

PROFESSIONAL **LIGHTING** DESIGN



Magazine for professional lighting design

MAIN TOPIC
Private atmospheres using new technology

LIGHTING DESIGN
Two private cinemas

Private spa in Ireland

Hotel in Austria

PRACTICAL ISSUES
Presentation techniques

PROFESSIONAL ISSUES
The decorative lighting market and the confusion as to what will follow the incandescent lamp

EuroLuce 2009:
On trends good and bad

Lightfair 2009:
The future has already begun

TECHNOLOGY
LEDs in hand rails
Thermal management for LEDs

A final glow, the new flicker, or the new drug LED

The incandescent lamp ban, energy-saving lamps, LEDs – and the fairy tales, trials and tribulations that currently hold sway over the market.

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Is the incandescent lamp going to disappear or not? Do we still need the compact fluorescent lamp or can we resort to LEDs straight away? Confusion spreads. Would-be experts and other non-lighting designers are finding it hard to cope with the current situation and information available. But are luminaire manufacturers prepared for the post-September 2009 era? Here is our attempt at a review of the situation...

LEDs would appear to have more critics than advocates. Poor colour rendering, high costs for their manufacture, and thermal management are the main points of contention. But we may have advanced further in the pursuit of solutions for all these issues than originally presumed. According to semi-conductor manufacturers Sharp, the true breakthrough of the white LED was in the year 2000. Back then nobody could judge how fast solid state lighting technology would develop.

Lamp life is always a key issue. Manufacturers such as GE and Philips guarantee up to 50,000 operating hours, but in their press releases Catellani & Smith maintain that the LEDs they use in their products will perform for 70,000 hours. Are they lone experts? Or just gullible designers!

LEDs are generally recognised as being an energy-saving light source. Public clients are forever embarking on test installations to see if and how they work. Street luminaires using



Paulina Villalobo, Chile

In Chile, the situation is a bit different from Europe. Of course, we are concerned about energy savings. But our climate is far hotter. Incandescent lamps produce heat. It costs three times as much to cool a room as it costs to heat it up. Therefore, many clients do not want incandescent lamps, because the costs are too high. That is why I use high quality LEDs, when I need warm light colours. The compact fluorescent lamp is not an alternative for me. The entire debate around it is no more than a huge marketing campaign.

"only" expects us to save 20 per cent of the energy used within the next 20 years. Why should municipalities invest money when the targets set can be realised with less funding and without retrofitting every single luminaire? And still public clients are extremely open for new installations.

And are LEDs really too expensive? Not any more! Today a Zenigata LED from Sharp with a rated lamp life of 40,000 hours costs just 15 euros, with prices for Osram products ranging from seven to ten euros.

In respect to heat management there are many approaches that are paying off well, such as LED packa-

ges with a ceramic substrate for improved heat transfer paths. Integral fans are another way of promoting heat dissipation, although that does not seem to make much sense!

What is interesting are the developments regarding the colour rendering index (CRI) of various light sources. Whereas linear fluorescent lamps have a CRI of 65 or 70 at the most, LEDs today have improved CRI. Products from Sharp and Osram are quoted as having a CRI of 90, with German manufacturer Optoled quoting 92, LEDtronics 94, and Projection Lighting 95 – with even better values promised over the next seven years. There is no doubt that the LED is the light



Rienk Visser, the Netherlands

I notice it when I am talking to clients. When I tell them that there will soon no longer be any general service lamps on the market, they always say: "Really? I can't believe that." The politicians are not informing the people properly. From September, I will have to resort to CFLs and LEDs. That doesn't mean to say I am happy with the situation. The colour rendering properties are different, the spectrum is different, they generate different kinds of shadows. This is very limiting for a lighting designer. But what can I do? People will be less happy with the results, that's for sure.

In 2003, the best LEDs were putting out just 20-25 lm/W. Philips/Lumileds can now produce LEDs that provide more than 100 lm/W. The Japanese manufacturer Nichia are quoting up to 150 lm/W at 15,000 operating hours (50 mA-mp) and 40,000 operating hours (20 mA-mp). Just two years ago experts were suggesting that the limit to their development, which was quoted at 165 lm/W, would not be attained until 2025.

LED technology are making their way onto the market, but the first examples show that energy savings of up to 80 per cent can be achieved without opting immediately for LEDs but by using modern versions of conventional light sources linked with daylight control. The EU



Heinrich Kramer, Germany

I cannot believe we are going to lose incandescent light. The quality of this light is something aesthetical – something really special compared to other light sources. It is very natural and we as human beings feel deeply connected to it. Compact fluorescent lamps cannot do that. The light is bad, unhealthy and unnatural. They contain mercury, which can also lead to ecological problems. For me one thing is for certain: There is no alternative for the incandescent lamp and there will never be.

source of the future.... even if that cannot be said for the present!

The interview with luminaire designers and manufacturers Catellani & Smith about future prospects (or insights) makes it clear that a lot of explaining and educating is still required.

But to what extent can luminaire manufacturers rely on data provided by lamp manufacturers, given that the latter have also played a role in banning the incandescent lamp and have definitely been pro-active in pushing the compact fluorescent lamp through advertising campaigns and the like?

The incandescent lamp will be banned. That's (almost) for sure! And it's going to happen soon. For many luminaire manufacturers that will mean converting their machines, or maybe their entire plants, to be able to adapt to new technologies. Added to that is customer satisfaction: what will consumers say when they notice that some of their favourite lighting products suddenly look quite different and the spaces they are applied in look quite different too?

The fact is that with just a few months to go before the first phase of the ban takes effect luminaire manufacturers whose products are designed to take general service lamps will have to come up with some concrete and well founded strategies for coping with this predicament. The future is otherwise destined to be rather bleak – economically speaking at any rate.

The Italian company Europa Design&Furniture produces a range of office luminaires, wall luminaires and decorative luminaires for private home owners. Their products are made of high-grade materials and their prices fair to middling. Practically all of their luminaires are designed to take incandescent lamps.

What does Managing Director Marcello Gnerm say to the ban? "It makes me angry, very angry. They were saying it was all to do with saving energy. But I don't believe it". Marcello Gnerm claims that he cannot afford to convert his machines. His factory produces luminaires round the clock and a break in production would cost him millions. He admits that he has taken precautions... well, a bit, anyway: "I have a

store of 5000 incandescent lamps. Others are doing the same thing. I reckon that between them European companies have around 20 million incandescent lamps stored away. I definitely plan to continue to work with incandescent lamps. They won't put me off that easily".

When asked what his company would do once his hoard of lamps has run out, Mr. Gnerm was unable to answer. He also had no ideas regarding alternative light sources – LEDs for example, or

compact fluorescent lamps. He had not even thought about it. "Nobody is going to tell me which lamps to use or not to use. Basta!"

Luminara, a company based in Pisa, also applies exclusively incandescent lamps for their products. They have a range of modern luminaires designed by top international designers. A free-standing luminaire from Luminara can cost anywhere up to 3500 euros. Sales manager Gianluca Ceccotti says that his luminaires only work with incandescent lamps. LEDs would be too difficult to use as a substitute. He, too, has no clear conception of how his company will react when September comes around. "This is a very difficult situation for us. We don't know actually what will happen. We'll have to see what happens next year. I could imagine maybe using low-voltage halogen lamps." Low-voltage halogen lamps may well offer a possible solution. Then again, this type of lamp is also likely to be phased out as of 2016 at the latest. This

again leaves Mr. Ceccotti somewhat clueless. "We will have to watch how the situation develops. I mean – watch very carefully what happens. I would say in the end it has to be the market that decides."

Together with his brother, Nicolas Terzani produces exquisite up-market luminaires. The two Italians consider precious stones, gold and silver essential

they need incandescent lamps to bring out the sparkle and warm colours that make their luminaires so special. Nevertheless, Nicolas Terzani does see some advantages in the European ban that is expected to take effect as of September 2009: "It's a good idea to save energy. I support that. And they won't be banning all incandescent light sources."

Well ... the EU currently plans to remove all types of incandescent lamps from the market by 2016. Current political developments in Italy – the ban has not yet been ratified by the Italian government – leave Italy in a relatively lucky situation. Exciting times for Italian manufacturers.

"We will get round it somehow," says Terzani. "It's part of our job as company owners to adapt to changing situations. Maybe something will be developed in the meantime. Then we will see what technology we opt to use."

Slamp is another company that will feel the ban particularly bad. The company's range comprises everything from simple free-standing luminaires for students to high-quality luminaires for all kinds of applications. Designers from all over the world design luminaires for Slamp. The majority of their products use incandescent lamps.

"The decorative sector in particular will be very hard hit by the ban," admits Maria Vittoria Bellelli, spokesperson for the company. "I could imagine using fluorescent technology for some products. We will also use LEDs, I think. Cold cathode would also be an option, but it will be hard to introduce modern technology into traditional design concepts. We'll have to wait and see."

As an aside: Australia put the ban into effect two years ago. You would think that two years would be enough to see what effect this has had. Companies could have observed the impact on the Australian market and used their findings to better prepare other markets, and above all to avoid confusion and insecurity.

This historical lamp has been burning in California practically uninterrupted for 108 years. When the ban on general service lamps takes effect, this glowing example will be extinguished forever...

"Technologically speaking, we can look forward to a lot of new developments. But these are difficult times," says Spanish supplier Pablo Rey Bautista, who was exhibiting a range of magnificent decorative luminaires at EuroLuce that appeal to more classic and traditional tastes. The incandescent lamp, the oldest and most traditional of all light sources, is essential for their products.

The sales managers are admittedly at a loss for ideas. "At the moment we are using xenon lamps. We lose a little of the beauty of our products that way, but we have no other alternative."

There are apparently very few lighting manufacturers who have gone into any depth to find out what the politicians are really all about, or to develop serious strategies in response to the EU ban. Why is that? Are manufacturers not interested in politics? Not even when



their own products are in the line of fire? Or have they, like billions of consumers, been completely taken in by the massive advertising campaigns?

One lamp manufacturer who has been actively involved in the discussions on and around the process to phase out the general service lamp is Osram. We spoke to Senior Vice-President Christian Schraft, ex-Marketing Manager and Osram 'veteran' Alfred Wacker, and Senior Director Dr. Thomas Noll on the topic before Euroluce.

"There have been no further developments made to the incandescent lamp since 1935, because as a light source it has reached its technological limits. We therefore concluded that we would be putting ourselves out of business, if we held onto this old technology," says Alfred Wacker.

However, back in the 1980s there was apparently an attempt to develop the incandescent lamp. An East-German clock-maker by the name of Dieter Binninger developed and patented the so-called "everlasting light bulb", of which some specimens still exist today. Binninger's idea was to use a ballast to lower the effective operating voltage and reduce the temperature of the filament, thus enhancing the luminous efficacy and increasing lamp life. According to Binninger's calculations his lamp would last up to 150,000 hours. It was even planned to produce the bulb in the East Germany. Tragically, in 1991, Binninger died in a plane crash. Errors in his calculations suggest that the lamp would not have attained a lamp life of 150,000 hours. Nevertheless, his research does point to the fact that the incandescent lamp may not yet have reached its technological limits.

Osram CEO Christian Schraft also basically sees the European ban of the incandescent lamp as a positive move. He supports the idea of communicating the energy-saving aspects of the compact fluorescent lamp to consumers. "The incandescent lamp will be phased out. We believe it is important to make it clear that this is a great chance."

As of September 2009 all 100 watt lamps will disappear from the market, from 2010 onwards all 40 watt lamps. Two years ago, Australia kicked off with the ban of the general

service lamp. Now it is Europe, Asia and the USA who are hit. Many other countries are debating whether to implement the ban. Alfred Wacker has been pursuing these developments with interest. He was amazed at the effects and reactions of these legislative initiatives, and saw the lamp manufacturers as being obliged to offer the market alternatives in the form of the compact fluorescent lamp. "It was clear to us that there was no holding back the ban after Australia took action, because it is an instrument with huge public impact. It affects every single household. Politicians were fast to react because it was a simple and immediate way to demonstrate they were doing something to counteract climate change."

Although compact fluorescent lamps are more expensive to buy, banning the bulb is not economically interesting for Osram. Sounds a bit surprising at first – but the reason is that they will lose shares in the market due to low-cost imports from Asia. The only way a company can assert itself on the market is by developing exclusively high-quality lamps.

In direct comparison to other light sources, so-called energy-saving lamps do save energy when in operation over longer periods of time. This is a clear advantage in contrast to incandescent lamps, which only transform around five per cent of the energy they produce into light. That would mean that ideal fields of application for compact fluorescent lamps are office buildings or other public facilities where the lamps are in operation all day long.

That having been said, critics of the ban see the threat of health hazards. The blue light component suppresses the secretion of melatonin in human beings, which has been proven to lead to sleep disorders if applied at the wrong time of day. Research findings point to the danger of human beings contracting cancer if subjected to the wrong light or excessive light with a high blue content at the wrong time of day. The World Health Organisation, WHO warns that night shift workers are more prone to developing cancer because their natural bio-rhythm is undermined. Fluorescent light and other cool white light sources with a

"We trust that the lamp manufacturers will come up with some good alternatives."

The LED is well on the way to becoming an established light source. Thanks to rapid development in the laboratories, the LED looks like it will be taking on an increasingly important role in the future. The time has come to clarify the facts and figures that have led to prejudice and concern. It is a known fact that much of the data currently doing the rounds on the market is unrealistic and exaggerated. Or is it? At Euroluce 2009, the Catellani & Smith stand caught our attention. The luminaire designers had a large sign on their stand stating that LEDs would reduce CO2 emissions and energy costs by 80 per cent, and that they have a "practically endless life span". Kevan Shaw, one of the Directors on the Council of the Professional Lighting Designers' Association and responsible for all issues concerning Sustainability, accompanied us to the stand and talked to sales manager Guido Parenzan ...

Kevan Shaw: Mr Parenzan, there are some statements in your advertisement that I have problems with. It states, for instance, that LED technology saves up to 4/5 of energy. Where did you get those figures from?

Guido Parenzan: Well, we compared the incandescent and LED light on a lumen/watt basis. The 60 watt light bulb produces 550 lumen (editorial note: manufacturers claim a figures of between 700 and 710 lumens/watt). That means about ten lumens per watt. Our new warm-white LEDs, those with 3100 Kelvin which have almost the same light temperature, achieve 90 lumens per watt. That means big savings. This technology is far more efficient.



Kevan Shaw: But again – where exactly did you get those figures from, the LED manufacturer?

Guido Parenzan: No, those are test results. The manufacturer gives us even higher figures – 114 lumens per watt. But we also see that as a bit critical. This is impossible, it has to be less.

Kevan Shaw: So what figures do you believe your products can achieve?

Guido Parenzan: I believe that energy savings of 20 per cent are realistic. When you look at the figures 20 per cent is absolutely possible.

Kevan Shaw: Your advertisement also states that the life of LEDs is almost infinite...

Guido Parenzan: I know. We have had the same story with other technologies. They first give you a really high figure and later it turns out that

in reality it is far lower. One hundred thousand hours is unrealistic and we know that. Remember what Philips used to say at the beginning.

Kevan Shaw: What figures do you think are realistic?

Guido Parenzan: I would say 30,000 hours. But only with good cooling. That is why we only use high quality products. This goes for LEDs and other light sources.

Kevan Shaw: At your stand you are only using LEDs. What about other light sources?

Guido Parenzan: Well, we would love to use incandescent. We still have them in our catalogue – but we have to deal with the ban. That is a problem for us. So the best alternative are LEDs at the moment. There have been some great developments and improvements. We are aware of the differences in the effect LED light is creating. That is why we want to use different light sources.

Kevan Shaw: Which ones might that be?

Guido Parenzan: Again – incandescent light would be our wish. But we can't and have to deal with the situation. We do not want to use compact fluorescent lamps, because the light is not aesthetic. Also, these lamps contain mercury. So one alternative we have for the 50 watt lamps are halogen lamps.

Kevan Shaw: What is your current strategy?

Guido Parenzan: Well, we have to see what the manufacturers will give us. This year we will only lose the 100 watt lamps. The 40 and 50 watt lamps will be gone by 2012 – so they still have some time. We hope they will be able to develop alternatives in that time.

Kevan Shaw: Mr Parenzan, thank you very much for talking to us.

Guido Parenzan from Cattellani & Smith talking to Kevan Shaw.

high blue content are used at night to reduce the secretion of melatonin and suppress fatigue during night shifts. All lamp manufacturers know about such findings, but choose to ignore the necessary consequences.



Anne Bureau, France

I think the problem was never the lighting which supposedly consumed too much energy. The debate has to be about something else – how to use a luminaire so that it works in the most effective way? As a lighting designer I do not use incandescent lamps very often. But I do at home, and this will be a problem. The new generation of compact fluorescent lamps has good quality. That is what I am going to use.

Even some luminaire manufacturers interpret generally accepted knowledge wrongly. Peter Dehoff from Zumtobel, for example, claims: "... there is no evidence of the fact that night-time lighting has a direct negative effect on human health..."

To quote Alfred Wacker from Osram again: "That is more a topic for psychologists and doctors. We are not doctors, but physicists and engineers". Dr. Thomas Noll is equally reticent: "We are not proactive on this topic".

The physicists and engineers from Osram do not deny that the incandescent lamp has definite advantages: the quality of the light is produced.

The full-spectrum light produced by incandescent lamps has a warm colour temperature and is a stark contrast to the cold, less pleasant light emitted by compact fluorescent lamps, which in turn also feature poorer colour rendering properties.

Alfred Wacker is aware of this problem.

"If I'm about to sit down and enjoy a glass of red wine, I don't want to do that under a compact fluorescent lamp. The same applies to a cup of tea. Take a cup of tea when it is first poured – the rich glowing colour is just wonderful! Viewed under compact fluorescent light the colour will look flat and uninteresting. The compact fluorescent has nothing whatsoever to do with sparkle."

Wacker recommends tungsten halogen when it comes to enjoying wine, tea, or fine cuisine. From an energy point of view, the tungsten halogen is an improvement on the general service lamp.

Many consumers are not aware of this downside – or indeed of the dangers – of the compact fluorescent lamp. Too many, in fact. Not

cury content to under 1 mg! Osram insist, however, that there is no way of doing without this metal altogether. So how can we ban mercury from the market?

New Zealand has decided not to ban the incandescent lamp. Good thinking! The decision appears to be responsive to public demand, but has had little impact on the world



Eric Ödmann, Sweden

In Sweden, we have been discussing light saving for quite a while now. It happens quite frequently that clients tell us not to use incandescent, sometimes even halogen light. We are already used to that. In order to cope with the situation, we use tricks! We use many filters and dim as much as possible. Of course, this is no real substitute. Especially in the private sector, the incandescent will be missed. Compact fluorescent only gives us bad light, nothing else.

surprising, when you consider what lamp manufacturers have invested into advertising campaigns that promote the 'seventeen good reasons' why people should buy and use compact fluorescents. Nothing is said about any disadvantages. Osram CEO Christian Schraft: "Communicating with the end user

market. The New Zealand market is too small to warrant lamp manufacturers maintaining the production of incandescent lamps. And there are not likely to be many lamp tourists travelling to New Zealand to buy lamps as souvenirs to take back home! In Australia incandescent lamps are confiscated at the border



Derek Porter, USA

In the United States, the incandescent lamp is not forbidden yet. But it is debated, indeed. Some states have suggested this kind of legislation.

Regarding the ban, I have mixed feelings. I am in favor of bringing in changes to our profession. Some have used light bulbs for thirty years and simply do not want to give them up because they are not used to anything else. That I think is wrong and I believe we need laws to bring in changes.

On the other hand, it is not a good idea to ban technology, because incandescent light as such is not a problem. It is the usage of it. What happens is that so-called experts get to decide on what is right and wrong. That, I think, is also wrong.

is a challenge. As far as we can see, nobody takes sufficient time to understand light to the extent that they can make an educated decision. We would love to have more time and opportunity, but that's what we have to live with."

The whole situation is still rather unclear. The EU has decided to implement the ban as of September 2009. Ten days after their decision to ban the incandescent lamp, a convention of environment ministers in Nairobi put forward the proposal to ban mercury worldwide! But compact fluorescent lamps do not work without mercury. In Europe every TC-L currently contains 4 mg of the toxic substance. Lamps from China have as much as 10 mg. Osram is working to reduce the mer-

and destroyed. Anyone trying to get away with smuggling general service lamps through the customs is treated as a criminal, much like a drug dealer attempting to get his wares past the border officials! But it is not considered breaking the law to fly regularly, to drive a Mercedes or to make a mistake using google – one false google enquiry uses as much energy as a 60 watt incandescent lamp burning for three hours. How often have you entered a misspelled word into google without being arrested, or feeling you have committed a felony?

To return to Europe: not all political representatives agree with the EU guideline. In Italy they are discussing whether to go along with the Brussels decision. As of Septem-

ber, people will still be able to buy incandescent lamps in the shops if they want to. Now, that could have a larger impact on lamp manufacturers' production plants! After all, the Italian lighting industry makes up for around 30 per cent of the European lighting market.

In many other countries there are

According to surveys, as much as seven per cent of the population in general intends to invest in a store of incandescent lamps before the law comes into effect. It would be interesting to compare this figure with the percentage of above-average earners and their level of education! Set against this might be the per-



Regina dos Santos, Brazil

I hate the ban and hope that other countries will not follow. Politicians like that kind of propaganda. It is easy for them to present themselves as innovative and eco-friendly people. I think I will use LEDs and tungsten lamps, because I probably will not have another choice. But it would be a good idea to increase the efficiency of halogen and incandescent lamps. Maybe that way, we could avoid the prohibition. Compact fluorescents are, any way, horrible..

reports of consumers buying and hoarding large numbers of lamps, so many in fact that lamp manufacturer Megaman is beginning to think differently about banning the bulb and announced in a press release that he recommended adding a surcharge of five euros per lamp sold. What greater proof do we need for the lack of sensitivity and understanding of average consumers fears? It's not about money. The population in general are concerned about their health, their well-being and better lighting conditions in their homes. A surcharge of the kind suggested would lead to a two-tiered society classified by income. Concern for the environment is suddenly not the driving force. Given the current economic developments and the inherent decrease and reduction in CO2

tage of persons from the lesser educated social classes who thoughtlessly throw their compact fluorescent lamps into the bin when they burn out, just as they inconsiderately dump all other sorts of rubbish in the countryside when they think no-one is watching.

Marketing activities pursued by leading lamp manufacturers also seem to be losing their momentum. The Hamburg school project, which involved equipping classrooms with fluorescent lamps which the teachers would have been able to control to further con-



Malcolm Innes, UK

As a lighting designer the ban has not had an impact on me yet. But I find it concerning how the debate has been lead. People that do not have a deep knowledge about lighting get the impression that incandescent technique was something bad. And that is not exactly true. The debate should be more about the wrong usage of it. Compact fluorescent light? I think in a couple of years people are going to be very disappointed with it. Then they might start a debate on producing incandescent lamps again – which also is not the way forward. That is why I believe manufacturers should get more time to improve good old technology: more efficient GLS, tungsten and low-voltage hybrid lamps. It is possible!



James Wallace, Australia

The ban of the incandescent light will be noticeable where people expect hospitality: in hotels, restaurants and, of course, at home. If compact fluorescents are going to be the substitution, then all I can say is that the light quality is going to be far worse. Good alternatives are tungsten halogen lamps. However, they are more expensive and will not be used by a lot of people.

But also the lighting of museums and galleries will be affected, as the low wattage PAR38 lamp (QR 122) will fall away. This light is ideal for the lighting of art pieces. Without it, a lot of lighting designers might have problems. Here, I believe the alternative would be the Color 900 Phosphor-Compact fluorescent lamp. It consumes less energy and its light quality is at around 90 per cent of the QR 122.

emissions, one is inclined to raise the question as to whether a different approach might be more effective in combating environmental pollution than phasing out incandescent lamps.

control the children's behaviour, was stopped after the Hamburg Senate called a meeting of experts to discuss the repercussions for the children. Opponents to the project were able to convince the Senate that

control of this kind would amount to manipulating the children against their will, which is highly questionable from a legal and ethical point of view. The lamp manufacturers claimed they were unaware of the negative effects of the light on the subjects and withdrew to review the information.

In press campaigns run by both leading lamp manufacturers in Europe they claim that people can save the snow in the Alps for skiers if they use compact fluorescent lamps instead of incandescent lamps. Well, now that's a statement! How stupid do they think we are? Or, how stupid are we really? Do those who wrote the PR text really believe that 1000 lamps will melt thousands of cubic metres of snow? Even people within the companies responsible were shaking their heads at the kind of message their PR people were sending out. A lot more energy could be saved if they quit produ-

cing snow in the snow hall in Dubai or in the Snow Dome in Bispingen, in a very flat part of Germany, to name just two of many around the world. And nobody gives a second thought to the thousands of cubic metres of snow produced for the otherwise snowless city of Düsseldorf for their biathlon event!? As if to make up for all that, Düsseldorf is now boasting that they are the pioneers in energy-saving lighting schemes – thanks to their new LED street lighting luminaires.

The incandescent lamp is a time-tested, irreplaceable light source. To ban it is wrong – for many reasons. All those that understand light agree. The compact fluorescent lamp will not and cannot, in spite of the few advantages it offers, ever be a serious alternative in private homes.

LED technology is well on the way to becoming a high-quality light

source for the future which has the potential to provide alternative solutions. From the reactions from many luminaire manufacturers it is obvious that a large part of the industry no longer has a clear overview of the situation, and is operating according to wrong information. The market is uncertain and doubtful. The next step: we need standards for new light sources.

To date there are no concrete regulations dictating which standards LEDs are required to adhere to and how their performance can be evaluated. Industrial associations such as the IES or CIE are currently developing a set of standards. This is necessary to save the market from drifting further into the world of fairy tales, and to free us all from the trials and tribulations new technologies entail.