

# NORDIC KNOW-HOW 2020



BEST PRACTICES OF  
SUSTAINABLE HEALTHCARE  
IN THE NORDICS

REPORT SERIES BY  
NORDIC CENTER FOR SUSTAINABLE HEALTHCARE

A black and white photograph of two surgeons in an operating room. They are wearing surgical masks, hairnets, and scrubs. The scene is illuminated by large, bright overhead surgical lights, creating a high-contrast environment. The surgeons are focused on their work, with their hands visible in the foreground.

**#3 LIGHTING**

# INTRODUCTION

**Climate change** is one of the greatest environmental challenges faced by societies today and action must be taken from a wide range of sectors – healthcare being no exception. A recent study estimates that the climate footprint of the healthcare sector is equivalent to 4.4% of global net emissions (HCWH, 2019).

**Nordic sustainable healthcare** is considered to be in the forefront in a global context (Eriksson et al, 2019). Sustainability within healthcare has a long tradition in the Nordics and there are many good examples of best practices.

The aim of this Nordic Know-How report series is to spread knowledge and examples of best practices to international actors in the field of sustainable healthcare.

The theme of this third report in the Nordic Know-How series is **lighting**. Lighting arrangements in hospitals and other healthcare buildings can save energy, create a better working environment and provide an optimal colour reproduction, which is important in a setting where operations and medical examinations take place. This report provides good examples from Swedish municipal regions and hospitals on sustainable lighting installments.

## NORDIC KNOW-HOW

### #3 LIGHTING

Report series by  
**NORDIC CENTER FOR SUSTAINABLE HEALTHCARE**  
2020

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# ABOUT LIGHTING IN HEALTHCARE

The healthcare setting is a demanding environment for lighting arrangements. Different rooms need to be lit in different ways depending on need and purpose. In examination- or operating rooms good lighting and colour reproduction are crucial, while a patient room or a hospital corridor have different premises for high quality lighting arrangements.

A hospital is a 24/7 operation and therefore requires sufficient lighting arrangements at all time. This is also why it is important to have energy efficient lighting solutions, with a long-life cycle and low maintenance cost.

Considering sustainability when installing lighting arrangements in a hospital or in other healthcare organisations can be both an environmental and financial saving. Good lighting can also have several health benefits for the patients. In this Nordic Know-How report we will look deeper into sustainable lighting for the healthcare sector.

## ENVIRONMENTAL IMPACTS

As mentioned above, hospitals are 24/7 operations in constant need of well-lit conditions in combination with a high energy consumption. Lighting is thus an area with good energy saving potential. By using high performance lamps, movement sensors, or other means to reduce the energy use of lighting in the hospital, substantial environmental savings can be made (Chalmers, 2016).

## HEALTH IMPACTS

Lighting can also have positive effects on human health, both for patients and the healthcare staff. Studies have shown that lighting can improve sleeping patterns of patients, speed up recovery and reduce the hospital stay (Thompson, 2015). It has also been proven that lighting can improve the working environment and increase both alertness and performance of healthcare staff (Sunde, et al., 2020).



# TECHNOLOGY FOR LIGHTING

In recent years the development of new light sources has dramatically taken off. This is mainly thanks to the LED technology that has revolutionized the energy performance of modern lighting. LED stands for Light Emitting Diode and has during the latest years become the leading technology for lighting thanks to low energy consumption, a small environmental footprint, long lifespan and controllability.

Old technology like fluorescent- and incandescent light sources has gradually been phased out due to bad energy performance and hazardous substances as mercury.

## LIGHT QUALITY AND FLICKER

Light quality is measured in Rendering index (Ra) which is how we measure the ability of the light source to render the spectrum of light. Full spectrum light (sun light) is represented by Ra100. Generally, a high-quality LED should have Ra95 or more. A low-quality light source with lower Ra is just rendering some parts of the spectrum. Some colours may therefore appear as grey since light is not present in that spectrum.

The ballast (the control unit of the light source) does also have an impact on the lamp's performance. A good LED chip in combination with a bad ballast will still be a bad light source. The design of the ballast affects the energy consumption, lifespan, as well as the quality of the light in the form of flickering.

Flickering light may be a stress factor to some people. Full spectrum lighting with minimal flicker is therefore prioritized to create a pleasant environment for patients and staff in stressful situations.

## LIFESPAN AND ECONOMY

Head to head a LED lamp is more energy efficient than other light sources. But there are also other parameters that can reduce cost. In a 24/7 environment, long lifespan is an important factor for reducing the maintenance cost and the frequency of replacement. Replacing lamps may be a considerable cost of the luminaire's life cycle.



# TECHNOLOGY FOR LIGHTING

## DESIGN AND ERGONOMICS

Traditionally indoor lighting has been limited to the physical design of the light sources. The luminaire has therefore been designed to reflect the light in desired directions with loss in efficiency as a result. LED emits light in one direction and depending on the placement of the luminaire, energy consumption can be reduced even further.

A luminaire that can be integrated and designed for the need may need even less energy since all the light is directed where it should be. This not only reduces energy consumption but also improves the working environment. Lighting solutions that can be adjusted for different working tasks in a room is called adaptive lighting.

## CONTROL AND SYSTEM INTERGRATION

LED can also be controlled by a dimmer or a presence sensor which can even further reduce the energy consumption by adjusting the need of light or be turned off when no one is in the room.

There are also more advanced control systems where lighting is included in the building's control system, data can then be used to analyse use of spaces to optimise this.

## FUTURE OF LIGHTING

Human Centric Lighting is a concept that can be especially interesting in a Hospital environment with a 24/7 operation. Human Centric Lighting is mimicking the natural sunlight during the day, which means that the light is bluer at daytime and more yellow at night-time. It has been shown that the night staff experience less stress if the light is adapted for night conditions, suppressing the blue colour spectrum.

T8 linear florescent tubes has been a widespread light source in public facilities and is now the next lighting source to be phased out. From 2023 and onwards the T8 tubes will no longer be available in the EU. Since this type of lighting is widely spread it is good to be prepared and find alternatives.



# EXAMPLES FROM SWEDEN

FOR MORE INFORMATION ABOUT THE EXAMPLES  
AND SUPPLIERS PLEASE CONTACT NCSH:

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## REGION JÖNKÖPING HÖGLANDSSJUKHUSET EKSJÖ

Högländssjukhuset Eksjö, located in Region Jönköping, is a modern emergency hospital and one of the largest county hospitals in Sweden.

From 2016 to 2020 the new building 37 was under construction. Regarding the lighting in the building, requirements were made on energy efficiency and long lifespan. Inside building 37, only LED luminaires are installed and all luminaires are equipped with drifters that are Dali compatible. A Helvar control system manages the functions of the luminaires (Region Jönköping, 2020).

In most areas where the hospital's operations do not require otherwise, lighting has functions such as presence control, absence control and daylight control (e.g. in bright corridors). In operating theatres it is possible to choose light color via RGB control and in the ICU, lighting where color temperature is controlled to follow the rhythm of daylight is installed. The luminaires are chosen for the different requirements of healthcare for function, illuminance, hygiene, and more. The LED luminaires also result in reduced maintenance when fluorescent lamp replacement is not required. At the start of the project, the LED luminaires were slightly more expensive than fluorescent lamps, but today there is no big difference (Region Jönköping, 2020).

## REGION BLEKINGE BLEKINGE HOSPITAL

At the premises of Blekinge Hospital in Karlskrona, LED lighting have been installed with Illuminance 1600 lux, colour temperature 4000 kelvin, system power 47 watts. Low energy efficiency, a long and economic life span and a simple maintenance are some important factors (Annell, n.d.).

Since 2014, Blekinge Hospital has ergonomic light in two rooms: an Angio intervention room and the room next to it. The ergonomic light is zoned and consists of red and green light. The light can be adjusted and adapted to the needs both before, during and after surgery. The ergonomic light contributes to an improved working environment and according to a survey conducted, 92% of users of ergonomic light thought it made a big difference and improved the view of the screen (Chromaviso, n.d.)

# EXAMPLES FROM SWEDEN

## REGION KALMAR

### KALMAR COUNTY HOSPITAL

At the Kalmar County Hospital, in Region Kalmar, LED luminaires are generally always used when new lighting is installed. Mainly active ignition is used with button, but absence extinguishing via sensor for presence. In the public corridors, time control and presence sensors that control the basic light are used 10% to 90% at the highest. Also in culverts and underground transport passages, presence control is used via sound or presence sensors that control from basic light 10% to a maximum of 90%. Daylight regulation is not normally used, as the technology is not considered stable enough for this type of workplace (Region Kalmar, 2020).

Measurements made have shown that for culverts, the current lighting system has resulted in a saving of between 70-80% in electricity, compared to the older technology with fluorescent luminaires. The general electricity saving is estimated to be at least 50% compared to fluorescent technology. Measurements made in a newly built health center of 4200 m<sup>2</sup> have shown a total maximum power per m<sup>2</sup> of local area of approximately 8-10 w/m<sup>2</sup>. The lighting there accounts for a large part of the power reduction. Dali communication with local control of light levels is used. It has been discovered that the same light level in a room can be obtained with fewer luminaires, which has led to saving on installation costs when replacing luminaires. The LED luminaires have been on the premises since 2012 and no increased costs when it comes to operation and maintenance have been experienced when compared to fluorescent technology. Today, the region has installed LED lighting in hospital premises of 45,000 m<sup>2</sup> (Region Kalmar, 2020).

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## CARLANDERSKA HOSPITAL

A couple of years ago, the Carlanderska Hospital in Region Västra Götaland got a completely new hospital building. In connection with this, a KNX system was introduced as part of the new building, which strived for high functionality together with the high demands that new constructions require. The KNX configuration, together with presence sensors, adapts led lighting to an optimal level that meets both the stringent accessibility requirements required by nursing facilities, while providing an energy saving – which forms the basis for Carlanderska's environmental certification in accordance with GreenBuilding (Västra Götalandsregionen, 2020).

Furthermore, the choice of LED lighting is a more sustainable option than the conventional halogen and fluorescent luminaires, not only from a lower energy demand and thus lower electricity costs, but also because the life expectancy increases significantly, which in itself generates lower maintenance costs.

Some monitoring is also available on this type of luminaire, which quickly gives the operating department indications of operational problems (Västra Götalandsregionen, 2020).

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## ABOUT NORDIC KNOW-HOW

**Nordic Know-How** is a report series created by Nordic Center for Sustainable Healthcare (NCSH), within the project *Platform for Internationalisation: Energy and Climate Smart Healthcare*. The project is financed by the Swedish Energy Agency.

This series consists several reports which provide an overview of good examples and best practices of sustainable healthcare in the Nordics.

Each report has a certain theme relating to a sustainability challenge in the healthcare sector. The purpose of this series is to bring Nordic practices and knowledge to international actors, spreading Nordic expertise in this field to the world.

Nordic Know-How:  
#1 Nitrous Oxide Destruction  
#2 Geothermal Energy  
#3 Lighting

