

Green Sports Alliance Lessons from the Field

New York Yankees Path to LED

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Project Highlights

- ▶ 884 HID lights were replaced with 692 GigaTera SUFA LED fixtures.
- ▶ Lighting electricity demand dropped by approximately 47%
- ▶ The retrofit has increased foot candle levels in the infield by 25~30%, and improved the light levels in the outfield by 45~50%
- ▶ More than 60% energy reduction will be achieved compared with the previous system's power use
- ▶ LEDs are designed to have a life expectancy of 30 years
- ▶ The GigaTera system is the first in MLB to offer ultra-slow motion replay without any flicker.
- ▶ The GigaTera LED fixtures used at Yankee Stadium have been selected as a 2016 Next Generation Luminaires Outdoor Lighting Design Competition Winner

 Over the 30-year life of the LEDs, the retrofit at Yankee Stadium will reduce energy demand by more than 16.4 million kWh, an amount equal to reducing carbon emissions by 12,469 tons.

Introduction

According to U.S. Department of Energy estimates, if LED lamps displaced virtually all others by 2030, total annual lighting sector energy consumption in the United States would decrease by 60%. This would amount to more than \$380 billion annually in avoided electricity costs. Such a comprehensive shift to LED lighting would also prevent the release of more than 3 billion tons of CO₂ emissions.

In our ongoing effort to help inform Green Sports Alliance members and other friends about the opportunities and challenges associated with implementing energy efficiency, the Alliance is pleased to share the following case study, reporting upon the installation of LEDs at Yankee Stadium, home of the New York Yankees, in partnership with Planled and GigaTera.

Allen Hershkowitz, Ph.D., President, Green Sports Alliance

Project Summary

In 2015, The New York Yankees Vice President of Stadium Operations, Doug Behar, was awarded the Green Sports Alliance's 2015 Environmental Leadership Award, its highest award, for implementing one of the most progressive environmental programs in professional sports. That same year, and in line with the Yankees' commitment to optimizing energy efficiency, Doug and his team changed the lighting at Yankee Stadium, shifting from High Intensity Discharge lamps (HIDs)¹ to higher efficiency Light-Emitting Diodes (LED).

The goal of this project was to achieve a meaningful reduction in electricity demand during New York City's higher-costing peak usage hours. Not only would this reduce the Yankee's carbon profile, it would also help promote the next generation of high efficiency lighting technology can offer. Besides the energy saving benefits that LEDs offer, they also provide an enhanced visual environment for players and fans, improved color rendering for broadcast engineers, and reduced light pollution by minimizing stray lights.

¹ High-intensity discharge lamps (HID lamps) are a type of electrical gas-discharge lamp which produces light by means of an electric arc between tungsten electrodes housed inside translucent or transparent fused quartz or a fused alumina arc tube.

Project Summary (cont'd)

Previous stadium lighting consisted of three systems: 486 units of 1500W HID's and 176 units of 2000W HID's for the game lights, and 222 units 1000w HID's for the maintenance lights, for a total of 884 HID lights. All three systems were replaced with 692 units of 1000W GigaTera SUFA A LED fixtures. This dropped the lighting electricity demand by approximately 47%, from an average of 1303kW with the pre-existing system, to 692kW with the new LED fixtures. Based on energy-use estimates related to the new LED adjusted light level during the first MLS night game at Yankee Stadium, a more than 60% energy reduction will be achieved compared with the previous system's power use.

LEDs are designed to have a life expectancy of 30 years. Consequently, over the 30-year life of the LEDs, the retrofit at Yankee Stadium will reduce energy demand by more than 16.4 Million kWh, an amount equal to reducing carbon emissions by 12,469 tons.

Illuminating Multi-Use Stadiums

Major League Baseball's lighting auditor, Mike Owens, declared that the retrofit at Yankee Stadium has increased foot candle (fc) levels in the infield by 25~30%, and improved the light levels in the outfield by 45~50% while maintaining or improving the uniformity of light. Outfield level was intentionally raised by higher percentage in order to match the infield uniformity.

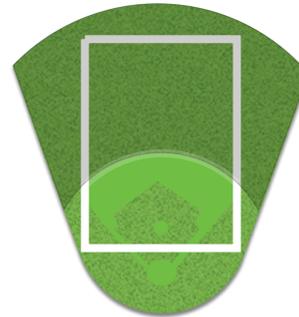
Traditionally, MLB has granted a lower fc requirement for the outfield area, where most stadiums are challenged to match infield lighting quality due to technology limitations. However, for multi-sports stadiums, having playing field areas with two different light levels creates uneven illumination for non-baseball sports events such as soccer or football. Also, two levels of lighting intensity on the playing field for night games creates a compromised viewing experience for some fans.

The current MLB field lighting standard allows for 20% less light in the outfield compared to the infield. Consequently, athletes playing sports other than baseball will face variable lighting at different locations on their field. The illustration to the right shows how this may impact non-baseball sports.

Current MLB Standard



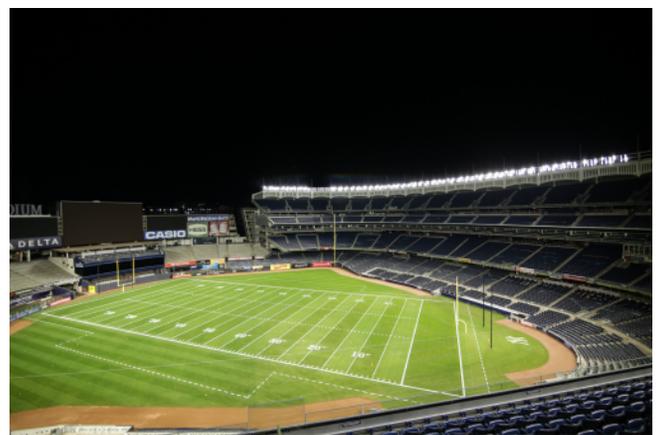
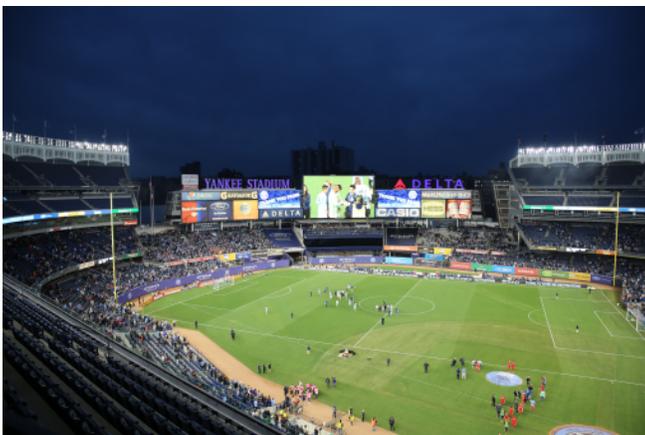
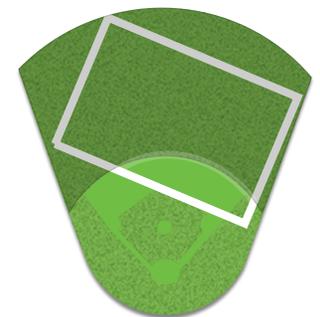
Football Field Layout



With LED Installation



Soccer Field Layout



HID Lighting System Challenges

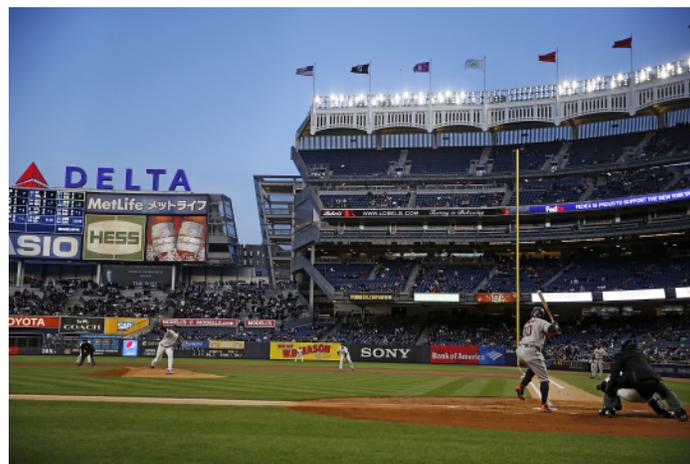
Lighting the outfield at Yankee Stadium to achieve MLB light level requirements while using light towers that range from 140-160 feet tall is not a simple task. Until the recent emergence of LED technology, stadium lighting options were limited to omni-directional HID light sources with large reflectors (typically having a diameter in the range of 23-24 inches wide). Two main challenges result from the use of HID lighting systems at baseball stadiums:

HID Challenge #1: Bowl-shaped reflectors

Attempting to create a narrow beam of light from an omni-directional light source with a bowl-shaped reflector is a challenge. A bowl-shaped reflector creates unwanted stray lighting and loses intensity exponentially by the time it reaches field level. One collateral benefit of using omni-directional lights is the brightening of fan seating areas. However, lighting spill over not only wastes energy, but results in light pollution in the surrounding community.

HID Challenge #2: Fixture configuration

Most of Yankee Stadium's light fixtures are densely mounted on a light tower (or a light ring). The large diameter of neighboring fixtures limits aiming and tilting. Moreover, this lighting configuration reflects light off the back of neighboring fixtures, diverting light designed to travel towards the field.



"The use of dual head SUFA-A fixtures allows more uniform lighting with less glare. The most important part of the installation is the aiming of the fixtures which seems to have minimized glare to the players while still providing good lighting for television."

Michael Owens
Field and Lighting Inspector, MLB

Benefits associated with LED System Design

The challenges resulting from the traditional HID system were overcome by GigaTera's development of a new sports light fixture design. That innovative design relies on a narrow uni-directional beam of light that minimizes stray lighting and results in the following benefits:

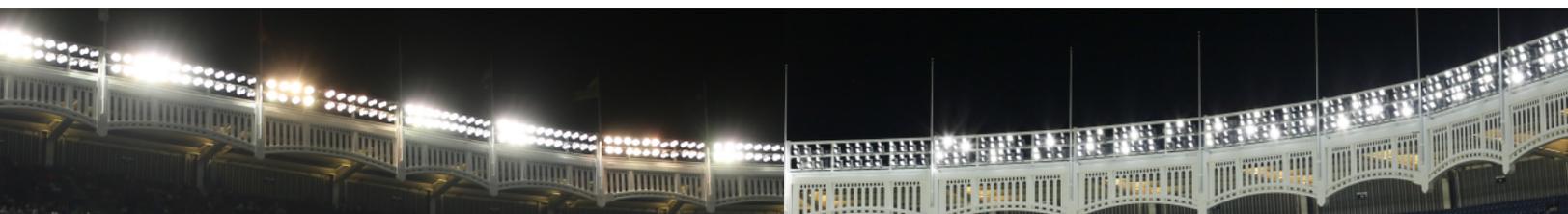
- ▶ **Spreading Out Glare Clusters** – By spreading out glare clusters, players have a better visual experience at the stadium, and fans watching the broadcast receive a better quality image. The before and after comparison below shows how Giga Tera's design strategy reduced glare significantly.
- ▶ **Doubling Aiming Points** – By doubling the aiming points, the Yankees improved vertical illumination resulting in fewer shadows on the field resulting in more uniform lighting.

"The response to the LED conversion of Yankee Stadium has been overwhelmingly positive..."

All these benefits were achieved in a stunningly short amount of time. The installation took two weeks and the demanding MLB inspection approval process took less than one week.

Making the transition to LED preserved the Yankee's commitment to providing the best venue for fan entertainment while reducing our energy consumption and environmental footprint."

Doug Behar
Vice President, Stadium Operations, New York Yankees



The images above illustrate the dramatic glare reduction resulting from switching to an LED lighting system. To the left, is the Yankee stadium light ring with HID fixtures; to the right is the light ring with LED fixtures.

Benefits for Broadcast Engineering

Non-flickering lights open up new possibilities

When broadcasting night games illuminated by HID lights, broadcasters' ability to deliver slow motion replays is limited to 180 frames per second (fps). HID lights flicker at 120 Hertz and greater than 180 fps which can create an uncomfortable viewing experience. The Yankees' new LED lighting system was field tested with a flicker rate of 0.2%, whereas the previous system had a flicker rate of 52%. As a result, broadcast engineers can now deliver ultra-slow motion viewer experiences of up to 1,000 frames per second without any perceptible flicker.

Improved Colors for Human Eyes and Cameras

During the summer, most night games begin during daylight. As the evening comes, the full spectrum of natural daylight is replaced with limited supply of color spectrum from HID lights. During this light source transition (from natural light to electric light), broadcast engineers go through a "paint down" process, during which the effect of residual daylight on a broadcast is phased out of the visual image. The new LED lighting system at Yankee Stadium offers broadcast engineers the option to eliminate the "paint down" process.



A comparison of the color rendering between the traditional HID system and the new LED system.

Conclusion

In this age of digital convergence, LED technology offers much greater benefits than mere energy savings and easier maintenance. It reflects a cultural shift in thinking about lighting technology. Yankee Stadium, a legendary sports venue, is helping to advance that cultural shift in sports lighting technology by powerfully displaying LED lighting on a grand scale.

About the Green Sports Alliance

The Green Sports Alliance leverages the cultural and market influence of sports to promote healthy, sustainable communities where we live and play. We do so by inspiring sports leagues, teams, venues, their partners and millions of fans to embrace renewable energy, healthy food, recycling, water efficiency, species preservation, safer chemicals and other environmentally preferable practices. Alliance members represent more than 330 sports teams and venues from 20 different sports leagues and 14 countries.

About the Planled and GigaTera Partnership

The partnership of Planled and GigaTera is challenging the limits of sustainability and productivity. Planled, a relentless innovator in the scientific and human effects of light, found an equally inventive manufacturer in GigaTera. Together they shook up 2015 by teaming up to make the Seattle Mariners and New York Yankees the first two LED lighted stadiums in MLB. Players, fans and broadcasters have all endorsed the biggest lighting change to America's favorite pastime in the last half-century. The LED conversion also presented the teams, along with corporate and industrial customers, savings of up to 70% and priceless performance benefits. The Planled and GigaTera partnership is built on the basic concept of elevating light to its highest potential in sustainability and the human experience.

