

# lux & lumen

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# lux & lumen

75 Years of  
**Light**  
1947-2022

## News magazine and product guide 2022

Published by Glamox

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Please refer to our website for information about our 5 year warranty.

# The Glamox Group

Glamox develops, manufactures and distributes professional lighting solutions for the global market.

## Quality brands and solutions

The Group owns a range of quality lighting brands. Glamox is committed to meeting customer needs and expectations by providing quality products and solutions, service and support.

## Technology and expertise

Our products and solutions are developed and tested by our engineers at our own research and testing facilities, and manufactured and certified in accordance with all relevant quality and environmental standards. They are based on the latest technology and expertise – and generations of experience.

## Our product brands for land based lighting



Glamox is a leading lighting brand for professional markets, onshore and offshore, established in 1947. The wide assortment of Glamox products is of superior technical quality, and available for a wide range of applications – including challenging environments.



For more than 80 years Luxo has designed mainly arm-based innovative, ergonomic lighting products. Luxo products improve lighting conditions, taking particular care of individual needs.



Küttel is a leading supplier of professional lighting solutions, based in Kriens in Switzerland. Products from Küttel combine quality, up-to-date technology and contemporary design.



Since 1986, Luxonic has excelled in the design and manufacture of energy efficient, aesthetically pleasing lighting products, for the education, health-care, commercial, retail and industrial sectors.



ES-SYSTEM's mission is to deliver energy-efficient, innovative and comprehensive lighting solutions while minimizing its negative impact on the natural environment and maximizing care for the users' comfort and health.

# lux Lumen

lumen (lm) is the unit of luminous flux; a measure of the total amount of visible light emitted by a light source.

lux (lx) is the unit of illuminance, measuring luminous flux per unit area; a measure of the intensity of light that hits a surface.

## Creating light for a better life

Creating light for a better life has been in focus since Glamox was established in 1947 by the Norwegian scientist Birger Hatlebakk. 75 years later, this is still the core of our offering and is reflected in our mission statement – “We create sustainable lighting solutions that improve the performance and wellbeing of people”.

Today, Glamox is a global organisation, which employs 2,300 professionals, operates in more than 60 countries and has production facilities in Europe, Asia and North America. We celebrate our 75-year anniversary by unveiling a double revamp of our external profile: a refurbished website and an updated logo and visual identity. Rather than signaling a major shift in strategy or position, the changes affirm Glamox’s established position as a leading provider of sustainable lighting solutions for the global professional market.

Lighting contributes to 15-20% of the world’s electricity consumption, and accounts for 5% of the world’s greenhouse gas emissions. Because of this we see it as our responsibility to create lighting solutions that improve the performance and wellbeing of people. Our solutions can reduce the energy consumption of a lighting installation by up to 90%, and our ambition is to be a sustainability leader in our industry.

Professional lighting solutions resemble most things in life. In the end, it’s about people. Whether in a production facility, a fishing vessel or an office building, the lighting should benefit those who work there – their working conditions and their wellbeing. This fundamental attitude has inspired Glamox’s new-coined vision: Creating light for a better life.

We hope you will enjoy the 2022 issue of lux&lumen.





## Modern products and solutions

We offer a range of lighting brands, and provide our customers with expert advice and solutions. Our products are engineered for easy installation, with modern electronic components and light sources for the best energy efficiency and economy. Our lighting solutions help create the experience of comfortable, flexible and stimulating working environments – enhancing efficiency and performance, while taking care of individual needs.

Glamox is certified in accordance with ISO 9001 and ISO 14001.

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## Product overview

Find your product by using our picture overview.



A man with grey hair, wearing a dark suit and a light-colored shirt, is sitting in a bright red armchair. He is smiling and looking towards the camera. The background is a wall made of large, irregular stone blocks. To the right of the man, there is a glass display case containing some plants. The overall lighting is warm and focused on the man.

# Proving your green credentials

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We are living in a world that is becoming increasingly globalised. There's also a much greater focus on the environment and cutting carbon emissions. Businesses competing in globalised markets now require verified and comparable documentation of the environmental performance of products and services throughout the lifecycle.

**B**ASED IN OSLO, Norway, The Norwegian EPD Foundation (EPD-Norway) helps businesses to communicate the environmental performance of their products through verified and understandable environmental declarations. The program ensures that the development of EPDs (Environmental Product Declarations) for all types of products are carried out in accordance with the requirements set out in ISO 14025, ISO 21930 and associated industry standards (EN 15804 for Building Materials). EPD-Norway cooperates with other EPD program operators around the world that also follow ISO 14025. Almost every European country has at least one EPD program operator. Many other countries around the world have equivalent EPD program operators.

#### What is an EPD?

Recognised in Norway and internationally, an EPD provides a standard way of declaring the impacts of manufacturing and using products through Life Cycle Assessment (LCA). An EPD is a concise document that summarises the environmental profile of a component, finished product or service in a standardised and objective way. It is created on the basis of an LCA according to ISO 14040-14044. These standardised methods ensure that environmental information within the same product category can be compared from product to product, regardless of region or country.

Since 2015, Håkon Hauan has been Managing Director of EPD-Norway. He comments: "I'm not an engineer. I studied International Economics and Administration at the Norwegian Business School in Oslo. From 1992, I worked as Director for Agfa Gevaert and CEO for Philips Norway. I also worked abroad for many years, including working for the Norwegian Government as CEO for Innovation in Spain,

where I was responsible for environmental [EEA] grants and projects within Renewable Energy and the Environment. This role and my interest in the environment ultimately led me to apply for a position at EPD-Norway."

EPD-Norway is a type III environmental declaration program operator under ISO 14025. The program has established a system for verification, registration and publication of EPDs, as well as the maintenance of registers for EPD and PCR (Product Category Rules). EPD-Norway is a co-founder and member of the ECO Platform, a not-for-profit organisation that aims to harmonise the development of the use of EN 15804 in EPDs for construction materials. Håkon was recently appointed as President of the ECO Platform.

#### Who should have an EPD?

The target audience for EPD applications is primarily Business-to-Business (B2B) but does not exclude B2C (Business-to-Consumers). To date, most EPD applications have come from the Building & Construction Industry – the biggest contributor to greenhouse gas emissions but also the sector with the greatest potential to reduce carbon emissions – with applications also coming from other industry sectors. Lighting, for example, comes under the 'Building Materials' category.

As Håkon Hauan states: "The purpose of an EPD is to enable the customer to compare the environmental profile and make an assessment and choice based on the environmental declaration. Anything from office furniture, glass and concrete used in a building project, to lighting, roofing, aluminium and asphalt, can be environmentally declared. The key is that an EPD is independently verified to ensure objectivity, comparability and credibility."



## What are the benefits?

Taking the Construction Industry as an example, products are assessed using a single set of Product Category Rules (PCR) to ensure consistent reporting for similar products. EPD for construction products in Europe use the European standard EN 15804 as key fundament for all PCRs, which ensures that the information provided uses the same Life Cycle Assessment (LCA) rules. This means the same environmental indicators are used, allowing lots of different products to be brought together to provide the environmental impacts for a building. An EPD should always be independently verified by a third party expert familiar with the product category.

“The benefits can be significant in today’s globalised markets and give you a real competitive advantage over other suppliers who do not have an EPD,” explains Håkon. “Originally, EPDs were provided in printed documents or as static pdfs. This resulted in enormous manual effort, as the data from a pdf cannot be read by software such as building LCA tools. So we needed digital EPDs.”

He continues: “Now, we can provide a digital EPD in an XML file format that can be read and used by building LCA tools. This format has the flexibility to adapt to future requirements or different national specifications and underlying standards.”

What this means is that EPDs can enable a company’s sales and marketing teams to make credible and verifiable environmental claims about their products, which enhances that company’s own credibility and allows comparisons against similar products.

Håkon explains further: “EPDs can be used as effective sales tools. They can be used as source information in the procurement and purchase of products. They give buyers and specifiers the confidence of knowing that the environmental performance of a specific product has been reviewed and verified by an independent expert with expertise in life cycle assessment.”

“We are seeing companies using their EPDs globally, not just in the European country where they applied for the EPD. In Europe, the key driver is the Construction Industry as they need to measure and provide proof of their environmental performance. However, in France, the biggest sector for EPDs is the electrical/technical industry. If you go to South Korea, it’s electronics. So it does differ from country to country.”

## How can you get an EPD?

Håkon advises that as a first step, companies considering EPDs that have multiple manufacturing sites around the world, should standardise and use one EPD program operator globally. This ‘centralised’ strategy is the most cost effective. Second, they should automate the EPD generation process, which means they should no longer pay for third-party EPD consultants to generate EPDs manually, which is expensive and time consuming.

“The good news is that software providers now offer EPD-generating tools with built-in ISO standards, LCA calculations, all the environmental indicators, the bill of materials for the different products and so on,” explains Håkon.

EPD documentation should be ‘digital’ to interface easily with Building Information Modelling (BIM) tools. A digital EPD can

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So cost isn’t the only factor any longer, it’s also going to be about the carbon footprint too, which may change the buying behaviour for many companies now and in the future.



also prove very useful if a building project is aiming for a BREEAM rating, an internationally-recognised sustainability assessment method for planning building and infrastructure projects.

“There are not too many lighting manufacturers with EPDs yet, but there is a manufacturer in Germany with one and some others dotted around Europe. Perhaps Glamox could take a lead in this area!” enthuses Håkon.

## Digital, automated route is best

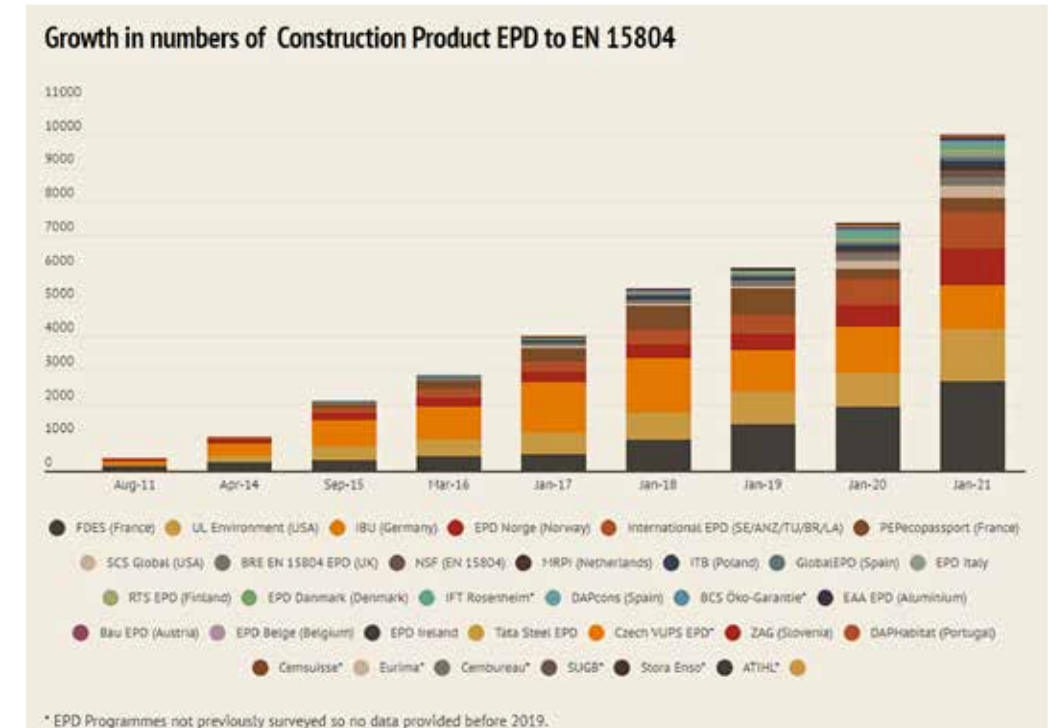
“It depends on the company and how it’s structured, but I would go the digital, automated EPD route from day one. You’ll need to make some kind of background work on EPDs. Most are based on standards and PCRs, so you’ll find existing rules for concrete, windows, piping and lighting and so on. These rules are international, at least within the Construction industry in Europe. So there are rules already available for lighting, but these can be developed further.”

For a company that’s considering an EPD, they may have thousands of different products, but 10% of the products they sell represent 90% of their sales turnover. In this case, you start with EPDs for those products for quick wins and build up from there. For Glamox, you could start with those lighting products that could support a customer’s BREEAM certification objectives.”

## More sustainable value chain

One aim of EPD is to help you document and ultimately reduce your company’s carbon footprint. As Håkon states: “It makes you look at where you are buying all your raw materials, components and sub-assemblies. When firms start using EPDs, they become very aware of where they are buying their raw materials. For example, Glamox would use a lot of aluminium in its lighting products. If you buy aluminium from China, it is likely to have a ten times higher carbon footprint than aluminium from a European supplier. So cost isn’t the only factor any longer, it’s also going to be about the carbon footprint too, which may change the buying behaviour for many companies now and in the future.”

At the start of January 2021, there were just over 10,000 verified EPDs to EN 15804 for construction products registered globally.







Birger Holo

EPDs and Glamox:

# The future of environmental impact labelling

How does the ongoing work with EPD (Environmental Product Declarations) affect production at Glamox? Technical Director Birger Holo is in charge of implementing sustainability measures throughout the entire value chain at Glamox. He breaks down how Glamox works with EPDs, both now and in the years to come.

EPDs is an important part of our ongoing sustainability work

Birger starts by explaining that EPDs are not the end-all and be-all of Glamox's sustainability work. He underlines the importance of implementing sustainability at every level of the organization. Glamox sustainability efforts will be fully implemented in 2022 and will be a holistic strategy encompassing sustainability in both environmental, social and governance.

— In our strategy, we follow two main tracks where we focus both on our products and our operation. EPDs is one of the initiatives that fall under the products track. We want our sustainability work to be genuine and transparent, both for our employees and our customers, Birger notes. Sustainability impacts our entire value chain such as our production, as well as which suppliers we do business with and how we package and ship our finished products.

## The impact of EPDs at Glamox

It might not come as a surprise that Glamox's largest environmental impact comes from our products. What might surprise some, however, is the fact that most of that impact happens after the products have left our hands. How the customer uses the product, and how long they use them is the main contributor to the total energy consumption related to a product when seen over its entire lifetime. Thus this is also the main contributor to the overall environmental footprint of the product.

— We are working on a generator that will let us quantify the environmental impact for all our products, and we will begin with a few existing products in the spring of 2022. This will be a life cycle analysis of every single thing from materials, transportation and production, as well as customer use and lifetime operation. This is what makes EPDs so complex - for example, since the use phase is so significant for the total footprint of a luminaire, we have to assess how the customer will use the product. And for the decision-makers that use EPDs as a tool, they need to ensure that the EPDs they are evaluating is based on the same scenarios. If not, they face the risk of making the wrong decision as they are potentially not comparing apples to apples.

He further clarifies that EPDs will force Glamox to become increasingly conscious of every choice made in the development of a product, right down to the initial sketches. Could a different material or a different choice of electrical components give a lower environmental footprint? At this time we are focused on mapping the impact of our current products, but soon we will have to make environmental considerations as early as the pre-production stage of every single luminaire that we make.

## An increasing market demand

Birger goes on to explain that the market demand for EPDs is increasing, especially in the Nordic countries and especially in the public sector. Sustainability is becoming a "need to have" rather than a "nice to have", and is prepared to meet that demand. This will only become more important in the coming years, and we need to stay ahead of the curve to keep our competitive edge.

— EPDs are a rating that our customers will actively use to make the best decisions possible for their projects. It is important for us to be transparent, and to never "greenwash" any of our products. Our goal is that the customer uses their lighting installations only when needed, that the luminaires are effective when in use and that they have as long longevity as possible. EPDs will be a great tool for Glamox to support and strengthen that vision.

He does, however, underline the importance of actually reading, understanding and comparing the EPD rating of a product.

— It is important to compare EPDs that are measured at the same criteria. If one company includes the entire product life cycle into their EPD, while another just includes the production, assembly and shipping stages, that company will look better than the other at first glance. EPDs are not a rating to be taken at face value, like a 7/10 movie score or the A or B energy rating on a washing machine. They are a little more complex than that, Birger instructs with a smile.





# Change for the better – it's glaringly obvious

The European standard for lighting of indoor work places, EN 12464-1, was revised in 2021 to include some key changes and additions. We spoke to Erlend Lillelien and Dr. Paul Walter Schmits-Reinecke - two long-serving members of the standard's Technical Committee about how they reached consensus on these changes and how the standard is being adopted across Europe.





ON 1ST SEPTEMBER 2021, the European standard EN 12464-1:2011 was superseded by a revised edition, EN 12464-1:2021 Light and Lighting – Lighting of work places – Part 1: Indoor work places. This is the second revision of the original standard, which was published in 2002, followed by a first revision in 2011.

So what has changed since the 2011 edition? There have been some fairly significant additions, particularly with regards to human and user needs, which now receive much wider recognition. Lighting requirements for task areas in order to fulfill visual tasks are given a close relationship to the room in which they are carried out. Technologically, LED has taken over as the most important light source from previous technologies. The main changes compared to the previous edition are:

- More parameters and changes in the table.
- Focus on increased 'room brightness.'
- Calculation areas are clarified.
- Recommended practice regarding the UGR (Unified Glare Rating) method (annex A).
- Non-visual effects of lighting (annex B).
- Lighting Design considerations (annex C).

One of the key changes to the standard is that more parameters have been added to the calculation table, particularly with regards to the use of 'modified illuminance'. Other parts of the table including some text and references have also been updated.

In terms of 'room brightness' and calculation areas, illuminances on walls and ceilings, together with surface reflectances, now contribute to luminances and are indicators for 'perceived room brightness'. Requirements for the 'visual task area' are now defined in terms of 'Em required' and 'Em modified', with 'room and space' referred to as 'Em wall', 'Em cylindrical' and 'Em ceiling'. The result

of these changes is that room brightness increases under these new requirements. The calculation areas, i.e. work field, near field and surrounding area are also clarified.

The standard states that lighting should be adjustable to the actual needs of users in the building and that the system should ensure that illuminances can be achieved that meet or exceed the recommended maintained illuminance level using only the electric lighting (assuming a worst case scenario without daylight contribution). Illuminance can be achieved by both daylight and electric lighting or any combination of the two. Lighting should also be designed to meet the lighting requirements of a particular task, activity or space in an energy efficient manner. However, it is important not to compromise the visual aspects of a lighting installation simply to reduce energy consumption. The required minimum illuminance levels as set in the standard are minimum values that should be maintained over time.

In Annex A of the new standard, recommended best practice is provided on use of the Unified Glare Rating (UGR) method. The lighting product must be verified with a UGR table to show that the product is suitable for the visual task. This table method therefore helps to curb any discomfort glare from the light fixtures in indoor lighting systems.

Annex B of the new standard refers to the visual aspects of lighting (e.g. room brightness) but also introduces the non-visual effects of lighting, including how lighting affects the circadian rhythm and mood of humans, as well as how lighting can improve their performance and wellbeing.

Annex C of the standard, 'Lighting Design Considerations', provides an example of the use of the 'Em Required' and 'Em Modified' parameters in a typical lighting design calculation for an office in which the majority of employees are over 50 years old.

## Personal Profiles

### ERLEND LILLELIEN

**Erlend Lillelien** is an independent consultant and senior lighting designer who has worked in the lighting industry since graduating from The University of Kansas. With a strong background as an architectural engineer in the field of electrical and lighting solutions, Erlend has been a valuable member of CEN/TC 169/WG2 (working group 2 – Lighting of work places) of CEN's Technical Committee on Light & Lighting since 1998. His most significant contributions have been to the EN 12464 standards for workplace lighting, both indoor and outdoor.



### PROF. DR. PAUL WALTER SCHMITS-REINECKE

**Prof. Dr. Paul Walter Schmits-Reinecke** studied electrical engineering at the Technical University of Berlin and has worked for many years in various committees within the German Lighting Technology Society, particularly in the field of interior lighting. Paul has been involved in a range of activities in both national and international standardization, as well as performing teaching roles in the field of lighting design at various colleges and universities in Germany, including the Faculty of Design of the HAWK in Hildesheim, the TFH Berlin and the BTU Cottbus. Paul has been a valuable member of CEN/TC 169/WG2 (working group 2 – Lighting of work places) of CEN's Technical Committee on Light & Lighting since 2000, specialising in indoor lighting. He is now a professor and consultant.



# Interview with...

Erlend Lillelien and Prof. Dr. Paul Walter Schmits-Reinecke  
of the Technical Committee for EN 12461-1: 2021



Can you describe the Technical Committee Working Group for EN 12464-1 and how it operates?

**EL:** The Working Group comprises around 22 to 25 members. We've met perhaps 25 times on the new revised 2021 standard, which has taken the best part of five years to complete. On each occasion we meet, there are typically between 10 and 15 members present. Each country is typically supported by one 'expert', except the UK and Germany, who have up to three experts in each meeting. The countries represented in the working group are predominantly from Western Northern Europe and include Norway, Sweden, Denmark, Finland, UK, Germany, Netherlands, Switzerland, Austria, Belgium, Italy, France and Spain. We report to the European Committee for Standardisation, CEN Technical Committee 169 for Light & Lighting.



we met online as a group using Microsoft Teams or Zoom. These have proved to be quite useful and worked well.

**PWSR:** Standards work should always be based on consensus. We all have to agree unanimously on a change or addition to a standard. But after the meetings, this means the country experts may have to accept some compromises. When they return home to their own country, they have to then 'sell' the compromise to their national committee, colleagues and co-workers. Having said all this, there are some national deviations in the new standard. We have only one now for Slovakia I believe. The biggest deviation over time for this standard has been Denmark, which had their own national regulations that stated they could have lower illuminance levels than our standard specified. But these deviations are rare.

**EL:** A lot of people who read the new standard forget, or are not aware of, the difference between a standard and a guide. We are writing a standard and these are basically a minimum solution that you must adhere to in order to reach a certain level. We try very hard not to describe the actual lighting solutions, but instead we describe the performance levels that you must reach. We're not saying what type of light you should be using, for example, downlights or wall-mounted lights, but simply about the levels of lux you must attain. Many readers buy the new standard and are disappointed because they need local country-specific guidance on how to interpret the new standard. They expect guidance on a lighting solution directly from the standard itself, but that is not part of our remit. This is where the National guides come into play, which help each country interpret the new standard and bring more detail into what the standard means for that particular country.

Due to cost issues, at least half of the working group members are employed by manufacturers. The other half typically represent the standards organisations. A few, like myself, are independent consultants. Trying to develop standards without the involvement of the manufacturers and lighting designers would be virtually impossible.

How did you end up with the 'Em Required' and 'Em Modified' values in the new standard?

**EL:** This was a long process indeed, which took three to four years. It went through a lot of iterations before we ended up where we are now. The lighting controls aspect, for example, the use of dimming, for me this was very important because I didn't want us to specify that you must use the 'upper' or the 'modified' value if certain conditions were in play. For instance, perhaps your workforce is generally older, which is very likely in the future. I didn't want this aspect to increase the energy consumption unnecessarily. So to me, it was critical to specify the 'upper' value and the 'modified' value together with the use of a lighting control system. The standard states that you may use a control system if you're using the modified value.

Now that the visual and non-visual effects of lighting have become part of the scope of the new standard, can you elaborate more on the process that has led this forward?

**EL:** At the beginning of the five-year review process, Lighting Europe sent a letter to us suggesting that we incorporate 'Human Centric Lighting' [HCL] into the new revised standard. So one of our first tasks was to review this aspect. We realised quite quickly that there was not enough empirical data to support HCL to enable us to add a new column to the calculation table with new values. There was no conclusive data at that time to support this addition. So we rejected Lighting Europe's request to include this in the whole table. However, we did add wording on HCL and adjustable lighting controls, but these were general formulations and hints rather than actual requirements.

**PWSR:** In order to gain consensus and one voice within the working group, there are two factors we must always consider: regulations that we define and add to the standard must be scientifically-based. HCL at the time wasn't and so it was left out. Also, any of the member countries joining the European standard are not allowed to have their own regulation that is not in line with the standard. So what we did in this revision was provide some hints, tips and

guidelines on HCL, but we cannot make it part of the standard yet.

However, we cannot ignore that there is currently a big discussion going on in the industry about this. So we felt we had to bring this aspect into the new standard, but not as a requirement, only as some informal references. If we had left this out, people would say that we have not even acknowledged its importance. So it's been a compromise I suppose. Now the standard is bigger although there is nothing really significantly new in it. The thinking has changed but not the standard itself. The substance didn't change at all. It looks different, but the same ingredients are in there.

The use of lighting control systems is mentioned and recommended in several parts of the new standard, particularly with respect to modified light levels. Can you tell us more about how the standard recommends the use of dynamic and smart lighting controls?

**PWSR:** Yes, lighting controls and dimming are mentioned in the new standard, but this is not new; it was in the previous version too. There was always a possibility to bring lighting levels up if the workforce is older or to allow for a specific visual task. With the new standard, we are now asking lighting designers to look at this and we want to push them further, for example, there may be a reason to include higher lighting levels that they should consider.

And this brings us to what is behind this new keyword 'modified'. Too many people were looking at the old standard and saying, "I mustn't go below the minimum or above the higher value". This was never intended by the old standard to give them a fixed number. With illuminance, planners have the option of using the table and the context modifiers to define and argue the illuminance themselves. So the new standard in my opinion is very educational.



**PWSR:** The first European standard that we worked on was a challenge, as we had to bring together the different requirements of each member country. This was, and is still, one of our primary jobs on the standards committee. We have to accept that people do things slightly differently compared to your own country and although it has to be copied and followed in the standard, every country still has some freedom to describe, for example, what the size of their 'task area' is in a lighting design calculation.

How do you reach consensus as a working group?

**EL:** We have a convenor who reports to CEN, who is elected by the technical committee. We reach consensus through meetings and discussions. On this 2021 revision alone, we had up to 25 meetings, which are typically two-day meetings held in different locations across Europe. Each member country takes turns hosting the meetings. We reach consensus at these meetings through discussions, often very lengthy ones! During the recent Covid lockdowns,





# Lighting for both mice and men

The new Veterinary Building at the Norwegian University of Life Sciences campus might be the most complex building ever built in Norway. With an enormous amount of functions and needs that need to be facilitated under the same roof, the Veterinary Building consists of 8 connected buildings and around 2400 rooms. How do you illuminate a project like this?





Benedikte Nilsen Rauan  
Lighting Designer, Multiconsult



**T**HE CONSTRUCTION OF the new Campus Ås began in 2009, and some parts of the campus were ready to move into in the spring of 2021. To call this project a big undertaking would be quite an understatement. We had a conversation with Benedikte Nilsen Rauan, who through her job as a Lighting Designer at consultancy firm Multiconsult has been involved with this project since 2011.

#### A very complex project

Calling the Veterinary Building one of the most complex buildings ever built in Norway is a big statement, but Nilsen Rauan is happy to elaborate.

— It was an extremely intricate project. The new Veterinary Building consists of a vast amount of functions. You need large teaching auditoriums with and without live animals, facilities for science and research, laboratories, aquariums, operating rooms, treadmills for horses and swimming pools for dogs, as well as museum rooms and exhibitions. There's even a perfectly

preserved veterinary office from the turn of the century. Some rooms house sick animals and thus need special functions to keep diseases and viruses contained. Every one of these objectives comes with its own unique set of requirements.

— As if this wasn't enough, we also needed the outside to be lit – roads, sidewalks, parks, and sculptures. The art inside the campus social areas needs to be lit in a way that compliments the pieces because we wanted the art to be visible from the outside when it's dark. The architecture is constructed with tall, open glass exteriors in order to let the large artworks become a part of the public space in the park outside. Finding the optimal lighting solutions for each of these elements has been quite the undertaking, she explains with a smile.

#### Close collaboration from day one

So where do you begin when designing lighting solutions for this kind of project? Nilsen Rauan tells us that the lighting designers were involved in the planning from start to end, which

is something that usually doesn't happen in her projects. This was a big advantage and made the process a lot easier.

— I was already aware of Glaxox when I was assigned to the Campus Ås project. Glaxox is well-known in the lighting industry. I knew the product range well and thought Glaxox would be a great fit for this project. I used your website to get a feel for what kinds of products I wanted to use, both for inspiration and to take a look at the technical specifications for the products. I also spent a lot of time looking at your reference projects for ideas.

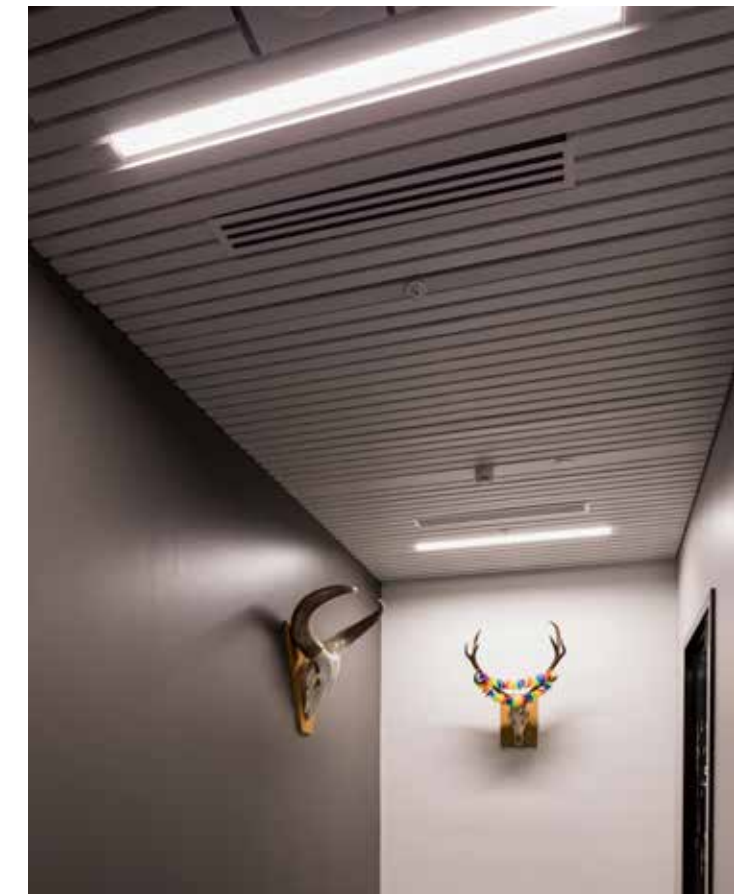
Furthermore, she tells us that they worked very detail-oriented from day one. The architects had very specific requirements for the ceiling lights, but aside from this, they had a large amount of freedom in the lighting design. The lighting designers presented their ideas to the architects, and in collaboration, they fine-tuned their vision before handing their sketches and renders over to the builders for approval.

— We used a lot of visualizations, both hand drawings and

digital reproductions. Lighting technical data was also used to visualize what the finished design will look like. We had to choose luminaires that complimented the architect's ceiling choices especially, and their colour choices directly affected how warm or cool the colour temperature of the lighting needed to be. We worked very closely with the architects, and this was extremely important for the final result. Some of the architect's digital visualization ended up looking exactly like images from the finished building, which is quite impressive.

There were, however, some limitations and adjustments that needed to be made along the way. Also, the 12-year build meant that there were considerable technological advances during this time. Some parts of the building were redesigned throughout the construction process, and this allowed for updates to the lighting solutions as well. There have also been requests from the users of the building, like red or green lighting for improved vision and precision in the operating theatres. These have been adjusted and added along the way.





### Lighting control for smarter energy use

As with most modern buildings, lighting control systems were also installed. The campus has 180 different variants of luminaires installed in 2400 rooms, the luminaires are controlled by Dali systems, and together with extensive use of state-of-the-art motion and daylight sensors, this contributes to sustainable use of energy.

— We had to allow the users of some rooms to override the automatic settings, though. Some research projects demand the ability to control the lighting in a room in a special way. I have been told there is one team that researches the circadian rhythm of fish, which means they need to be able to manipulate the light to change according to their specific needs. We were faced with a lot of scenarios that we couldn't have imagined when we first took on the project, Nilsen Rauan adds

From the builder's point of view, it was an advantage to have as few suppliers as possible. From a practical standpoint, this makes both management and maintenance a lot simpler. Glamox

supplied custom corridor and office luminaires, as well as custom luminaires in laboratories and luminaires for use in clinical areas of hospitals and healthcare buildings. Along with these high spec luminaires Glamox also supplied luminaires for technical rooms, bench lighting, and table lamps.

The project manager and sales engineer from Glamox provided help and follow-up during the entire building process, especially since support was highly important when it was time to mount the luminaires. This ensured that every step of the process went as smoothly as possible.

Today the Veterinary Building is a state-of-the-art university building with brand new facilities for the people who work, study, or do their research there. Both employees and students have access to world-class research, laboratory, and teaching facilities. Practical solutions and technologically advanced equipment promote animal welfare for both the fishing industry, agriculture, sports, and domestic pets.



