

ELLED™ Airfield Ground Lighting

Driverless LED Lighting Solution



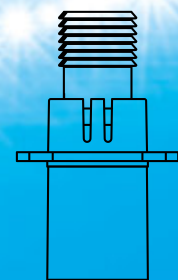
Upgrade or build new

ELLEGO™ is a reliable and desired partner for demanding power solutions and lighting systems. For over 40 years, our products have powered power stations, ships, and airports.

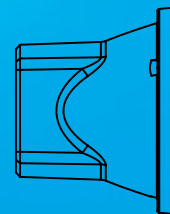
ELLED™ Airfield Ground Lighting portfolio provides a reliable and sustainable solution throughout the airside from approach to the apron. Driverless innovation ensures operational reliability and cost savings and reduces the environmental burden. Driverless LED means that all lights in the field are passive components, without failure prone driver electronics. PECS directly controls a luminous output of the LED chip, enabling robust and simplified, yet intelligent lighting infrastructure.

ELLED™ Airfield Ground Lighting system is suitable for both existing and new installations, providing a solution throughout the airside from approach to the apron. The system consists of ELLED™ bulbs or lights powered by ELLEGO™ PECS, providing superior energy efficiency, easy maintenance, and high reliability.

ELLED™ retrofit can be installed on almost all halogen installations in the market, reusing light fixtures, cabling, connectors, and transformers. Only bulbs and PECS will be changed.



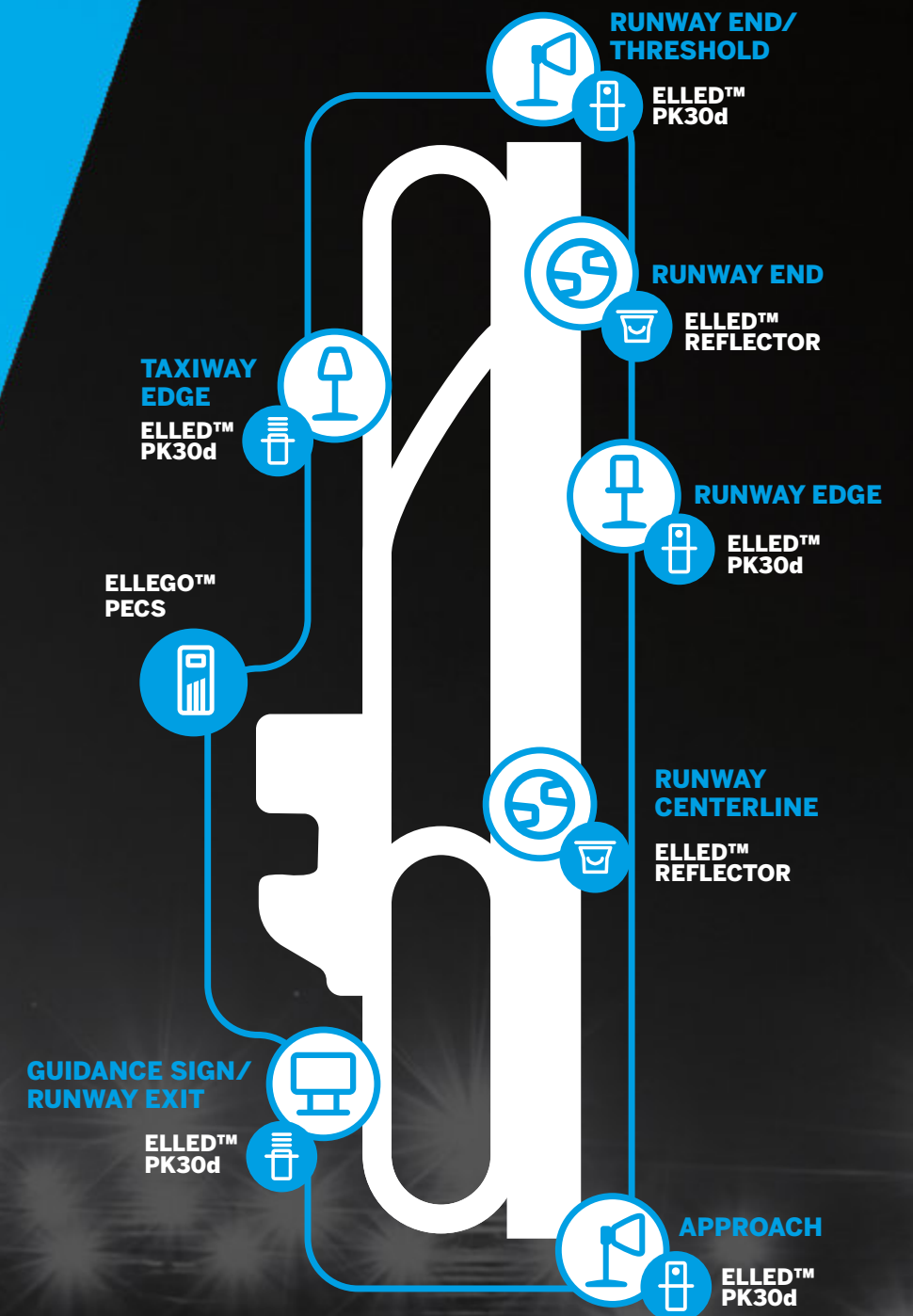
ELLED™ PK30d
LED lamp



ELLED™ Reflector
LED lamp



ELLEGO PECS



ELLED™ system benefits

Driverless ELLED™ technology enables a highly efficient operation and lower lifecycle costs. The system is designed to comply with ICAO light intensity requirements at 1,0 – 3,0 A current, and the conventional 6,6 A current is not required.

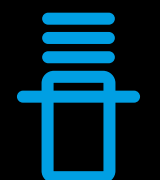
The system has three main elements: ELLEGO PECS, ELLED™ bulbs and light fixtures. Reusing existing cables, connectors, and isolation transformers allows the economic transition from halogen to LED lighting.

ELLED™ system enables a long service life without the problems caused by electronics. It's quick and easy access to fundamental LED efficiency.

Low series circuit currents give your existing cabling an extended lifetime and enable cable and transformer size optimization in new installations. The maximum output voltage of 990 VAC means safer maintenance work, less insulation stress, and a longer lifetime for the AGL circuits.

The ELLEGO™ PECS has many features making operation and maintenance easy.



 Reduces energy consumption by over 90%	 Safer and easier maintenance work	 Investment savings
 Makes reaching carbon neutrality easier	 Lower spare part cost	 Replace only the bulb if needed
 Only one PECStype	 ELLEGOELLED™ in 24/7 field use since 2019	 Remarkable OPEX reduction

ELLEGO™ PECS



For low current series circuits

The ELLEGO™ PECS is a next generation series circuit power supply for AGL systems, as defined in the IEC 61820-3-2.

The term PECS stands for “power electronic converter system” and is used within the standard as a way to differentiate between the technologies.

The ELLEGO™ PECS operates similarly to a constant current regulator by carefully controlling the series circuit primary current, only using significantly lower current levels.

In airport lighting systems, series circuits are commonly used to power the approach, runway, and taxiway lights. These circuits consist of multiple lights connected in a series configuration, where the same PECS controlled current flows through each light. The ELLEGO™ PECS can control the LED luminous output directly without redundant control electronics withing each light unit.

The driverless LED solution is based on the interplay between the low current PECS and the ELLED™ bulbs. The rest of the existing 6,6A infrastructure can be utilized, such as cabling, transformers, and light fixtures*.

*Subject to compatibility verification.



Key Features and Benefits:

- A single PECS model to cover all standard AGL circuits
- Modern user-friendly interface for easy commissioning and maintenance
- PECS provided web interface for:
 - Easy configuration and parameter settings
 - Access to history logs and fault and warning information
- Easy applicability for off-grid and battery backed-up systems

Functionality Highlights:

- 7 configurable intensity levels
- Status indication
- Earth fault detection
- Open secondary fault detection
- Circuit selector
- Circuit direction changer



Technology	Microprocessor controlled IGBT based power supply
Input	500-750 V DC / 3-phase 400 V AC +/- 10%, 6,5 Arms nominal, 50/60 Hz
Output	Maximum 990 V AC, 0 - 3,0 Arms, 3,0 kVA, continuous power signal
User interface	Touch display, local maintenance web pages, status indication colour theme
Remote control	Dual Modbus TCP/IP, Parallel relays (14 inputs, 30 outputs), Profibus DP
Unit	W448mm x D724mm x H1552mm, 158kg, IP20, max 1000m above sealevel

ELLEGO™ Driverless ELLED™ LED solution is a novel and distinctive concept that maximizes operational efficiency while minimizing expenses. Meeting the ICAO light intensity requirements within the current range of 1,0 to 3,0 A, depending on the fixture type, eliminates the need for the conventional 6,6 A current. The ELLEGO™ PECS and ELLED™ LED-bulbs and existing circuit cables and transformers enable easy access to fundamental LED efficiency with very low series circuit currents, down to 0,05 A. Low currents minimize energy losses throughout the series circuit infrastructure, including cables and transformers, with savings up to several kilowatts per circuit.

The ELLEGO™ PECS's 990 VAC maximum output voltage ensures safer maintenance, less insulation stress, and a longer AGL circuit lifetime. Furthermore, the ELLEGO™ PECS has sophisticated features for easy operation, maintenance, and service.

Current controlled ELLED™ Airfield LED-Lamps

The airfield lighting applications provide essential visual guidance for aircrafts during taxi, take-off, approach, and landing. The ELLED™ LED-lamps are highly efficient with minimum number of components.

Key Features and Benefits

- Energy consumption reduces over 90% as compared to the conventional LED-lighting and Halogen lighting.
- Fixture independent LED-lamp.
- The ELLED™ LED-lamps help reaching airport's carbon neutrality goals and reduce annual operational costs.
- Driverless design enables LED's efficiency with Halogen-like simplicity, without failure-prone electronics
- Energy consumption reduces up to 70% compared to 6,6A LED and 95% compared to halogen lighting



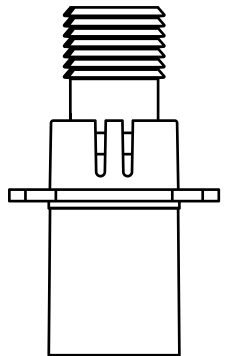
ELLED PK30d LI/MI/HI

PK30d mechanical fit allows modular fixture design with easy repairability and simple spare parts



Low, medium and high intensity omnidirectional applications

- Elevated runway and taxiway lights
- Elevated approach lights
- Guidance signs
- Elevated helipad lights



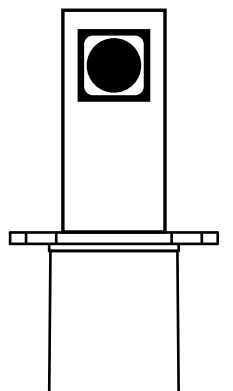
ELLED PK30d DHI

PK30d mechanical fit allows modular fixture design with easy repairability and simple spare parts



High intensity directional and bi-directional applications

- Elevated runway and taxiway lights
- Elevated approach lights
- Guidance signs
- Elevated helipad lights



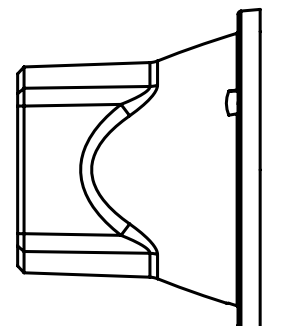
ELLED Reflector 35/50mm

Self-contained bulb design allows modular fixture design with easy repairability and simple spare parts

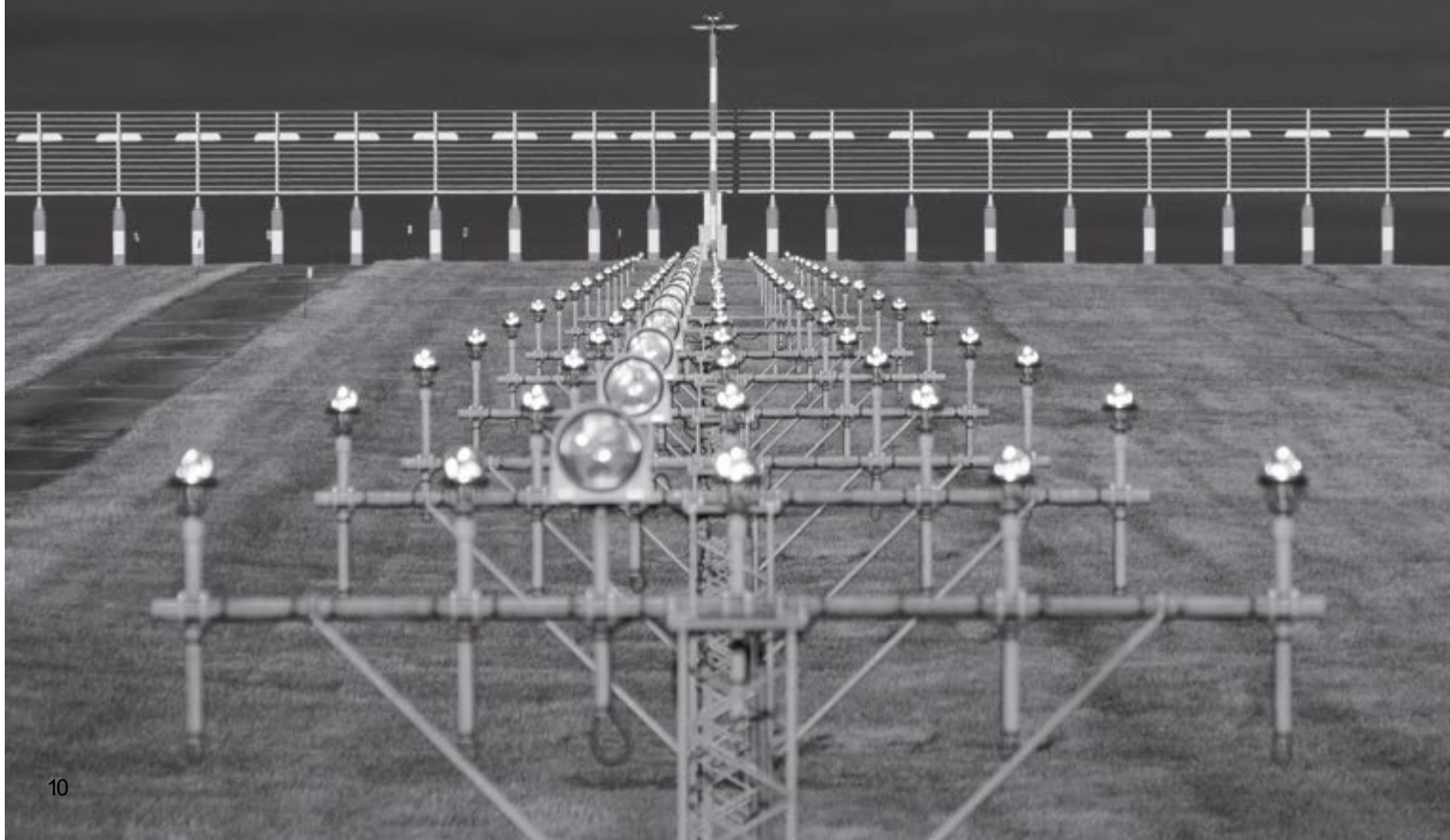


High intensity directional and bi-directional applications

- Inset runway edge and centerline
- Inset threshold and runway end
- Inset approach
- Inset taxiway edge and centerline.
- PAPI



ELLEGO™ AGL Lineup



ELLEGO™ Airfield Ground Lighting portfolio provides a reliable and sustainable solution throughout the airside from approach to apron. The portfolio comprises ELLED™ bulbs and fixtures powered by ELLEGO™ PECS, providing superior energy efficiency, easy maintenance, and high reliability.



ELLEGO™ Approach

Runway Approach Lighting consists of lighting fixtures designed to aid aircraft approaching and landing on a runway. This array of lights offers visual guidance to pilots, helping them align the aircraft accurately with the runway and ensuring a safe landing. The primary purpose of Approach Lighting is to improve the visibility of the runway environment and provide pilots with information about the runway's position and alignment. Various categories of approach lighting systems exist, depending on the runway category and the level of air traffic. The ELLEGO™ Approach lineup is versatile and suitable for various needs, from non-precision to precision approach lighting.

ELLEGO™ Approach portfolio provides a comprehensive solution for sustainable retrofitting and new light installations, including:

- Approach Centerline
- Approach Siderow
- Low-Intensity Approach



CASE EXAMPLE

Precision Approach Lighting, CAT I

Approach Lighting System plays a vital role in enabling aircraft to land safely and accurately in challenging weather conditions. The primary purpose of the approach lighting is to improve visibility for pilots during the critical phase of landing, providing a sequence of lighting elements and visual cues that guide the aircraft along the correct approach path. Below is an example of the ELLED installation calculated for the CAT I approach lighting with a distance coded centerline, and savings compared to a 6,6A LED or halogen installation.

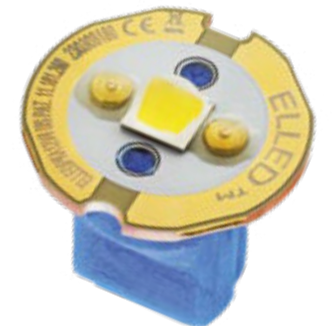
Circuit Information and Fixtures

Description: APCH CAT I, High-Intensity Approach Lighting. The project involves replacing 120 halogen bulbs, each with a power rating of 150W. These bulbs are distributed across three circuits. Each primary circuit has a length of 5km. The calculation takes into account a 50m secondary circuit per fixture and losses from cabling, transformers, and other electronic components.

The calculation is based on assumed daily usage of 10 hours, 7W control power for 6.6A LEDs, 6mm2 primary cabling, 2,5mm2 secondary cabling and 90% transformer efficiency.

The relative usage times for the five brightness steps are listed below

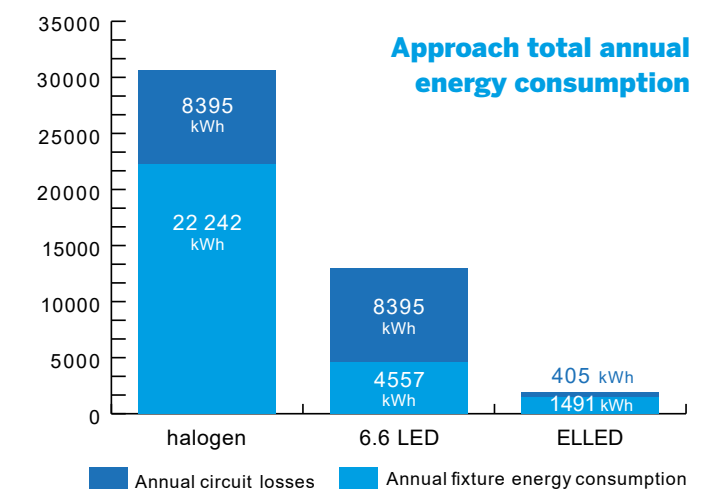
Brightness Steps	5	4	3	2	1
Relative Usage Time	5%	10%	20%	35%	30%
6.6A Currents	6,6	5,3	4,1	3,4	2,8
ELLED Current	2,5	0,75	0,25	0,075	0,025
Relative Brightness Level	100%	30%	10%	3%	1%



Installed Products: ELLEGO PECS 400V, ELLED PK30d DHI LED bulbs. ELLED bulbs were installed directly into the existing halogen fixtures, and no additional holders or fitting components were needed.

Long service life reduces costs and increases predictability

The location and mast installation of the approach lights require careful planning and preparation of the installation equipment before maintenance procedures can be carried out. The long service life and durability of ELLED bulbs reduce costs and increase the predictability of maintenance.



ELLEGO™ Runway

A runway lighting system is a crucial component of an airport's infrastructure, designed to provide visual guidance and aid safe aircraft operations during takeoff, landing, and taxiing. The lighting system comprises various lights and markings strategically placed along the runway. The configuration and design of runway lighting may vary depending on airport size, operational requirements, and regulations established by aviation authorities in a particular region.

ELLEGO™ Runway portfolio provides a solution for a wide range of runway lighting applications, from non-precision runways to more demanding precision runways. These applications include:

- Runway Edge
- Runway Threshold
- Runway End
- Runway Centerline
- Touchdown Zone



CASE EXAMPLE

Runway Edge (CAT I)

Runway edge lights are a fundamental part of an airport's lighting infrastructure, providing pilots with clear visual references. Below is an example of the ELLED installation calculated for the runway edge circuit at CAT I airport, and savings compared to a 6,6A LED or halogen installation.

Circuit Information and Fixtures

Description: RWYE, Runway Edge. The project involves replacing 100 halogen bulbs, each with a power rating of 150W. These bulbs are distributed across two circuits. Each primary circuit has a length of 6,5km. The calculation takes into account a 1m secondary circuit per fixture and losses from cabling, transformers, and other electronic components.

The calculation is based on assumed daily usage of 10 hours, 7W control power for 6,6A LEDs, 6mm2 primary cabling, 2,5mm2 secondary cabling and 90% transformer efficiency.

The relative usage times for the five brightness steps are listed below

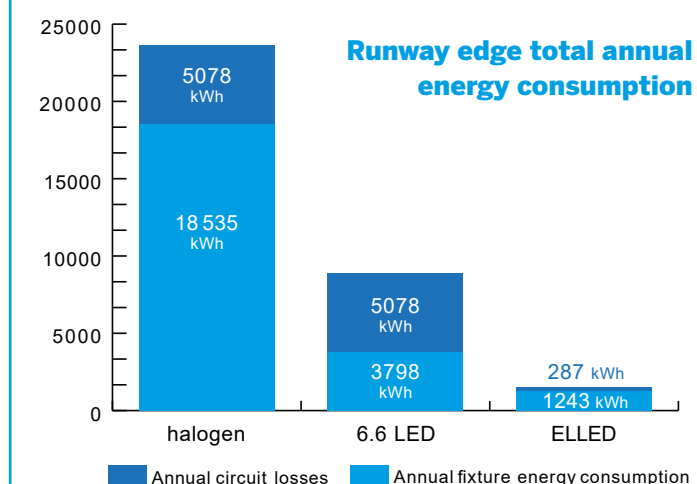
Brightness Steps	5	4	3	2	1
Relative Usage Time	5%	10%	20%	35%	30%
6.6A Currents	6,6	5,3	4,1	3,4	2,8
ELLED Current	2,5	0,75	0,25	0,075	0,025
Relative Brightness Level	100%	30%	10%	3%	1%

Installed Products: ELLEGO PECS 400V, ELLED PK30d DHI LED bulbs. ELLED bulbs were installed directly into the existing halogen fixtures, and no additional holders or fitting components were needed.



Why are cable losses important considerations for runway edge lighting?

Cable losses in AGL (Airfield Ground Lighting) circuits result from the inherent resistance of electrical cables and are a significant consideration in AGL systems. This is because they can affect the performance and efficiency of the lighting and may lead to safety issues if not properly managed. Runway edge lighting is typically interleaved in 2-3 circuits, depending on the runway's length and implementation. As circuit lengths and quantities increase, cable losses become even more critical. Therefore, proper design, materials selection, and maintenance are essential to manage and minimize these losses.



ELLEGO™ Taxiway & Apron

Airport taxiway and apron lighting is a crucial component of the airfield lighting system, designed to provide visual guidance to pilots and ground personnel during aircraft taxiing operations. Taxiway lighting plays a vital role in maintaining safe and efficient ground movements at airports, reducing the risk of collisions, and ensuring clear visual guidance for pilots and ground personnel.

ELLEGO™ Taxiway and Apron portfolio provides a comprehensive solution for a wide range of lighting applications, from the taxiways to the gate, including:

- Taxiway Edge
- Taxiway Centerline
- Stopbar
- Intermediate Holding Position



CASE EXAMPLE

Taxiway Edge

The Taxiway Edge Lighting is a vital component of airport infrastructure, designed to enhance the safety and efficiency of aircraft movements on taxiways, enhancing visibility during day and night operations, adverse weather conditions, and low-visibility scenarios. Below we present the installation reference for the taxiway edge circuit at Turku airport (TKU), and the actual measurements and savings compared to a 6,6A LED or halogen installation.

Circuit Information and Fixtures

Description: TWYE DC, Taxiway Edge. Replacement of 130 Halogen bulbs, each with a power rating of 45W. These bulbs are installed in one circuit, 58 bulbs in the TWYE fixtures and 72 in the signs. Primary circuit has a length of 4,5km. The calculation takes into account a 2m secondary circuit per fixture and losses from cabling, transformers, and other electronic components.

ELLED and halogen data is based on field measurements at the airport with an average daily use of 8 hours. The calculation of 6.6A LED is based on assumed 7W control power, 6mm2 primary cabling, 2,5mm2 secondary cabling and 90% transformer efficiency.

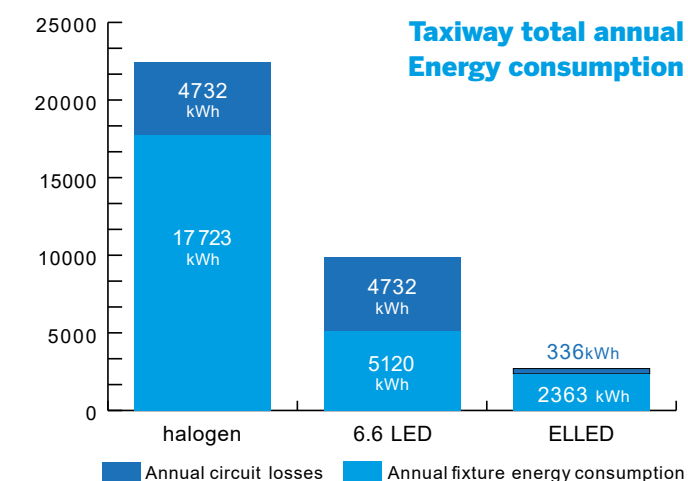
Brightness Step	5
Relative Usage Time	100%
6.6A Currents	6,6
ELLED Current	1,0
Relative Brightness Level	100%

Installed Products: ELLEGO PECS 400V, ELLED PK30d MI LED bulbs with improved thermal management. The bulb holders in the signs were changed to aluminum versions for improved heat dissipation.



Flexible implementation for different applications

In addition to the lights, guidance signs may also be installed on the taxiway circuit. The ELLED retrofit is based on driverless technology, where all the control electronics are placed in the PECS. Driverless technology, along with ELLED's extensive adjustment options, enables ELLED bulbs to be installed and used in various ground lighting applications throughout the airport, including light fixtures and guidance signs.

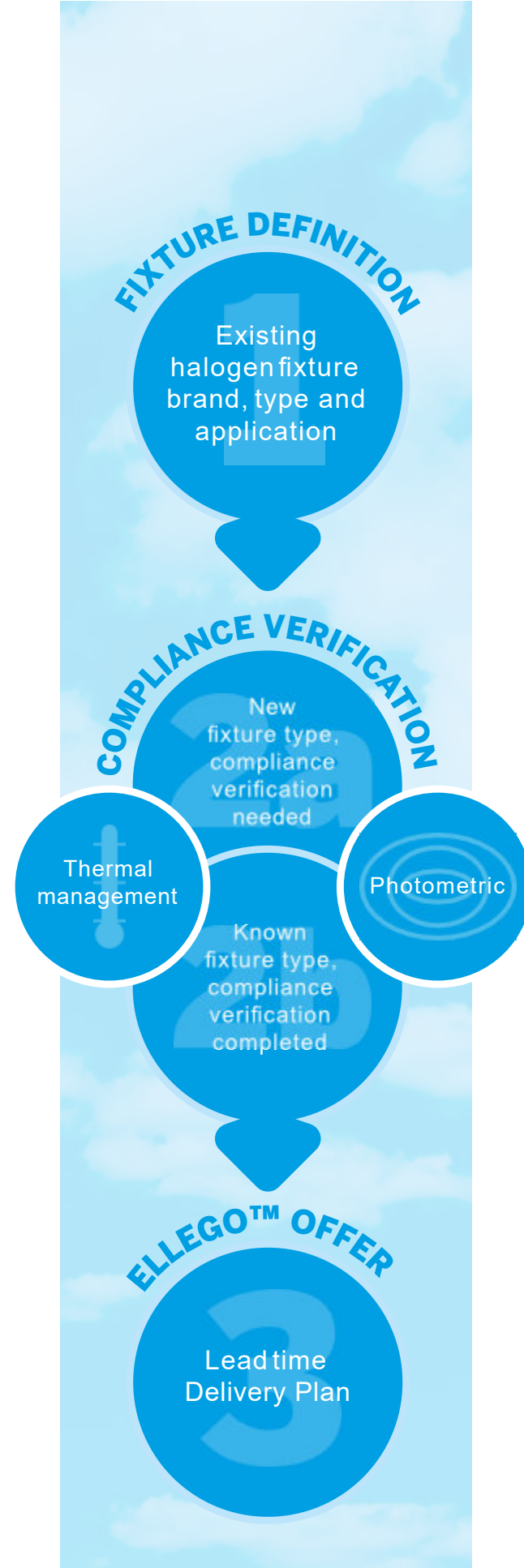


Easy Steps to ELLED™ Retrofit

The ELLEGO™ retrofit verification process ensures a hassle-free yet reliable modification of AGL, meeting the most common industry regulations. Following these easy steps guarantees a seamless transition from halogen to LED: Define, Verify, Install – that's all it takes for an efficient lighting modification.

Energy-saving potential and return on AGL investment can be assessed as part of the process.

Once the verification is complete, we can specify the final solution and plan the installation.



Our Sustainable Commitment

Sustainability and sustainable development play a vital role in everything ELLEGO™ does and it's deeply ingrained in our company culture. Throughout the years, we've taken significant steps to enhance how we manage CO2 emissions and lessen our environmental impact. Using renewable energy has been a cornerstone of our sustainable development strategy. Sources like the Sun, wind, and Earth provide power to most of our facilities. The commitment to sustainability is also evident in our innovative products, where we aim to help our customers operate sustainably.

Our Airfield Ground Lighting portfolio represents an innovative ELLED™ technology contributing to a circular economy and

energy efficiency within the AGL sector. Reusing materials is an effective method for lessening the effects of growth. Simultaneously, the exceptional energy efficiency of this technology allows for optimized infrastructure with minimal energy consumption – resulting in a reduction of over 90%. It's time to take AGL from awareness to action.



The key properties of this technology have been patented in multiple countries



TURN ON THE SOLUTIONS



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