6.4 Space Uses

Each thermal block discussed above may be subdivided into HVAC zones and the HVAC zones may be further subdivided into space uses. This section presents the building descriptors that relate to the space uses. Space uses and the defaults associated with them are listed in Appendix B. Every thermal block shall have at least one space, as defined in this section, when the space-by-space method is used. The spaces and space uses in the baseline building shall generally be the same as the rated building, except that when daylighting is modeled in the baseline building but not the rated building,the space in the baseline building shall be divided into a daylighted portion (50%) and a non-daylighted portion (50%).

6.4.1 General Information

Classification	
Applicability	When building space type uses are known and can be delineated within the building area
Definition	Space-by-space classification is one of two available classification methods for identifying the function of the building, which for most purposes determines certain energy-related requirements for the baseline and create defaults for the proposed building design. See Appendix B for a list of the building types and space types that may be selected.
Units	List: See the tables in Appendix B. If the building activity is specified by the whole building method, then this input is not applicable.
Input Restrictions	The space-by-space method is restricted to the common space types defined in Section 9 of ASHRAE 90.1 and listed in Appendix B. Detailed information about each space must be known in order for the space-by-space method to be used over the whole building method. Either method may be used, but the two may not be mixed within a single rating.
Baseline Rules	The baseline building shall have a corresponding space type for each one in the proposed design and the classifications shall be the same.

Floor Area	
Applicability	All projects that use the space-by-space classification method (see above)
Definition	The floor area of the space. The area of the spaces that make up a thermal block shall sum to the floor area of the thermal block.
Units	Square Feet (ft²)
Input Restrictions	Area shall be measured to the outside of exterior walls and to the center line of partitions.
Baseline Rules	Area shall be identical to the proposed design.

6.4.2 Occupants

Number of Occupants	
Applicability	All projects
Definition	The number of persons in a space. The number of persons is modified by an hourly schedule (see below), which approaches but does not exceed 1.0. Therefore, the number of persons specified by the building descriptor is similar to design conditions as opposed to average occupancy.
Units	The number of persons may be specified in an absolute number, ft²/person, or persons/1000 ft².
Input Restrictions	The number of occupants is prescribed for tax deductions. The number of occupants is a default for green building ratings and Design to Earn ENERGY STAR. For tax deductions, the values in Appendix B from the California 2005 ACM shall be used. Other defaults are also shown in Appendix B.
Baseline Rules	The number of occupants must be identical for both the proposed and baseline design cases.

Occupant Heat Rate	
Applicability	All projects
Definition	The sensible and latent heat produced by each occupant in an hour. This depends on the activity level of the occupants and other factors. Heat produced by occupants must be removed by the air conditioning system as well as the outside air ventilation rate and can have a significant impact on energy consumption.
Units	Btu/h specified separately for sensible and latent gains
Input Restrictions	The occupant heat rate is prescribed for tax deductions. The occupant heat rate is a default for green building ratings and Design to Earn ENERGY STAR. For tax deductions, the values in California 2005 ACM Appendix B from the shall be used.
Baseline Rules	The occupant heat rate for the baseline building shall be the same as the proposed design.

Occupancy Schedule	
Applicability	All projects
Definition	The occupancy schedule modifies the number of occupants to account for expected operational patterns in the building. The schedule adjusts the heat contribution from occupants to the space on an hourly basis to reflect time-dependent usage

patterns. The occupancy schedule can also affect other factors such as outside air ventilation, depending on the control mechanisms specified.

Units — Data structure: schedule, fractional.

Input Restrictions — The occupant schedule is prescribed for tax deductions. The occupant schedule is a default for green building ratings and Design to Earn ENERGY STAR. For tax deductions, an appropriate schedule from Appendix C Tables 12-16 (California 2005 ACM) shall be used.

Baseline Rules — Occupancy schedules are identical for proposed and baseline building designs

6.4.3 Interior Lighting

The building descriptors in this section are provided for each lighting system. Typically a space will have only one lighting system, but in some cases, it could have two or more. Examples include a general and task lighting system in offices or hotel multi-purpose rooms that have lighting systems for different functions.

Regulated Interior Lighting Power

Applicability — All projects

Definition — Total connected lighting power for all regulated interior lighting power. This includes the loads for lamps and ballasts.

Units — W/ft²

Input Restrictions — As designed. The connected power should be cross-referenced to a space type and to the construction documents

Baseline Rules

With the building classification method, use the product of the lighting power density for the building classification from Appendix B and the floor area of the space.

With the space-by-space method, use the product of the lighting power densities for the space-by-space from Appendix B and the floor areas for the corresponding spaces.

Non-Regulated Interior Lighting Power

Applicability — All projects

Definition

Power for the following lighting equipment and applications are exempt from the baseline standards, provided they are controlled by an independent control device:

a. Display or accent lighting that is an essential element for the function performed in galleries, museums, and monuments.
b. Lighting that is integral to equipment or instrumentation and is installed by its manufacturer.
c. Lighting specifically designed for medical or dental procedures and lighting integral to medical equipment.
d. Lighting integral to both open and glass enclosed refrigerator and freezer cases.
e. Lighting integral to food warming and food preparation equipment.
f. Lighting for plant growth or maintenance.
g. Lighting in spaces specifically designed for use by the visually impaired.
h. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
i. Lighting in interior spaces that have been specifically designated as registered historic landmark interiors.
j. Lighting that is an integral part of advertising or directional signage.
k. Exit signs
l. Lighting that is for sale or lighting educational demonstration systems.
m. Lighting for theatrical purposes including performance, stage, motion picture or television production.
n. Lighting for television broadcasting in sporting activity areas.
o. Casino gaming areas.
p. Furniture mounted supplemental task lighting that is controlled by automatic shut-off and local control (added in ASHRAE 90.1-2007).

In addition, lighting is exempt that is specifically designated as required by a health or life safety statute, ordinance, or regulation for reasons of safety or security.

Emergency lighting that is automatically off during normal building operation is not considered.

Units — W/ft²

Input Restrictions — As designed. The non-regulated lighting power should be cross-referenced to the type of exception and to the construction documents. The default for non-regulated lighting power is zero.

Baseline Rules — The non-regulated interior lighting in the baseline building shall be the same as the proposed design.

Lighting Schedules

Applicability — All projects

Definition — Schedule of operation for interior lighting power used to adjust the energy use of lighting systems on an hourly basis to reflect time-dependent patterns of lighting usage. Different schedules may be defined for different lighting circuits, depending on the capabilities of the software.

Units — Data structure: schedule, fractional

Input Restrictions — The lighting schedule is prescribed for tax deductions. The lighting schedule is a default for green building ratings and Design to Earn ENERGY STAR. For tax deductions, an appropriate schedule from Appendix C Tables 12-16 for the California 2005 ACM shall be used. For green building ratings and Design to Earn ENERGY STAR, the default schedules

California 2005 ACM shall be used. For green building ratings and Design to Earn ENERGY STAR, the default schedules are presented in Appendix C.

Baseline Rules The baseline building shall use the same lighting schedules as the proposed design. The only exception to this rule is when the proposed design has a task/ambient lighting system. In this case the proposed design task lighting system may be controlled on a different schedule and the proposed design schedule proposed for the ambient lighting system is used for all the lighting in the baseline building.

Retail Display Lighting Power

Applicability Display lighting in retail display and other space-by-space classifications

Definition

Display lighting is special lighting to highlight merchandise. Its purpose is to enhance the visual appearance of the merchandise and not to provide lighting for a visual task. Display lighting is treated as use-it-or-lose-it in ASHRAE Standard 90.1. To qualify for display lighting, the lighting must be separately controlled from the general lighting.

ASHRAE Standard 90.1-2007 defines four categories of display lighting:

- Retail Area 1 (all other)
- Retail Area 2 (vehicles, sporting goods)
- Retail area 3 (furniture clothing cosmetics)
- Retail area 4 (jewelry, crystal, china).

Units W or W/ft²

Input Restrictions As designed. The default for lighting power for retail display wattage is 0.0 watts. When display lighting is entered in the software, its purpose shall be defined (see the categories above in the definitions section).

Baseline Rules Baseline building lighting power is the lesser of proposed design power or the allowed power. The allowed lighting power is defined as the floor area of the retail display times the allowances in Table 6.4.3-1 [1].

Table 6.4.3-1: *"Lighting Power Allowances for Retail Display Lighting"*

ASHRAE Standard 90.1-2007	
Category	Allowed Power (W/ft²)
Retail Area 1	1.0
Retail Area 2	1.7
Retail Area 3	2.6
Retail Area 4	4.2

Decorative Lighting Power

Applicability All projects that have decorative lighting and are rated using the space-by-space method

Definition

Decorative lighting includes wall sconces, chandeliers and other decorative lighting that is provided for purposes other than illuminating visual tasks. The baseline standards treat this lighting as use-it-or-lose-it.

Units W or W/ft2

Input Restrictions As designed. The default for decorative lighting power is 0.0 watts/ft2. When using the space-by-space method, the user may input the power for qualifying decorative lighting using the decorative lighting power descriptor and cross-referencing the construction documents.

Baseline Rules For the space-by-space method, decorative lighting power in the baseline building is equal to the lesser of the actual wattage of decorative lighting specified for the proposed design or 1.0 W/ft2.

Lighting Power for VDT Viewing

Applicability Tax deductions only (ASHRAE Standard 90.1-2001 baseline)

Definition

ASHRAE Standard 90.1-2001 provided additional lighting in spaces that are intended for use with video display terminals (VDT). This special allowance was eliminated with ASHRAE Standard 90.1-2007 and only applies for the purpose of calculating tax deductions.

In order for a space to qualify for the special allowance, the specified luminaires must have special optical characteristics that direct most of the light down and minimize light cast to the sides. Specifically, a qualifying luminaire must serve a VDT viewing task and provide a maximum luminance measured from the vertical of 80 candelas/ft2 at 65 degrees, 33 candelas/ft2 75 degrees and 17 candelas/ft2 at 85 degrees or greater.

Units W/ft2

Input Restrictions As designed. The default for lighting power for VDT viewing is 0.0 watts/ft2 . The user may input qualifying lighting power for qualifying areas with cross-references to lighting schedules and spaces on the construction documents. A cut-sheet tabulating the candela distribution of the luminaires shall be provided.

Baseline Rules The allowed lighting power for qualifying spaces is increased by 0.35 W/ft2 from the allowed values in Appendix B.

Light Heat Gain Distribution

Applicability All projects

Definition

The distribution of the heat generated by the lighting system that is directed to the space, the plenum, the HVAC return air, or to other locations. This input is a function of the luminaire type and location. Luminaires recessed into a return air plenum contribute more of their heat to the plenum or the return air stream if the plenum is used for return air; while pendant mounted fixtures hanging in the space contribute more of their heat to the space. Common luminaire type/space configurations are listed in Table 3, Chapter 18, 2009 ASHRAE Handbook – Fundamentals, summarized in Table 6.4.3-1 [2] below. Typically the data will be linked to list of common luminaire configurations similar to Table 6.4.3-1 [2] so that the user chooses a luminaire type category and heat gain is automatically distributed to the appropriate locations.

This input may also be used to approximate the benefit of displacement ventilation (see Chapter 7).

Units List (of luminaire types) or data structure consisting of a series of decimal fractions that assign heat gain to various locations.

Input Restrictions Default values listed in Table 6.4.3-1 [2] shall be used as a default when the luminaire categories apply. Values within the ranges of Table 6.4.3-1 [2] may be used when following the rules in the 2009 HOF. Other values may be used when manufacturers' literature and/or testing data is available, and adequate documentation is provided to the rating authority. Where lighting fixtures having different heat venting characteristics are used within a single space, the wattage weighted average heat-to-return-air fraction shall be used.

Baseline Rules The baseline building shall use the above referenced defaults.

Table 6.4.3-2: *"Light Heat Gain Parameters for Typical Operating Conditions"*

Source: 3, Table 3, Chapter 18, 2009 ASHRAE Handbook – Fundamentals

Luminaire Category	Space Fraction	Radiative Fraction
Recessed fluorescent luminaire without lens	0.64 to 0.74 (default 0.69)	0.48 to 0.68 (default 0.58)
Recessed fluorescent luminaire with lens	0.40 to 0.50 (default 0.45)	0.61 to 0.73 (default 0.67)
Downlight compact fluorescent luminaire	0.12 to 0.24 (default 0.18)	0.95 to 1.00 (default 0.97)
Downlight incandescent luminaire	0.70 to 0.80 (default 0.75)	0.95 to 1.00 (default 0.97)
Non-in-ceiling fluorescent luminaire	1.0 (default 1.0)	0.50 to 0.57 (default 0.53)

Power Adjustment Factors (PAF)

Applicability All projects

Definition Automatic controls that are not already required by the baseline standard and which reduce lighting power more or less uniformly over the day can be modeled as power adjustment factors. Power adjustment factors represent the percent reduction in lighting power that will approximate the effect of the control. Models account for such controls by adjusting the installed power by (1 – PAF).
The types of controls that are recognized for credit are listed in ASHRAE Standard 90.1-2007, Appendix G, Table G3.2 and shown below in Table 6.4.3-3 [3].

Units List: control types (see above) linked to PAFs

Input Restrictions As designed

Baseline Rules PAF is zero

Table 6.4.3-3: *"Power Adjustment Factors"*

Automatic Control Device	Non-24-hour occupied buildings that are less than 5,000 ft²	Other buildings
Programmable timing control	10%	0%
Occupant sensor	15%	10%
Occupant sensor and programmable timing controls	15%	10%
Bi-level parking garage controls[1]	30%	30%
Bi-level controls in hotel corridors	20%	20%
Scene controller with timeclock	20%	20%

1. Bi-level Smart LED Parking Garage Lighting, Public Interest Energy Research Program IOU Partnership Draft-Case Study http://cltc.ucdavis.edu/images/_projects/demonstration/bi_level_smart_led_parking_garage_lighting/pier_demo_uc_csu_bi_level_smart_led_parking_garage_lighting.pdf

6.4.4 Daylighting Control

This group of building descriptors is applicable for spaces that have daylighting controls.

Daylight Modeling Method

Applicability All spaces with daylighting controls

Definition

The method used to model daylighting. Daylighting credits must be calculated based on the local climate and daylight models of the space. Building descriptors are provided in this section for an internal daylighting model and two variations of an external daylighting model:

1. **Internal daylighting model**. With this method, the simulation model has the capability to model the daylighting contribution for each hour of the simulation and make an adjustment to the lighting power for each hour, taking into account factors such as daylighting availability, geometry of the space, daylighting aperture, control type and the lighting system. The assumption is that the geometry of the space, the reflectance of surfaces, the size and configuration of the daylight apertures, and the light transmission of the glazing are taken from other building descriptors.
2. **External daylighting model**. An external daylighting model may be used in combination with an hourly simulation program to calculate daylighting savings as long as it produces consistent results and makes use of the key assumptions described below for internal daylighting models. Exterior daylight models include, but are not limited to, the following types of methods:
   A. **Schedule adjustments**. With this method, a space is modeled in a stand alone daylighting program to determine the amount of interior daylight available different times of the year and for different times of the day. In addition this program has an electric lighting model that calculates the electricity savings by hour based on interior illuminance and the daylighting control type (switching, dimming etc.). These savings values are converted into a schedule of electric lighting power reduction multipliers. This lighting power reduction schedule is applied to the proposed design energy simulation model and results in reduced electric lighting energy consumption and reduced internal heat gain, both of which are reflected in the proposed design energy consumption.
   B. **Daylight ratio**. With this method, an outside program pre-calculates a relationship between outdoor daylight conditions (illuminances or luminances) and interior illuminance. Within the rating software, interior illuminance is calculated from the daylighting ratios and the daylight conditions derived from data on the local weather file. The remainder of the calculations are the same as for an internally calculated daylight model where the interior illuminances are compared to an illuminance setpoint and electric lighting power is calculated based on control type. The two most widely used methods of pre-calculating daylighting ratios are the modified daylight factor method and the daylight coefficients method.
      a. The modified daylight factor method uses pre-calculated diffuse and direct illuminance daylight factors and multiplies these by diffuse and direct beam outdoor illuminance from the weather file to calculate interior illuminance.[1] Daylight factors are calculated from a simulation of the space that relies on user entered information about the space modeled such as orientation, geometry, material properties (transmittances and reflectances) etc. For any given hour, the interior illuminance at the reference point is calculated by the direct beam angle specific daylight factor multiplied by the outdoor direct beam and clear sky illuminance and this is added to the overcast daylight factor multiplied by the overcast sky illuminance. Outdoor direct beam, clear sky and overcast sky illuminances are calculated from the weather data used in the proposed building energy simulation.
      b. The daylight coefficients method is essentially a similar but more accurate method that relates internal illuminance to the luminance of patches of the sky.[2] The sky is divided up into patches as defined by altitude and azimuth. The daylight coefficients are ratios of interior illuminance to luminance for patches or areas on the sky dome. An outside daylight simulation program uses information about the space modeled: its orientation, geometry, material properties (transmittances and reflectances) etc, and calculates daylight coefficients for each sky patch. The precalculated daylight coefficients are then used to calculate interior illuminances for each hour. The illuminance for a location with the space at any point in time is the product of the luminance for each sky patch multiplied by the specific daylight coefficient for each sky patch integrated over the entire sky dome. The luminance for each sky patch is calculated from the weather data used in the proposed building energy simulation.

Other methods may be used by software developers as long as they produce consistent results. Regardless of the method used, it is desirable that all methods have the same key assumptions.

Units List (see above)
Input Restrictions As designed
Baseline Rules Not applicable

Lighting Schedules for Daylighting

Applicability Daylighted spaces that use the schedule adjustment method
Definition A schedule that indicates the reduction in electric lighting for the lighting system that is being controlled. This schedule is applied to the lighting schedule (see above) to produce a schedule for lighting with daylighting controls.
Units Data structure: schedule, fractional
Input Restrictions The schedule of adjustments should account for seasonal variations in the time of day. Since the schedule will apply for both sunny days and overcast days, the adjustments should represent the conservative condition, e.g. the smallest savings.
Baseline Rules Baseline does not have daylighting

Daylight Ratios

Applicability Daylighted spaces that use the daylight ratio method
Definition A matrix of daylight factors for the space that represent the ratio on illumination at the daylighting reference point to the exterior illumination. The simulation engine calculates the daylighting illumination at the reference point based on this information and the exterior illumination and uses the daylighting control building descriptors to determine for each hour how the lighting power is reduced.
Units Data structure: matrix
Input Restrictions The special daylighting program used to calculate the daylight factors should use inputs consistent with those described below for the internal daylight model method.

Baseline Rules The baseline building does not have daylighting

Daylighted Area

Applicability All daylighted spaces

Definition The floor area that is daylighted. Two types of daylighted areas are recognized. The primary daylighted area is the portion that is closest to the daylighting source and receives the most illumination. The secondary daylighted area is an area farther from the daylighting source, but still receives useful daylight.

Units Data structure

Input Restrictions

The default primary daylight area for sidelighting is a band near the window with a depth equal to the distance from the floor to the top of the window. The default secondary daylight area for sidelighting is a band beyond the primary daylighted area that extends a distance double the distance from the floor to the top of the window. Other daylight areas may be defined with appropriate documentation.

The default primary daylight area for toplighting is a band around the skylight well that has a depth equal to the 70% of the ceiling height. The default secondary daylight area for toplighting is a band beyond the primary daylighted area that extends 140% of the ceiling height.

Daylighted areas may not overlap or extend beyond partitions higher than 5 ft.

Error checking includes ensuring that the following is true:

Sidelit depth is less than or equal to ceiling height.

Total daylit area is no greater than space area.

Baseline Rules The baseline building does not have daylighting

Reference Position for Illuminance Calculations

Applicability Daylighted spaces that use the internal daylight model method

Definition The position of the daylight reference point within the daylighted space. Lighting controls are simulated so that the illuminance at the reference position is always above the illuminance setpoint. Thus for step switching controls, the combined daylight illuminance plus uncontrolled electric light illuminance at the reference position must be greater than the setpoint illuminance before the controlled stage of lighting can be tuned off. Similarly, dimming controls will be dimmed so that the combination of the daylight illuminance plus the controlled lighting illuminance is equal to the setpoint illuminance.

Units Data structure

Input Restrictions The reference location shall be as far away from daylight apertures as possible (but still within the daylighted area) so that all occupants have sufficient amounts of total illuminance (combined daylight and electric light) under all daylighting conditions.

Baseline Rules The baseline building does not have daylighting.

Illuminance Setpoint

Applicability Daylighted spaces that use the internal daylight model method

Definition The design illuminance for the daylighted space. The daylighting control adjusts the controlled lighting to maintain this level of illuminance at the reference point.

Units Footcandles

Input Restrictions As designed, but should be consistent with the visual tasks in the space and the recommendations of the IESNA.

Baseline Rules Baseline does not have a daylighting control.

Fraction of Controlled Lighting

Applicability Daylighted spaces that use the internal daylight model method or the daylight ratio method

Definition The fraction of the lighting power in the daylighted space that is controlled by daylight. This is applicable when some of the luminaires in the space are controlled by daylighting and others are not. This input can be eliminated if multiple lighting systems are modeled for each space and the system that is controlled by daylight is separately specified.

Units Numeric: fraction

Input Restrictions As designed

Baseline Rules Baseline does not have a daylighting control.

Daylighting Control Type

Applicability Daylighted spaces that use the internal daylight model method or the daylight ratio method

Definition

The type of control that is used to control the electric lighting in response to daylight available at the reference point. The options are:

- Step Switching controls have discrete steps of light output, where the fraction of rated power matches the fraction of light output. See Figure 6.4.4-1 [4].
- Step Dimming controls also have discrete steps of light output but typically the intermediate steps of light output are associated with higher levels of fraction of rated power. When the lights are fully off or fully on, the fraction of rated power matches the fraction of light output. See Figure 6.4.4-1 [4].
- Continuous Dimming controls have a fraction to rated power to fraction of rated output that is a linear interpolation of the minimum power fraction at the minimum diming light fraction to rated power (power fraction = 1.0) at full light output. See Figure 6.4.4-2 [5].
- Continuous Dimming + Off controls are the same as continuous dimming controls except that these controls can turn all the way off when none of the controlled light output is needed. See Figure 6.4.4-2 [5].

all the way off when none of the controlled light output is needed. See Figure 6.4.4-2 [5].

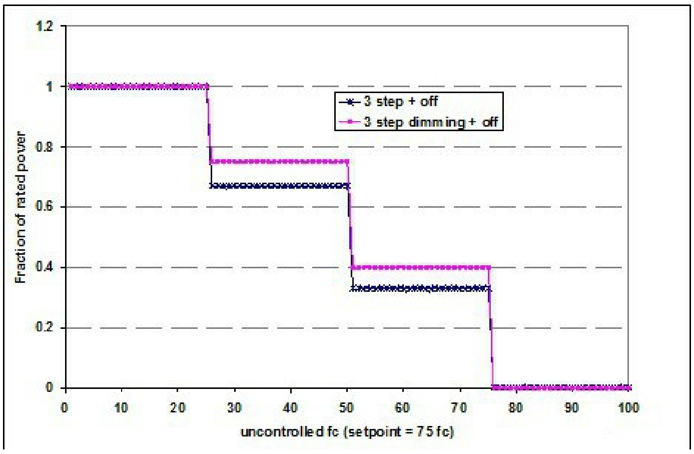

Figure 6.4.4-1: *"Example Stepped Daylighting Control"*

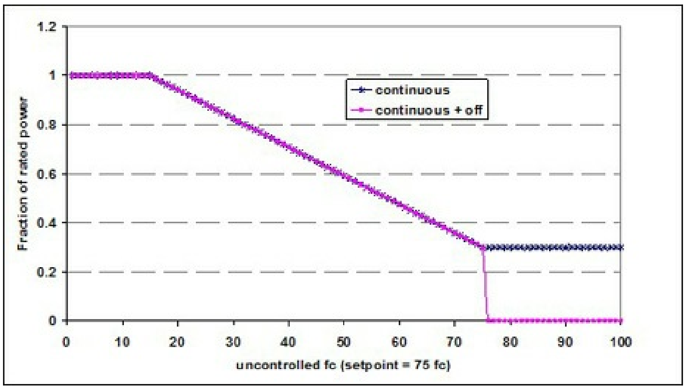

Figure 6.4.4-2: *"Example Dimming Daylight Control"*

Units	List (see above)
Input Restrictions	As designed
Baseline Rules	Baseline does not have a daylighting control.

Minimum Dimming Power Fraction

Applicability	Daylighted spaces that use the internal daylight model method or the daylight ratio method and dimming controls
Definition	The minimum power fraction when controlled lighting is fully dimmed. Minimum power fraction = (Minimum power) / (Full rated power). See Figure 6.4.4-2 [5].
Units	Numeric: fraction
Input Restrictions	As designed
Baseline Rules	Baseline does not have a daylighting control.

Minimum Dimming Light Fraction

Applicability	Daylighted spaces that use the internal daylight model method or the daylight ratio method and dimming controls
Definition	Minimum light output of controlled lighting when fully dimmed. Minimum light fraction = (Minimum light output) / (Rated light output). See Figure 6.4.4-2 [5].
Units	Numeric: fraction
Input Restrictions	As designed
Baseline Rules	Baseline does not have a daylighting control.

Number of Control Steps

Applicability	Daylighted spaces that use the internal daylight model method or the daylight ratio method and stepped controls
Definition	Number of control steps. For step switching, this term defines even steps of light output and even steps of rated power fractions. For step dimming, identifies number of steps that require fraction of rated light output and rated power fraction.
Units	Numeric: integer
Input Restrictions	Integer less than 10.
Baseline Rules	Baseline does not have a daylighting control.

Step Dimming Control Points

Applicability	Daylighted spaces that use the internal daylight model method or the daylight ratio method and stepped dimming controls
Definition	Number of control steps. For step switching, this term defines even steps of light output and even steps of rated power fractions. For step dimming, identifies number of steps that require fraction of rated light output and rated power fraction.
Units	Data structure. Matched pairs of data (light output and fraction of rated power) for the defined number of control steps
Input Restrictions	Integer less than 10. More than 10 steps approximate with continuous dimming.
Baseline Rules	Baseline does not have a daylighting control.

1. F. Winkelmann & S. Selkowitz. "Daylighting Simulation in DOE-2: Theory, Application, Validation and Applications." LBL-19829. http://simulationresearch.lbl.gov/dirpubs/19829.pdf
2. Tregenza P., Waters I, " Daylight coefficients", Lighting Research and Technology, 15(2), pp. 65- 71, 1983

6.4.5 Receptacle and Process Loads

Receptacle and process loads contribute to heat gains in spaces and directly use energy.

Receptacle and Process Power

Applicability All building projects

Definition

Receptacle power is power for typical general service loads in the building. Receptacle power includes equipment loads normally served through electrical receptacles, such as office equipment and printers, but does not include either task lighting or equipment used for HVAC purposes. Receptacle power values are slightly higher than the largest hourly receptacle load that is actually modeled because the receptacle power values are modified by the receptacle schedule, which approaches but does not exceed 1.0.

Receptacle power is considered an unregulated load; no credit has been offered in the past for savings; identical conditions have been required for both the baseline building and the proposed design. Offering credit for receptacle loads is difficult due to their temporal nature and because information is not always available on what equipment will go in the building. Tenants also have the ability to plug and unplug devices leisure or switch them out for different equipment, adding to the difficulty of assigning credit for promised energy efficiency.

Units Total power (W) for the space or power density (W/ft²)

Input Restrictions

For federal tax deductions, values from the California 2005 ACM column from Appendix B shall be used as a prescribed value. For this purpose, there is no credit for reductions in receptacle loads.

For green building ratings and Design to Earn ENERGY STAR, receptacle loads in the proposed design may be calculated in one of three ways:

1. The COMNET recommended defaults from Appendix B may be used, in which case the same values are used for the baseline building and there is no credit for reductions.
2. If detailed information is known, the receptacle power can be calculated using Equations (6.4.5-1) and (6.4.5-2). In this instance, the energy analyst must be able to estimate the number of personal computers, the number of printers and the number of other equipment in the space. If this detail is not available, then Method 1 above must be used. With Method 2, the multipliers in Equation (6.4.5-2) shall be equal to 1.0, e.g. no credit for reductions.
3. If detailed information is known and the owner is willing to make a long term commitment to purchase ENERGY STAR equipment, then Method 3 may be used. Method 3 is the same as Method 2, except that credit may be taken in the proposed design for reductions in receptacle power. The magnitude of the reduction depends on the length of the commitment, as determined from Table 6.4.5-3 [6].

Baseline Rules With Methods 1 and 2, the receptacle power in the baseline building shall be the same as the proposed design. When Method 3 is used for the proposed design, the baseline building receptacle power is established using Method 2, thereby providing a credit.

Requirements for Long Term Commitment One of the largest hurdles is establishing accountability; savings must be verified and credible. A commitment to good behavior will have to be documented appropriately, either in leasing language, within corporate (or organizational) resolutions, or in tenant manuals to ensure that energy efficient equipment will be used not only initially but also for future replacements. The inability to make long term commitments has prevented credits from being offered, since the equipment that makes up receptacle loads is short lived and replaced frequently. It is unfortunate that buildings have been restricted in this dimension since there is significant room for saving energy, especially as state and local regulations become more stringent and some strive for zero net-energy.

Equations for Estimating Receptacle Loads

This section describes the COMNET procedure for estimating receptacle and process power when detailed information is known. The procedure provides a means for taking credit for energy reductions when the owner is willing to make a long term commitment to purchase ENERGY STAR equipment. COMNET Methods 2 and 3 are based on procedures developed by NREL[1] which estimate receptacle and process power density based on a count of computers, printers and other equipment in the space. The procedure is shown in Equations (6.4.5-1) and (6.4.5-2).

(6.4.5-1)

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where

P	is the estimated power density for the space in W/ft².
PD_{sd}	is an estimate of receptacle power from personal computers, monitors, servers, printers and other equipment determined from Equation (6.4.5-2). Units are W/ft².
PD_{misc}	is an estimate of miscellaneous receptacle power for equipment not specifically accounted for in PDsd.

C_{sd}, is an adjustment coefficient from Appendix B, Table 2 based on the occupancy of the space. This coefficient along with PDmisc accounts for unreported equipment. Csd scales with the estimated equipment power, while PDmisc is a constant.

d is a diversity factor from Appendix B, Table 2 based on the occupancy of the space.

(6.4.5-2)

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where

M_{xx} is the energy efficiency multiplier from Table 6.4.5-3 [6] for the "xx" device in question. For Method 2, Mxx is always unity (1.0), e.g. no credit.

N_{xx} is the number of devices in the proposed design for the "xx" device in question.

P_{xx} is the nominal mean power from Table 6.4.5-1 [7] for the "xx" device in question.

Area is the area of the space in ft².

Credit is limited to equipment where the ENERGY STAR program applies, including PCs, monitors, copiers, laser and inkjet printers, vending machines, and refrigerators. No credit is offered for equipment for which the program does not apply.

Table 6.4.5-1: *"Nominal Mean Power for Surveyed Devices"*

Subscript	Mean Nominal Peak Power Levels of Surveyed Devices	CBECS Variable	Data Source	Nominal Mean Power (W)
PC	Personal computers	PCNUM8	Roth et al. 2002	55
CRT	CRT personal computer monitors	PCNUM8	Roth et al. 2002	90
LCD	Flat personal computer monitors	PCNUM8	Roth et al. 2002	25
Server	Servers	SRVNUM8	Roth et al. 2002	650
POS	Point of sale (cash registers)	RGSTRN8	Roth et al. 2002	50
Las	Laser Printers	PRNTRN8	Roth et al. 2002	263
Ink	Ink Jet Printers	PRNTRN8	Roth et al. 2002	42.5
Copy	Copy machines	COPRN8	Roth et al. 2002	660
Refrig	Residential refrigerators	RFGRSN8	Assumption	350
Vend	Vending machines	RFGVNN8	Assumption; see ADL 1993)	450

Table 6.4.5-2: *"Credits for Energy Efficient Equipment"*

The credits are based on a 4% discount rate, which is consistent with the ENERGY STAR program.

		Credit for Energy STAR Equipment							
Subscript	Equipment	1 Year	2 Years	4 Years	5 Years	10 Years	15 Years	20 Years	30 Years
PC	PC	0.014	0.028	0.054	0.067	0.121	0.165	0.201	0.254
CRT	CRT Monitors	0.031	0.060	0.115	0.141	0.256	0.349	0.425	0.538
LCD	LCD Monitors	0.019	0.037	0.071	0.087	0.158	0.216	0.263	0.333
Server	Servers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
POS	POS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Las	Laser Printers	0.015	0.029	0.056	0.069	0.125	0.171	0.209	0.264
Ink	Inkjet Printers	0.027	0.052	0.100	0.123	0.223	0.304	0.370	0.469
Copy	Copiers	0.004	0.007	0.014	0.018	0.032	0.044	0.053	0.067
Refrig	Residential Refrigerators	0.011	0.022	0.043	0.052	0.095	0.130	0.159	0.201
Vend	Vending Machines	0.020	0.039	0.075	0.092	0.168	0.229	0.279	0.353

Table 6.4.5-3: *"Multipliers for Energy Efficient Equipment (1 – Credit)"*

The credits are based on a 4% discount rate, which is consistent with the ENERGY STAR program.

		Multipliers for Energy Efficient Equipment (1 – Credit)							
Subscript	Equipment	1 Year	2 Years	4 Years	5 Years	10 Years	15 Years	20 Years	30 Years
PC	PC	0.014	0.028	0.054	0.067	0.121	0.165	0.201	0.254
CRT	CRT Monitors	0.031	0.060	0.115	0.141	0.256	0.349	0.425	0.538
LCD	LCD Monitors	0.019	0.037	0.071	0.087	0.158	0.216	0.263	0.333

Server	Servers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
POS	POS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Las	Laser Printers	0.015	0.029	0.056	0.069	0.125	0.171	0.209	0.264
Ink	Inkjet Printers	0.027	0.052	0.100	0.123	0.223	0.304	0.370	0.469
Copy	Copiers	0.004	0.007	0.014	0.018	0.032	0.044	0.053	0.067
Refrig	Residential Refrigerators	0.011	0.022	0.043	0.052	0.095	0.130	0.159	0.201
Vend	Vending Machines	0.020	0.039	0.075	0.092	0.168	0.229	0.279	0.353

Receptable Schedule

Applicability	All projects
Definition	Schedule for receptacle power loads used to adjust the intensity on an hourly basis to reflect time-dependent patterns of usage.
Units	Data structure: schedule, fraction
Input Restrictions	For green building ratings and Design to Earn ENERGY STAR the schedule is a default. The default schedule for green building ratings and Design to Earn ENERGY STAR is taken from Tables 1 through 11 of Appendix C.
Baseline Rules	Schedules for the baseline building shall be identical to the proposed design.

1. Griffith, B, et. al., Methodology for Modeling Building Energy Performance across the Commercial Sector, Technical Report, (NREL/TP-550-41956, March 2008, Appendix C, Section C.14. Note that elevators and escalators have been removed from the NREL equation, since they are treated separately.

6.4.6 Commercial Refrigeration Equipment

Commercial refrigeration does not need to be modeled for calculation of tax deductions.

Commercial refrigeration equipment includes the following:

- Walk-in refrigerators
- Walk-in freezers
- Refrigerated casework

The 2008 California energy efficiency standards include refrigerated warehouses for the first time and there are plans to include walk-in refrigerators and freezers in the next update for 2011. ASHRAE has expanded the scope for Standard 90.1 to include more process energy, including commercial refrigeration. The building energy efficiency standards generally do not address commercial refrigeration, however, a recent USDOE standard scheduled to become effective in 2012 does address some of the equipment.

Walk-in refrigerators and freezers typically have remote condensers. Some refrigerated casework has remote condensers, while some have a self-contained condenser built into the unit. Refrigerated casework with built-in condensers reject heat directly to the space while remote condensers reject heat in the remote location, typically on the roof or behind the building.

Refrigerated casework can be further classified by the purpose, the type of doors and, when there are no doors, the configuration: horizontal, vertical or semi-vertical. USDOE has developed standards for refrigerated casework. Table 6.4.6-1 [8] shows these classifications along with the standard level of performance, expressed in kWh/d, which depends on the class of equipment, the total display area, and the volume of the casework.

Table 6.4.6-1: *"USDOE Requirements for Refrigerated Casework (kWh/d)"*

Table I-1- Standard Levels For Commercial Refrigeration Equipment

Equipment class [2]	Standard level * ** (kWh/day)***	Equipment class	Standard level * ** (kWh/day)
VOP.RC.M	0.82 x TDA + 4.07	VCT.RC.I	0.66 x TDA + 3.05
SVO.RC.M	0.83 x TDA + 3.18	HCT.RC.M	0.16 x TDA + 0.13
HZO.RC.M	0.35 x TDA + 2.88	HCT.RC.L	0.34 x TDA + 0.26
VOP.RC.L	2.27 x TDA + 6.85	HCT.RC.I	0.4 x TDA + 0.31
HZO.RC.L	0.57 x TDA + 6.88	VCS.RC.M	0.11 x V + 0.26
VCT.RC.M	0.22 x TDA + 1.95	VCS.RC.L	0.23 x V + 0.54
VCT.RC.L	0.56 x TDA + 2.61	VCS.RC.I	0.27 x V + 0.63
SOC.RC.M	0.51 x TDA + 0.11	HCS.RC.M	0.11 x V + 0.26
VOP.SC.M	1.74 x TDA + 4.71	HCS.RC.L	0.23 x V + 0.54
SVO.SC.M	1.73 x TDA + 4.59	HCS.RC.I	0.27 x V + 0.63
HZO.SC.M	0.77 x TDA + 5.55	SOC.RC.L	1.08 x TDA + 0.22
HZO.SC.L	1.92 x TDA + 7.08	SOC.RC.I	1.26 x TDA + 0.26
VCT.SC.I	0.67 x TDA + 3.29	VOP.SC.L	4.37 x TDA + 11.82
VCS.SC.I	0.38 x V + 0.88	VOP.SC.I	5.55 x TDA + 15.02

HCT.SC.I	0.56 x TDA + 0.43	SVO.SC.L	4.34 x TDA + 11.51
SVO.RC.L	2.27 x TDA + 6.85	SVO.SC.I	5.52 x TDA + 14.63
VOP.RC.I	2.89 x TDA + 8.7	HZO.SC.I	2.44 x TDA + 9.
SVO.RC.I	2.89 x TDA + 8.7	SOC.SC.I	1.76 x TDA + 0.36
HZO.RC.I	0.72 x TDA + 8.74	HCS.SC.I	0.38 x V + 0.88

[*] *TDA is the total display area of the case, as measured in the Air-Conditioning and Refrigeration Institute (ARI) Standard 1200-2006, Appendix D.*

[**] *V is the volume of the case, as measured in ARI Standard 1200-2006, Appendix C.*

[***] *Kilowatt hours per day.*

[2] *For this rulemaking, equipment class designations consist of a combination (in sequential order separated by periods) of : (1) An equipment family code (VOP=vertical open, SVO=semivertical open, HZO=horizontal open, VCT=vertical transparent doors, VCS=vertical solid doors, HCT=horizontal transparent doors, HCS=horizontal solid doors, or SOC=service over counter); (2) an operating mode code (RC=remote condensing or SC=self contained); and (3) a rating temperature code (M=medium temperature (38º F), L=low temperature (0ºF), or I=ice-cream temperature (-15ºF)). For example, "VOP.RC.M" refers to the "vertical open, remote condensing, medium temperature" equipment class. See discussion in section V.A.2 and chapter 3 of the TSD, market and technology assessment, for a more detailed explanation of the equipment class terminology. See table IV-2 for a list of the equipment classes by category.*

Walk-in refrigerators and freezers are not covered by the USDOE standards and test procedures. COMNET default values for these are given in Table 6.4.6-2 [9]. These values are expressed in W/ft² of refrigerator or freezer area. This power is assumed to occur continuously. Some walk-ins have glass display doors on one side so that products can be loaded from the back. Glass display doors increase the power requirements of walk-ins. Additional power is added when glass display doors are present. The total power for walk-in refrigerators and freezers is given in Equation (6.4.6-1).

(6.4.6-1)

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Where

$P_{Walk\text{-}in}$	is the estimated power density for the walk-in refrigerator or freezer in (W)
A_{xxx}	the area of the walk-in refrigerator or freezer (ft²)
N_{xxx}	the number of glass display doors (unitless)
PD_{xxx}	the power density of the walk-in refrigerator or freezer taken from Table 6.4.6-2 [9] (W/ft²)
D_{xxx}	the power associated with a glass display door for a walk-in refrigerator or freezer (W/door)
$_{xxx}$	subscript indicating a walk-in freezer or refrigerator (Ref or Frz)

Table 6.4.6-2: *"Default Power for Walk-In Refrigerators and Freezers (W/ft²)"*

Source: These values are determined using the procedures of the Heatcraft Engineering Manual, Commercial Refrigeration Cooling and Freezing Load Calculations and Reference Guide, August 2006. The EER is assumed to be 12.39 for refrigerators and 6.33 for Freezers. The specific efficiency is assumed to be 70 for refrigerators and 50 for freezers. Operating temperature is assumed to be 35 F for refrigerators and -10 F for freezers.

Floor Area	Refrigerator	Freezer
100 ft² or less	8.0	16.0
101 ft² to 250 ft²	6.0	12.0
251 ft² to 450 ft²	5.0	9.5
451 ft² to 650 ft²	4.5	8.0
651 ft² to 800 ft²	4.0	7.0
801 ft² to 1,000 ft²	3.5	6.5
More than 1,000 ft²	3.0	6.0
Additional Power for each Glass Display Door	105	325
Note:		

Refrigeration Modeling Method

Applicability	All buildings that have commercial refrigeration for cold storage or display
Definition	The method used to estimate refrigeration energy and to model the thermal interaction with the space where casework is located. Three methods are included in this manual:

- **COMNET defaults**. With this method, the power density values provided in Appendix B, Table 6[1] are used; schedules are assumed to be continuous operation.
- **USDOE performance ratings**. With this method, the energy modeler takes inventory of the refrigerated casework in

the rated building and sums the rated energy use (typically in kWh/day). Walk-in refrigerators and freezers shall use the defaults from Equation (6.4.6-1) and the values from Table 6.4.6-2 [9]. All refrigeration equipment is then assumed to operate continuously.

- **Explicit refrigeration model**. With this method, all components of the refrigeration system are explicitly modeled in DOE-2.2R or other hourly simulation program with this capability.[2]

The remaining building descriptors in this section apply to buildings that use either the COMNET defaults or the USDOE performance ratings.

Units	List (see above)
Input Restrictions	None
Baseline Rules	Method used to model the proposed design shall be used for the baseline building. Note that credit is offered only when the *USDOE performance ratings* method is used.

Refrigeration Power

Applicability	All buildings that have commercial refrigeration for cold storage or display and do not use the explicit refrigeration model
Definition	Commercial refrigeration power is the average power for all commercial refrigeration equipment, assuming constant year-round operation. Equipment includes walk-in refrigerators and freezers, open refrigerated casework, and closed refrigerated casework. It does not include residential type refrigerators used in kitchenettes or refrigerated vending machines. These are covered under *receptacle power*.
Units	Kilowatts (kW)
Input Restrictions	With the *COMNET defaults* method, the values in Appendix B, Table 6 are prescribed. These values are multiplied times the floor area of the rated building to estimate the refrigeration power. With the *USDOE performance ratings* method, refrigeration power is estimated by summing the kWh/day for all the refrigeration equipment in the space and dividing by 24 hours. The refrigeration power for walk-in refrigerators and freezers is added to this value.
Baseline Rules	Refrigeration power is the same as the proposed design when the COMNET defaults are used. When the *USDOE performance ratings* method is used, refrigeration power for casework shall be determined from Table 6.4.6-1 [8]; the power for walk-in refrigerators and freezers shall be the same as the proposed design.

Remote Condenser Fraction

Applicability All buildings that have commercial refrigeration for cold storage or display and use the *COMNET defaults* or *USDOE performance ratings* methods

Definition

The fraction of condenser heat that is rejected to the outdoors. For self-contained refrigeration casework, this value will be zero. For remote condenser systems, this value is 1.0. For combination systems, the value should be weighted according refrigeration capacity.

For refrigeration with self contained condensers and compressors, the heat that is removed from the space is equal to the heat that is rejected to the space, since the evaporator and condenser are both located in the same space. There may be some latent cooling associated with operation of the equipment, but this may be ignored with the *COMNET defaults* or *USDOE performance ratings* methods. The operation of self-contained refrigeration units may be approximated by adding a continuously operating electric load to the space that is equal to the energy consumption of the refrigeration units. Self-contained refrigeration units add heat to the space that must be removed by the HVAC system.

When the condenser is remotely located, heat is removed from the space but rejected outdoors. In this case, the refrigeration equipment functions in a manner similar to a continuously running split system air conditioner. Some heat is added to the space for the evaporator fan, the anti-fog heaters and other auxiliary energy uses, but refrigeration systems with remote condensers remove more heat from the space where they are located than they add. The HVAC system must compensate for this imbalance.

For remotely located condensers using the COMNET defaults or USDOE performance ratings methods, the heat that is removed from the space is determined as follows:

(6.4.6-2)

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Where

Q	The rate of heat removal from the space due to the continuous operation of the refrigeration system (kBtu/h). A negative number means that heat is being removed from the space; a positive number means that heat is being added.
kW	The power of the refrigeration system determined by using the COMNET defaults or the USDOE performance ratings method (kW)
F	The remote condenser fraction (see building descriptor below) (unitless)
COP	The coefficient of performance of the refrigeration system (unitless)

The simple approach outlined above assumes that there is no latent cooling associated with the refrigeration system. The heat addition or removal resulting from the above equation can be modeled in a number of ways, to accommodate the variety of calculation engines available. It can be scheduled if the engine can accommodate a heat removal schedule. It can be modeled as a separate, constantly running air conditioner, if the engine can accommodate two cooling systems serving the same thermal block. Other modeling techniques are acceptable as long as they are thermodynamically equivalent.

Units Fraction

Input Restrictions	None
Baseline Rules	Same as the proposed design

Refrigeration COP

Applicability	All buildings that have commercial refrigeration for cold storage or display and use the *COMNET defaults* or *USDOE performance ratings* methods
Definition	The coefficient of performance of the refrigeration system. This is used only to determine the heat removed or added to the space, not to determine the refrigeration power or energy.
Units	Fraction
Input Restrictions	This value is prescribed to be 3.6 for refrigerators and 1.8 for freezers.[3]
Baseline Rules	Same as the proposed design

Refrigeration Schedule

Applicability	All buildings that have commercial refrigeration for cold storage or display
Definition	The schedule of operation for commercial refrigeration equipment. This is used to convert refrigeration power to energy use.
Units	Data structure: schedule, fractional
Input Restrictions	Continuous operation is prescribed.
Baseline Rules	Same as the proposed design

1. See Table C-43, p. 146 of NREL/TP-550-41956, Methodology for Modeling Building Energy Performance across the Commercial Sector, Technical Report, Appendix C, March 2008. The values in this report were taken from Table 8-3 of the California Commercial End-Use Survey, Consultants Report, March 2006, CEC-400-2006-005
2. Direct modeling of refrigeration equipment in buildings is not broadly supported by energy simulation programs. The simulation program that is used in most energy analysis of refrigeration equipment is DOE-2.2R, which is a proprietary and limited release version of the DOE-2.2 simulation engine used by EQuest. EnergyPlus also has refrigeration modeling capabilities. These software applications allow the user to define the configuration of equipment and to specify the performance characteristics of each piece of equipment. These applications can also account for the interaction of the equipment with the temperature and humidity of the space where it is located. The complexity and variation of input for these models makes it very difficult to specify baseline conditions. For this reason, credit for efficient refrigeration systems is not offered in COMNET Phase I when explicit refrigeration models are used.
3. These values are consistent with the assumptions for the default values for walk-ins, which assume an EER of 12.39 for refrigerators and 6.33 for freezers.

6.4.7 Elevators, Escalators and Moving Walkways

Elevators, escalators and moving walkways do not need to be modeled for calculation of tax deductions.

Elevators, escalators and moving walkways account for 3% to 5% of electric energy use in buildings.[1] Buildings up to about five to seven stories typically use hydraulic elevators because of their lower initial cost. Mid-rise buildings commonly use traction elevators with geared motors, while high-rise buildings typically use gearless systems where the motor directly drives the sheave. The energy using components include the motors and controls as well as the lighting and ventilation systems for the cabs.

Elevators are custom designed for each building. In this respect they are less like products than they are engineered systems, e.g. they are more akin to chilled water plants where the engineer chooses a chiller, a tower, pumping and other components which are field engineered into a system. The main design criteria are safety and service. Some manufacturers have focused on energy efficiency of late and introduced technologies such as advanced controls that optimize the position of cars for minimum travel and regeneration motors that become generators when a loaded car descends or an empty car rises. These technologies can result in 35% to 40% savings.[2]

The motors and energy using equipment is typically located within the building envelope so it produces heat that must be removed by ventilation or by air conditioning systems. In energy models, a dedicated thermal zone (elevator shaft) will typically be created and this space can be indirectly cooled (from adjacent spaces) or positively cooled.

Little information is known on how to model elevators. As engineered systems, the model would need information on the number of starts per day, the number of floors, motor and drive characteristics, and other factors. Some work has been done to develop and categorize energy models for elevators[3] however for Phase I of this rules and procedures manual, a simple procedure is recommended based on a count of the number of elevators, escalators and moving walkways in the building. This data is shown in Table 6.4.7-1 [10].[4]

Table 6.4.7-1: *"Unit Energy Consumption Data for Elevators, Escalators and Moving Walkways"* [5]

Mode	Elevators		Escalators and Moving Walkways	
	Power (W)	Annual Hours	Power (W)	Annual Hours
Active	10,000	300	4,671	4,380
Ready	500	7,365	n.a.	0
Standby	250	1,095	n.a.	0
Off	0	0	0	4,380
Typical Annual Energy Use	7,000 kWh/y		20,500 kWh/y	

Elevator/Escalator Power

Applicability	All buildings that have commercial elevators, escalator, or moving walkways
Definition	The power for elevators, escalators and moving walkways for different modes of operation. Elevators typically operate in

three modes: active (when the car is moving passengers), ready (when the lighting and ventilation systems are active but the car is not moving), and standby (when the lights and ventilation systems are off). Escalators and moving walkways are either active or turned off.

Units	W/unit
Input Restrictions	The power values from Table 6.4.7-1 [10] for different modes of operation are prescribed for the proposed design.
Baseline Rules	Same as the proposed design

Elevator/Escalator Schedule

Applicability	All buildings that have commercial elevators, escalator, or moving walkways
Definition	The schedule of operation for elevators, escalators, and moving walkways. This is used to convert elevator/escalator power to energy use.
Units	Data structure: schedule, state
Input Restrictions	The schedule specified for the building should match the operation patterns of the building. The total number of hours for each mode of operation should match the values in Table 6.4.7-1 [10] (the default) unless documentation is provided to demonstrate that other schedules are appropriate.
Baseline Rules	Same as the proposed design

1. Sachs, Harvey M., Opportunities for Elevator Energy Efficiency Improvements, American Council for an Energy Efficiency Economy, April 2005
2. Ibid.
3. Al-Sharif, Lutfi, Richard Peters and Rory Smith, Elevator Energy Simulation Model, Elevator World, November 2005, Volume LII, No11
4. TIAX, Commercial and Residential Sector Miscellaneous Electricity consumption: Y20005 and Projections to 2030, Final Report to the U.S. Department of Energy's Energy Information Administration (EIA) and Decision Analysis Corporation (DAC), September 22, 2006, Reference Number D0366.
5. The TIAX report does not give energy consumption data for moving walkways. For the purposes of this manual, it is assumed to be equal to escalators.

6.4.8 Process, Gas

Commercial gas equipment does not need to be modeled for determination of tax deductions.

Commercial gas equipment includes the following:

- Ovens
- Fryers
- Grills
- Other equipment

The majority of gas equipment is located in the space and may contribute both sensible and latent heat. Gas equipment is typically modeled by specifying the rate of peak gas consumption and modifying this with a fractional schedule. Energy consumption data for gas equipment is only beginning to emerge.

Because of these limits, the COMNET procedure for commercial gas is limited in this first release of the rules and procedures. The procedure consists of prescribed power and energy values for use with both the proposed design and the baseline building. No credit for commercial gas energy efficiency features is offered.

The prescribed values are provided in Appendix B, Table 6[1]. Schedules are defaulted to be continuous operation.

Gas Equipment Power

Applicability	All buildings that have commercial gas equipment
Definition	Commercial gas power is the average power for all commercial gas equipment, assuming constant year-round operation.
Units	Btu/h-ft²
Input Restrictions	The values in Appendix B, Table 6 are prescribed.
Baseline Rules	Same as the proposed design

Gas Equipment Schedule

Applicability	All buildings that have commercial gas equipment
Definition	The schedule of operation for commercial gas equipment. This is used to convert gas power to energy use.
Units	Data structure: schedule, fractional
Input Restrictions	Continuous operation is prescribed. The default values for power are based on continuous operation, although this is not realistic.
Baseline Rules	Same as the proposed design

Gas Equipment Location

Applicability	All buildings that have commercial gas equipment
Definition	The assumed location of the gas equipment for modeling purposes. Choices are in the space or external.
Units	List (see above)
Input Restrictions	As designed.
Baseline Rules	Same as the proposed design

Radiation Factor

Applicability	Gas appliances located in the space

Definition	The fraction of heat gain to appliance energy use
Units	Fraction
Input Restrictions	Default value is 0.15. Other values can be used when a detailed inventory of equipment is known. The override value shall be based on data in Table 5C, Chapter 18, ASHRAE HOF, 2009, or similar tested information from the manufacturer.
Baseline Rules	Same as the proposed design

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1. See Table C-43, p. 146 of NREL/TP-550-41956, Methodology for Modeling Building Energy Performance across the Commercial Sector, Technical Report, Appendix C, March 2008. The values in this report were taken from Table 8-3 of the California Commercial End-Use Survey, Consultants Report, March 2006, CEC-400-2006-005

Source URL: http://www.comnet.org/mgp/content/64-space-uses

Links:
[1] http://www.comnet.org/mgp/content/643-interior-lighting#lighting-power-allowances-for-retail-display-lighting
[2] http://www.comnet.org/mgp/content/643-interior-lighting#light-heat-gain-parameters-for-typical-operating-conditions
[3] http://www.comnet.org/mgp/content/643-interior-lighting#power-adjustment-factors
[4] http://www.comnet.org/mgp/content/644-daylighting-control#example-stepped-daylighting-control
[5] http://www.comnet.org/mgp/content/644-daylighting-control#example-dimming-daylight-control
[6] http://www.comnet.org/mgp/content/receptacle-and-process-loads#multipliers-for-energy-efficient-equipment-(1—-Credit)
[7] http://www.comnet.org/mgp/content/receptacle-and-process-loads#nominal-mean-power-for-surveyed-devices
[8] http://www.comnet.org/mgp/content/commercial-refrigeration-equipment#USDOE-requirements-for-refrigerated-casework-(kWh/d)
[9] http://www.comnet.org/mgp/content/commercial-refrigeration-equipment#default-power-for-walk-in-refrigerators-and-freezers-(W/ft²)
[10] http://www.comnet.org/mgp/content/elevators-escalators-and-moving-walkways#unit-energy-consumption-data-for-elevators-,-escalators-and-moving-walkways