA[2] (watts/sq. ft.)
Automotive facility	((~~0.9~~)) 0.85
Convention center	((~~1.2~~)) 1.10
Court house	((~~1.2~~)) 1.10
Cafeterias, fast food establishments[5], restaurants/bars[5]	((~~1.3~~)) 1.20
Dormitory	((~~1.0~~)) 0.85
Dwelling units	1.00
Exercise center	((~~1.0~~)) 0.95
Gymnasia((~~[3]~~)), assembly spaces((~~[3]~~))	((~~1.0~~)) 0.95
Health care clinic	((~~1.0~~)) 1.00
Hospital, nursing homes, and other Group I-1 and I-2 Occupancies	((~~1.2~~)) 1.20
Hotel/motel	((~~1.0~~)) 1.00
((~~Hotel banquet/conference/exhibition hall[3,4]~~	~~2.0~~))
Laboratory spaces (all spaces not classified "laboratory" shall meet office and other appropriate categories)	((~~1.8~~)) 1.62
Laundries	((~~1.2~~)) 1.20
Libraries[5]	((~~1.3~~)) 1.20
Manufacturing facility	((~~1.3~~)) 1.20
Museum	((~~1.1~~)) 1.00

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Table 15-1

Unit Lighting Power Allowance (LPA)

Use[1]	LPA[2] (watts/sq. ft.)
Office buildings, office/administrative areas in facilities of other use types (including but not limited to schools, hospitals, institutions, museums, banks, churches)[5((,7,11))]	((~~1.0~~)) 0.91
Parking garages	((~~0.2~~)) 0.20
Penitentiary and other Group I-3 Occupancies	((~~1.0~~)) 0.90
Police and fire stations((~~8~~))	((~~1.0~~)) 0.90
Post office	((~~1.1~~)) 1.00
Retail[10], retail banking, mall concourses, wholesale stores (pallet rack shelving)	((~~1.5~~)) 1.33
School buildings (Group E Occupancy only), school classrooms, day care centers	((~~1.2~~)) 1.00
Theater, motion picture	((~~1.2~~)) 0.97
Theater, performing arts	((~~1.6~~)) 1.25
Transportation	((~~1.0~~)) 0.80
Warehouses((~~11, storage areas~~))	((~~0.5~~)) 0.50
Workshop	((~~1.4~~)) 1.20
Plans Submitted for Common Areas Only[7]	
Main floor building lobbies[3] (except mall concourses)	((~~1.2~~)) 1.10
All building common areas, corridors, toilet facilities and washrooms, elevator lobbies, including Group R-1 and R-2 Occupancies	((~~0.8~~)) 0.80

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NREC: Table 15-1

Lighting Power

- **Additional Lighting Power Allowance – Retail**
  - This information is found in Footnote 10.
  - An additional lighting power allowance is allowed for merchandise display luminaires installed in retail sales areas that are specifically designed and directed to highlight merchandise.

    The following additional allowable wattages apply:

    i. 0.6 watts per square foot of sales floor area not listed in items ii and iii.

    ii. 1.4 watts per square foot of furniture, clothing, cosmetics or artwork floor area; **or**

    iii. 2.5 watts per square foot of jewelry, crystal, or china floor area.

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NREC: Table 15-1

Lighting Power

- **Additional Lighting Power Allowance – Retail**
  - The specified floor area for items i, ii, or iii and the adjoining circulation paths shall be identified and specified on building plans.
  - Calculate the additional power allowance by multiplying the above LPDs by the sales floor area for each department excluding major circulation paths.
  - The total additional lighting power allowance is the sum of allowances for sales categories i, ii, or iii plus an additional 1,000 watts for each separate tenant larger than 250 square feet in area.

NREC: Table 15-1

Lighting Power

- **Additional Lighting Power Allowance – Retail**
  - The additional wattage is allowed only if the merchandise display luminaires comply with **both** (a) and (b):

    (a) Located on ceiling-mounted track or directly on or recessed into the ceiling itself (not on the wall).

    (b) Adjustable in both the horizontal and vertical axes (vertical axis only is acceptable for fluorescent and other fixtures with two points of track attachment).
  - This additional lighting power is allowed only if the lighting is actually installed **and automatically controlled, separately from the general lighting, to be turned off during non-business hours.**
  - **This additional power shall be used only for the specified luminaires and shall not be used for any other purpose.**

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NREC: 1532

Lighting Power

- **1532 Exterior Lighting Power Allowance**
  - 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 designated on the buildings plans to be illuminated and are permitted in Table 15-2B for the applicable lighting zone.
  - Trade-offs are allowed only among exterior lighting applications listed in the Table 15-2B "Tradable Surfaces" section.
  - **The lighting zone for building exterior is determined from Table 15-2A unless otherwise specified by the local jurisdiction.**

NREC: Table 15-2A

Lighting Power

- **Table 15-2A Exterior Lighting Zones** (new)

TABLE 15-2A
Exterior Lighting Zones

Lighting Zone	Description
1	Developed areas of national parks, state parks, forest
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed areas
3	All other areas
4	High activity commercial districts in major metropolitan areas as designated by the local jurisdiction

NREC: Table 15-2B

Lighting Power

- **Table 15-2B Lighting Power Densities for Building Exteriors**
  - Note that this entire table has changed.

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Table 15-2B Lighting Power Densities for Building Exteriors

	Specific area description	Zone 1	Zone 2	Zone 3	Zone 4
Base site allowance[1]		500 W	600 W	750 W	1300 W
Tradable Surfaces [2]					
Uncovered Parking Areas	Parking areas and drives	0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	0.13 W/ft^2
Building Grounds	Walkways less than 10 ft wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 ft wide or greater, Plaza areas, Special feature areas	0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Exterior stairways	0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian tunnel	0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Landscaping	0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2	0.05 W/ft^2
Building Entrances and Exits	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry canopies	0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
Sales Canopies	Free standing and attached	0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	1.0 W/ft^2
Outdoor Sales	Open areas[3]	0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	0.7 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance	No Allowance	10 W/linear foot	10 W/linear foot	30 W/linear foot

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Table 15-2B Lighting Power Densities for Building Exteriors

Nontradable Surfaces[4]				
Building Facades	No Allowance	0.1 W/ft^2 for each illuminated wall or surface[5]	0.15 W/ft^2 for each illuminated wall or surface[6]	0.2 W/ft^2 for each illuminated wall or surface[7]
Automated Teller Machines and Night Depositories	270 W per location[8]	270 W per location[8]	270 W per location[8]	270 W per location[8]
Entrances and Gatehouse Inspection Stations at Guarded Facilities	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area
Loading Areas for Law Enforcement, Fire, Ambulance and Other Emergency Service Vehicles	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area

Specific area description	Zone 1	Zone 2	Zone 3	Zone 4
Base site allowance[1]	500 W	600 W	750 W	1300 W
Tradable Surfaces [2]				
Material Handling and Associated Storage				0.5 W/ft^2
Drive-up Windows and Doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
Parking Near 24-hour Retail Entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

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NREC: Table 15-2B

Lighting Power

- **Table 15-2B Footnotes**
  1. Base site allowance may be used in tradable or nontradable surfaces.
  2. Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.
  3. Lighting power allowance for open areas includes vehicle sales lots.

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NREC: Table 15-2B

Lighting Power

- **Table 15-2B Footnotes**

4. Lighting power density calculations for non-tradable 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.

5. Building façade Zone 2 may alternately use 2.5 watts per linear foot for each wall or surface length.
6. Building façade Zone 3 - 3.75 watts per linear foot.
7. Building façade Zone 4 - 5 watts per linear foot.
8. An additional 90 watts is allowed per additional ATM location.

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Energy Metering

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NREC: 1201

Energy Metering *New Chapter in the Code*

- Whole building energy supply sources and various energy consuming components shall be metered to provide energy consumption data to the building owner. This new requirement provides the means to effectively monitor and manage building energy consumption and diagnose potential issues.

- Metering is defined as having the ability to collect overall totalized energy use data.
  - Small buildings with a single electric meter would comply under this definition.
  - For larger buildings with separate meters for various tenants, a means of collecting the energy use of all building meters would be required.

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NREC: 1202

1202 Whole Building Energy Supply Metering – Source Metering

TABLE 12-1
ENERGY SOURCE METER THRESHOLDS

Energy Source	Main Metering Threshold
Electrical service	> 500 kVA
On-site renewable electric power	> 10 kVA (peak)
Gas and steam service	> 300 kW (1,000,000 Btu/h)
Geothermal	> 300 kW (1,000,000 Btu/h)heating
On-site renewable thermal energy	> 10 kW (30,000 Btu/h)

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NREC: 1202/1203

Energy Metering *New Chapter in the Code*

- **1202 Whole Building Energy Supply Metering – Source Metering**
  - *On-site renewable energy systems* - Photovoltaic, solar thermal (solar collectors for space heating, service water heating, and pool heating), geothermal energy, and wind systems used to generate energy and located on the building project.
  - *Geothermal energy* - Heat extracted from the Earth's interior and used to produce electricity, mechanical power, or provide thermal energy for heating buildings or processes. Geothermal energy does not include systems that use energy independent of the geothermal source to raise the temperature of the extracted heat, such as heat pumps.

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NREC: 1202/1203

Energy Metering *New Chapter in the Code*

- **1202 Whole Building Energy Supply Metering – Source Metering**
  - For energy sources listed in Table 12-1, whole building energy supply meters with remote metering capability or automatic meter reading capability (AMR) are required.
  - Utility service entrance/interval meters are allowed as a means to fulfill this requirement provided they have AMR capability.
  - Digital type meters are required.
  - These requirements and thresholds apply to new construction and replacement of existing energy source systems (1203).
  - Existing buildings are allowed to reuse existing analog-type utility service entrance/interval meters.

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NREC: 1202

1202 Whole Building Energy Supply Metering – Submetering

TABLE 12-2
COMPONENT ENERGY MASTER SUBMETERING THRESHOLDS

Component	Submetering Threshold
Chillers/heat pump systems	> 70 kW (240,000 Btu/h) cooling capacity
Packaged AC unit systems	> 70 kW (240,000 Btu/h) cooling capacity
HVAC fan systems	> 15 kW (20 hp)
Exhaust fan systems	> 15 kW (20 hp)
Make-up air fan systems	> 15 kW (20 hp)
Pump systems	> 15 kW (20 hp)
Cooling towers systems	> 15 kW (20 hp)
Boilers, furnaces and other heating equipment systems	> 300 kW (1,000,000 Btu/h) heating capacity
General lighting circuits	> 15 kVA
Miscellaneous electric loads	> 15 kVA

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NREC: 1202

Energy Metering *New Chapter in the Code*

- **1202 Whole Building Energy Supply Metering – Submetering**
  - Miscellaneous electric loads are any other electric load that is not cited in Table 12-2. This may include plug loads and electric circuits for items such as for commercial cooking and refrigeration equipment, elevators and escalators.
  - For subsystems with multiple similar units, such as multicell cooling towers, only one meter is required for the subsystem.
  - Current sensors or flow meters that have remote metering capability are allowed for submetering.
  - These requirements and thresholds apply to new construction and replacement of existing subsystems (1203)

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2009 Washington State Nonresidential Energy Code Compliance Forms

- Interior Lighting Summary (LTG-INT)
- Lighting Power Allowance Adjustments (LTG-LPA)
- Exterior Lighting Summary (LTG-EXT)
- Lighting, Motor and Transformer Permit Plans Checklist (LTG-CHK)

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Question & Answer

- NREC compliance forms will be available for free download from www.neec.net in June 2010.
- Technical Assistance
  - Stan Price & Lisa Rosenow at NEEC
    - » Stan@putnamprice.com
    - » Lisa@putnamprice.com

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