TACKLE

Practice to be assessed and included in the Guidelines

Number/code: OM/SM25

Title: SECONDSUN TECHNOLOGY

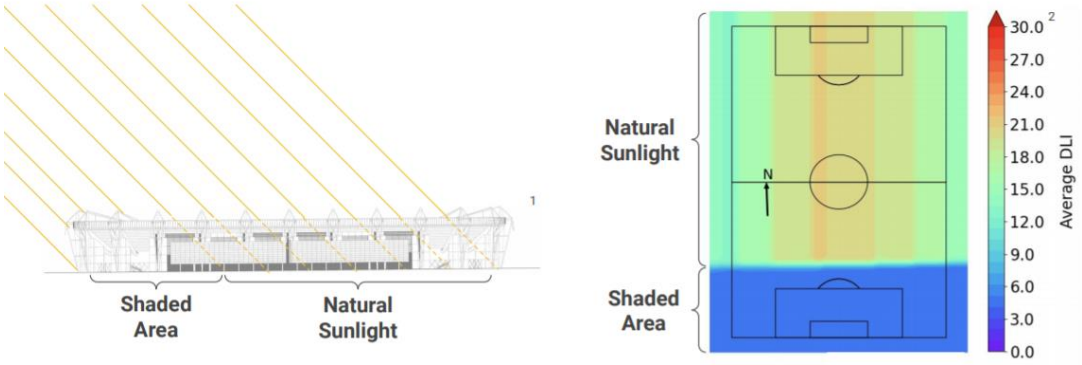
Guidelines section:

[ ]	Governance	[X]	Operational management

[ ]	*Context of the event*	[ ]	*Procurement*
[ ]	*Event*	[ ]	*Mobility and logistics*
[X]	*Stadium management*	[ ]	

Description

Grass needs four components to grow: light, water heat and nutrition. Some large stadiums experience issues in growing natural grass due to the fact that natural sunlight cannot reach the whole grass pitch. The reasons can be related to local climate conditions (i.e. in Northern Europe, winter's hours of sunlight are limited so natural grass doesn't grow naturally), or to the shape of the stadium that might prevent sunlight to reach some spots of the pitch (Image 1)[1].



Heatmap of the sunlight inside Brøndby Stadium for a sunny day in March

So far, solutions that imply the use of artificial lights have been both financially and environmentally costly. Assuming that a stadium in average European weather conditions is equipped with 72 high pressure sodium light bulbs of 1000W each, that consume up to 3.000 MWh1, it is estimated that **the yearly costs (for electricity only) amount to € 300.000. In terms of environmental costs, this solution emits up to 1.000 ton of CO_2.**

[1] All the images and data were provided by Nicolai Moustgaard, CEO and Co-founder at Second Sun.

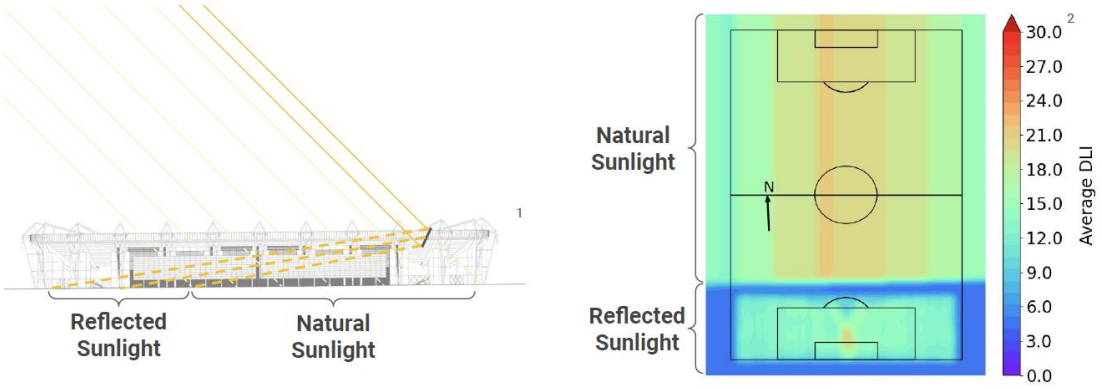
Every year more than 1.500 stadiums each

- Consume up to 3.000 MWh[1]
- Emits up to 1.000 ton CO2[2]
- Spend up to € 300.000[3] (electricity only)
- Up to 1.000 man hours

Yearly costs

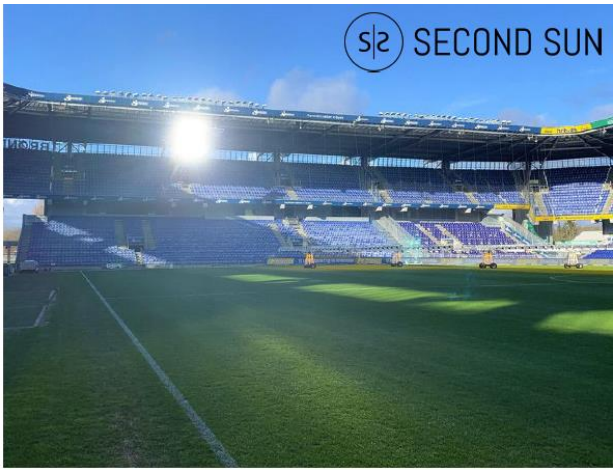
4.500 GWh	1.500.000 tCO2	450.000.000 EUR	1.500.000 Man-hours

Second Sun has developed an innovative solution based on a reflector system that can reduce the need for artificial light using the natural sunlight from the sun. Their sustainable system for natural grass growth is based on intelligent and automated mirrors that redirect the natural sunlight onto any area of the pitch where the grass needs it inside a sports stadium. This will provide the necessary Photosynthetic Active Radiation (PAR) light to promote the photosynthesis inside the grass plant. In this way, this system can substitute the usage of UV lamps installed for grass growth: this means much lower energy consumption and CO_2 emissions, while keeping the pitch in the high-quality condition needed.



Heatmap of the sunlight inside Brøndby Stadium for a sunny day in March with the deployment of the Second Sun System

The Second Sun System can be installed in the existing structure of the stadium and the mirrors automatically deploy and retract from underneath the stadium's roof when needed. These reflectors can be easily installed and moved around the stadium and project the sunlight onto the desired areas of the pitch where sunlight is needed. The system is designed and built with advanced automation and an intelligent control technology. In contrast to artificial light rigs, there will be no inconvenience to the groundsman team to neither transport the system in and out of the stadium nor storing it when not in use.



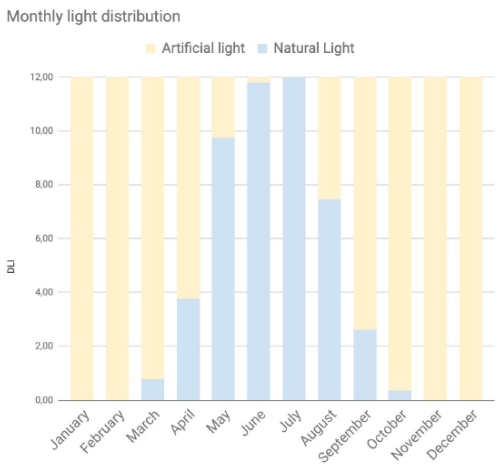
Environmental benefits

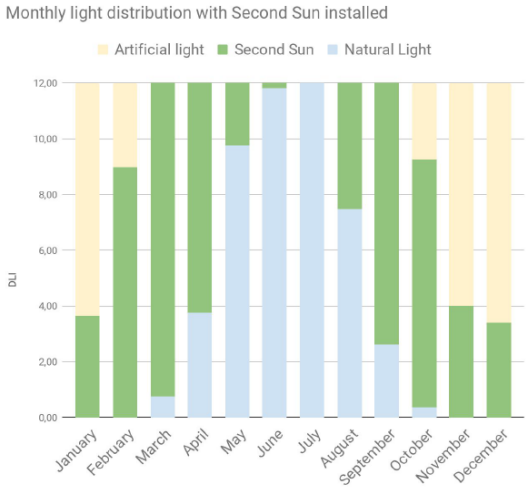
This system can substitute the usage of UV lamps dedicated to grass growth: this means lower energy consumption and thus also lower CO2 emissions. Furthermore,

Economic benefits

No running costs associated and a quick return on investment from energy- and labour savings.

Thanks to the Sunlight Simulation tool, they can simulate the yearly sunlight for any stadium in the world based on historical weather conditions. The yearly savings in terms of costs and CO_2 emissions vary from stadium to stadium depending on geography and structure. Second Sun provided an example from the Brøndby stadium:





By deploying this solution, **the savings for sports stadiums are substantial both from a financial and sustainable perspective** since the need for supplementary artificial growth lightning is significantly reduced or eliminated[2]: the yearly consumption of a stadium is estimated to decrease to 2.250 MWh1, with **yearly costs (for electricity only) decreasing to € 225.000. In terms of environmental costs, emissions would decrease to up to 750 ton of CO_2.**

[2] Depending on the country, this system cannot fully substitute artificial light in winter, but can substantially reduce the need to use it throughout the year.

Every year more than 1.500 stadiums could save

- Up to 2.250 MWh[1]
- Up to 750 ton CO2
- Up to € 225.000 (electricity only)
- Up to 750 man hours[2]

Yearly savings

3.375 GWh	1.125.000 tCO2	337.500.000 EUR	1.125.000 Man-hours

The following table compares artificial light rights (9 SGL MU360 light rigs with 72 1000W High Pressure Sodium Light Bulbs) and the Second Sun technology (60 mirrors) in a large stadium in Central Europe, for a 10-year period and same DLI provided per year:

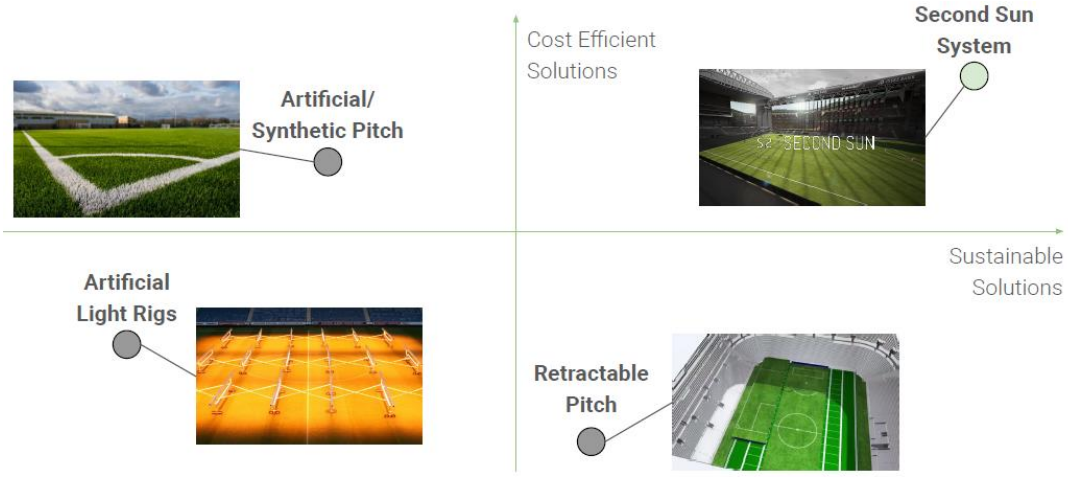
Comparing Artificial Light Rigs and Second Sun

Example from Larger Stadium in Central Europe

Parameter (Based on 10-year period and same DLI provided per year)	**9 SGL MU360 (1000W)**	**Second Sun (65 mirrors)**
Capital investment	€ 1,500,000	€ 1,000,000
Operational expense (For same PAR-light delivered)	€ 1,500,000[1]	€ 0
Maintenance and service	€ ?	€
Total Cost of Ownership	**€ 3,000,000**	**€ 1,000,000**
Related CO2 emission	2.130.000 kg CO2[2]	0 kg CO2
Ease of deployment	☹	☺
Ease of storage	☹	☺
Weather independence	☺	😐
PR potential	☹	☺

1: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_non-household_consumers
2: https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity-8 using a 10 year average from 2020-2030

Some research from Second Sun confirmed that among the existing alternative solutions for maintaining high quality pitch, the Second Sun technology results to be the most sustainable and cost efficient.



The use of LED lighting systems to promote grass growth as a less energy consuming alternative to HPS systems was tested in many European countries. However, LED trials in Germany, Ireland and France revealed that it was not possible to create the same quality of growth during winter with less total energy input than with an HPS system. 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 Systems[3]. For instance, 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.

The Second Sun technology stands out as an innovative solution from both environmental and economic points of view.

For more information on artificial/synthetic pitch and artificial light rigs, please see the related documents OM/SM10 and OM/SM5.

Replicability potential

This practice can be applied to all fields in artificial turf that must be renewed. The replicability potential is naturally linked to the presence of natural turf in the football fields.

Source

https://www.secondsun.dk

[3] 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)