



ARTIFICIAL LIGHT ASSESSMENT SERVICES

PENDOLEY ENVIRONMENTAL

LIGHTING THE WAY



As the world wakes up to the harmful impacts of artificial light pollution, Pendoley Environmental is leading the way, developing cutting-edge tools and techniques to measure, monitor and manage its impacts.

Established in 1997 by Dr Kellie Pendoley, one of Australia's leading artificial light specialists, our rigorous scientific research unlocks the data you need to meet compliance obligations, sending a powerful message to regulators and industry partners about your environmental commitment and eco credibility.

Much of what we do is now considered national best practice, making Pendoley Environmental the go-to experts for government and private sector clients nationwide.

EYES WIDE OPEN

Artificial light is everywhere. Our streets, our homes, offices and coastlines, even offshore. As its prevalence has grown, so too has our knowledge of its impact on wildlife, habitats and human health.

And it's not natural.

Artificial light mimics daylight, sending natural instincts haywire. On turtle nesting beaches it confuses hatchlings so they can't find the ocean. In our homes it disrupts sleep patterns, placing additional stress on our bodies. In the bush it can change wallaby mating behaviour, with joeys born at the wrong time of year when food is scarce.

The more we learn, the more our eyes open to the fact that most forms of artificial lighting need immediate and appropriate management to minimise harmful impacts.

OUR EXPERTISE

Pendoley Environmental is at the forefront of artificial light management. Armed with over two decades of experience in industrial and urban environments, we're extremely familiar with the issues all light producers face.

Such is our understanding of existing and rapidly evolving regulations, standards and compliance requirements that the Commonwealth Government nominated us to develop Australia's first National Light Pollution Guidelines. The guidelines were released in February 2020 and are helping organisations across the country manage and limit light impacts on marine turtles, seabirds and migratory shorebirds.



HOW WE CAN HELP YOU

Pendoley Environmental offers four specialist services to identify artificial light problems and advise on real solutions.

DESKTOP ASSESSMENT

We have a thorough understanding of Australia's emerging regulator framework for the management of artificial light, including the Environmental Impact Assessment process. Our scientists can support you through each step of the EIA process, characterising potential light emissions from a project, developing a risk assessment and providing management plans.

MONITORING

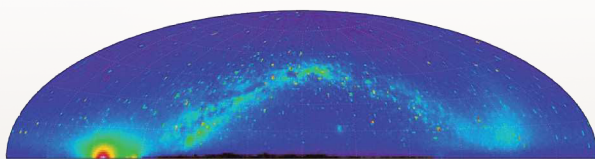
Do you need to demonstrate your lighting has not significantly increased overhead light pollution from levels prior to development? Thanks to our cutting edge light monitoring tools, we can monitor the amount of light visible to sensitive species in habitats adjacent to your project site. Additionally, benchmark light monitoring data can be used as an input if light modelling is required.

MODELLING

Do you need to measure the potential risk of artificial lighting to specific light-sensitive species such as marine turtles or wedge-tailed shearwaters? Our scientists have developed a sophisticated artificial light model that accounts for direct and scattered (glow) light sources, and can accurately represent the wavelengths, intensities and overall spatial visibility of the project lighting.

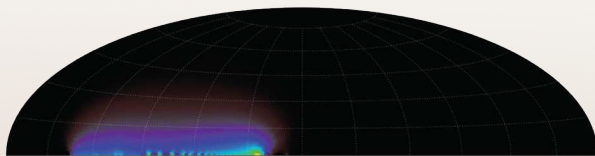
AUDITING

Our experts can audit light at your project site, measure outputs and confirm that emitted wavelengths match manufacturer specifications. In the event we identify problematic lighting, we'll provide advice on effective measures to reduce your lighting output without compromising stringent HES standards and employee safety.



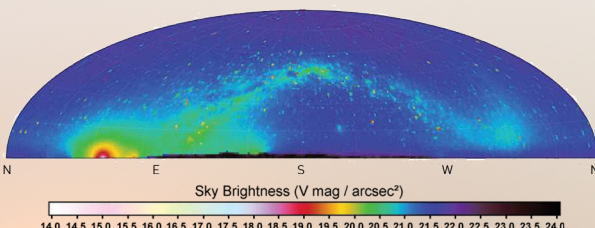
MEASURED OUTPUT

Our light monitoring cameras capture a 360 degree fisheye image and quantify existing light emissions across the whole hemisphere at a given location.



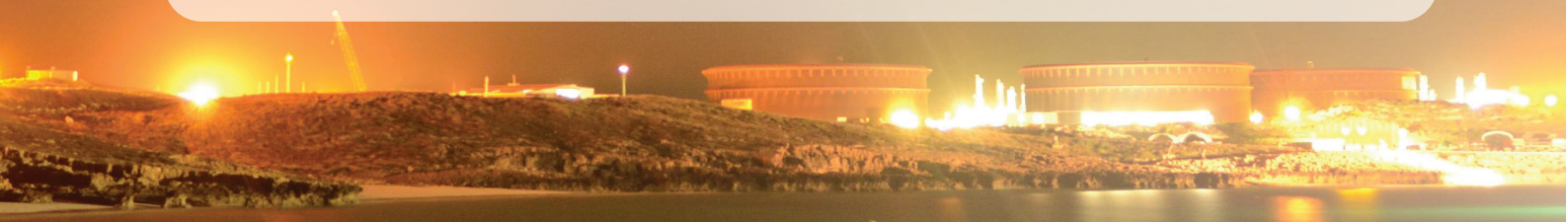
MODELLED OUTPUT

We can model predicted light emissions based on luminaire parameters, locations, and topography. We can also model alternative lighting design scenarios.



MEASURED + MODELLED OUTPUT

We can combine our measured and modelled light outputs to provide a comprehensive view of what the predicted cumulative light horizon will be at your project site.



THE SKY42™ IS THE LIMIT

Our Sky42™ technology is a cost-effective, highly accurate tool that measures light emissions on a scale not previously seen in the industry. Using high-resolution DSLR cameras with fish-eye lenses and in-house purpose-built circuitry, we can capture per-pixel sky brightness values across a hemispherical 360 degrees.

Free from reliance on handheld Sky Quality Meters which can only measure a small zone of overhead sky brightness, Sky42™ uses specialised software to remove the influence of natural brightness sources such as stars and the Milky Way, resulting in highly accurate and comparable visual brightness outputs of the entire sky.

What's more, our hand-built cameras are rugged and weatherproof, able to withstand the sand, dust, rain, humidity, heat and wildlife that is common in Australia's harsh environments. That arms Sky42™ with the ability to operate autonomously on-site for an entire night, taking photographs every 15 minutes, uninterrupted.

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CASE STUDIES

SUNSHINE COAST

The challenge

Every year, marine turtles nest on beaches along the Sunshine Coast. Artificial light can deter adult turtles from nesting and cause disorientation in hatchlings as they leave the nest and seek the ocean. With growing concern about these effects, Pendoley Environmental was contracted to measure current levels of light as a 'benchmark' to assess future change and identify problematic sources of light in order to recommend effective solutions to reduce visible light.

The solution

We measured light at 16 locations on 12 beaches during the new moon. The image data was then carefully analysed to measure sky glow, taking into account dune profile, vegetation and other observations of natural features to identify the direction and source of the brightest point sources of light visible from the beach.

The outcome

By adding motion sensors, timers and filters to bright white LED streetlights, the client reduced the amount of light visible to nesting turtles. Our report also supported decisions to maintain useful, healthy vegetation screens along the coastline to allow the nesting beach to remain dark. The data gathered set a benchmark for artificial light in the Sunshine Coast region so that conducting repeat surveys will enable us to identify exactly how artificial light profiles have changed, paving the way for effective future management.

PLUTO LNG PLANT

The challenge

Woodside's Pluto is an LNG plant 190km off Karratha in WA's northwest. Situated in close proximity to a turtle nesting beach, the client called upon Pendoley Environmental to audit their facility to ensure compliance and make recommendations for lighting management.

The solution

Pendoley Environmental audited lighting at 15 site locations and surveyed three beach locations over several nights during the new moon. We analysed light type, spectral output, height, directionality, shielding and switching function. The image data was then used to identify specific lights that were visible from the beach, as well as quantify the overall sky glow from the LNG site, LNG vessels and flaring events. Our analysis also looked for any links between lighting and historical turtle nesting and hatchling orientation data.

The outcome

The data allowed us to make recommendations to reduce lighting within the LNG site, including the addition of shielding to lights visible from the beach, a reduction in reflected lighting and the design of smart lighting to be taken into consideration during the next maintenance program.



GORGON DEVELOPMENT

The challenge

Chevron's Gorgon project, one of the world's largest LNG plants, is located on Barrow Island, a Class A Nature Reserve off the coast of WA's coast on the North West Shelf. Prior to construction, the client called on Pendoley Environmental to provide a long-term solution to measure and limit the impacts of the plant's artificial light on flatback turtles that use beaches on the east coast of the island.

The solution

Using specialised Sky42™ technology, Pendoley Environmental designed and implemented an annual light-monitoring program to measure and compare light during baseline, construction and operations. Deployed across multiple sites, up to eight nesting beaches are surveyed annually on the new moon to detect and measure light as perceived by turtles. We also developed a novel technique to use the light data to assess changes in hatchling sea-finding behaviour that may be caused by fluctuating light.

The outcome

This ground-breaking program provided unprecedented insights. Whole-of-sky glow had never before been measured with this level of detail, nor had anyone captured information that is biologically relevant to a specific species through all phases of a major coastal development. The data collected allowed us to identify any impacts on turtle behaviour (both on- and offshore), pinpoint light sources and patterns, and recommend management solutions as required.

LIGHT POLLUTION GUIDELINES

The challenge

The Commonwealth Government of Australia called upon Pendoley Environmental to develop the 'National Light Pollution Guidelines for Marine Turtles, Seabirds and Migratory Shorebirds'. The document will be the first of its kind to address the potential impact of artificial light, identify endangered species and habitats at greatest risk and provide methods to model, measure, monitor, mitigate and manage light pollution for these taxa.

The solution

Pendoley Environmental assembled an international, multi-disciplinary team comprising specialists in the fields of marine turtle and seabird biology, artificial light modelling, light measurement and monitoring, lighting design, engineering, urban planning, legislation and standards. During development of the guidelines, the team consulted with multiple stakeholders, end users and other experts to ensure all information was current and relevant.

The outcome

The Guidelines were publicly released in February 2020 and set the national standard for best practice of management of artificial light in proximity to sensitive habitats. They have been well-received by stakeholders and new developments are already incorporating them into their lighting design and management plans.



PENDOLEY
ENVIRONMENTAL

12A PITT WAY, BOORAGOON, WESTERN AUSTRALIA, 6154

+61 8 9330 6200

penv.com.au