IMPROVING LIGHTING EFFICIENCY

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In any comprehensive energy management program improving the efficiency/effectiveness of lighting systems, both interior and exterior, is a basic component. Lighting is usually one of the first items addressed in an energy management effort, simply because it is a subject with which everyone is familiar and it is easily understood. In many situations lighting enhancements are inexpensive and easy to implement. They can take many forms, but generally fall into two major categories; increasing system efficiency and optimizing control of fixtures.

Increasing system efficiency means not only utilizing a more efficient source, but also improving the delivery system; i.e. how the luminaire, lamp, reflector and lens all work together to get the light to the desired location. For example, converting fluorescent systems to T-8 (26 mm) lamps and electronic ballasts has been a widely applied practice for a number of years. So has replacing incandescent fixtures with fluorescents, mercury vapor with metal halide or high pressure sodium, and other similar retrofits. These upgrades focus on increasing the efficacy of the source (lumens of light delivered/watts of power input) and result in lower peak electrical demand (kW) and reduce energy consumption (kWh). This then lowers the system operating cost.

However, the type of luminaire can have a dramatic impact on how much of the light generated actually reaches the working surface. As an example, in a recent renovation of a series of service station canopies, old style metal halide fixtures were replaced with a new fixture design. Due to the increased efficiency of the design in getting the illumination out of the fixture, 20% to 40% fewer fixtures were required. In addition, the new fixtures provided better distribution of the light yielding in a higher lighting level surrounding the service islands. The overall result was a brighter safer more attractive sales area with a significant reduction in energy and number of fixtures.

Optimizing system controls revolves around the old adage that *if you don't need it turn it off*. Unlike steam, compressed air and HVAC systems, illumination is not normally required unless a space is occupied*. Therefore, if we can turn off fixtures in unoccupied spaces we can save energy and potentially reduce maintenance costs. Examples of areas where improved control can result in savings include: conference rooms, offices, storage areas, copy/mail rooms, assembly rooms, break rooms, locker rooms, warehouses, electrical/mechanical rooms, satellite instrumentation houses, boiler rooms, and other frequently unoccupied spaces. Even in exterior applications there can be opportunities to optimize controls.

Automating the control of lighting systems can typical be accomplished at a relatively low cost. Photocells, timers, occupancy sensors, and timed switches are all effective devices for providing positive control to existing lighting systems. In new designs, or major renovations, if a building automation system (BAS) exists, then including the lighting to the system can usually be accomplished with minimal additional work. It should be noted that a BAS does not replace the application of other controls, but can provide positive control for extended unoccupied periods, such as evenings and weekends for multiple buildings.

* This statement excludes safety and security considerations.

A point frequently brought up regarding increased on/off operation of fixtures is that this would shorten the life of the lamps. This may or may not be true, simply based upon the method used in determining lamp life. But, assuming it is true the amount of money saved through conservation far outweighs the additional cost that may be incurred from replacing the lamp more often. With respect to potentially decreasing maintenance cost, if a space is usually unoccupied, i.e., electrical/mechanical room, compressor rooms, etc., then keeping the fixtures off would actually increase the useful life of the lamps, ballasts, and fixtures, thereby decreasing maintenance.

More than just energy and dollar savings -
In justifying lighting (or other energy management) measures, most companies focus on the potential energy and demand reductions and dollar savings. There is, however, an additional benefit that is receiving more attention; environmental emissions reduction.

It has been estimated that on average in the United States for every kilowatt-hour of electricity saved (not generated) 1.5 pounds of carbon dioxide (CO_2), 0.2 ounces of sulfur dioxide (SO_2), and 0.09 ounces of nitrous oxide (NO_X) are not released into the atmosphere. The Energy Information Administration of the US Department of Energy has published a brochure (Form EIA-1605) entitled Voluntary Reporting of Greenhouse Gases. In this publication CO_2 emissions by regions and states are listed. Therefore, instead of using the average, state specific values can be used to assess the environmental benefits of a potential project. The values listed in the publication are based upon the approximate electrical generation mix for the given states and, therefore, provide a more accurate representation of emissions. For North Carolina the listed value is 1.35 pounds of CO_2 per kWh. It should be acknowledged that this is not an exact number, but a reasonable estimate based upon the best data available.

Using the appropriate CO_2 value for a given state, the quantities for SO_2 and NO_X can be directly proportioned. Therefore, information is readily available that can assist in assessing the potential environmental impact of any lighting renovation.

Available training –
There are a number of places where training in the fundamentals and design of lighting systems is provided. Lamp manufacturers, fixture vendors, controls companies, energy service companies, colleges and universities, and private companies offer seminars and assistance in helping businesses and industry in understanding lighting sources, fixtures, and how to improve their systems. Some of the most effective course are those provided by the Industrial Extension Service of North Carolina State University. Courses are offered several times a year throughout North Carolina on both fundamentals and advanced lighting. These workshops focus on the practical aspect of lighting energy management and offer a low-cost alternative for upgrading lighting skills.