

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
LIGHTING SYSTEM IMPROVEMENT

(No.)

CODE 670

DEFINITION

Complete replacement or retrofitting of one or more components of an existing agricultural lighting system.

PURPOSE

This practice may be applied as part of a conservation management system to reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any agricultural facility with an existing lighting system and a completed lighting assessment that complies with the guidelines for a Type 2 on-farm energy audit for the major activity of lighting per American National Standards Institute (ANSI)/American Society of Agricultural and Biological Engineers (ASABE) S612.

CRITERIA

General Criteria Applicable to All Purposes

Implement recommendations of a Type 2 on-farm energy audit as it pertains to lighting system improvement. To use this practice, the lighting assessment must document the following:

- The baseline—the current energy use of a lighting system.
- The replacement or retrofit that will satisfy the minimum energy efficiency requirements established in this practice.
- The expected reduction in energy use over the baseline after the recommended replacement or retrofit is implemented.

Comply with all applicable electrical codes and fire protection standards as well as any local regulations.

Housing, wiring, mounting, and connections shall meet National Fire Protection Association (NFPA) 70: National Electrical Code, Article 547, Agricultural Buildings.

Ensure that the modified lighting system meets the recommended light quality and light levels (illuminance) for the space being lighted and the tasks performed in that space (see Tables 2, 5 through 7, and 9 through 11 in ASABE EP344.3). Light levels are measured in foot candles (fc) (lumens per square foot [lm/ft^2]) or in luxes [lx] (lumens per square meter [lm/m^2]).

Install lamps with a Color Rendering Index (CRI) of 70 or greater in areas where inspections are occurring such as milk room wash areas, egg inspection, or milking parlor pit.

A lighting system may include luminaires (lamps, ballasts, and fixtures), controls, and wiring as appropriate.

Where components will be exposed to dust, moisture, or corrosive atmosphere (such as in animal housing operations), use non-corrosive, water-resistant, light fixtures to protect lamps from environmental exposure in accordance with NFPA 70: National Electrical Code, Article 547.

Provide light uniformity based on Table 3 in ASABE EP344.3, columns “Task Classification” and “Corresponding s/Hp ” (the spacing-to-mounting-height ratio which is equal to the ratio of the fixture spacing [s] to the mounting height above the work plane, [Hp]). Use manufacturer’s uniformity data if available or a commercial light modeling

software to ensure level and uniform distribution of light.

Lamps and ballasts. Select replacement lamps or lamp/ballast combinations that have a minimum rated efficiency of 50 lumens per watt (lm/w).

Select lamps and ballasts that meet facility requirements for starting characteristics of the light (warm-up period and start-up temperature).

Ensure that ballasts are compatible with the wattage, number, and type of lamps they support. Replace magnetic ballasts with electronic ballasts where feasible to improve energy efficiency, extend lamp life, and lower starting temperature in some cases.

Dispose of lamps and ballasts in accordance with environmental laws and regulations.

Controls. Use automatic controls to reduce operating time or input power of a lighting system if intermittent use or natural lighting makes continuous artificial lighting unnecessary. Lighting controls include (but are not limited to) switches, dimmers, photo-sensors, occupancy sensors, and timers.

Design and install sensors and controls to meet their intended purpose and to ensure compatibility with the luminaires used.

When automatic controls are used, install an independent manual override.

Safety and welfare. To ensure worker and animal safety and welfare, do the following:

- Locate light sources to minimize shadows cast on the work area by workers and obstructions.
- Illuminate from more than one direction to minimize the density of shadows and to provide uniform illuminance.
- Reduce glare by selecting and installing fixtures with reflectors, refractors, and diffusing shields.
- Locate all light fixtures above the horizontal line of sight.

CONSIDERATIONS

In some cases, lighting modifications may impact heating, cooling, or ventilation requirements of a building. These impacts are often minor, but they should be considered when planning for changeover of lamp types.

Protect switches and dimmers from environmental exposure by locating them away from damp or dusty environments (where feasible) or by using corrosion-resistant controls.

In buildings, use of reflective, matte finishes on interior surfaces will reduce glare and help create a comfortable visual environment.

The color of a light source can impact the ability to distinguish colors in the lighted area and, in some cases, affect the mood of people or livestock.

Light quality, luminance, and photoperiod may be adjusted to enhance plant and animal production.

Using daylight to supplement artificial light may reduce the energy requirements of a lighting system and provide higher quality light.

For exterior lighting systems, the direction and intensity of the lights may dramatically affect the impact of light pollution on people and wildlife.

Consider stray voltage when planning improvements to reduce hazards and negative impacts on animal health,

PLANS AND SPECIFICATIONS

Ensure that plans and specifications for lighting systems meet the requirements of this standard. Plans and specifications shall:

- Identify and describe the existing lighting environment—including lumen output, number and placement of luminaires, number of lamps per fixture, wattage, lamp type, brand and model of fixture, controls and wiring, and activity for discrete areas.
- Identify the replacement brand and model of fixture, number of lamps per fixture, ballast type, lamp wattage, lamp type, and fixture rating (dust-proof, water-resistant, wash-down, etc.). State the recommended

illumination level and, if different from the existing level, why the change is recommended.

- Describe the specific number and arrangement of fixtures to be replaced or installed, along with the power source and controls.
- Include a plan view showing the location of the lighting system—including an electrical wiring diagram.

OPERATION AND MAINTENANCE

The producer/client is responsible for maintaining the lighting system. Provide operation and maintenance instructions that include the following:

- Regularly inspect lamps, ballasts, fixtures, wiring, and controls. Replace burned-out lamps promptly and repair or replace other system components (as appropriate) to ensure the system is functioning properly.

- Clean lamps, fixtures, and room surfaces regularly to ensure that a high-quality light environment is maintained.

REFERENCES

American Society of Agricultural and Biological Engineers. 2010. Lighting Systems for Agricultural Facilities ASAE EP344.3 JAN2005 (R2010) ASABE, St. Joseph, MI.

American Society of Agricultural and Biological Engineers. 2009. Performing On-farm Energy Audits. ANSI/ASABE S612 JUL2009. St. Joseph, MI.

National Fire Protection Association (NFPA) 70: National Electrical Code, Article 547, Agricultural Buildings. 2014. Boston, MA.

National Lighting Product Information Program. 2011. NLPIP Lighting Research Center Glossary. <http://www.lrc.rpi.edu/programs/NLPIP/glossary.asp>