Energy Effective Lighting Checklist

Energy Effective Lighting accomplishes the dual objectives of being efficient while meeting the needs of the space occupants. The USDOE Federal Energy Management Program is committed to saving energy and improving workspaces for Federal workers at the same time. This checklist will help you avert common mistakes and improve your Federal relighting project.

PROJECT NAME _____ SPACE NAME _____

FORM COMPLETED BY _____ DATE _____ PAGE _____

SPACE DESCRIPTION, PLANNED USAGE AND WORKER TASKS _____

CURRENT LIGHTING SYSTEM AND CONTROLS _____

OPERATING HOURS _____ MAINTENANCE _____

Using this form: See the back of this form for instructions and information about each of these characteristics. Consideration of the issues below will allow the project team to implement the maximum energy savings feasible without compromising the comfort and effectiveness of the occupants.

NOTE: In all cases refer to the *IESNA Lighting Handbook 9th Edition, 2000* to find the lighting levels for your space and for additional design guidance.

1☑ Surface Brightness

WALLS *(use one or more of the following)*
- ☐ Wallwashing systems
- ☐ Parabolics within 3 feet of walls
- ☐ Lensed troffers within 4 feet of walls

CEILINGS *(if applicable)*
- ☐ Direct/indirect or indirect systems

ENVIRONMENTAL CONSIDERATIONS
- ☐ Light colored matte surfaces
  - ○ walls ○ ceiling ○ partitions

2☑ Overhead Glare

OVER WORKSTATION AREAS
- ☐ Open-cell parabolic fixtures have T8 lamps
- ☐ Open-cell parabolic fixtures have semi-specular louvers and white reflectors
- ☐ CF downlights have cross baffles

3☑ VDT Glare

FURNITURE PLAN REVIEW
- ☐ VDT screens oriented away from windows

REFLECTED GLARE FROM LENSED FIXTURES
- ☐ Bright screen background with dark text
- ☐ VDT screen covers if necessary

4☑ Task Lighting

TO SUPPLEMENT AMBIENT LIGHT LEVELS
- ☐ Fluorescent task lights with moveable arm

IN OFFICE FURNITURE SYSTEMS
- ☐ Under-cabinet task lighting

INDUSTRIAL SPACES
- ☐ Task lighting for visually difficult tasks

5☑ Controls

ALL SPACES
- ☐ Control strategy is appropriate for space usage
- ☐ Maximum energy savings potential is achieved
- ☐ Controls are compatible with lamps and ballasts
- ☐ Occupancy sensors are correctly located
- ☐ Clear commissioning guidelines
- ☐ Maintenance manual and staff training

HIGH INTENSITY DISCHARGE (HID) SOURCES
- ☐ Use bi-level ballasts with occupancy sensors

DAYLIGHTING CONTROLS
(see section 6)

6☑ Daylighting

WINDOWS
- ☐ Operable window shades or blinds
- ☐ Wallwashing fixtures or sconces in-between windows to avoid excessive contrast

DAYLIGHTING CONTROLS
- ☐ In task areas: continuous dimming with photocells
- ☐ In non-task areas: step switching with photocells

7☑ Lamp color and CRI

FLUORESCENT SOURCES
- ☐ Lamp colors match where possible
- ☐ Color Rendering Index of 70 or higher

HID SOURCES
- ☐ Color appearance appropriate for tasks
- ☐ CRI appropriate for tasks

8☑ Flicker / Ballasts

FLUORESCENT SOURCES
- ☐ Fixtures are wired in tandem
- ☐ Electronic ballasts are compatible with:
  - ○ lamps ○ controls ○ other technologies

HID SOURCES
- ☐ 3-phase system with alternating luminaires

☑ Checklist Instructions:

Use this checklist when developing your design and reviewing drawings for approval. Duplicate the checklist so that you have one for each of your project areas, and then review the project plans noting your acceptance or rejection of the plans considering each of the issues. If the plans need improvement, work with your project team to make the necessary changes prior to issuing approval.

1 **Surface Brightness** • Walls and ceiling should have light colored matte surfaces wherever possible to save energy and improve lighting quality. Go the extra mile to work with others as necessary to get interiors refinished with light colors throughout. Avoid the cave effect by lighting walls and/or ceilings. Use wallwashing fixtures to create brightness at the walls. If wallwashing is not possible, then be sure to locate recessed fixtures close to the walls. Typically, parabolic fixtures should be within 3 feet of the wall and should be fitted with semi-specular louvers in order to minimize scallops. White louvers may be used in hallways to increase wall brightness. Lensed fixtures should be within 4 feet of the wall. Consider direct/indirect or indirect lighting to create high visual comfort and a perception of brightness.

2 **Overhead Glare** • Direct glare from overly bright lamps and reflectors can cause significant visual discomfort. For downlights with compact fluorescent lamps, use cross baffles to provide shielding from the glare. In parabolic fixtures, use T8 lamps. T5's are best used in indirect or wallwashing fixtures so lamps are not exposed directly to the eye. For parabolic fixtures use semi-specular louvers and white reflectors. Specular reflectors are only acceptable in lensed or indirect fixtures.

3 **VDT Glare** • Modern computers have greatly improved monitors which has helped to reduce VDT glare from lensed fixtures. If lensed fixtures are unavoidable, instruct VDT users to select a bright background and dark text. If VDT screens are old or of poor quality, obtain diffuse screen covers. Avoid daylight glare by reviewing your furniture plan and orienting VDT screens away from windows.

4 **Task Lighting** • If occupant controlled task lights are used to supplement general lighting levels it may be possible to have the ambient light levels slightly reduced. Flexible fluorescent task lights with a moveable arm are the best for visual task performance. Linear under-cabinet task lights are important to reduce shadows and contrast in furniture systems. Industrial spaces with visually difficult tasks may need task lighting to achieve IESNA recommended lighting levels.

5 **Controls** • One of the best ways to save lighting energy is with the use of controls. Use them to reduce hours of operation and to adjust light levels according to tasks. Location and commissioning of occupancy sensors are critical to their correct operation. Careful selection and calibration of controls is needed to ensure occupant acceptance with optimum performance. Check with manufacturers to ensure compatibility of control system with lamps and ballast. Use bi-level ballasts with HID lamps in combination with occupancy sensors. Have clear commissioning guidelines and a maintenance manual.

6 **Daylighting** • Daylight is a great way to save energy and please occupants. The best daylighting provides gentle, uniform illumination throughout a space. Skylights (including retrofits) can work well in single story spaces. Be sure to provide window shades or blinds so occupants can control the intensity of the daylight. Bright windows can make adjacent walls look dark. To avoid excessive contrast, light the walls in between windows with wallwashing fixtures or sconces. To ensure energy savings, install continuous dimming controls with photocell sensors in daylit office or task areas. Step switching with photocells is very effective in non-task areas such as lobbies, corridors, and warehouse areas. Be sure that the lighting circuits on photocontrols are consistent with daylight illumination patterns. Pay extra attention to the commissioning of controls to ensure proper operation.

7 **Lamp Color and CRI** • In office environments, lamp color (Kelvin temperature) should be similar where possible. The CRI (Color Rendering Index) should be 70 or above. In industrial environments color is usually less critical, unless color-oriented tasks are being performed. For color appearance, metal halide (white light) is preferred over high pressure sodium (HPS, yellow light). Be aware that most colors are difficult to distinguish under HPS.

8 **Flicker / Ballasts** • Electronic ballasts reduce flicker, which has been shown to improve visual performance while saving energy. When choosing ballasts evaluate compatibility with lamps, controls and other technologies. When using 1 or 2-lamp fixtures, wire them in tandem to reduce ballast requirements. In industrial spaces with HID lamps use a 3-phase electric distribution system and put adjacent luminaires on alternate phases. This will reduce the possibility of stroboscopic effects from flicker, which is a potential safety concern.

[Source: IESNA Handbook]

Fig. 30-4. Checklist of Energy-Saving Guidelines for New Construction and Existing Spaces

Lighting Needs		
☐	Visual tasks: specification	Identify specific visual tasks and locations to determine recommended illuminances for tasks and for surrounding areas.
☐	Safety and esthetics	Review lighting requirements for given applications to satisfy safety and esthetic criteria.
☐	Overlighted application	In existing spaces, identify applications where maintained illumination is greater than recommended. Reduce energy by adjusting illuminance to meet recommended levels.
☐	Groupings: similar visual tasks	Group visual tasks having the same illuminance requirements, and avoid widely separated workstations.
☐	Task lighting	Illuminate work surfaces with luminaires properly located in or on furniture; provide lower ambient levels.
☐	Luminance ratios	Use wallwashing and lighting of decorative objects to balance brightnesses.
Space Design and Utilization		
☐	Space plan	When possible, arrange for occupants working after hours to work in close proximity to one another.
☐	Room surfaces	Use light colors for walls, floors, ceilings and furniture to increase utilization of light, and reduce connected lighting power to achieve required illuminances. Avoid glossy finishes on room and work surfaces to limit reflected glare.
☐	Space utilization branch circuit wiring	Use modular branch circuit wiring to allow for flexibility in moving, relocating or adding luminaires to suit changing space configurations.
☐	Space utilization: occupancy	Light building for occupied periods only, and when required for security or cleaning purposes (see chapter 31, Lighting Controls).
Daylighting		
☐	Daylight compensation	If daylighting can be used to replace some electric lighting near fenestration during substantial periods of the day, lighting in those areas should be circuited so that it may be controlled manually or automatically by switching or dimming.
☐	Daylight sensing	Daylight sensors and dimming systems can reduce electric lighting energy.
☐	Daylight control	Maximize the effectiveness of existing fenestration-shading controls (interior and exterior) or replace with proper devices or shielding media.
☐	Space utilization	Use daylighting in transition zones, in lounge and recreational areas, and for functions where the variation in color, intensity and direction may be desirable. Consider applications where daylight can be utilized as ambient lighting, supplemented by local task lights.
Lighting Sources: Lamps and Ballasts		
☐	Source efficacy	Install lamps with the highest efficacies to provide the desired light source color and distribution requirements.
☐	Fluorescent lamps	Use T8 fluorescent and high-wattage compact fluorescent systems for improved source efficacy and color quality.
☐	Ballasts	Use electronic or energy efficient ballasts with fluorescent lamps.
☐	HID	Use high-efficacy metal halide and high-pressure sodium light sources for exterior floodlighting.
☐	Incandescent	Where incandescent sources are necessary, use reflector halogen lamps for increased efficacy.
☐	Compact fluorescent	Use compact fluorescent lamps, where possible, to replace incandescent sources.
☐	Lamp wattage reduced-wattage lamps	In existing spaces, use reduced-wattage lamps where illuminance is too high but luminaire locations must be maintained for uniformity. *Caution:* These lamps are not recommended where the ambient space temperature may fall below 16°C (60° F).

Fig. 30.4. *Continued*

Lighting Sources: Lamps and Ballasts		
☐	Control compatibility	If a control system is used, check compatibility of lamps and ballasts with the control device.
☐	System change	Substitute metal halide and high-pressure sodium systems for existing mercury vapor lighting systems.
Luminaires		
☐	Maintained efficiency	Select luminaires which do not collect dirt rapidly and which can be easily cleaned.
☐	Improved maintenance	Improved maintenance procedures may enable a lighting system with reduced wattage to provide adequate illumination throughout system or component life.
☐	Luminaire efficiency replacement or relocation	Check luminaire effectiveness for task lighting and for overall efficiency; if ineffective or inefficient, consider replacement or relocation.
☐	Heat removal	When luminaire temperatures exceed optimal system operating temperatures, consider using heat removal luminaires to improve lamp performance and reduce heat gain to the space. The decrease in lamp temperature may, however, actually increase power consumption.
☐	Maintained efficiency	Select a lamp replacement schedule for all light sources, to more accurately predict light loss factors and possibly decrease the number of luminaires required.
Lighting Controls		
☐	Switching: local control	Install switches for local and convenient control of lighting by occupants. This should be in combination with a building-wide system to turn lights off when the building is unoccupied.
☐	Selective switching	Install selective switching of luminaires according to groupings of working tasks and different working hours.
☐	Low-voltage switching systems	Use low-voltage switching systems to obtain maximum switching capability.
☐	Master control system	Use a programmable low-voltage master switching system for the entire building to turn lights on and off automatically as needed, with overrides at individual areas.
☐	Multipurpose spaces	Install multicircuit switching or preset dimming controls to provide flexibility when spaces are used for multiple purposes and require different ranges of illuminance for various activities. Clearly label the control cover plates.
☐	"Tuning" illuminance	Use switching and dimming systems as a means of adjusting illuminance for variable lighting requirements.
☐	Scheduling	Operate lighting according to a predetermined schedule.
☐	Occupant / motion sensors	Use occupant / motion sensors for unpredictable patterns of occupancy.
☐	Lumen maintenance	Fluorescent dimming systems may be utilized to maintain illuminance throughout lamp life, thereby saving energy by compensating for lamp-lumen depreciation and other light loss factors.
☐	Ballast switching	Use multilevel ballasts and local inboard-outboard lamp switching where a reduction in illuminances is sometimes desired.
Operation and Maintenance		
☐	Education	Analyze lighting used during working and building cleaning periods, and institute an education program to have personnel turn off incandescent lamps promptly when the space is not in use, fluorescent lamps if the space will not be used for 5 min or longer, and HID lamps (mercury, metal halide, high-pressure sodium) if the space will not be used for 30 min or longer.

Fig. 30.4. *Continued*

Operation and Maintenance		
☐	Parking	Restrict parking after hours to specific lots so lighting can be reduced to minimum security requirements in unused parking areas.
☐	Custodial service	Schedule routine building cleaning during occupied hours.
☐	Reduced illuminance	Reduce illuminance during building cleaning periods.
☐	Cleaning schedules	Adjust cleaning schedules to minimize time of operation, by concentrating cleaning activities in fewer spaces at the same time and by turning off lights in unoccupied areas.
☐	Program evaluation	Evaluate the present lighting maintenance program, and revise it as necessary to provide the most efficient use of the lighting system.
☐	Cleaning and maintenance	Clean luminaires and replace lamps on a regular maintenance schedule to ensure proper illuminance levels are maintained.
☐	Regular system checks	Check to see if all components are in good working condition. Transmitting or diffusing media should be examined, and badly discolored or deteriorated media replaced to improve efficiency.
☐	Renovation of luminaires	Replace outdated or damaged luminaires with modern ones which have good cleaning capabilities and which use lamps with higher efficacy and good lumen maintenance characteristics.
☐	Area maintenance	Trim trees and bushes that may be obstructing outdoor luminaire distribution and creating unwanted shadows.

struction or existing spaces. The list can be scanned quickly to determine which ideas may be applicable for a particular installation. The designer should review these guidelines in consultation with the client and consider those which meet the needs of the client and occupants.

REFERENCES

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