Background

How new LED systems are making airport lighting even more efficient

Many airfields have been converted to LEDs for a long time. The first "Airfield Ground Lighting" providers are now bringing completely new systems onto the market. Because the simple retrofit solutions by no means exhaust all energy-saving potentials. An overview from induction to solar solutions.

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TKH Airport Solution

Summary

The use of LEDs at an airport not only saves electricity, but also maintenance work.

Conventional AGL systems, on the other hand, still work with a 6.6 ampere system.

The full energy saving potential of LEDs can only be exploited through other approaches.

The aviation industry has set itself the goal of becoming climate neutral by 2050. It is true that the focus is often primarily on converting flight operations to new engines and fuels. But also on the ground it is about avoiding greenhouse gas emissions. A closer look at the energy savings potential that is often still unused through the use of LED technology in "Airfield Ground Lighting".

The airports in Europe want to operate climate-neutrally by 2050. According to Master Plan 1 climate protection of the German aviation industry, savings targets in the areas of vehicle fleets, building technology and energy supply are on the agenda for airports. The airport-specific systems are therefore an additional essential area for the further reduction of emissions.

At a large airport, the lighting system consists of thousands to tens of thousands of lights. This makes them a factor that should not be underestimated when it comes to the electrical power consumption of an airport. Most airports have long since started converting runway lighting, apron and taxiway lighting ("Airfield Ground Lighting", AGL) - just like with the installation of new floodlights, improvements in building technology and the installation of solar panels.

These efforts are already bearing fruit. According to the German Airport Association, airports have already reduced their CO2 emissions by 24 percent between 2010 and 2018. The further reduction should be 50 percent by 2030. However, further efforts are needed in all areas in order for climate neutrality to be achieved in 2050.

But the simple replacement of light sources has reached its limits in terms of potential savings. Because even if retrofitted LEDs consume significantly less electrical power than classic halogen lamps, there are stilllosses in the old systems
major efficiency- and thus considerable potential in the fight for every kilowatt-hour saved.

This is why the first manufacturers such as the Dutch TKH Airport Solutions are now relying on completely new systems specially designed for LED technology, which are intended to help reduce the electricity requirements for lighting systems at

airports even further. Radio-controlled solar lights, such as those offered by the Polish S4GA, can help to take another step towards climate neutrality. In any case, the use of LEDs alone is not enough.

LED retrofitting is only the first step towards saving electricity

The advantages of LEDs are now well known to everyone in the home. They need less electricity and last much longer. In addition to the climate aspect and less waste,speaks in favor of converting
the savings potential in terms of maintenancefrom halogen to LED at airports.

Assic underflight lighting for the runway with halogen bulbs
Dewitec

LEDs only require around a fifth as much electricity as conventional bulbs. Runway Centreline lights from ATG, for example, now only need around 15 watts and last over 60,000 hours. For comparable halogen lamps, ATG specifies a service life of between 1500 and 3500 hours - depending on the output, which is typically given as 45 to 105 watts. So it is clear that both the power consumption and the operating time will improve.

The use of semiconductors as light sources at airports has other advantages, which the airport lighting specialist ATGin an extensive Icao presentation on the subject of LED [2] pointed out ten years ago. LED chips are comparatively insensitive to temperature fluctuations and also have few problems with vibrations. Both are important for use on the airfield.

In addition, there is better and simpler color rendering. In contrast to halogen lighting, the power consumption of light colors such as yellow or red is significantly lower than that of white. Another energy saving potential that conventional halogen technology lacks.

As in the home area, the same applies to the airport: The easiest way to convert to LED is to replace the light source relatively quickly. Even if this already saves a lot of energy - the potential savings in the overall system are still high even after the lamps have been replaced.

Instead of using cabling and power supply optimized for LED technology, the old system for retrofit lamps remains. In the case of AGL, this is often a 6.6 ampere
system with many transformers and corresponding system losses.

The losses are clearly shown by the LED [3] underflight lights FX850CW. This is used at the edge of the slope and lights up in two directions with 40 watts each, for a total of 80 watts. In the worst case, however, 154 watts are still required due to efficiency losses.

For comparison: A conventional halogen solution from the same manufacturer requires 105 watts in [4] directions. The losses in the ZA483 on the 115-watt transformer are comparatively low (2 x 10 watts). In addition, the system does not save any energy when it is switched to yellow / red. The LED variant, on the other hand, sinks to around 90 watts when the color changes - even with the enormous losses on the transformer.

In the worst case scenario, the airport still saves over 70 watts per luminaire in this scenario. In the best case, the power consumption is almost halved and around 140 watts are saved per runway-edge light.

The scenario also shows, however, that there is still potential for further optimization towards an energy-saving airport due to
the continued high power consumption. There are two solutions here: to set up a completely new system of cabling and power supply or to use self-sufficient solar solutions, which are basically possible thanks to the energy-saving LEDs.

TKH relies on new induction systems

If the Dutch at TKH Airport Solutions have their way, then in the future there would only be LEDs when it came to airfield ground lighting. The new, energy-saving system should score points with another innovation: Neither control nor the energy supply of the lamps is done via a direct plug-in cable connection.

TKH calls the system "CEDD AGL". This stands for

"Contactless Energy & Data Distribution Airport Ground Lighting". The manufacturer therefore relies on wireless, inductive transmission. It is still plugged in, but only the light source is plugged into a corresponding socket in the
floor. Cables run underneath that no longer need to be connected to the luminaire.

he structure of the CEDD system.
TKH Airport Solutionscable harness

A system consists of a doubleup to two kilometers long, on which the airport lighting is connected in series. Up to 40 lights can be supplied per base station - including communication, be it for color changes, reading out sensor data or
to detect faults.

This means that more than one base station per row of lights is necessary per runway, especially for larger aircraft. For redundancy, however, at least two strings are always built in anyway, so that every second light still works in the event of a fault.

An important point for efficiency gains for the TKH solution is not to use the old infrastructure at all. In contrast to the constant current strength of the conventional 6.6ACEDD
solution,is a voltage-driven system. Airports save numerous transformers that need conventional lighting solutions.
With this change alone, TKH promises 40 percent energy savings - or rather a reduction in losses that would otherwiseon a 6.6 amperealready been modernized with LED lighting
be expectedsystem that has.

In addition, the system is more robust against weather influences, since thanks to induction there are no longer any direct cable connections to each light. Disturbance influences should also be lower and communication should accelerate. In several scenarios, the manufacturer speaks of response times between 0.5 and 1.0 seconds.

A certain loss must also be taken into account with induction. TKH does not say how high this is. However, the system is not comparable to electric toothbrushes or a Gameboy, two well-known examples with inductive energy transfer, which are considered inefficient and the inductiona bad 5 missedreputation.Efficiencies of 90 percent are now possible, for example, in electric vehicles with induction (Bombardier Primove, Conductix Wampfler).

Partial conversions are also possible.

Of course, just converting to LEDs without changing the system remains an interesting option for airports in order to reduce the energy requirements of an airport, especially since the investment costs are lower. For TKH's CEDD system, on the other hand, new cables and new sockets have to be laid on the apron or on the slopes. So it is a considerably higher investment than just replacing the light sources.

Typically, however, not entire airports have been operated with the CEDD system so far. TKH named airliners.de some examples of its use at Inter Airport. Some products, such as the white Sequential Flash Light or the Papi LEDs, which are part of the approach products, are not even available as CEDD versions. The same applies to obstacle lights or the runway protection lights (runway guards).also
TKHoffers retrofit solutions for illuminated signs
that are also not supplied with the CEDD system.

Demo unit of the CEDD system at Inter Airport Europe
© airliners.de / David Haße

So far, TKH has been able to convince seven airports, mainly in the Netherlands, of its technology. However, some installations are still in test operation, such as in Marseille.

Istanbul Sabiha Gökçen is one of the airports with a completed installation. There the taxiways are equipped with CEDD. A total of 7000 lamps were installed. According to TKH, the airport is also an example of a "Follow the Green" that serves as a supplement to the Follow-Me car, which CEDD also supports. Aircraft then follow apparently moving airport lights. The slope, however, continues to work with the old 6.6 ampere system.

S4GA relies on solar-powered products and radio control

Solar systems are another option when it comes to saving energy consumption at airports, including in the area of airfield lights. The complexity, especially when setting up the infrastructure, can be significantly reduced with a solar system. No cables are pulled here. Definitely an advantage, especially for places in areas that have a lot of sunlight, but
a poorly stable power supply.

The Polish provider S4GA has been relying on solar systems for years and, according to its own information, has a complete portfolio for airport

lighting, including Papi solutions. In general, the lights each have their own solar panels and a rechargeable battery so that they can work independently and without wiring. These lights should also be able to replace the classic 6.6A installations. Even with the advantage that there is no need for cabling because the electricity is produced locally at the respective lights.

Since there is no cabling, alternative communication with the system control is required, which makes the individual luminaires more complex. In this regard, S4GA works on the 868 MHz frequency band, a free ISM
band (Industrial, Scientific, Medical) - in other words, it does not require a license in the EU for use. Since frequencies are rarely harmonized worldwide, restrictions apply in some countries. In the USA, for example, this tape cannot simply be used without permission.

The S4GA radio system is a mesh network. The devices simply connect to each other, which is an advantage over longer distances. The manufacturer also offers the option of using 433 MHz or 2.4 GHz. These are also typically ISM bands, but with different characteristics.

Solar is not a solution everywhere.

However, a solar solution naturally also requires a certain amount of solar radiation. S4GA therefore seldom sells its products in very northern (or southern) countries. Depending on the position on the hemisphere in relation to the sun, the system can sometimes not be used at all. The long winters in the respective hemispheres do not offer enough solar time - regardless of the weather.

Łukasz Kornacki from S4GA shows the manufacturer's solar-powered portable AGL system.
© airliners.de / David Haße

At Inter Airport, S4GA calculated some examples in a presentation. In southern Europe there is generally nothing to be said against its use. The further north it goes, the sooner larger batteries have to be installed so that operation is ensured during the night (astronomically speaking) and at the latest before and after nautical twilight.

S4GA speaks of a target autonomy of 15 days, which provides enough power even in bad weather. In general, the systems are then designed in such a way that the power consumption falls below the power generated by solar cells. The size of the battery at a location also depends on the typical operating hours plus reserve. For example, an airport like Leipzig / Halle has a higher profile of requirements for its lighting systems than Berlindue to the continuous night flight operations
Brandenburg, where flights are mainly carried out during the day,.

However, practical examples are still rare. This includes military customers, airfields in remote areas without a stable power supply - but also temporary use during construction work.as example [6] Thessaloniki in Greece was named. In 2017, an AGL system was delivered within a month and set up in a few days. In this way, flight operations could continue during the construction work.

Links on the topic of

ICAO: ATG presentation on the advantages of LED technology from 2012 (PDF)[2]

1. https://www.bdl.aero/de/themen-positionen/nachhaltigkeit/klimaschutz/
2. https: // www .icao.int / SAM / Documents / 2012 / VISUALAIDS.11 / 7_ATG_CP.pdf
3. https://www.atgairports.com/wp-content/uploads/2020/12/FX850CW_inset_runway_edge_60mts.pdf
4. https: // www .atgairports.com / wp-content / uploads / 2018/03 / ZA483_Runway_Edge.pdf
5. https://www.golem.de/news/e-busse-im-ueberblick-effiziente-induktion-wasserstoff-fuer-akkus- and-flywheels-1507-115074.html
6. https://solutions4ga.com/project/thessaloniki-airport-ready-solar-runway-lighting/