

Practice to be assessed and included in the Guidelines

Number/code: OM/SM5

Title: OPTIMIZED LIGHT MANAGEMENT (e.g. LED LIGHTS INSTALLATION)

Guidelines section:

| | | | | | |
|--------------------------|------------|-------------------------------------|------------------------|--------------------------|------------------------|
| <input type="checkbox"/> | Governance | <input checked="" type="checkbox"/> | Operational management | | |
| | | <input type="checkbox"/> | Context of the event | <input type="checkbox"/> | Procurement |
| | | <input type="checkbox"/> | Event | <input type="checkbox"/> | Mobility and logistics |
| | | <input checked="" type="checkbox"/> | Stadium management | <input type="checkbox"/> | |

Description:

Lighting system such as *High Pressure Sodium (HPS)* or *Metal Halide (MH) lighting* were traditionally used to illuminate sports stadiums and arenas. Metal halide lights are five to six times more energy efficient than incandescent lights, and give top quality white light, which is crucial for the illumination of both outdoor night games and events held indoors.

Between 2005 and 2010, lighting technology moved forward with the advent of LED lights.

There are several reasons why LED lights are becoming popular in stadiums:

- LEDs are free from harmful mercury, contained in metal halides, which can lead to serious health side effects and negative environmental impacts at end of life.
- LEDs are energy efficient in their operation with virtually no heat loss. The use of less energy is always better for the environment as it cuts down on strain to the resources of the planet. This will also save on utility costs each month for the life of the LED fixture.
- The lamps and the fixtures last much longer than other options on the market (LEDs have a life span three times as long as metal halides) which helps to reduce overall waste and cut down replacement costs.
- They require little or no maintenance.

The initial cost of LEDs is higher than Metal Halide and other traditional fixtures, however the payback over time is very high. For instance, while initially the upfront cost was the barrier to entry¹, now with the high efficiency, dropping costs and versatility, LED lights have superseded the older technologies in sports lighting². The implementation of energy-saving light bulbs or other practices

¹ In 2012, a LED system was 8 percent more expensive than metal halides, but by 2014, the LED premium has been lowered.

² <https://www.environmentalleader.com/2019/02/led-lighting-poised-to-take-over-stadiums-and-arenas/>

related to lighting systems in football stadiums provides a great contribution to reduce energy consumption.

Examples:

- 1) In the stadium of Leverkusen, in the VIP area, 500 50w halogen spotlights were replaced by 3.9w led spotlights, while 270 50w halogen spotlights were replaced by 10.0w led spotlights
 - 2) FIFA World Cup Germany 2006: Around 20 % of the electricity used in stadiums in World Cup stadiums is accounted for by lighting. Energy-saving light bulbs and detector alarms as well as time and twilight switches to shorten the duration of lighting contribute in all stadiums, if to a varied degree, to reducing demand for electricity. In Kaiserslautern and Stuttgart, for example, the latest fluorescent lamps (T5 technology) were used, which save up to 20% compared to previous models. In Dortmund, the number of lights was reduced as a result of measurements of illumination intensity.
 - 3) Among other practices, Guidelines of French Ministry of the Sport simply suggest to install presence detectors in the in-locker rooms, washrooms and other places where presence detectors or timers pass to prevent the lighting of different spaces from being lit during periods of inactivity.
 - 4) Fédération Française de Rugby: Generalize the installation of detectors presence / timers in the buildings of the FFR
 - 5) USTA Centre: The USTA Billie Jean King national tennis center, is an American stadium complex and home of the US Open Grand Slam tennis tournament that works with eco evolutions llc, Green Sport Alliance and more generally with venues and teams in order to expand its sustainability program that involve, among others, some green initiatives related to the installation of LED lights. Regarding the environmental benefits, the use of LED lights in the different stadiums of the centre allows to reduce the level of energy consumption respect to standard solutions.
 - 6) Yankee Stadium: The Yankee Stadium is the stadium of the New York Yankees, club of Major League Baseball. It is considered a very state-of-art from a sustainable point of view, thanks, among others, to its solutions in terms of LED field lighting that allow a better energy system. Regarding the environmental benefits, The LED field lighting is 40% more efficient than standard and consequently allows to reduce the impact on the environment.
 - 7) Major League Baseball: The Major League Baseball along with the MLB network and MLB advanced media are part of a variety of sustainability efforts that include initiatives such as 'Green Team' activations during MLB All-Star Week, front office volunteer efforts and those operated by MLB clubs. In particular, many MLB clubs are working on energy efficient practices through the implementation of LED field lighting along with solar panels in the stadiums.
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- 8) Twickenham Stadium (rugby) has new LED low energy floodlights and two new big screens at either end of the stadium.
- 9) In preparation for the FIFA 2010 in South Africa, LED technology substituted fluorescent tubes on the emergency lighting circuit and reduced the electricity load. This translated into energy saving of 56% or 2,119,482 kWh per annum (i.e. 21,120 tCO₂e over their lifetime). Replacing old stadium floodlights with energy-efficient floodlights reduced the total electricity load from 315,7 kW to 126 kW. This translates into an energy saving of 12,096 kWh per annum, i.e. 151 tCo₂e over their 15-year lifetime.

Environmental benefits:

One of the examples given above achieved electricity savings for 74,130 kwh/year, which means an ecological saving of approximately 26,612 kg CO₂ per year. Another positive aspect according to the producer of the LED lights is that their life-span is four times longer than that of halogen lights.

Economic benefits:

The economic benefit depends on the savings, in any case the time to see the investment returned could be very low.

Applicability and replicability potential

The measure could be replicated in every stadium that adopts the same centralised system: the investment would be swiftly repaid thanks to the electricity lower consumption.

Sources

[Women Football World Cup Germany 2011](#) (p. 28)

[Mercedes-Benz Stadium](#)

[Mercedes-Benz Stadium](#)

[USTA Centre](#)

[Yankee Stadium](#)

[Major League Baseball](#)

[FIFA World Cup Germany 2006](#) (p. 64)

[Guidelines of French Ministry of Sport](#) (p.15)

[France's strategy for sustainable development](#) (p.11)

[Twickenham Stadium \(rugby\)](#)

[UN Environment Programme \(UNEP\) report on the environmental performance of South Africa 2010](#) (p.27)

[FIFA 2010 South Africa](#)

Case study: Yankee Stadium

The Yankee Stadium is the stadium of the New York Yankees, club of Major League Baseball. It is considered a state-of-art from a sustainable point of view.

Prior to the 2016 Major League Baseball season, the New York Yankees Stadium became the second major league baseball (MLB) stadium to convert to LED lighting, after the Seattle Mariners Safeco field. The arena was previously dominated by metal halide technology. The move to LED was not only aimed at promoting energy efficiency, but also at improving the lighting for the players and spectators and, more particularly, for TV broadcast, where the move to ultra-high definition TV requires higher lux levels, superior uniformity and no flicker.

In an interview with MLB official auditor Michael Owen, he confirmed that “the lighting level of the infield is over 25% higher and the level in the outfield is over 50% higher than the last measurements of the HID system, made in June 2015 (see Tables below)³.

| | Seattle Mariners Safeco field | | New York Yankees Stadium | |
|-----------------------------|-------------------------------|-------|--------------------------|-------|
| | Before | After | Before | After |
| Technology | Metal halide | LED | Metal halide | LED |
| Luminaire power consumption | 2,130 W | 800 W | Various 1 – 2 kW | 1 kW |
| Quantity | 579 | 578 | 888 | 692 |
| Total power kW | 1,233 | 462,4 | 1,227 | 692 |
| Energy savings | | 63% | | 43% |

| | Seattle Mariners Safeco field | | New York Yankees Stadium | |
|----------------------|-------------------------------|---------|--------------------------|-------|
| | Before | After | Before | After |
| Average | 2088 lx | 2917 lx | 3 746 | 4747 |
| Minimum | 1281 lx | 2228 lx | 3552 | 4467 |
| Maximum | 2422 lx | 3423 lx | 3896 | 4984 |
| E_{min}/E_{max} | 0529 | 0651 | 110 | 1116 |
| E_{min}/E_{av} | 0614 | 0764 | 095 | 094 |
| Enhanced illuminance | Infield | 25% | Infield | 25% |
| Enhanced illuminance | Outfield | 50% | Outfield | 50% |

Overall, the LED lights used at Yankee Stadium resulted to be 40% more efficient and 50% brighter than the previous field lighting used at the Stadium, which were also the most efficient lights available

³ <https://www.ee.co.za/article/case-study-use-leds-sport-stadium-lighting.html>

for use at the time. Increased Color Temperature of the light produced results in higher contrast, improving player reaction time, alertness and visual acuity. Improved Color Rendering provides the truest colors the human eye can see. Reduced Flicker Rate means the lighting can now support UHD Ultra Slow Motion filming. Improved optical design with twice the aiming points reduces glare and light pollution, and the energy saved from the new field lighting is enough to power about 45 homes every day⁴.

Case study: 2010 FIFA world cup South Africa

Among the carbon mitigation projects put in place in Cape Town in preparation for the FIFA 2010 in South Africa, LED technology substituted fluorescent tubes on the emergency lighting circuit and reduced the electricity load. At the time of construction, fluorescent tubes were the most cost-effective and energy-efficient option to provide feeder and escape lighting in the stadium. As LED technology became more affordable, it was consequently installed to provide emergency lighting, taking advantage of the significant energy saving over fluorescent tubes. The installation of LED lighting on the emergency lighting circuit reduced the electricity load from 1,116.9 kW to 632.9 kW. This translates into an energy saving of 56% or 2,119,482 kWh per annum i.e., 21,120 tons of CO_{2-eq} over their lifetime⁵.

LED retrofitting of traffic lights was also introduced: 75 Watt incandescent lamps were replaced with 7.5 Watt LED luminaires at 36 intersections. Average electricity costs at intersection with incandescent amounted to R13,140 per annum. Average electricity costs at intersection fitted with LED's amounts to R8,760 per annum. Average saving is 43% and 2,971 tons of CO_{2-eq} reduction for 15-year lifespan of the product.

While in general for lighting the LED technique seems to be more efficient both in terms of energy and cost savings, its use for the stimulation of grass growth in alternative to High Pressure Sodium (HPS) systems does not seem to be the best solution. For instance, tests made in some European stadiums showed that **LED Lighting Systems result to be less effective than the original HPS systems in reaching the same quality of grass growth during winter**. In individual situations it even occurred that the LED systems with infrared requested more energy input to create the same amount of light output (mmol) and heat (°C) as HPS Systems⁶. Research showed that “the influence of warmth has been often underestimated as a growing factor. Although the light is creating photosynthesis, the temperature is crucial for the process and should always be in balance with the light. In most climate regions the minimum temperature is not achieved naturally during the winter season; it requires an additional heat-source to allow growth”. While with HPS up to 50% of the energy reaches the plant as radiation heat, the energy-heat (convection) from LED does not reach the plant. Therefore, although LED lights are more energy efficient than HPS, they are not the best solution for promoting optimal quality pitch.

For alternative solutions for the promotion of grass growth, see the template OM-SM25.

⁴ <https://www.mlb.com/yankees/ballpark/information/sustainability-initiatives>

⁵ https://www.westerncape.gov.za/Text/2011/7/green_goal2010_part1.pdf

⁶ https://www.stadiaworld.com/index.php?head=Research-on-LED-technique-for-grass-growth&folder=sites/news&site=news-view&nid=14485&company=sgl_b_v (Stadiaworld, 19.02.2018)