

## Case Study

### **Thor: Road Lighting Solution for Copenhagen**

*London, May 2016 - In the Danish capital Copenhagen half of the lighting points have been exchanged with energy efficient LED luminaires. The Thor lantern from Thorn offers Scandinavian design and ideal lighting performance for the application. Connected via a wireless lighting control management system, future proof lighting control management can be realized, which is an important aspect for the Smart City.*

#### **Background**

The City of Copenhagen, Denmark, is one of the world's smartest and most sustainable cities. Having set an ambitious target to become carbon neutral by 2025, Copenhagen is currently transforming how it manages energy, and is on track to become the first carbon neutral city in the world. Contributing to this target is the usage of renewable energies, the construction of energy efficient buildings as well as increasing the cycle path network in the city. Based on these efforts, the community with its 600.000 inhabitants has already been awarded "Green City" in 2014.

Another key requirement for achieving Copenhagen's carbon neutral target, is a substantial reduction of the energy consumption from the street lighting. To meet this target the almost 20 000 street lanterns with mainly high-pressure sodium lamps needed replacing.

#### **Lighting objectives**

Copenhagen wanted an energy efficient lighting solution that would not only consume less energy but also use secure wireless lighting controls to increase energy savings. Further aims were enhanced safety as well as comfort and better lighting quality.

At the beginning of 2016 almost 20 000 road lighting luminaires have now been replaced with luminaires with LED technology only. The majority are mounted on catenary systems above the

roads. With the change to LED light sources the energy consumption has been reduced by close to 57% - securing a reduction in both the carbon footprint and maintenance costs. The renewal project, which includes intelligent lighting controls too, is managed by Citelum, who won the contract in 2013 when the City of Copenhagen tendered it out. Thorn delivered the customized road lantern Thor for this project. The Thor luminaire meets the specific project requirements, including the mounting options of either catenary or post-top.

The City of Copenhagen's lighting objectives were as follows:

- Replace the high pressure sodium lamps on Copenhagen's residential roads, larger streets and highways with an efficient custom designed LED lantern
- Achieve substantial energy and CO<sub>2</sub> savings to help the city achieve its target of being carbon neutral by 2025
- Improve the quality of street lighting to increase security and comfort
- Integrate lighting control with traffic density data to adapt lighting levels according to road use in the future
- Create a central management system for the effective management and control of street lighting

### **Developing a custom lantern for the City of Copenhagen**

In quarters like 2100 *Oesterbro* or 2300 *S Amager* the elegant *Thor luminaire* shapes the cityscape. The City of Copenhagen wanted to bring something new and urban to the streets, but also to maintain familiarity with a similar shape to the old luminaires, and a broad Nordic appeal that will last for decades. The luminaire also needed to be able to integrate future technology for a Smart City and offer the possibility for uplift. And it goes without saying that it should be possible to mount the luminaire on catenary systems as well as post-top mounting. Furthermore it should have a uniform light distribution, similar to the old lamps.

The lighting distribution should cover the road, pavements and cycle paths. This increases the feeling of safety and pedestrians perceive the sidewalks as an attractive, public space.

Having already designed other successful Thorn luminaires, Thorn appointed Danish lighting designer Morten Lyhne to help realise Copenhagen's objectives. His design is characterized by simplicity. It combines functionality with aesthetics, and always include a certain intelligence as well. This becomes apparent in the design of the LED road lantern Thor, which he created for Thorn.

With a round, simple design the luminaire continues Copenhagen's tradition for round lighting fixtures. The luminaire efficacy of 97lm/W fulfils the performance requirements. The polycarbonate top dome can house an additional LED module and as a result provide the specified uplift. This

indirect light ensures that the luminaire keeps its shaped appearance, also when it is dark. The dome also provides the smart city requirements, i.e. an antenna and electronics can be mounted inside the fixture.

Approximately 8 500 Thor lanterns mounted in 8m height catenary system as well as 1 500 post-top luminaires in 6m height create the Scandinavian look and feel, and integrate harmoniously into the cityscape. With different colour temperatures to choose from, and distances between the luminaires from 28m to 30m, main roads as well as residential areas, plazas and parks are lit up according to the road standards. According to Danish lighting levels, generally lower than for the rest of Europe, Thor is installed with luminance levels of 0,75 to 1 cd/m<sup>2</sup> and illuminance levels of 2,5 to 15 lux. Other strict requirements, especially for wet roads are met as well.

### **Connectivity for energy efficiency, monitoring and traffic management**

The new Copenhagen road lighting is connected via a wireless control system from SilverSpring Networks, which is based on the “wireless IPv6” protocol and is compatible with the servicing software from Citelum. Based on this, the functionalities of the luminaires can be used for smart lighting management, and as a result for an energy efficient operation as well as a complete monitoring accompanied by planned maintenance intervals.

There are preparations in place to control the luminaires based on daylight levels in the future. Another possibility is to connect the lighting with traffic management data and adapt the illuminance – without affecting safety – based on traffic density and the situation on the road. If the traffic density is lower, the luminaires, which have a wet road optic optimised for illuminating wet roads, can be dimmed between 30% and 70%. Beyond that the cycle-friendly transport policy of Copenhagen can be included by introducing optional sensors and camera systems, that can be integrated in the Thor luminaire. Cyclists can be detected, and then guided to what seems to indicate the quietest or fastest route. This shows what possibilities data connectivity and technologies offer today, and how much Copenhagen focuses on creating a Smart City that is beneficial for the citizens.

### **Benefits of the new custom designed Thor lantern**

The new Thor lantern, custom designed and developed by Thorn, is providing the following benefits for the City of Copenhagen:

- Energy efficient LED lighting (97Llm/W) which reduces energy consumption by up to 60%
- Maximised energy savings with light output management through the night. Control options currently include a pre-set schedule and daylight dimming. In the future smart data will be used to adjust light levels automatically to road use.
- Better quality of light for improved comfort and safety (luminance levels of 0,75 to 1 cd/m<sup>2</sup>; illuminance levels of 2,5 to 15 lux; various colour temperatures; colour rendering index of 80)

- Reliable build, and set for simple maintenance to substantially reduce costs of operation during a very long expected lifetime.
- Easy to maintain with instant failure/fault alerts to the central management system
- Designed to enhance Copenhagen's distinctive architecture

**Key facts**

- Custom designed urban lantern
- Energy savings of up to 60%
- Substantially reduced maintenance with a 90 000-hours lifetime
- High quality of light for comfort and safety
- Smart lighting controls

**Focusing on the application – the new Thor L**

The experience from the demanding project has been used to create the second generation of Thor, which will be launched at L+B. New from Thorn, Thor L is an intelligent urban lantern based on the City of Copenhagen's custom designed Thor lantern. Thor L offers a truly connected solution for smart, energy efficient lighting. It can incorporate intelligent wireless control systems and is compatible with various communication devices, including sensors and CCTV cameras. Thor L's polycarbonate top dome allows components to be mounted inside the dome to meet Smart City requirements.

Designed for easy integration into every city environment, Thor L features great light optics for high user comfort and a wide range of flexible mounting options including lateral, post-top, suspended and catenary. Thor L delivers a light output of up to 12 000 lumens with the choice of either a full dome or opal finish to help create a distinct luminaire signature. Compatibility with three R-PEC optics (narrow road, wet road and street comfort) allows precise light placement with no waste light. Thor L is available in 3000K and 4000K.

Thor is ideal for energy efficiency and sustainability systems. With its Scandinavian aesthetic, it provides value and benefits for every cityscape.

**Pictures:**



The luminaire integrates perfectly into the surroundings, mounted post-top.



Most street lanterns in Copenhagen are catenary mounted above the road, depending on the size of the road in one or two rows.



Thor installed on one of the main roads in Copenhagen.



The LED street lantern Thor L from Thorn

### **About Thorn**

Thorn Lighting is a globally trusted supplier of outdoor and indoor luminaires with integrated controls. Our mission is to make great lighting available to all. Our high performance lighting solutions can be found in many different applications such as sport, road, tunnel, cityscape, office, education or industry.

Founded in 1928, we have years of experience in providing lighting solutions. Leveraging our research and development facilities, we actively work to promote the correct lighting standards and are uniquely placed to combine the latest light source technology with our specialist expertise in optical and luminaire design. We focus on digitally-integrated solutions through the latest lighting controls technology. Our aim is to exceed the requirements of customers all over the world to become the trusted, reliable, professional long-term partner for cost-effective lighting.

We offer energy savings without compromising performance, efficiency and comfort. To achieve a lighting solution where aesthetics, optical performance, and energy consumption are all in perfect balance is at the core of what we do. Our lighting solutions are easy to specify, install, and maintain. Thorn is part of the Zumtobel Group.

For more information, go to [www.thornlighting.com](http://www.thornlighting.com)

### **Press Contact:**

Wiebke Marie Friedewald

Head of Brand Communications

Mobile +44 (0) 7785 224914

[wiebke-marie.friedewald@zumtobelgroup.com](mailto:wiebke-marie.friedewald@zumtobelgroup.com)