GREEN SEAL'S Choose GREEN REPORT

NOVEMBER-DECEMBER 2000

ENERGY-EFFICIENT CFL DOWNLIGHT LUMINAIRES

The electricity cost to light US offices, factories, retail stores, warehouses, other commercial and industrial concerns, combined with outdoor lighting, is close to $20 billion annually. Lighting energy use accounts for about one quarter or more of the estimated one trillion kWh of energy yearly expended by the US commercial and industrial sectors. In fact, commercial and industrial lighting account for three-quarters of all lighting energy use in the US.

Downlight fixtures are one of the most popular lighting fixtures in the US, accounting for about 8% of all lighting energy use.

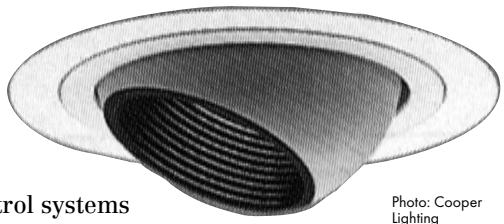

Photo: Cooper Lighting

It has been estimated that over 500 million downlight fixtures have been installed in institutional, commercial, and residential settings in the last two decades. They are now one of the most popular lighting fixtures in the US, accounting for about 8% of all lighting energy use. The majority of these fixtures relies on less efficient incandescent technology, and are often coupled with manual controls. More energy-efficient alternatives currently available include compact fluorescent systems with electronic ballasts, low-wattage high-intensity discharge systems, as well as advanced controls and sensors. More energy-efficient luminaires, combined with modern control systems, not only offer greater lighting comfort and productivity, but also longer lifetimes and reduced maintenance. Most importantly, these new luminaires and control systems together can cut lighting energy use in half or more—up to 80 percent by some estimates, over the incandescent lighting systems currently found in most buildings.

Less efficient indoor lighting sources often create heat along with light, and can be a serious source of excess heat in buildings. The additional cooling energy required to counteract this effect increases a building's total energy use. Thus, efficient lighting design not only reduces lighting energy usage and cost, it can also make a difference in other operational areas as well. This Green Seal™ *Choose Green Report* is the third in a series of three that focus on commercial and business applications of energy-efficient lighting.

Energy derived from fossil fuels or other non-renewable energy sources can seriously affect the environment: mining and exploration can damage fragile areas; the burning of fossil fuels releases carbon dioxide and methane, the two largest contributors to global climate change. In addition to greenhouse gases, electricity generation is a large source of sulfur oxides (S0x), the leading cause of acid rain, and nitrogen oxides (N0x), the leading cause of urban air pollution. Although energy use is the main environmental issue associated with lighting, another is the use of natural resources required to manufacture fixtures and lamps. Commercial and industrial lamp disposal can be a problem, since they may contain high pressure gases or mercury vapor.

This *Report* focuses specifically on applications of compact fluorescent lamp (CFL) downlight fixtures for general commercial, institutional, and retail use—where specific lighting conditions are required, combined with the need for long periods of illumination. Except for a few situations, applications of fluorescent lamp systems, both full size and compact, are recommended for most office, commercial, institutional, retail and even some industrial needs (see Green Seal's *Choose Green Report* on linear fluorescent luminaires). For warehouses, factories, large retail stores and other situations where uniform levels of illumination are required from high-mounted fixtures (12 feet or more in ceiling height), Green Seal recommends that high-intensity discharge (HID) lighting systems be con-sidered (see Green Seal's *Choose Green Report* on HID luminaires).

Because of their efficiency, new compact fluorescent downlight systems in both retrofitted and newly built spaces can provide many advantages, including:

- Reduced lighting energy use
- Improved lighting appearance
- Increased user comfort
- Reduction of excess heat in buildings
- Reduced maintenance needs.

CFL downlight luminaires are also referred to as "recessed cans" or "high-hats."

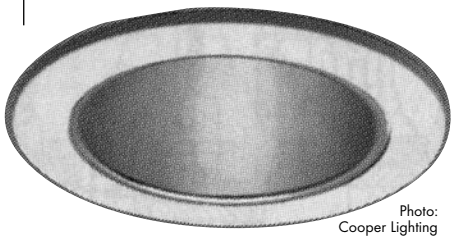

Photo: Cooper Lighting

CFL Downlight Luminaire Considerations

CFL downlight luminaires are also referred to as "recessed cans," or "high-hats," and their suitable applications can include:

- retail stores
- office and meeting spaces
- schools and other institutions
- hallways and lobbies
- waiting areas.

For these above spaces, compact fluorescent luminaires generally provide greater efficiency and ease of maintenance than incandescent lighting systems. A wide variety of downlight luminaire designs exists to meet most needs, and pricing for these products can range from under $50 per unit with lamp, to $200 or more, depending on trim, reflector, and diffuser options, as well as lamp, ballast selection and quantity.

Note that metal halide downlight luminaires are also available for certain lighting tasks, but are beyond the scope of this *Report*.

The term "downlight," as used in this *Report*, describes a recessed luminaire (lamp, ballast, housing, reflector, and/or lens or louver and trim assembly) with a circular or square aperture, housing one or more compact fluorescent light sources at the top of a dome-shaped housing/reflector unit. (In general usage, a "downlight" can also mean any ceiling fixtures used to direct light downwards.) Due to the nature of their design, most of the light produced by a downlight fixture is directed

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downward, typically in a conical shape. Reflectors, lenses, or louvers and trims are used to further direct or control the light output. Some specific luminaire types include:

Downlights are luminaires used to deliver a controlled beam of light from compact apertures, generally from 4 to 8 inches in opening diameter. Typically, the light beams from downlights can render better forms and textures. Thus, they are generally used in hallways, offices, conference rooms, and reception areas to provide soft, low-glare ambient lighting. They are also used to illuminate or highlight specific features or objects in a space, to provide the "accent " lighting.

"**Wallwashes**" are downlights used specifically to illuminate vertical surfaces, supplementing the ambient lighting in a space. Energy-efficient wallwash luminaires are available for both

TYPES OF LIGHTING

In general, the three types of lighting found in commercial, retail, and institutional applications include:

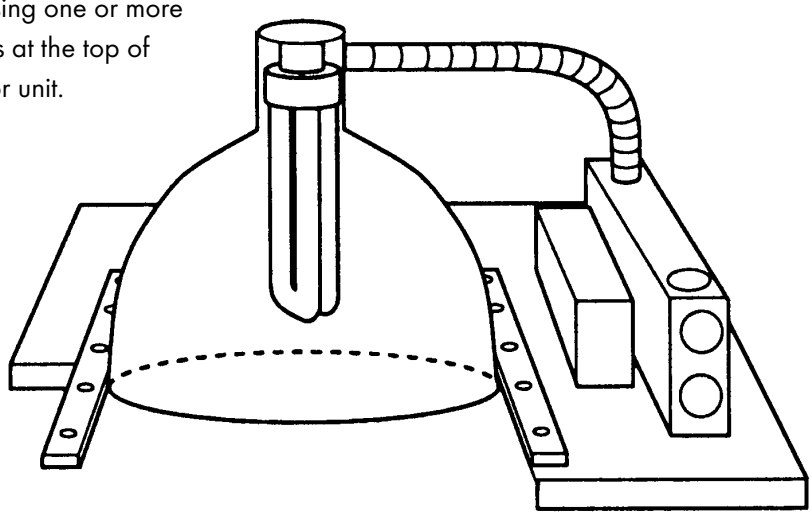
Ambient or **general lighting** creates the light that fills a space, and can utilize any number of lighting methods—indirect, direct, or diffuse. Downlights can be used to provide ambient or fill lighting, depending on the space's design. Ambient light levels can range from low to high. Most office, waiting areas, and other specialty, commercial /retail space use low to medium ambient levels.

Task lighting illuminates a specific work space only, and can come from luminaires mounted above, or a portable luminaire, such as table or desk lamps. It often supplements ambient lighting. Downlights have a rather limited usage as task lighting.

Accent lighting highlights specific features of a space: artwork, architectural or retail attraction, or graphics. It directs and focuses light to create visual interest in a space rather than any specific function. Accent lighting with downlights and/or spotlights is used more extensively in the retail environment to create dramatic effects for merchandising.

THE MECHANICS OF A DOWNLIGHT LUMINAIRE

A "downlight" is a recessed luminaire (lamp, ballast, housing, reflector, and/or lens or louver and trim assembly) with a circular or square aperture, housing one or more compact fluorescent light sources at the top of a dome-shaped housing/reflector unit.



Source: *Specifier Reports: CFL Downlights,* Lighting Research Center, 1996

linear and compact fluorescent lamps. They are used to illuminate the vertical surfaces near the intersection of walls and ceilings, and are generally found in the perimeter of open plan offices, conference rooms, reception, lobby and executive areas.

Retrofit vs. New

For a large number of existing downlight applications, incandescent and tungsten halogen systems tend to use more energy and produce excess heat, resulting in high energy consumption and user discomfort. They also require high levels of maintenance due to the shorter life of incandescent lamps. Energy and labor saving measures for these spaces can come from:

- Replacing incandescent lamps with compact fluorescent lamps.
- Improving existing fixtures to increase light quality, efficiency, and user comfort.
- Installing control technologies such as sensors or automatic switching systems.
- Retrofitting or replacing existing systems with the most efficient downlight luminaires.

The first three measures listed above are beyond the scope of this *Report*. The fourth is within the scope of this *Report*, but users need to note that retrofitting existing systems often does not mean a one-to-one fixture swap.

Compact Fluorescent Lamp Technology Overview

Compact fluorescent lamps, or CFLs, work on the same principle as their full-size brethren. CFLs use an electric arc from ballast to energize mercury atoms enclosed in an evacuated, phosphor coated glass tube. The energy released by the mercury atoms as they return to their lower energy state cause the phosphor coating inside the glass tube to glow, or "fluoresce," creating light. CFLs, however, differ from full-size fluorescent lamps in several important areas: their tube diameters are much narrower—most CFLs are T-5s (5/8 in. in diameter or less); they connect to their power supply through a base or socket system. Integral CFLs have a ballast built into the base of the lamp.

CFL are available with either magnetic or electronic ballasts, in both integral and modular configurations. CFLs' efficacy—the light output from a given amount of input power—can vary greatly with lamp wattage, ballast type, and ballast quality. In general, higher wattage lamps are more efficient than lower wattage lamps. Electronically-ballasted CFLs are about 20 percent more efficient than magnetically ballasted models, and offer many advantages, including smooth starting, silent operation, and light weight.

In addition, electronic ballasts capable of driving more than one CFL are now available from a number of manufacturers at competitive prices. These new designs offer increased efficiency (ballast losses are divided among the lamps), and reduced cost. Table 1 illustrates the difference in lamp/ballast combinations' efficacy levels.

CFL downlights' combination of energy efficiency and long life makes their application compelling, especially where they are likely to be on for long periods, or where lamps are difficult to

SOME KEY CFL POINTS

- Compact fluorescent lamps (CFLs) are now available in a wide range of wattages (7 to 55) and color rendering indices (up to 85+ CRI) to suit a variety of needs.
- CFLs are currently available in different color temperature ranges (2,700 K to 5,000 K) to match incandescent and halogen lamp's color temperature range (2,700 K to 3,000 K), as well as daylight (5,000 K).
- Dimmable CFL and ballast systems are now available from a number of manufacturers at competitive prices.
- CFLs offer two significant benefits over incandescent lamps that are often overlooked: longer life (8,000 to 20,000 hours vs. 800 to 2,000 hours), and high efficacy (up to 75% less energy for the same light output).

TABLE 1 *System Efficacy by Wattage*

Lamp Wattage	Typical System Efficacy (lumens/Watt) Magnetic Ballast	Electronic Ballast
9 W	37	44
13 W	48	53+
18 W	50	60+
27 W	60	65+
42 W	68	70+

replace. However, there are some applications where extra care is needed to avoid less than desirable results; these include:

■ **Extremely high ceiling**: CFLs may not produce enough light for ceilings of 12 feet or more. Although this situation has been partially compensated with multiple-lamp luminaires, alternatives to consider include low-wattage HID.

■ **Glittery/sparkle illumination (for retail)**: Because CFLs are diffuse sources of light, their use for certain accent applications, such as where a tight beam spread is needed, or for a display requiring a sparkle/glittery effect, may not be appropriate.

■ **Extreme ambient temperature**: Ambient temperatures that are either too hot or too cold affect CFL light output and lifetime. Heating from lack of venting or poor venting designs may affect CFLs downlights.

■ **Dimming circuit**: Where dimming is required, care is needed that the ballast/lamp system selected is capable of this function, as some CFLs are not designed to be installed on dimming circuits.

■ **Electromagnetic interference**: Some electronically ballasted CFLs can interfere with remote controls for televisions, stereo, and video players. Care should be taken when specifying CFLs for such settings.

Luminaire Selection Overview

The primary considerations of luminaire selection are the location and purpose for which the lighting system or systems will be used. Currently, high-efficiency compact fluorescent lamps and ballasts are available in various combinations and in a number of different fixture designs to suit commercial, retail and institutional applications.

Note that this *Report* assumes a certain level of familiarity with fluorescent and control system terminology and technologies, and mostly focuses on luminaire selection. For a brief primer on lighting terminology, please see included box.

An important consideration for selecting luminaires is whether the chosen fixtures will fulfill illumination needs. The luminaire should provide both adequate illumination levels (brightness in foot-candles) as well as color quality (CRI) needed for the particular application. Color temperature—the color appearance of the light that comes from a light source—is a more subjective selection, and should be specified based on application.

The selection of an efficient downlight luminaire today is usually the blending of a number of factors, such as efficacy, light quality and light output, weighted against one another to produce the desired lighting effect. Good lighting designs often combine ambient, task, and accent lighting to provide sufficient and comfortable levels of light. However, unlike most lighting systems in current commercial and institutional applications, where the emphasis may be on light quantity, downlights are often used to provide ambient lighting, accent lighting, or to supplement other lighting schemes, especially in retail situations. Thus, the emphasis may be more heavily weighted towards design, comfort, and ambience or "look" rather than just high levels of light.

Lamp Orientation

Most compact fluorescent downlights operate the lamp or lamps in the horizontal position. This lamp orientation makes for a more compact package with low overall height, permitting their installation in more locations. Horizontal-lamp luminaires can accommodate up to three compact fluorescent lamps in one luminaire, and generally have wider light distribution patterns. They are available with both round and square apertures.

TABLE 2 *Comparison of Lamp Types*

Lamp Type	Input (Watts)	Rated Lamp Output (lumens)	Max System Efficacy (lumens/Watt)	Energy Cost ($/Year)
1 x 150W incandescent	150	1,900	12.7	65.7
2 x 26 W CFL	52	3,600	69.2	22.8

CFL downlights are also available with the lamp or lamps in the vertical position. This lamp orientation can be easier to manufacture, but usually results in a taller package than luminaires with lamps in the horizontal position. The majority of these downlights use only one compact fluorescent lamp, although luminaires are available with two vertically oriented lamps. These luminaires tend to have a narrower light distribution pattern. The vertical orientation can concentrate heat at the top of the luminaire, which can affect CFL operating characteristics.

Performance and Comfort

A major issue with downlight luminaires is **glare**—glare can come from two possible sources: the reflection of the lamp on a reflector surface, and the actual brightness of the lamp, especially with luminaires using long, vertically oriented lamps. To reduce glare, manufacturers offer optional louvers or shielding assemblies to further hide lamps from direct view. While glare can be reduced through these devices, luminaire efficiency (its actual light output) is also reduced with their use. Efficiency reduction with louvers can range anywhere from two to fifteen percent or more.

A related issue specific to CFLs is **iridescence**—this effect is created when the anodized aluminum reflectors found in many downlights reflect the light of rare-earth phosphors used in CFLs. The light reflected by these reflectors can have different angles of reflection for different wavelengths. This situation results in a visible color separation of the luminaire's light output into a rainbow-like effect, affecting both luminaire appearance and user comfort. Low iridescence reflectors are available as options from most manufacturers, however, as with louvers and other shielding methods, their use may also reduce luminaire efficiency.

Properly designed and applied, however, CFL downlight systems hold a distinct advantage over most other downlight systems because of their high efficiency, especially where their service is required for long periods. Table 2 provides an example of savings possible with CFL downlights.

Note that in the above example, the CFL downlight is being compared directly with the incandescent downlight (at 12 hours a day, 365 days a year, and $0.1/kWh). In actuality, the number of fixtures can be reduced due to the CFL luminaires' higher output, thus yielding additional savings.

Efficient Fluorescent Luminaire Choices

As discussed, the most common office and commercial applications of CFL downlight luminaires are where ambient illumination, or specific lighting requirements, such as wall-wash or accent, are required for long periods of time. Discussions and general guidelines for the selection of luminaires—lamp, ballast and reflector systems—for office, commercial, and retail spaces are outlined in the sections below.

Many of the currently available CFL downlight luminaires, especially low-priced ones, are simply incandescent fixtures rewired to accept CFL sources. These fixtures tend to have low efficiency levels as well as poor performance characteristics. For example, reflectors in many fixtures designed to accept incandescent lamps may not provide the desired distribution or quantity of light when used with a CFL. Thus, fixture efficiency information and the availability of photometric testing information are a good first indicator of fixture quality.

Environmentally Responsible Luminaire Selection

To fully utilize CFLs in downlight luminaires involves consideration of CFLs' thermal characteristics, optical designs, and ballast performance. In addition, according to lighting designers, making direct comparisons among various CFL downlight systems based on their specifications remains mostly guesswork. Thus, the best rule of thumb for downlight selection, purchase, and specification remains hands-on experience.

TABLE 3 *Recommended LERs for CFLs*

Luminaire Type (NEMA Designation)	FEMP Recommended LER
Open Optics	29 or higher
Baffled Optics	21 or higher
Lensed Optics	24 or higher

TABLE 4 *Recommended Efficiencies of CFL Luminaires*

Luminaire Type	Minimum Efficiency
Open and wallwash downlights without white reflectors or optional louvers	65%
Open downlights with white reflector or optional louver	38%
Downlights with diffusers	20%

We recommend that you use performance data from independent laboratories, and acquire or purchase samples to assess glare, and evaluate other performance characteristics, such as luminaire efficacy ratings (LER) where available, or luminaire efficiency (LE) where LER is not available.

For downlight luminaire selection, we first recommend that you select the luminaire design that suits your particular lighting needs, and equip it with an efficacious combination of compact fluorescent lamp and electronic ballast (a system that provides high light output from the input wattage). Luminaire efficiency comparison can be done based on the LER, where available. In addition, lighting control strategies can significantly affect a system's overall energy consumption, so that measures such as automatic switching, daylight dimming, or sensors should be considered where appropriate. We also recommend that you look for luminaires with the desirable environmental characteristics covered below.

Green Seal™ has developed a list of criteria below to help you select luminaires that have less overall impact on our environment. These criteria take into account the most obvious resource reduction opportunity—energy efficiency (in the forms of lamp and system efficacy). We also considered the overall performance of the luminaire, in terms of lamp longevity, ballast characteristics, manufacturers' warranty and factors such as safety testing, since these affect how soon a replacement system is needed, and because longer lasting products can reduce the volume of waste entering the waste stream. Finally, we considered the manufacturing impacts of the luminaire—the metals, plastic and other components used as well as the production methods, where such information was available.

In addition, we recommend that economic factors such as replacement lamp and labor cost also be factored into cost-benefit analyses, since a low-cost product may not be inexpensive to operate in the long run.

Luminaire Energy Efficacy (LER)—In this *Report*, Green Seal used the Federal Energy Management Program (FEMP) recommended luminaire efficacy ratings (LER), derived from the National Electrical Manufacturers' Association (NEMA) standard LE-5A as a baseline for identifying energy-efficient luminaires. This must be done with the same ballast, fixture type and bulb type/wattage ratings in order to make an equal comparison.

LER is defined as: LER = (Luminaire efficiency x Total rated lamp lumens x Ballast Factor) ÷ Input Watts

Green Seal recommends that you look for luminaires meeting or exceeding the FEMP recommended levels in Table 3.

Where LER is not available (we found that very few manufacturers have LER information readily available on downlight products), we recommend the luminaire efficiency (LE) levels in Table 4.

Lamp Color Rendering and Color Temperature—In general, we recommend that you choose efficient luminaires with good light output and excellent color rendering index (80+) for areas where accurate color perception is needed, such as specialty retail. For general lighting (mass retail, waiting areas or hallways), We recommend efficient luminaires with adequate light output and good CRI (70+). If the area to be lit requires a lesser degree of illumination but an image or "look" is needed (company waiting

area, lobby, or specialty retail, for example), then the lamp color temperature and lamp CRI should be taken into consideration.

Lamp Longevity—Although most compact fluorescent sources last for a long time, various factors can affect system performance and reduce lamp life. The selection of a durable system not only ensures that less solid waste will be introduced into the environment, it also means that the components have been tested to be used as a system, thus ensuring user satisfaction and reducing failure incidents. Green Seal™ recommends choosing systems with rated lamp life of 8,000 hours or more.

Ballast Performance—Ballasts play a critical role in fluorescent luminaire performance and are an integral part of the lighting system. We recommend electronic ballasts meeting the following requirements:

- Class P thermal protection.
- Sound Rating of Class A or quieter.
- Compliance with ANSI/IEEE C62.41 specifications for withstanding electrical transients.
- Compliance with FCC Class A Part 18.305 and 18.307 Subpart for EMI and RFI.
- Have a current crest factor of 1.7 or less.
- Have total harmonic distortion of no more than 32% and power factor no less than 0.9.

Longevity of Luminaire Components—Because these fixture tend to be used for long periods, we recommend choosing lenses or diffusers constructed of glass or UV-stable optical grade plastics that are also heat stable. Reflectors, if included, should also be UV resistant and heat stable.

Electrical Safety—To ensure longevity and safety of luminaires, Green Seal recommends that luminaires be tested by an independent laboratory, such as Underwriters Laboratories (UL), the Canadian Standards Association (CSA) or equivalent.

Warranty—At a minimum, we recommend products should carry a manufacturer's warranty of 2 years or more, to ensure user satisfaction while reducing failure incidents, replacement costs and waste.

Production Methods and Materials—We also recommend that you consider products that were made using methods and materials that are less damaging to the environment, and products with recycled content.

The Sagamore Hotel, a landmark hotel located in upstate New York, choose to install compact fluorescent downlights for general and perimeter lighting in its new fitness center. The CFL lamps chosen for the job exceeded the hotel's CRI requirements of 80 CRI. The lamps' expected life of over 12,000 hours also made them much more attractive to the management. After consideration, a system of 23W CFLs were chosen over incandescent systems of 65W and 90W, due to the CFLs' long life and energy saving potential. The hotel also found that it needed a smaller number of luminaires than if it had chosen the 65W incandescent system.

What finally clinched the deal for hotel management was that the lighting system in the new fitness center is projected to have a 360% return on investment and a simple payback period of 3 months.

SOME LIGHTING DEFINITIONS

Ballast—The operation of light sources such as fluorescent, high-intensity discharge, and low voltage halogen requires a ballast to control the current needed to operate these light sources. Ballast can be magnetic, hybrid, or electronic. The latter types can be found in better-quality luminaires and permit better control of lamp operations.

Ballast Factor (BF)—The light output of a fluorescent lamp(s) operated on a ballast as a percentage of the light output when operated on a standard "reference" ballast. Ballasts with high ballast factor put out more light from a given lamp than ballasts with low ballast factor.

Color Correlated Temperature (CCT)—Also known as ***color temperature,*** and expressed in degrees Kelvin, it measures the color appearance of the light that comes from a light source. Available lamp color temperature range from 1700 degrees Kelvin to 5000 degrees Kelvin, with 2700–3500 degrees Kelvin being the comfortable range for most public areas.

Color Rendering Index (CRI)—CRI measures light sources' ability to render color of objects. CRI uses a scale of 0 to 100, with 100 representing the color rendering ability similar to sunlight. Light sources with "good" color rendering indices range from 70 to 80 CRI. Sources with CRI of 80+ are considered to have "excellent" CRI.

Efficacy—Efficacy measures a light source's ability to convert electric energy into light. It is measured in lumens per watt (lpw). The higher the lpw, the more efficient a light source. Efficacy can be measured for both lamp as well as lamp/fixture combination (system efficacy).

Illuminance—This term refers to the amount of light that falls on a surface, measured in foot-candles. It is equal to the number of lumens striking a surface, divided by the area of the surface. Foot-candle values can be determined for both horizontal surfaces, like a desktop, and vertical surfaces, like a chalkboard. One foot-candle is equal to the light of one standard candle striking one square foot of surface located one foot away.

Light Output—Also known as ***light quantity,*** used to described the quantity of light from a source. It is measured in lumens. Light quantity measurement is taken directly at the light source and is a calculation of the flow of light. The brighter the light source, the higher its lumen measurement. For example, a typical 60 W incandescent bulb will have the lumen output of approximately 700–800 lumens.

Lumen Maintenance—The term used to describe a light source's ability to maintain a consistent light output overtime. Most light sources suffer from reduced output as they age, some more drastic than others. It can be more noticeable in longer-lived sources.

Luminaire—This term is generally used to describe a hard-wired, fixed position apparatus that houses a light source and related components (ballasts, reflector, sockets), and provides illumination in a prescribed manner.

Luminaire Efficacy Rating (LER)— Measures the lumen output of a fixture as a function of input power, enabling comparisons between fixtures. The higher the LER, the more efficient the luminaire. LER is defined as: LER = (Luminaire efficiency x Total rated lamp lumens x Ballast Factor) ÷ Input Watts (The National Electrical Manufacturers Association (NEMA) publishes the *Procedure for Determining Luminaire Efficiency Ratings for Fluorescent Luminaires* (NEMA LE-5))

Luminaire Efficiency—Measures a luminaire's light output. It is a ratio of the lumen output of the luminaire to the lumens produced by the lamp/ballast combination(s) used in the luminaire, expressed as a percent. In other words, it compares the light that comes out of the luminaire to the light of the lamp. LE does not take into account the ballast factor.

Types of Lighting—Lighting can be separated into three distinct categories: general, task, and accent. General (or ambient) lighting fills a space with overall illumination. Its main purpose is to allow occupants to see and move around. Task lighting is designed to facilitate intensive visual activities without eye discomfort. It generally involves the bright illumination of an area. Accent lighting is used for decorative purposes; to add drama, set a mood, or highlight certain features of a space.

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WHO IS GREEN SEAL?

Green Seal 's mission is to achieve significant environmental benefits by encouraging organizations and individuals to choose environmentally responsible products and services. We accomplish this goal in two key ways.

First, we set rigorous environmental standards for products and services and award a seal of approval to those meeting the standards. When consumers select products bearing the Green Seal,™ they know they are buying products that have a lessened impact on the environment, without sacrificing performance.

Second, through our ***Choose Green Report,*** *we help large and small institutions become environmentally sensitive shoppers. We provide detailed guidance — such as this report —on how organizations can protect the environment while saving money.*