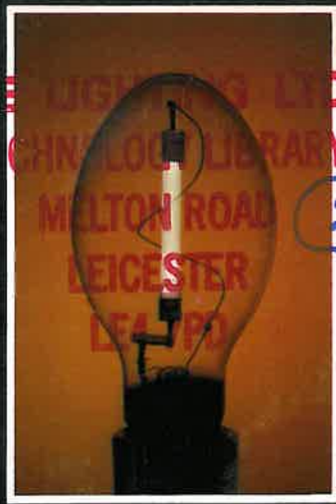
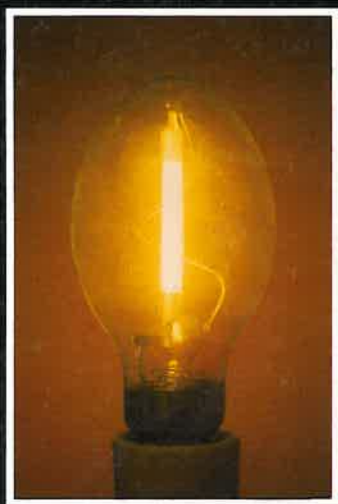


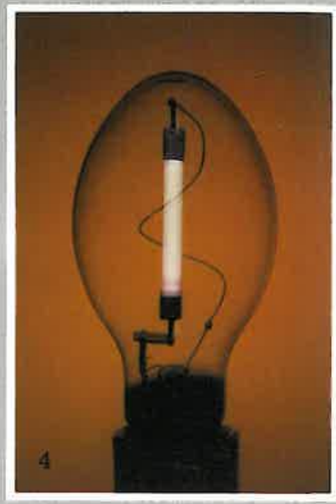



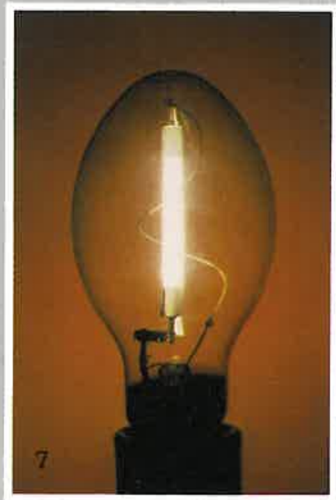

Lighting Journal 22

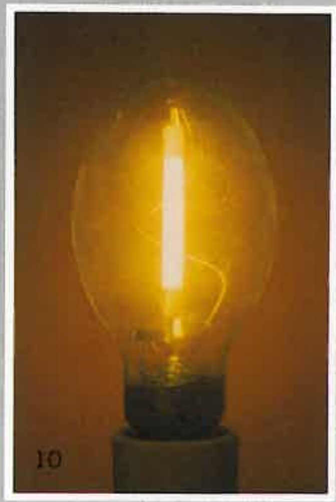


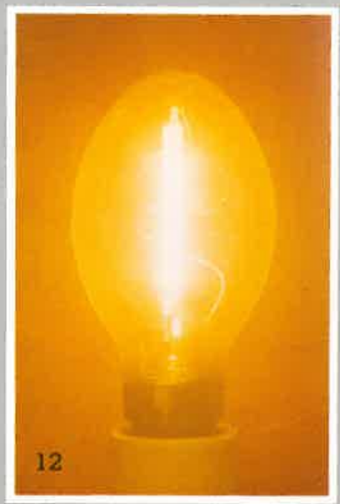













The sequence of pictures shows stages in the ignition and run-up of a SON lamp.

(1) and (14) show the lamp before switching on and immediately after switching off. Note the red glow of the arc tube that persists for several seconds after switching off.

(2) and (3) The arc strikes initially in xenon.

(4) to (7) Mercury vaporises and takes over the discharge.

(8) The sodium commences to vaporise at the ends on the arc tube, and (9) to (10) takes over from the mercury.

(11) to (13) As the vapour pressure increases, the light-output grows with it and the colour of the light changes from the monochromatic yellow of low-pressure sodium to the characteristic golden glow of the SON lamp.

Lighting Journal 22

In this issue of *Lighting Journal* we have followed our established custom of trying to achieve a balance between articles on lamp technology and on lighting practice, both at home and abroad. The past decade has seen a number of very considerable advances in the former, such as the perfection of the monolithic arc tube in the high-pressure sodium lamp and the extension of the range of these lamps into the lower wattage ratings. Considerable improvements have been made in the tungsten halogen lamp, notably the introduction of a single-ended mains voltage lamp suitable for floodlighting. In the last few years, too, surprising advances in fluorescent phosphor techniques have been made.

All this has led to new techniques based on the new lamps and new approaches to the use of old ones. We have already seen the use of floodlighting equipment indoors, when linear high pressure sodium lamps in SONline floodlights were used to light the enormous rolling mill of British Steel at Thryburgh *(Lighting Journal No. 15).* In this issue a scheme using tungsten halogen floodlighting equipment to light the interior of York Minster is described.

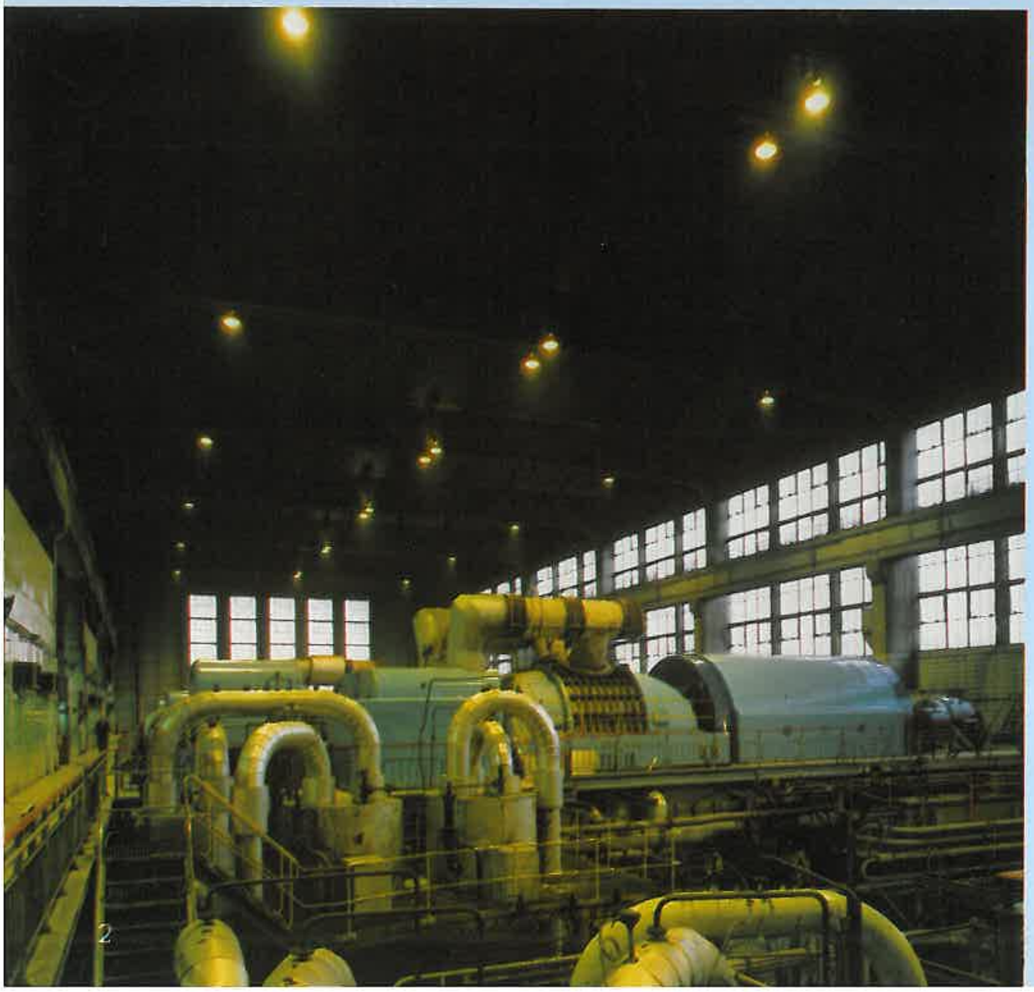
The variety of uses of the CSI lamp, introduced at the beginning of the decade for football floodlighting continues to increase. A recent application is for testing solar panels. The use of this unique Thorn lamp has spread all over the world, as is witnessed by the floodlighting of the great basilica of St. Joseph at Montreal. High-pressure sodium lamps are perhaps a more conventional light-source for this purpose and have been employed in France in the historic town of La Rochelle. Most unusual techniques have been used in the installation of linear metal halide floodlights at a ski-slope in Sweden.

The integration of lighting, heating and ventilation, a novel idea in 1970, is a commonplace today, and the emphasis on energy conservation has given it added importance. The article on this subject looks at the effect that this emphasis has had on building design and how this has affected integrated design techniques.

Lamp technology is the essential requirement in any great lighting company, but the knowledge of how to apply it is of equal importance. In this issue of the Journal we have attempted to show some of the ways in which both of these desiderata have been achieved.

Contents

Published by Thorn Lighting Limited
Thorn House, Upper Saint Martin's Lane, London WC2H 9ED
Printed offset litho by
Robert Pearce & Co. Ltd.
Designed by Zee Creative Ltd.



The turbine room of Skelton Grange CEGB generating station in Yorkshire. The forty 400W SON lamps are in use day and night as can be seen from the picture. Only half ***a*** *dozen have failed* ***in over*** *8,000 hours'* ***use.***

Derek Peach

A Decade of SON

Mr. D. C. Peach is Product Development Manager for Light Sources at Thorn House.

Left: The Laker Skytrain hangars at Gatwick have recently been relighted. A hundred and sixty 400W SON lamps in Hi-Pak reflectors have been installed, half of them replacing 700W MBF lamps in the old hangar, where they reduced the loading from 60 to 32kW and raised the illuminance from 200 to 500 lux. The very long life of the SON lamps is likely to add a further cost benefit.

High pressure sodium lamps have been commercially available now for at least ten years, so perhaps it is appropriate today to review the progress of this lamp which has made such an impact on the lighting market. The first SON lamps to be introduced were the 400W and 250W ratings and because of their high lumen packages and efficacy, they found immediate application for street lighting. As the dimensions of the SON were the same as those of existing mercury lamps of equivalent rating, a range of luminaires was already available, and by substituting the correct control-gear, SON was able to be offered to a wider market than would otherwise have been possible. Floodlighting was an obvious extension; again suitable lanterns were available, and the golden white colour of the light from the SON lamp has proved very acceptable for brick and stonework.

Bringing SON indoors

Because it is generally accepted that high colour temperatures are most acceptable at higher lighting levels, such as obtain in natural daylight, and that the lower colour temperatures are more popular at lower illuminances, such as may be found in domestic lighting, it can be expected that SON, with a colour similar in some respects to a slightly under-run filament lamp would be most acceptable in the latter.

Commercial interiors

The lamp has already proved its worth in industry, and the introduction of lower powered lamps may well provide the impetus for it to penetrate commercial interiors. Obviously its use in such places needs to be treated with care, but there is already evidence that its use in these situations is growing.

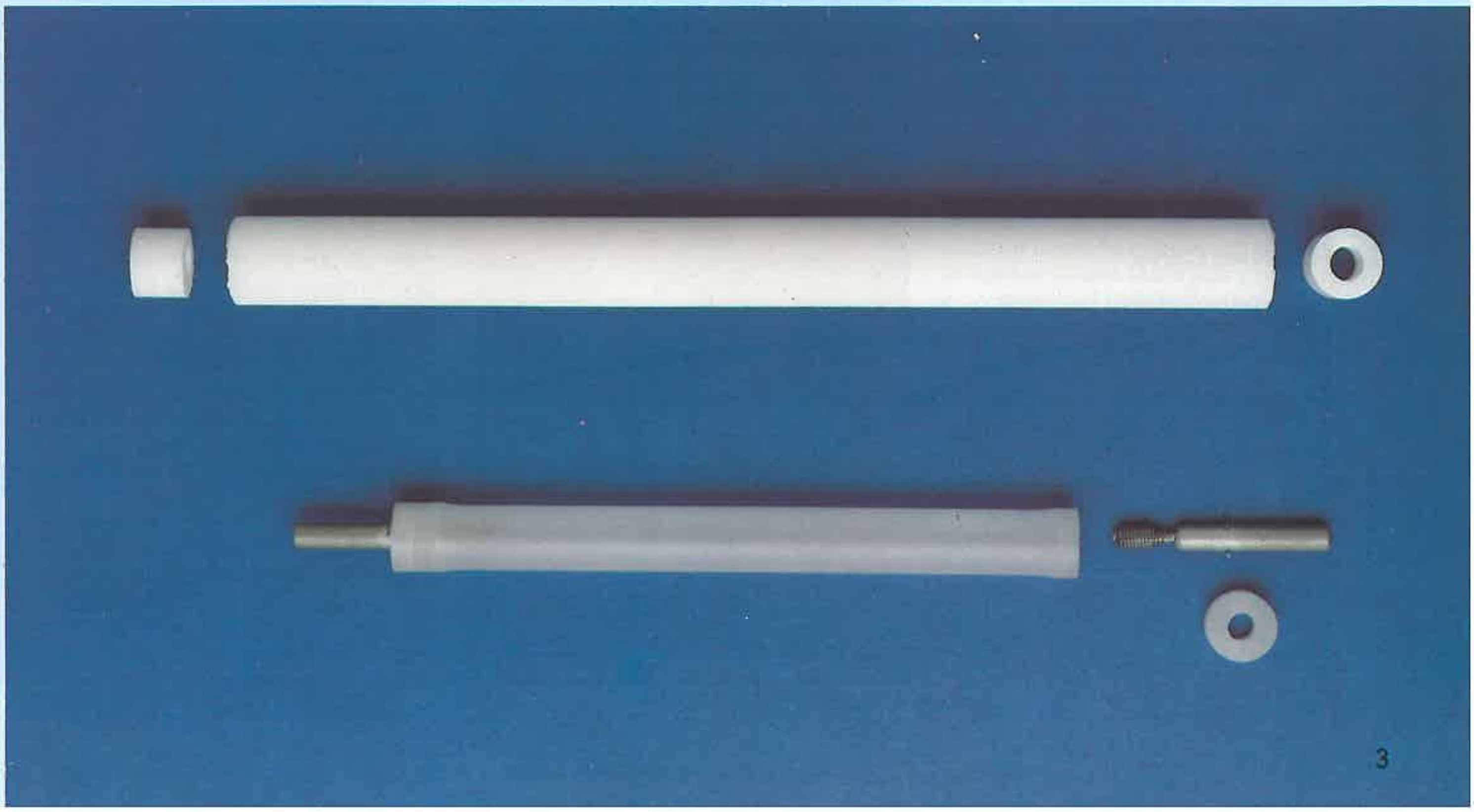
Because of the pleasant effect on stonework mentioned above, it is beginning to appear in churches; SON lamps are used to augment the daylight under the dome of St. Paul's and in the Anglican Cathedral in Liverpool, and it is not out of place in such buildings. Another, rather surprising area in which it is gaining ground is the lighting of swimming baths, where it makes pale bodies look more healthy.

SON in industry

The initial industrial applications were almost exclusively confined to high-bay lighting. The long lamp life and good lumen maintenance has reduced operating costs considerably and this application is still growing, but the use of SON lamps has now been extended to situations with lower mounting heights and the introduction of the Thorn Lo-Pak range of fittings, as well as that of the 70W and 150W lamp ratings, has encouraged this development.

The 70W rating, originally intended for street lighting, has also

Components of the arc tube of a SON lamp. The alumina arc tube and plug shown below are in their 'green', unheated state. After the plugs have been inserted, the tube is heated to a temperature of about 1800°C in a furnace, so that the individual grains of aluminium oxide coalesce to form the much smaller but infinitely stronger arc tube seen below. The plugs are fused into the tube forming a 'monolithic' construction. The electrodes are then inserted, each within a frit or washer that is heated in vacuo to form a solid gas-tight seal.



The British Oxygen Company's factory at Ramsgate, Kent is lighted by 204, 250W SON lamps in Hi-Pak fittings, and was commisioned in August 1977. Only four lamps have failed since installation, in nearly 18,000 hours use.

enabled commercial luminaires to be produced. These are suitable for use in shops, foyers, staircases, lift halls and similar locations. The recent announcement of the 70W reflector lamp (another Thorn first) is likely to turn attention to the possibility of using it in downlighters and swivel-mounted display fittings. In the latter case, one can see the possibility of providing economical lighting in a shop window. SON lighting is used on railway stations, airports and sports halls and indeed its use is spreading to most areas where there are long operating periods and high labour costs. There is no doubt that as the range of lamps widens, so will the market.

Technical difficulties overcome

The fact that increasing the pressure of sodium in the discharge would lead to an improvement in colour was known in the laboratory for many years, but the technical problems of producing a gas-tight envelope which would resist the attack of sodium at high pressure and temperature and withstand temperature changes over a range of from 0° to 1300°C were very difficult to solve. The material used for the arc tube is polycrystalline aluminium oxide — alumina — and as it is not possible to work this material in the same way as the more conventional glass or quartz, entirely new methods of sealing the arc tube had to be devised.

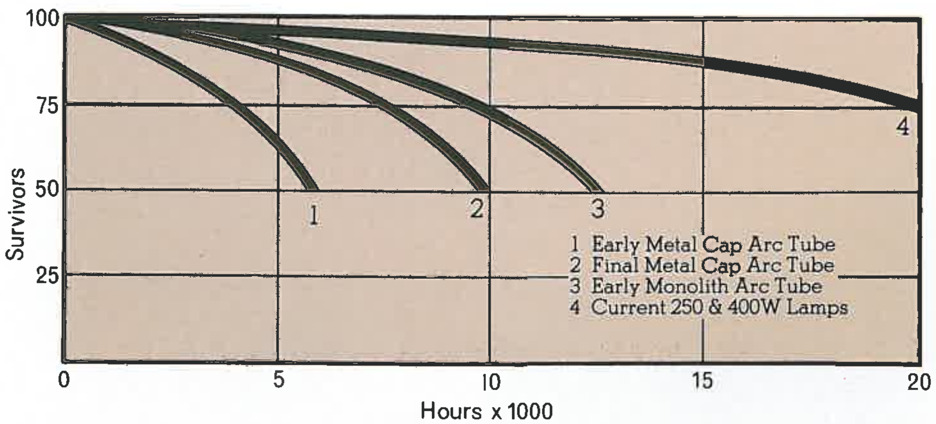
Sealing the arc tube

At first a metal cap was used at the ends of the arc tube to produce this seal and to support the electrodes, but because of the inherent difficulties in this form of construction, leaks in the seal area were the most common form of failure in early commercial lamps and average life was only 6,000 to 8,000 hours. The introduction of the monolith construction by Thorn in 1975 effected a dramatic improvement in reliability.

Monolith construction

In order to seal the electrode assemblies into the ends of the alumina arc tube, a hollow plug of the same material is inserted at each end of the tube. This is then fired at 1800°C in a hydrogen furnace to fuse the plugs and tube into a homogeneous whole, hence 'monolith'. The electrode mount is then inserted through a hole in the plug and sealed with a 'washer' of ceramic forming a large seal area of great strength. This construction effectively eliminates the leak problem of the earlier metal capped lamps and the reduction in early failures due to leaks has increased the average life of the lamps considerably.

SON Survival Curve



Determining lamp life

The life of discharge lamps is best shown on mortality curves which indicate the number of survivors to be expected from a representative batch of lamps throughout a determined period of time. Generally failures are likely to occur from two main causes.; First, the intrinsic 'life' of the product, that is to say the time that elapses before the electron-emitting material coating the electrodes is exhausted, or the electrode itself disintegrates and second, random failures due to manufacturing tolerances, limiting technology, adverse environmental conditions and so on.

Effect of random failures

In the first few years after the introduction of a new product, these random failures are usually predominant and produce a curve such as here shown as 1 in the graph. As the various causes of early failure are identified and cured, the curve begins to improve until the majority of the reasons for early failure have been eliminated (curves 2 and 3). For an established lamp the curve should stay close to the 100% survival line for a fair proportion of the lamp's life before failures begin to increase. This situation (curve 4) has now been achieved on the established SON ratings and the 250W and 400W lamps, for example, will now reach 10,000 hours with a negligible percentage of failures. Each new rating introduced is bound to have its own peculiar set of problems and although the experience gained on other ratings helps the lamp engineer to achieve reliability sooner than in a pioneer lamp type, over the first year or two after the introduction of a new lamp rating its reliability will never be so good as that of an established one.

Advantages of an external ignitor

The excellent reliability achieved by Thorn SON lamps has been helped by the Company's policy of operating them with an external ignitor, designed and manufactured by Thorn to suit the lamp. Only with an electronic ignitor can a reliable starting pulse be produced, as it can be tailored to meet the requirements of the individual lamp, and at the same time comply with current and imminent international standards. Lamp reliability is only as good as the weakest link in the chain and eliminating all unnecessary components within the bulb reduces the risk of failure. Adding the many other components needed to produce a lamp with an internal starter inevitably leads to a loss of reliability, offsetting any initial savings in control gear.

Methods of life-testing SON lamps

In order to obtain information on the performance of SON lamps, samples are taken regularly from production and life tested on internal racks or on outdoor streetlighting columns. However, although this method gives the fastest results as lamps can be operated for 8,000 hours a year, relatively few lamps can be tested in this way and more representative information can be obtained by field testing larger quantities of lamps. From the results of many hundreds of lamps operated under normal streetlighting and industrial lighting conditions, mortality curves more representative of field conditiong can be constructed.

Such information was used to prepare the graph opposite.

Information from users

In addition to this information, SON lamps have now been in use in the market for long enough for users to appreciate their reliability and the installations shown in the table below illustrate this point, it must be appreciated that enquiries of this nature are bound to give less definite results than formal field testing.

The users' comments are remarkably favourable, especially in view of the fact that at least two installations used the 'first off' lamps. It seems likely that similar results will be obtained from installations of SON lamps in 'Lo-Pak' fittings, but these installations are too recent to be used in this survey, which can only include installations that have been in use for some years.

Lumen maintenance throughout life

A very important attribute of the high-pressure sodium lamp is its remarkably good lumen maintenance throughout life. The light-output of all lamps including fluorescent tubes diminishes steadily throughout life, so that even if a lamp continues to operate electrically for an extended period, it may cease to be an economical light source before it actually fails. The light output of Thorn SON lamps, however, is maintained extremely well throughout life, reducing by less than 1% per 1,000 hours after the 2,000 hour figure. This means that the excellent life performance is fully useable, the lamp giving adequate light output to the end. In the case of the Tecalamit Belliver installation shown in Table 1, for example, lightmeter readings showed a negligible diminution of illuminance after more than 10,000 hours life.

User	Number and type of lamps and fittings	When installed	Approx. annual hours use	Users comments on Replacements
B.S.C.* Thryburgh bar mill	890 x SON.TD in SONLINE projectors	Nov. 1974	8,000	"First bulk change after 16,000-18,000 hrs very few failures at 16,000 hrs."
British Oxygen Co. Ramsgate	204 x 250W SON in high-bay fittings	Aug. 1977	6,000	"Four lamps have failed since installation; Installation very satisfactory in use"
C.E.G.B. Skelton Grange Leeds	40 x 400W SON in high-bay fittings	March 1977	8,000	"About half a dozen in two years"
Corporation of the City of London	350 x 150W SON in Alpha 8 Lanterns	Early 1978	4,000	Have now operated over 8,000 hours with no failures
Tecalamit Belliver, Plymouth	249 x 400W SON in high-bay fittings	July 1977	6,500	"12 failures in first two years. No measurable fall-off in illuminance"
Dunlop and Rankin Leeds	43 x 400W SON in high-bay fittings	March 1974	2,500	"In third year of installation 9 lamps had been replaced Completely relamped in November 1979"
J. Wilder, Engineers Wallingford	38 x 400 and 250W SON in high-bay fittings	1976-7	3,500	"Beginning to change a few lamps in January 1980"
Amersham** District Council	30 x 150W SON Street Lighting	1977	4,000	"Original lamps averaged 9,000 hours"

*The first large installation of SON.TD lamps

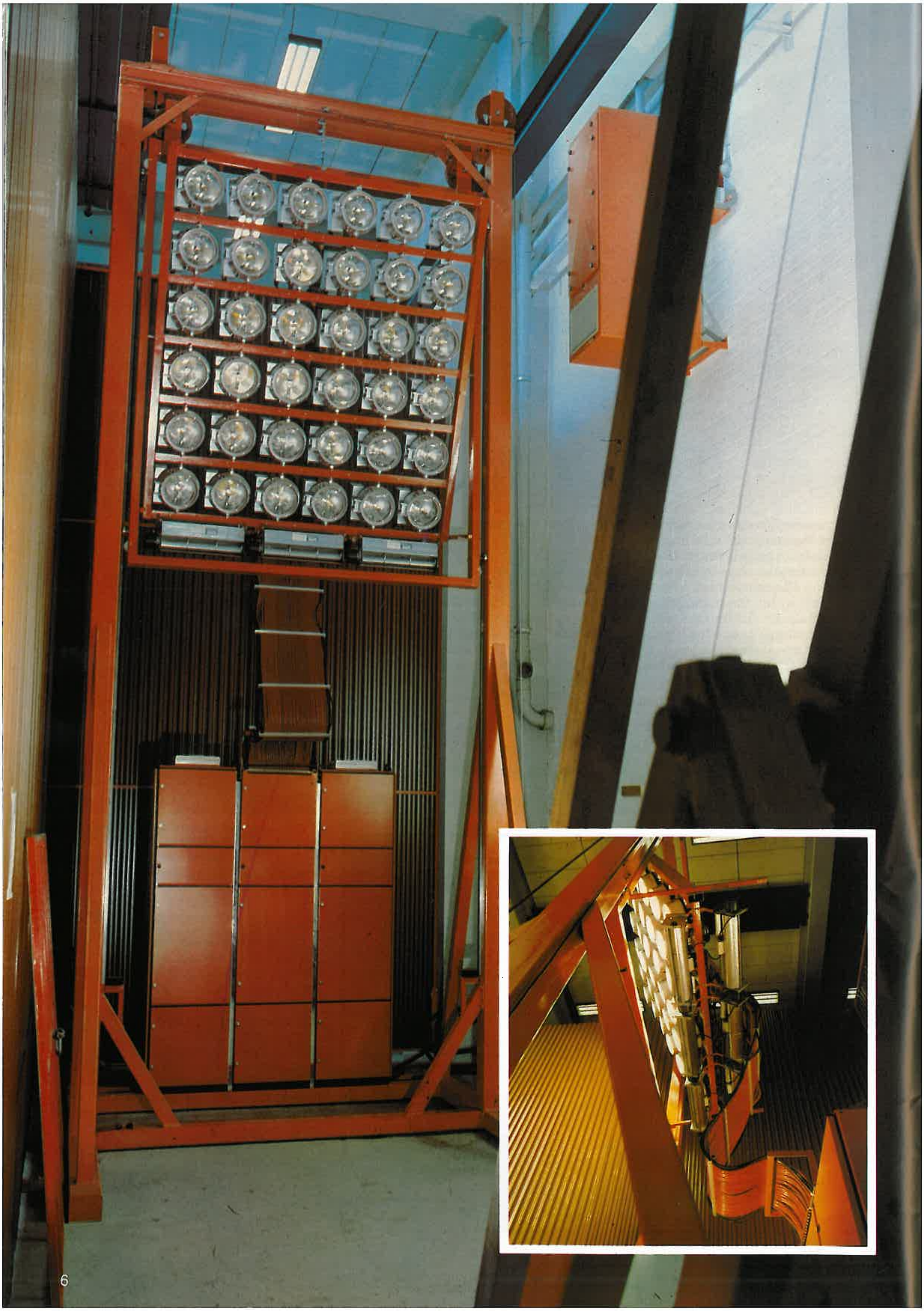
**The first field trial of pre-production 150W SON lamps.

Research and development

Thorn has pioneered the introduction of smaller ratings of lamps, and here the facilities of the research laboratories at Leicester have been invaluable. Extremely elegant and effective methods of evaluating the optimum characteristics of lamps of different power ratings and arc pressures have been developed, as for example the indium bath method described by Dr. Wharmby in Lighting Journal No. 17 and these methods of investigation were used when the 150W, the 70W and most recently the 70W reflector ratings were developed and introduced. Development is continuing with the aim of producing lamps with even better colour-rendering properties and also in the direction of still lower wattage ratings.

Conclusion

In the decade since its introduction, the high-pressure sodium lamp has made astonishing progress from a laboratory novelty to a commercial lamp offering excellent value for money. Much of this is due to work in the Thorn laboratories. It does not seem unreasonable to predict that it may well prove to be the major discharge lamp of the future. It has the advantages of compactness and robustness and its long, reliable life, good lumen maintenance and steadily improving efficacy and colour-rendering properties make it likely to be seen in the future in situations which are at present the domain of the filament lamp and fluorescent tube.



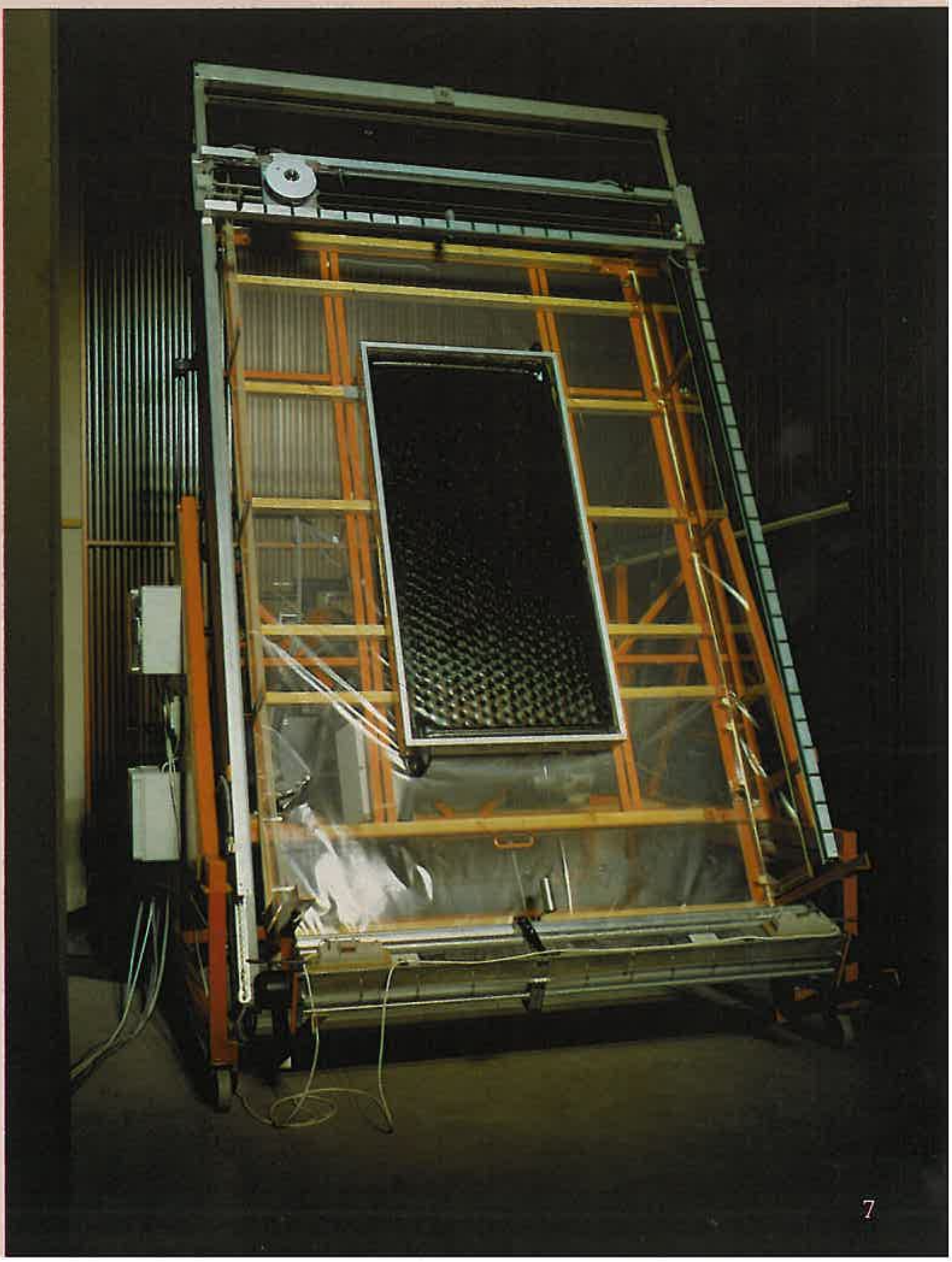
Testing Solar Panels in Denmark

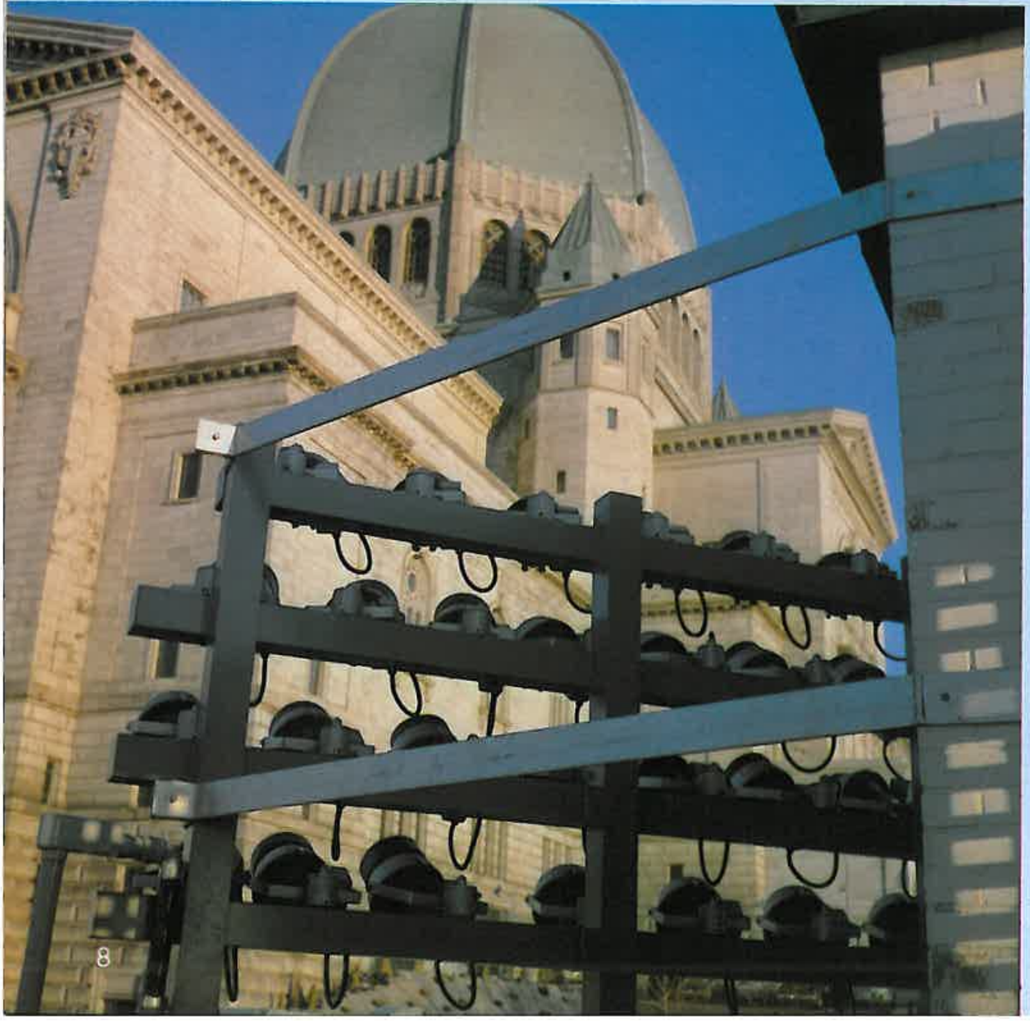
A use of the CSI lamp which was scarcely likely to have been envisaged when they were introduced some eight or nine years ago is to provide an 'artificial sun' to test solar panels. An installation of this kind has recently been installed in the laboratory of thermal insulation at the Technical University of Denmark. Other installations exist in the United Kingdom, notably in the 19kW installation at Cardiff University, described in the February issue of "Thorn Lighting News" and in Sweden and Holland.

The Danish installation consists of two large frames facing one another. One carries the solar panel to be tested and is provided with a console containing measuring equipment to register the energy supplied to the unit and by means of the liquid in the solar panel itself to determine the energy absorbed by it. These results are automatically recorded, accumulated and registered by the equipment on the back of the supporting frame.

The opposite frame carries a battery of 36 1kW CSI lamps in OM1000 housings. Since the solar panels are tilted slightly backwards, the array of floodlights is tilted forward at the same angle. The two frames are spaced from 8 to 12 metres apart, that carrying the floodlights also having their control gear mounted in cupboards at its base. With a luminous output of 1000W/m² and a diversity better than .85, the 'artificial sun' makes it possible to obtain accurate tests of all types of solar panel.

The battery of 36 1000W CSI lamps on their tilted frame can be seen on the left, while right is depicted the facing frame carrying a solar panel. Insetted left is a view of the lamps from below, showing the arrangement of the control-gear and above, the back view of the facing frame with its recording apparatus.





Above: The great church of St. Joseph dominates the hill-top at Montreal on which it stands. Batteries of CSI lamps, one of which is pictured below, produce the effect of a 'frozen sunset' at night.

Stewart Fraser

Thorn Lighting in the New World

As the sun dips towards the horizon, the banks of floodlights come into action. Here, only those with yellow filters are lighted.

Mr. Fraser is President of Thorn Lighting, Canada.

The Basilica of St. Joseph not only dominates Montreal, it is one of the most famous churches in North America. A white stone structure with a baroque west front, its great central dome is comparable in size to that of St. Paul's in London, or the Madelaine in Paris. At sunset it is the last object to catch the light, and seems to float above the city on a hill of shadows. It was this aspect of the building that inspired Miroslav Pflug, who can truly be called a lighting impresario, when he was asked to plan a floodlighting scheme for St. Joseph's early in 1975.

A lighting impresario

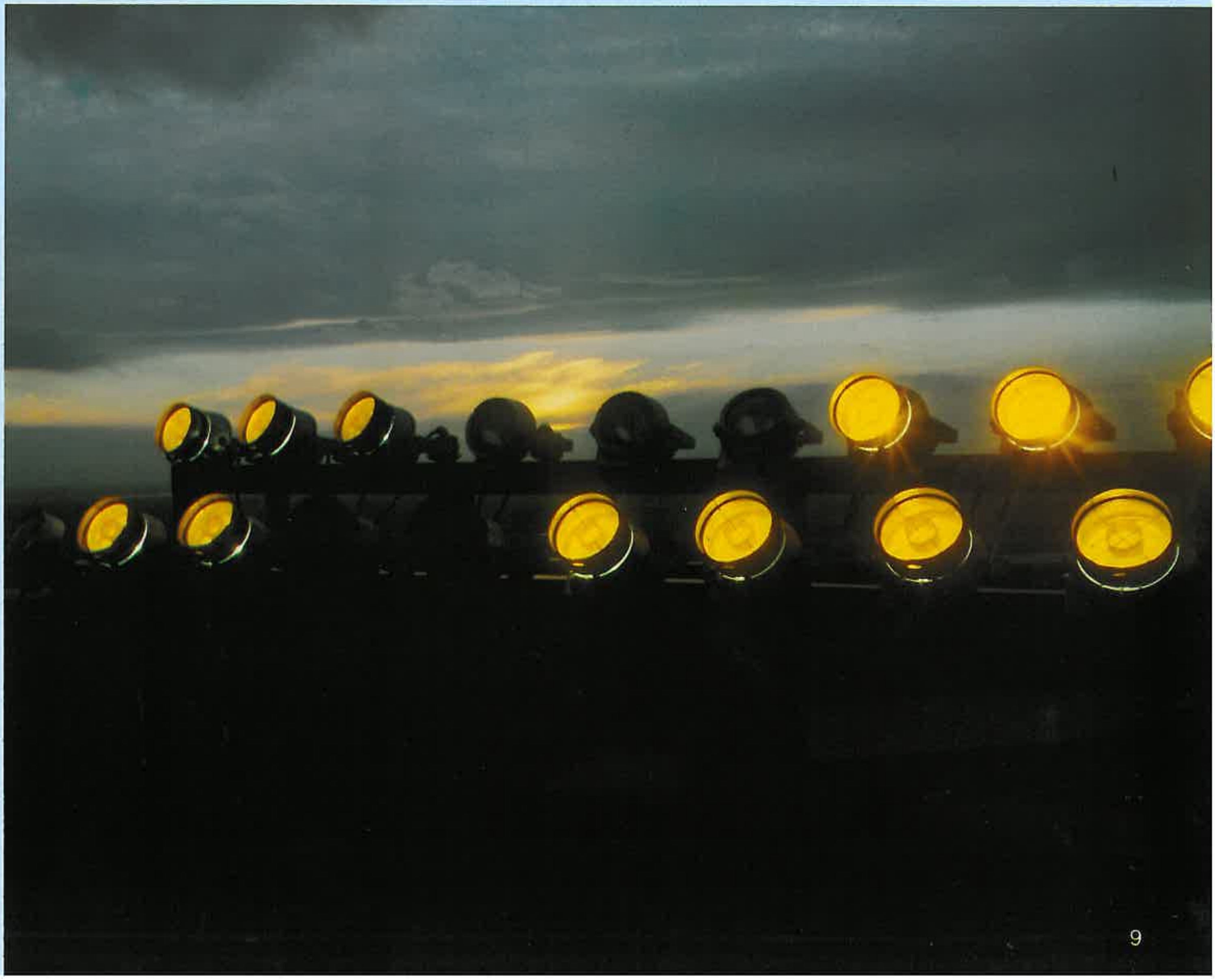
Mr. Pflug has been responsible for a number of remarkable lighting installations, including the lighting of the Czech pavilion at the 1958 Brussels Exhibition and fantastic stage settings in opera houses all over Europe.

In his own country, he is a Czech by birth, he was mainly concerned with such types of installation, but since he has been living in the States, he has designed a number of open-air projects, including the lighting of the Blanchard Springs caverns in Arkansas.

The design and installation of the control system was the responsibility of Mr. Kukor, who is also of Czech origin, and who worked very closely with Mr. Pflug in this project.

The frozen sunset

The aim of Mr. Pflug's design, is, as he puts it, to produce a 'frozen sunset'. As the last rays of the setting sun gild the façade of the great oratory, the floodlights take over imperceptibly, so that when darkness finally falls the gigantic shape seems to hover over the darkened hillside. The illusion is complete – the moment of sunset is held far into the night.



The problem of maintenance

The design of such an installation obviously raised a number of problems, one of the first of which was the very practical one of maintenance. To light the whole building effectively required a great many floodlights — the final number used was 217 — and Mr. Pflug saw that if he could standardise on a single type of lamp, and one that was easily and quickly replaced, the problem of keeping the whole installation going would be vastly simplified.

The Thorn CSI lamp

He found the answer to this problem in the unique Thorn 1kW CSI lamp: a very powerful metal halide discharge lamp sealed into a standard PAR 64 pressed glass reflector bulb. With no reflectors to keep clean, and a very simple housing to protect the lamps from the weather, one of the maintenance headaches was removed at a stroke. The CSI lamp moreover, gives a very narrow beam of light but the beam can be "spread" by the use of standard lenses, giving considerable versatility in its use.

The problem of colour

Initially the colour of the artificial lighting had to match the sunset, but as the night progressed the building would be seen in its true colours, or strongly coloured mood light might be used on the whole or parts of the building. Since the basic light-source was a metal halide lamp, giving light like natural daylight, its light had to be modified by the use of colour filters. Here the stage lighting techniques of mixing the primary colours, red, green and blue, to achieve any desired colour was the obvious answer.

Banks of floodlights

The floodlights were arranged in banks to light the various parts of the building. The floodlights lighting the west front, for example, numbered 53, of which 17 gave their own white light, 16 had yellow, eight red, eight blue, and four green filters. Banks of floodlights were concealed behind walls and mounted on the roofs of buildings and on five 18m masts at a distance of up to 130m, about a quarter of a mile, from the building.

The colour filters

The concentrated heat from a 1 kW discharge lamp in a reflector posed a problem where the colour filters were concerned, especially in the rigorous conditions of a Canadian winter. This was overcome by mounting the glass filters on concentric metal louvres, which not only spaced them away from the lamps, but acted as heat sinks, and also had the merit of shielding the spill light from the direct view of observers.

Orientation and switching

Another difficult problem was the orientation of the lighting. The sun only sets at the same point on the horizon twice in the year: at the latitude of Montreal, it ranges over an

PGP

E C L A I R A G E

DE L'ORATOIRE SAINT-JOSEPH DU MONT-ROYAL

Localisation et distribution des luminaires.

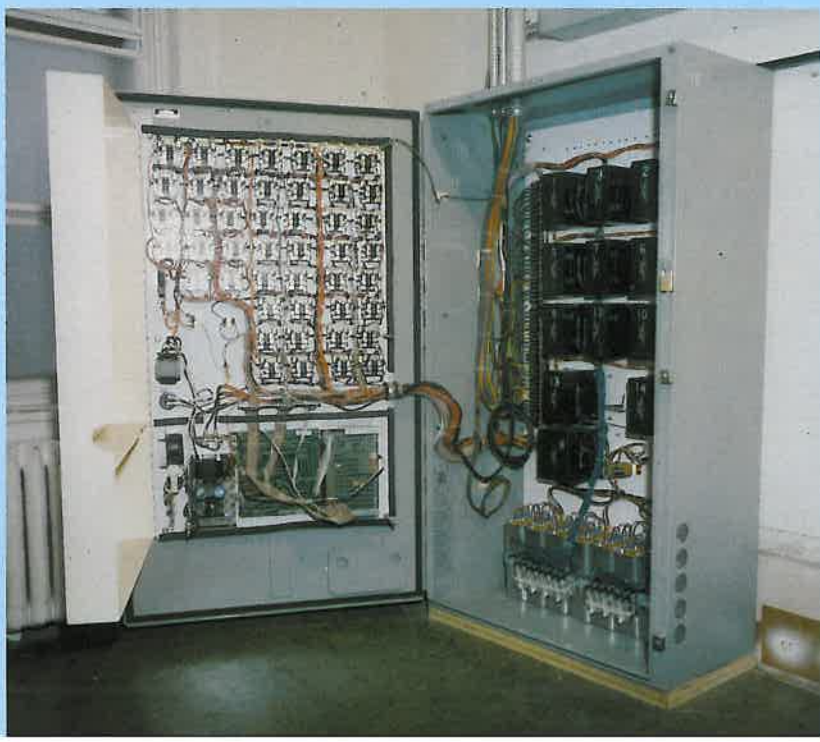
Localisation des luminaires	Blanc	Jaune	Rouge	Vert	Bleu	Total
A	5	16	1		1	23
B	10	9	4		4	27
C	1	2	1	1	1	6
D	1	2	1	1	1	6
E	3					3
F	5	1	1		1	8
G	10		4		4	18
H	7		3		3	13
I	8	1	3		3	18
J	7	12	1		1	21
K	2	2	2		2	8
L				2		2
M	3	2	3	1	3	12
N	2		1	1	1	5
O	2		1	1	1	5
P	2		1	1	1	5
Q	1					1
R	1		1	1	1	4
S	2	1	1	1	1	6
T	2	2	1	1	1	7
U	3	5	3	1	3	15
V	4					4
	81	55	33	12	33	217

Total des localisations: 22

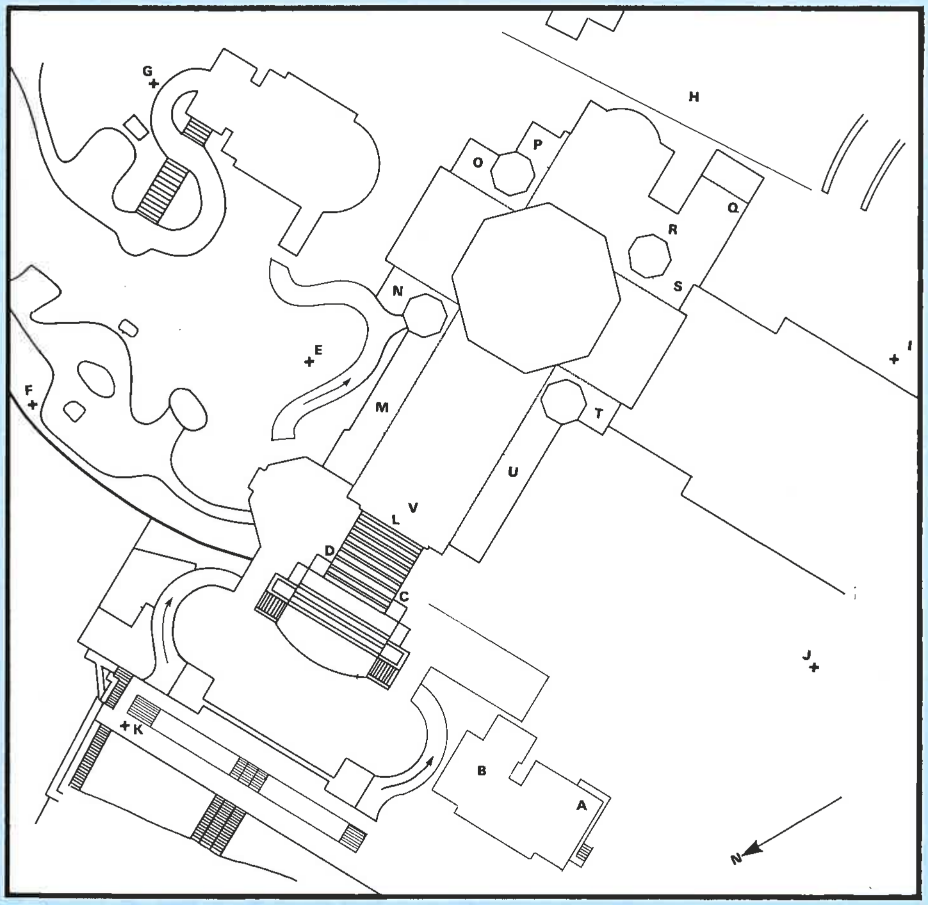
Date: 03/03/79

P.G.P. Consultants Ltd. — Les Consultants P.G.P. Ltée
325 Grande Caroline, Rougemont, Qué. J0L 1M0 Tél.: (514) 878-9675

The page from the specification reproduced above shows the number and colour of the projectors at each location. Right can be seen the control panel which can be manually operated or controlled automatically by computer, and a bank of computer-controlled switchgear.



Right is the plan of the Oratory showing the positions of the banks of CSI lamps, and at the foot of this page the lighting arrangement to achieve the 'frozen sunset' effect.

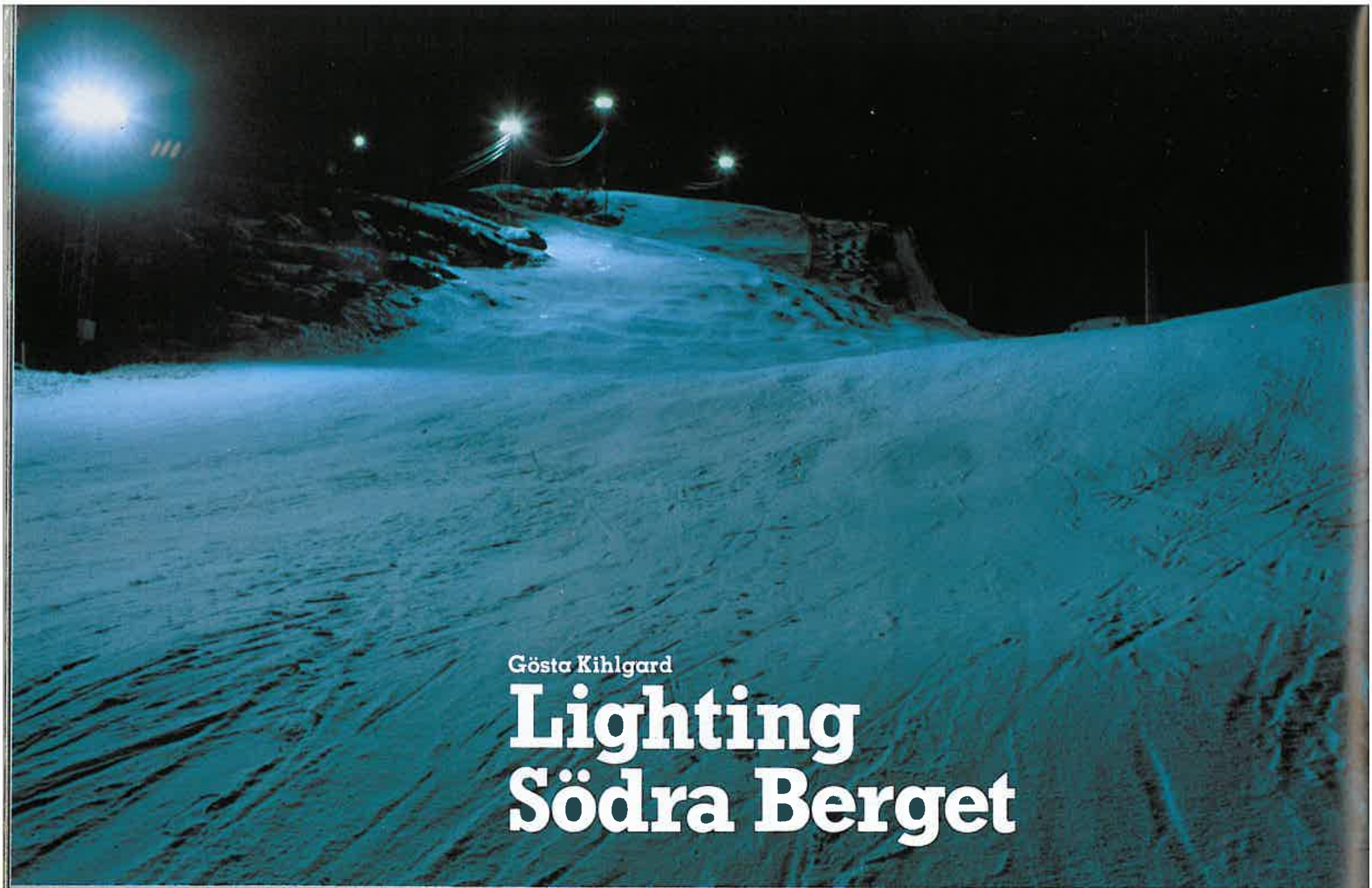


arc of about 90°, that is to say, there is a weekly variation of some 3° in azimuth. Thus the floodlights must be adjusted, not only for the time of sunset, but also for the direction of the light. To do this, an elaborate computer controlled switching system had to be designed and this is, perhaps the most complicated example of its kind in the world. The design and installation of this control system was the responsibility of Mr. Kukor, who worked very closely with Mr. Pflug in this project.

The computer system

In order to ensure that the lighting was switched on at the correct moment every evening, the computers are programmed in milliseconds over a four-year cycle (to take account of leap years). In the event of power failure, a battery operated master controller takes over and when the mains are restored, the computer "asks it the time", so that there is no danger of mis-timing. Solid-state switching is used to avoid sparking. In the initial stages of the design experiments were carried out on eight lamps. They were operated for 12 hours per day over a period of 2½ months — equivalent to about three years service. No hesitation in striking, or erosion of the electrodes was observed at this time and the special chokes designed to operate on the 60 cycle supply are quite satisfactory. Some idea of the size of the installation can be had when it is realised that 160,000m of coaxial cable, feeding groups of eight, twelve, sixteen or twenty-two circuits have been installed on 21 locations, each of which is fed from both 'ends' to ensure reliability of supply.

This is indeed one of the most elaborate and versatile floodlighting installations the world has ever known, and at the heart of it is a unique lamp: the Thorn Compact Source Iodide (CSI) reflector lamp.



Gösta Kihlgard

Lighting Södra Berget

Far right: A helicopter lowers a floodlighting tower into position on the steep slope of the mountain.
Below is a general view of the ski slope and skiers in action on the floodlit snow.

Mr. Kihlgard is Sales Manager for the Sundsvall office of Thorn Belysning.

Sundsvall, a town about 400km north of Stockholm, is surrounded by mountains, offering excellent possibilities for winter sports and for both cross-country and slalom ski-ing down the steep slopes. There are four slalom slopes within the city limits, each 600-700m long with drops of 70-130m. One of the steepest, 600m long with a drop of 130m is on Södra Berget, the Southern Mountain.

Overcoming difficulties

The steepness of the slope presented some problems, not only in making sure that there were no "dead zones" which could not be lighted from floodlights shown on the preliminary plan of the slopes, but also the physical difficulty of transporting and erecting towers on the steep slopes of the mountain. The first was overcome by a careful

survey of the slopes, the second by the use of a helicopter that placed the masts with millimetre precision in the holes drilled by the contractor to receive them, after which they were bolted in position.

The installation

The work of digging trenches for underground cables, erecting the masts and wiring to the floodlights was carried out by a local firm, Asberg O Thunström, in less than a fortnight; the positioning of the towers by helicopter was completed in 80 minutes. Forty-eight ON 1600 floodlights housing 1500W MBIL/H lamps operating on 380V were used, mounted on three 18m and five 12m towers.

A successful outcome

The slope is patronised by both professional and amateur skiers. From mid-November to March it is in use every evening from 6-9pm, six days a week.

Rudolf Blum

An Unusual Installation near Hamburg

Mr. Blum is Chief Lighting Engineer at Thorn Licht Beleuchtungsgesellschaft at Porz.

Although at first sight the lighting of this swimming pool in its green plastic air-hall may appear quite conventional, it has one very unusual feature.

The basic lighting is provided by eight 1500W linear metal halide lamps in ON1600 projectors mounted in pairs on five 3m high columns to give about 230 lux of shadowless indirect lighting. The unusual thing is a sixth column carrying two floodlights housing 400W SON.TD lamps, each provided with a hot-restrike ignitor.

In the event of a momentary interruption of supply extinguishing the lamps, the metal halide lamps would take several minutes before they would restrike, but the high-pressure sodium lamps on their special ignitor circuit would restrike immediately power was restored, so that the pool would not be left in darkness.

The scheme was designed by the lighting engineering department of Thorn Licht Beleuchtungs Gesellschaft in collaboration with the Thorn Advisory Department in Romford.

Charles Brown and Don Stallworthy

The Lighting of the Nave of York Minster

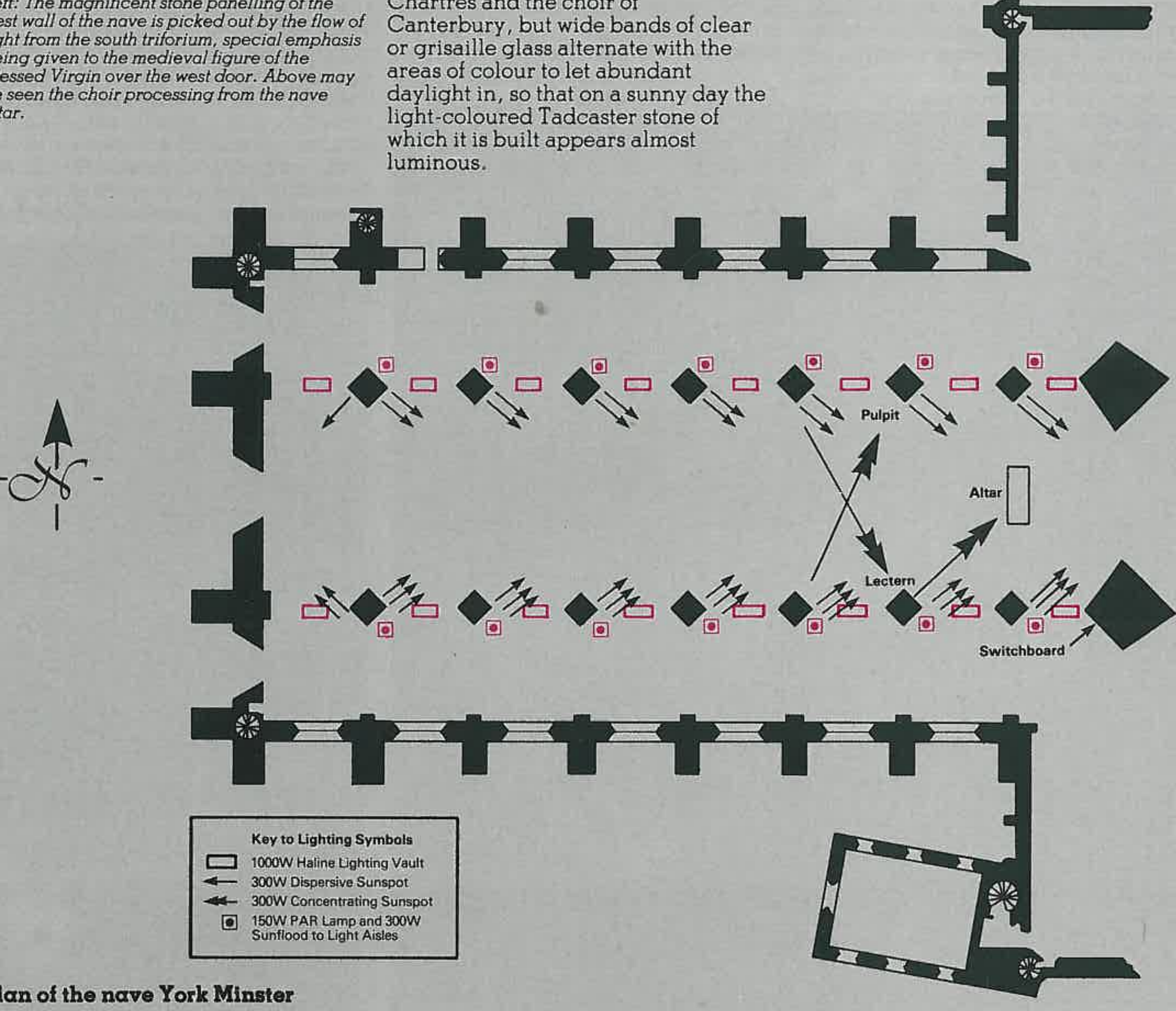
Left: The magnificent stone panelling of the west wall of the nave is picked out by the flow of light from the south triforium, special emphasis being given to the medieval figure of the Blessed Virgin over the west door. Above may be seen the choir processing from the nave altar.

Mr. Charles Brown, FRIBA Dip. Arch. (Birm) Dip. L.A. is Surveyor of the Fabric to York Minster. He was responsible for the lighting of Lichfield and Coventry Cathedrals described in Lighting Journal No. 17. Don Stallworthy, MCIBS is Chief Lighting Engineer at Thorn Lighting, Leeds.

The nave of York Minster is the broadest and the loftiest in England. It is about 20m wide and 65m long; the ridge of the vault is 30m above the floor and is only exceeded by that of Westminster Abbey. The problem of lighting such a building is nearer to that of floodlighting a school playground than to lighting a room.

Of course, when it was originally built, artificial lighting scarcely existed. The building was designed to be seen in daylight and indeed it is meant to be filled with light. The huge windows of aisles and clerestory are not completely filled with coloured glass to give a dim religious light as at Chartres and the choir of Canterbury, but wide bands of clear or grisaille glass alternate with the areas of colour to let abundant daylight in, so that on a sunny day the light-coloured Tadcaster stone of which it is built appears almost luminous.

Originally the only artificial lighting was from candles in the choir or on the altars. The former were probably only used for night offices or in the winter, the latter had a mainly liturgical significance. At night the only lights in the great building would have been the sanctuary lamps or the lights before a shrine.



Plan of the nave York Minster

The original lighting scheme

When at the beginning of this century, electric lighting was first installed in the nave, it took the form of pendants, two to a bay, each carrying four bare lamps on a cruciform frame. Long brackets, like fishing rods were thrust out from the triforium to support them. The light they gave was totally inadequate and the fittings themselves were glaring and unpleasant when lit, while in daylight the horizontal brackets broke the line of the triforium and the vertical chains interfered with the rhythm of the main arcades.

Lighting requirements

The nave is used for a variety of purposes. The Minster is, of course, primarily the mother church of the Diocese and Province of York and the nave is used for services attended by quite large, sometimes very large, congregations every sunday and some other days in the year. In addition it is used for concerts, which may involve turning the seating so that it faces west instead of east. The lighting must be enough for the people to read their service books comfortably on a dark winters evening and not be uncomfortably glaring when they are facing the 'wrong' way.

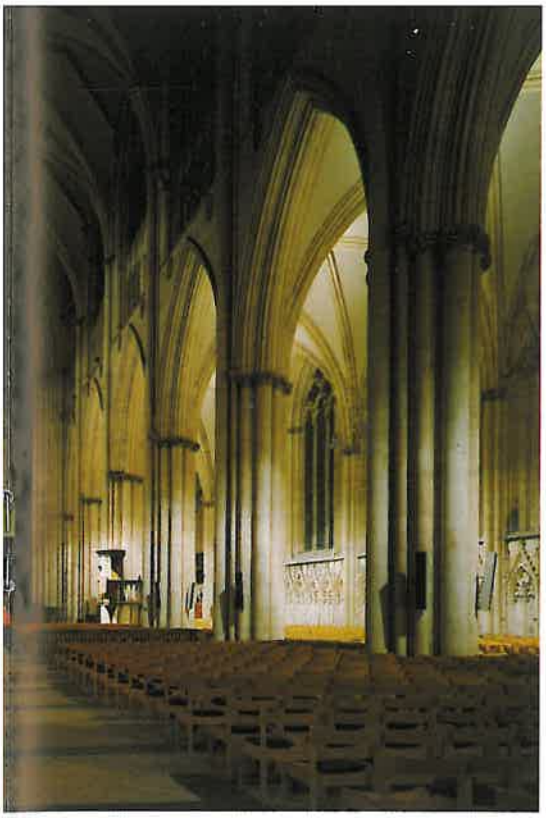
Augmenting daylight

But these were not the only considerations. All day and every day the great church is full of visitors. Usually the natural lighting is more than adequate, but even in summer on a dark day with an overcast sky the building can look quite gloomy and it can be impossible to see interesting detail so that some artificial lighting must be provided. Except on the brightest day, too, the focal points, the nave altar, pulpit and lectern need to be emphasised by special lighting. One of the chief glories of York is its stained glass, only Chartres among European cathedrals has so perfect a set of windows, so that the auxiliary lighting must be discreet so as not to detract from its effects. This necessitates a carefully designed switching programme to avoid all the lighting being switched on at once, or more being provided than is actually needed. The new lighting must complement the architecture and must itself be as unobtrusive as possible.

Two schemes rejected

Two possible schemes were rejected before any tests were made. The first, to recess luminaires in the flat areas between the ribs of the vault, a method used quite effectively at Hereford many years ago, was rejected here as it seemed likely that glare would reduce the visibility of the carved and painted bosses. The second, to use asymmetrical floodlights mounted in the triforium would have resulted in glare to people seated in the aisles. SON R high-pressure sodium reflector-lamps made by another manufacturer were considered, but were found unsuitable for several reasons. The lamp replacement cost would have been higher than if standard lamps were used, there was the possibility of

Left: The nave looking east showing the indirect lighting of the vault. The smaller picture shows the arrangement of the 'Sunspots' between the mullions of the triforium. One of the 'Haline' floodlights used for the indirect lighting can be seen in the central opening.



Left: The lighting used for general circulation on a dull winter day. Light reflected from the aisle vaults is supplemented by spotlights on the nave altar, pulpit and lectern. Below is the north aisle lighted in this way with a detail picture showing the arrangement of a 150W PAR lamp for indirect lighting of the vault and a 'Sunflood' for use when people are sitting in the aisles.

unreliable performance due to the internal starting device used in this class of lamp, and there would have been no choice of beam-spread.

Direct and indirect lighting

Fortunately the medieval architects provided York with a generous triforium. This had already been used to mount floodlights to illuminate the main vault at "Son et Lumière" performances. It was decided to retain these floodlights, Thorn 'Haline' projectors housing 1000W tungsten halogen lamps, but augment them with a direct lighting system using reflectors concealed as far as possible by the triforium mullions. Obviously the most efficient lamps possible ought to be used in the interest of energy conservation but a more important consideration was to provide light of a colour to suit the very subtle cream-coloured limestone of which the church is built. Consequently it was decided to experiment with various types of lamps. Three types were tried, using a large diameter (600mm) reflector mounted in the triforium.

One of the facts that came out of the quite extensive experiments on site was that linear tungsten halogen floodlights (Sunfloods) although easily concealed from the view of people seated in the centre part of the nave, were distinctly glaring to those in the aisles.

Choosing the light-source

High pressure sodium appeared attractive at first, but was rejected because its light reduced the effect of the colours of vestments, pictures and hangings. Metal halide lamps were tried, but their rather cold light, although quite acceptable on vestments and altar hangings, failed to show the rather subtle colour of the Tadcaster stone to advantage, so that the choice finally fell on tungsten halogen lamps, already in use for the floodlighting of the vault. These were considered to give a very acceptable effect, similar in appearance to direct sunlight, and an added advantage was that the lamps could be dimmed if necessary.

The new 'Sunspot' projector

A further advantage of the use of tungsten halogen lamps was their small size which allowed the very compact Thorn 'Sunspot' projector to be used. The alternative of using fewer but larger lamps in 600mm diameter reflectors was tried, but the glare was found unacceptable, and the reflectors themselves were difficult to conceal. The 'Sunspots' about a third in size, were easily hidden and it was observed that a number of smaller light-sources was less glaring than one large one. In any case, the accurate placing of the lamp in the parabolic reflector much reduced the glare from spill light.

General lighting and accent lighting

The downlighting system, provides an adequate 'working' light at "prayer-book level" when required and also allows a few spotlights to be used independently to highlight altar, pulpit and lectern. When the nave was only being used by visitors, this would normally be the only lighting provided, but on a dull day, it could be augmented by floodlighting the vault. An attempt to overcome the tendency of congregations to cluster at the back of the church has been made by switching the lighting equipment at the east and west ends of the nave separately.

The lighting of the Nave of York Minster

The west wall of the nave was given special treatment for two reasons. First of all, the elaborate system of panelling was considered important enough to be emphasised and secondly, this wall forms a background when concerts are held in the nave with the orchestra deployed in front of it. Extra 'Sunspots' were provided in the south-west bay of the triforium to give the effect of glancing sunlight. It is proposed to light the choir screen in a similar way, mounting the spotlights in the western triforium of the south transept as soon as the scaffolding needed for the repair of the roof has been taken down.

Lighting the aisles

Although the central area of the nave is the most important, some lighting had to be provided in the aisles both to balance the effect when artificial lighting alone is used and to provide a 'working light' for those occasions when the whole place is packed with people. An important point is that the seating in the aisles faces north and south instead of eastwards as it does in the nave.

In the initial experiments a 300W 'Sunflood' was used to provide the indirect lighting of the vault and a 'Sunspot' fitted with a prismatic front glass to produce a wide angle beam used for downward lighting. This gave too much light on the vault and in addition the 'Sunspot' mounted at the level of the top of the shaft of the main pier, looked clumsy. A further trial installation was made using a 300W 'Sunflood' for downward lighting and a bare 150W PAR lamp to light upwards into the vault. This was judged very satisfactory, as when the PAR lamp was used alone it was very inconspicuous, and the 300W Sunflood with its wide asymmetric distribution provided an even spread of light when it was required and unlit was hardly noticeable.

These lamps are mounted on the eastern faces of the main piers 'inside' the spring of the arch of the main arcade. They are virtually invisible to the casual viewer, and their positioning prevents them presenting a glare source to viewers in the opposite aisle. They are, of course, well above the normal angle of view of people in the same aisle. An unforseen result of their use was the revealing of a number of carved figures on the aisle walls that had hitherto escaped most people's notice. Some of them are playing musical instruments and bear a strong resemblance to similar carvings at Beverley.

Electrical load and switching arrangements

The table shows the calculated illuminance and lighting load for various numbers and wattages of lamps in the nave and aisles. In the event, 300W lamps were used throughout, as the illuminance they provided was considered adequate. Except for the lighting of the main vault, where it already existed, no provision for dimming was made as the problem of varying the lighting levels to suit the occasion was overcome by providing a carefully thought-out switching programme, a copy of which is attached to the main switchboard fixed on the north-east pier of the crossing.

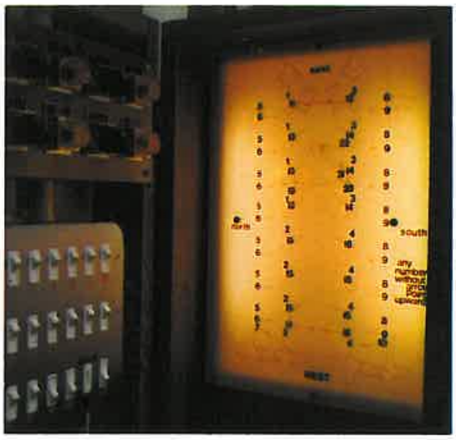
Calculated illuminance and lighting load for different numbers and wattages of lamps (downward lighting only).

NAVE Quantity	Floodlight	Lamp	Assessed Illuminance		Lamp Load	Rated Lamp Life in Hours
			L/Ft²	Lux		
40	OSS/C 500	M38 300W TH.	5/6	60	12.0kW	2,000 hrs.
56	OSS/C 500	M38 300W TH.	8	84	16.8kW	2,000 hrs.
40	OSS/C 500	M40 500W TH.	9.5	102	20.0kW	2,000 hrs.
Aisles						
16	OSP.500	M38 300W TH.	4	47	4.8kW	2,000 hrs.
16	OSP.500	M40 500W TH.	7.5	80	8.0kW	2,000 hrs.

The Zouche Chapel and Hatfield Tomb

In addition to the lighting in the nave, the Zouche chapel on the south side of the choir has been relighted and floodlighting provided on the tomb of Prince William of Hatfield in the north choir aisle, which hitherto had been difficult to see as it is in rather a dark corner.

Meanwhile experiments are being made for the lighting of the choir stalls, the high altar is already picked out by a 'Sunspot' mounted in the triforium, and it is hoped that the relighting of the whole cathedral will be completed in about a year's time.



Above is seen the control panel with its illuminated plan of the nave, while on the right is the Zouche Chapel, showing indoor floods mounted on the cills to light the vault and low voltage spotlamps hidden behind a shaft on the north wall to illuminate the clergy stalls.

B. J. Cannell and P. W. Ranby

Why T-8 Lamps?

The 26mm Polylux tube compared with the standard 38mm type. Note that the standard bi-pin conformation is retained so that the tubes can be used as direct replacements in existing switch-start fittings.

Dr. Cannell is Fluorescent Lamp Engineering Development Manager and Dr. Ranby Chief Chemist at the Jules Thorn Lighting Laboratories at Enfield.

Most tubular fluorescent lamps have a diameter of 38mm and are called T12s, but a diameter of 26mm tubing is not uncommon and these lamps are usually referred to as T8's. Thorn have been producing T8 fluorescent lamps in a range of different sizes and colours for both domestic and industrial lighting applications for over 15 years, but there is now a renewed interest in this size of lamp. To explain this interest, and to appreciate what has been happening it is necessary to look at the changes which have been taking place recently in fluorescent lamp design. Certain of these changes are of special interest from the point of view of energy conservation.

A new phosphor technique

Just over five years ago a range of conventional T12 fluorescent lamps appeared on the market in which the phosphor coating consisted of a mixture of three phosphors — called rare-earth phosphors, instead of the more usual single component, halophosphate material. These three rare-earth phosphors, a red, a green, and a blue, when mixed together in the appropriate quantities give white light. With these special phosphors, a lamp of higher colour rendering index and higher luminous efficacy can be obtained than one of the same nominal colour which uses only a halophosphate phosphor.

In chemical terms most phosphors consist of a highly purified host material or lattice, called the matrix, in which a carefully controlled amount of a specific foreign element, called the activator, is incorporated. The activator is combined with the matrix by heating a suitable mixture of the required components to a relatively high temperature and this also serves to produce the phosphor in a well crystallised and stable form.

The rare earths

The 14 chemical elements known as the "rare-earths" are of particular interest to the phosphor chemist because they are often effective as activators. Yttrium oxide activated by the rare earth europium is a red phosphor with an outstanding performance in discharge lamps because of its high brightness and good maintenance characteristics; its red emission is in the form of an intense narrow band (Fig. 1 (a)). The green "rare earth" phosphor is a magnesium aluminate activated by two rare earths, cerium and terbium. This emits a narrow and intense green band together with a few smaller bands in other parts of the spectrum (Fig. 1 (b)). A blue phosphor whose characteristics are well matched for use with these red and green phosphors is barium magnesium aluminate activated by europium (Fig. 1 (c)). All of these materials, red yttrium oxide, green magnesium aluminate and blue barium magnesium aluminate are prepared at higher temperatures, than is usual for conventional lamp phosphors such as the halophosphates. An important result of this high temperature treatment is their good lumen maintenance characteristic which makes them especially suitable for use in T8 lamps where the phosphor coating is closer to the arc and therefore subjected to higher temperatures than occur at the wall of a T12 tube.

Some disadvantages in the use of rare-earth phosphors

Although improvements in colour and brightness can be obtained when mixtures of these phosphors are used to produce fluorescent lamps emitting white light, they have some disadvantages. For example, because of the prime cost of the phosphors and the high temperatures required in their preparation, they can be as much as 50 times the price of the more conventional phosphors. Also, because the apparent white emission from the lamp is made up largely of narrow spectral bands, certain dye-stuffs can show a colour defect known as "metamerism" when viewed under light from these lamps despite their theoretically high colour rendering index. Another problem with fluorescent lamps singly coated with only a blend of these three rare-earth phosphors, is that some separation of the individual phosphor components can occur during the preparation of the lamp with the result that there can be a small, but significant, colour different from one end of the fluorescent tube to the other.

Combinations of rare earth phosphors and halophosphate phosphors

Many of these problems can be overcome by first coating the inner surface of the glass tube with a conventional halophosphate and then applying a layer of the phosphor blend on top of it, so that it is on the 'inside' of the phosphor-coated glass wall of the lamp. In these double-coated tubes the halophosphate layer is about half the thickness of that in an ordinary fluorescent tube and the rare earth layer is also about half the thickness that would be necessary if it were used alone. The major portion of the light is generated in the blended phosphor coating; the halophosphate utilises any residual U.V. radiation which penetrates the layer of rare earth phosphors. The precoating of halophosphate phosphor serves to mask the defects shown when the three phosphors are used alone and in addition, the fluorescent emission from the halophosphate although only a minor contributor to the total light output of the lamp, is a continuous emission band and this helps to reduce the metameric effects which occur when blends of phosphors are used on their own. It also improves the appearance of the lamp.

Variations in gas filling

Changes in the phosphor coating are not the only way of improving the efficacy of a fluorescent lamp; changes in the gas filling can also be of benefit. Consequently in order to obtain the maximum energy savings the gas filling in these lamps has been changed from the normal argon to krypton-argon, or krypton-neon mixtures. This improves the lamp efficacy and at the same time reduces the lamp watts. By utilising both modified tube coatings and modified gas fillings a new range of energy saving T12 fluorescent lamps has been produced.

Polylux lamps

As indicated in the introduction, Thorn has pioneered the development of T8 fluorescent lamps. Lamp engineers are very conscious of the need to make the maximum savings in energy and it was a natural step to try and incorporate all the improvements in phosphors, methods of phosphor coating and gas filling achieved in the T12 lamps in the T8 configuration.

By using a T8 tube with a pre-coating of a halophosphate phosphor which in turn has been coated with a mixture of the three rare earth phosphors, and a krypton-neon gas filling, a fluorescent lamp with all the advantages of high efficacy and high R_a but in addition with considerable savings in materials compared to a normal T12 lamp, is obtained. These new Polylux lamps are available in different sizes and colours. The average colour rendering index (R_a) is about 85 with efficacies in the range 75 to 96 lm/W depending on the colour and wattage. This represents approximately a 50% increase in efficacy over conventional deluxe T12 tubes, and is in fact the answer to the question that forms the title of this article.

Savings in material as well as gains in luminous efficacy

In addition to the very real advantage to the customer resulting from improved luminous efficacy, the materials saving achieved by using T8 tubes is considerable. There is a 33% saving in glass and phosphor and even a 55% saving in the gas filling compared with T12 lamps. This is particularly important with respect to the very expensive rare earth phosphors. Another, less obvious but very real economy which comes about by using T8 tubes is seen during storage and transport.

The spectra of yttrium oxide, magnesium aluminate and barium magnesium aluminate unite to produce white light in a multiphosphor tube.

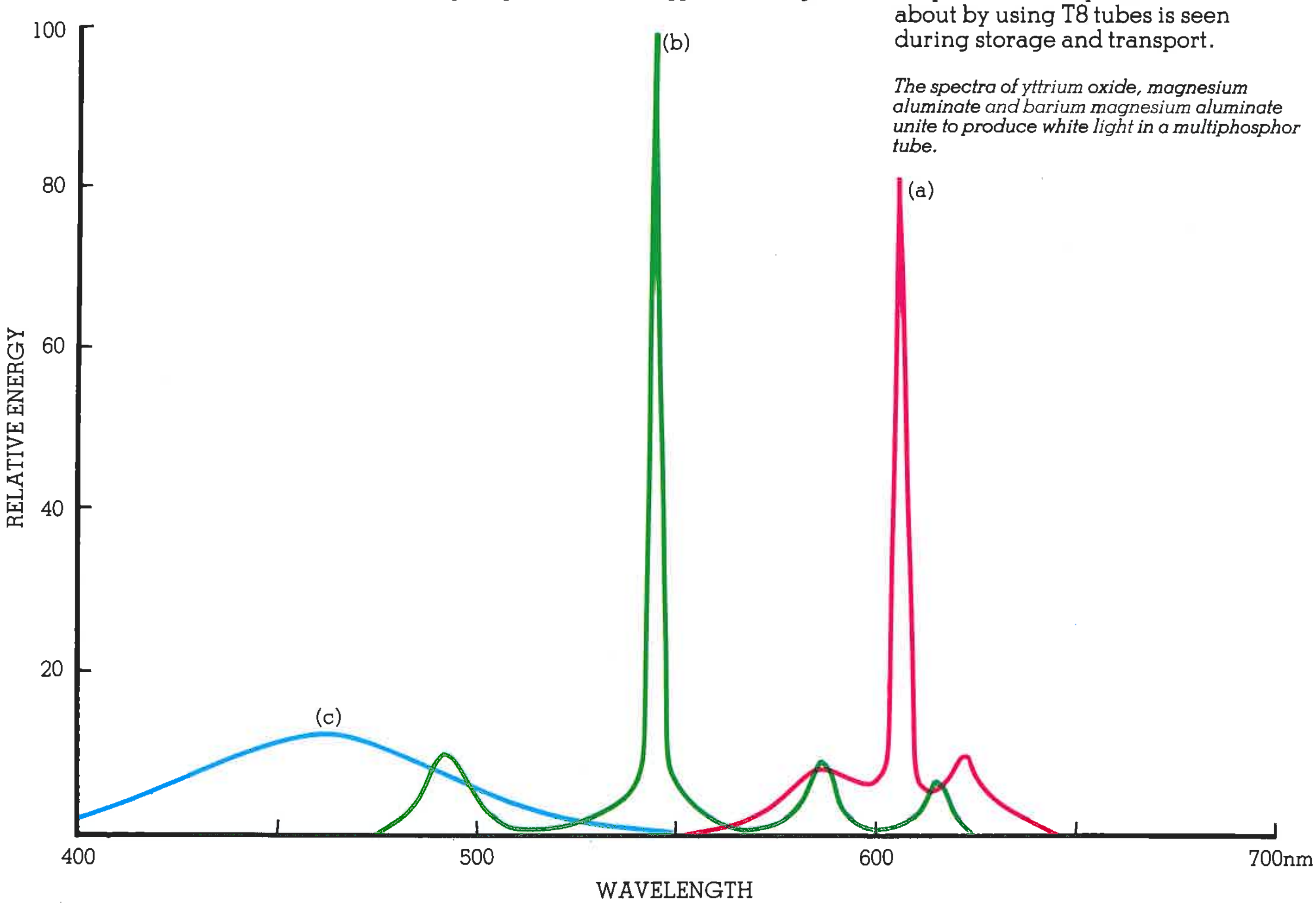


Fig. 1 Spectral energy distribution curve

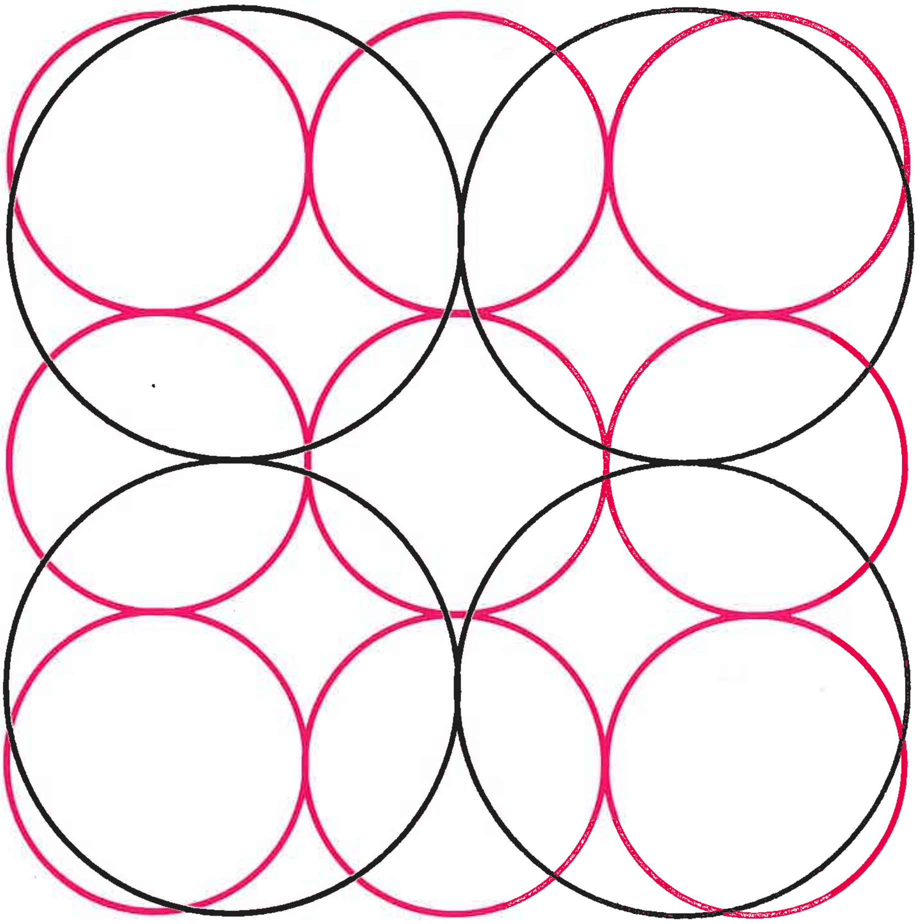


Fig. 2 Nine T8 lamps (red circles) occupy the same space as only four T12 lamps (black circles).

Although the diameter of a T8 lamp is only half an inch less than that of the T12, no less than nine T8 lamps occupy the same space as is taken up by only four T12 lamps of the same length, (Fig. 2). This also means that where new fittings are designed for the T8 lamp (rather than using it as a replacement lamp) there will also be considerable savings in the materials used in the manufacture of the new fittings; in fact, using the smaller diameter tube enables a more compact but highly efficient luminaire to be designed, with better optical control and hence higher light output ratios than can be obtained with conventional T12 lamps. These new lamps are therefore not only energy saving, but also material saving.

T8 Polylux lamp range

At present Thorn Polylux tubes are available in three sizes, 600mm 18W, 1200mm 36W and 1500mm 58W. Each size represents a 10% saving in lamp watts compared to conventional tubes of the same length (see table) The saving in lamp watts is due to the fact that when the lamps are run on the equivalent T12 size circuit, (600mm 20W, 1200mm 40W, or 1500mm 65W) there is less energy lost in heating the gas filling and hence the lamp watts are reduced. With an increase of up to 50% in luminous efficacy, this is indeed a 'plus'.

The lamps will ultimately be available in four colours 3000, 3500, 4000 and 6500°K which are similar in colour appearance to Warm White, White, Cool White and Tropical Daylight respectively.

T8 Pluslux lamps

Another aspect of the use of T8 tubes is seen in the new Thorn range of 'Pluslux' tubes. The T8 halophosphate lamp has been available in the 900mm and 1500mm sizes for many years and these lamps have had an acceptable lumen maintenance. The range has now been extended to cover the 600mm and 1200mm sizes, and is marketted under the name of the Thorn 'Pluslux' lamp. these lamps have similar colour characteristics to the conventional T12 halophosphate tubes, but an improved luminous efficacy and reduced current consumption. Because of the higher wall temperature, however, they show a slight reduction in lumen maintenance (between 5 and 10% in 6000 hours), but although they offer similar advantages in energy and materials savings as the Polylux tubes, their initial cost is lower.

Circuits

Due to the presence of krypton in the gas filling, and the use of the smaller diameter tubing these T8 lamps are restricted to operation on switch start circuits. However, this is a small disadvantage compared with the energy saving features of Polylux and Pluslux lamps and in any case, there are indications that electronic starters, like those being used for T12 lamps, will be developed for the new T8 lamps.

The next step forward

In a world increasingly faced with shortages of both energy and materials, T8 fluorescent tubes are obviously here to stay. In the future, further combinations of the factors described in this article may well result in further ranges of lamps with improved colour rendering properties or enhanced luminous efficacy, nor is there reason to suppose that still further improvements in phosphors may not be made, to extend and improve the range still more. That such a future may eventually be possible is yet another attribute of the energy-saving T8 lamp.

Tube Size	Lamp Watts	Type	Lumens (at 100 hours)
2ft. T12 2ft. T8 2ft. T8	20 18 18	Standard Polylux Pluslux	1225 1450 1300
4ft. T12 4ft. T8 4ft. T8	40 36 36	Standard Polylux Pluslux	3050 3450 3100
5ft. T12 5ft. T8 5ft. T8	65 58 58	Standard Polylux Pluslux	5100 5400 5100

Comparison of the lumen characteristics of white lamps of different types.

Thierry de la Pommeraye

Floodlighting at La Rochelle

Left: The ancient 'Donjon' or municipal citadel and the Hôtel de Ville of La Rochelle. The main façade of the latter building can be seen below left. Below are an ancient street, 'la Rue des Gentilhommes' and a view of the corner of the Donjon showing the Thorn Area Floods mounted on the walls of the buildings facing it.

Mr. de la Pommeraye is Manager of Thorn Electrique S.A., in France.

The name of the ancient port of La Rochelle is familiar to all students of 16th century history and, for that matter, to all who have read Dumas' "Three Musketeers". Today, in spite of its bloodthirsty past, it is a peaceful backwater, its harbour filled with yachts instead of warships and its streets with tourists in search of the picturesque.

A short time ago, the City Fathers decided to renew the floodlighting of the Hôtel de Ville and its Donjon or Citadel and they chose SON lamps in Thorn Area Floods to do it. The main factor that influenced their choice was that these floodlights are constructed of non-corrosive materials and that the control gear is enclosed within them. They would resist the corrosive atmosphere of the Atlantic coast and be easily installed without the necessity for extra wiring.

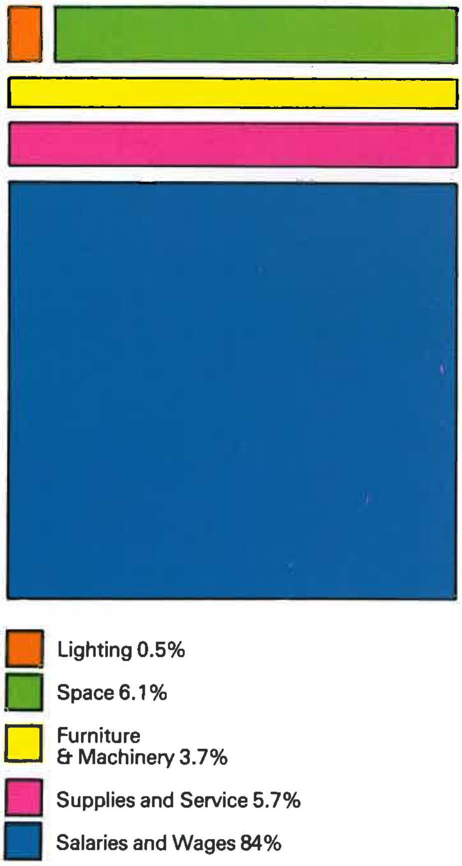
The floodlights are mounted on the walls of houses near the two buildings and contribute to the lighting of the narrow streets. Fifteen have been installed so far, housing 400W and 250W SON lamps and a further fifteen are to be added next year.

Iain Maclean and Richard Springford

Lighting and Energy Management

Mr. Maclean is Manager of the Ceiling Systems Division at Thorn House and Mr. Springford is Ceiling Systems Design Manager.

Comparative costs of operating an office building. Lighting is only 0.5% of the total.



In any study of the changes that have taken place in the design of IED buildings over the past ten years, the one factor that dominates all others is the greater awareness of the need for efficient use and control of the total energy requirement for the building. The technique for achieving this is called Integrated Environmental Design (IED).

Looking back to one of the first successful environmental services designs, that at the South Western Electricity Board's District Headquarters Building at Avonbank and comparing it with the recently completed CEGB Harrogate headquarters, the changes that have taken place are immediately obvious. These cover all aspects of building design, from the architectural style, window sizes and daylight considerations, to artificial lighting.

Increased influence of daylighting

The increasing cost of primary fuels has led to a reappraisal of the contribution to the lighting of the interior by the lateral penetration of daylight, this being a direct function of the depth of the lit space and the percentage and position of the glazing. In the early days of IED it was not uncommon for the proportion of the window area to be as low as 10 to 15% of that of the external walls. The deep plan offices were artificially lit to a high level, often to an illuminance of 1,000 lux, using fluorescent tubes of good colour-rendering properties, but comparatively low efficacy. This was the case at Avonbank, but at Harrogate the window area was increased to 50% of wall area and daylight studies established that a 2% daylight factor could provide a minimum illuminance of 100 lux, which would often be exceeded throughout the year, in an area up to four metres from the window line. Consequently, a reduced level of artificial lighting was considered and finally 750 lux was chosen as being the most appropriate for this type of office, primarily because of the need to make provision for drawing office illuminances anywhere within the building. Taking into account the predicted illuminance from daylight close to the windows, adequate provision was made during the planning stage for the separate switching of luminaires adjacent to the window line.

Left: The considerably larger window area of the CEGB offices at Harrogate is clearly seen when comparing the illustration with that below. The lower picture shows the offices of Rank Xerox at Micheldean, Gloucestershire, installed soon after the SWEB installation at Avonbank, mentioned in the text, and closely resembling it.

The photograph of CEGB, Harrogate is by courtesy of "Building Services", the CIBS monthly journal.

The cost of lighting compared to other services

Today, energy consumption must be viewed against energy productivity. Energy must be used to save energy. But although buildings need energy to operate, and particularly they need lighting because no-one can work in the dark or work effectively in poor lighting conditions, the relative cost of lighting is very small among other costs for a successful operation. It has been estimated that the total cost of such an operation can be apportioned as follows: Salaries and wages 84%, furniture and machines 3.7%, Services and supplies 5.7%, Space 6.1% and lighting only 0.5%, but although lighting is such a small percentage of the total, a small sum spent on its improvement can to a large degree determine the return on the much larger investment in total costs, since a pleasant and effective place in which to work helps to provide the ability and motivation for people to complete their work effectively.

It is interesting to see how we always think in relative terms. We might conclude that in view of the rapidly increasing electricity charges, we can no longer afford good lighting, but if we view productivity against good visual conditions it is very clear that we cannot afford to do without it. Experience has shown that good lighting boosts performance, whereas reducing lighting to save operating costs can be counter-productive. The only change that can reasonably be made is to light tasks selectively, rather than to provide even lighting all over the building.

What changes need to be made in our approach to lighting?

We are operating lighting today at a certain cost level to provide an adequate working environment, good task visibility and pleasing surroundings. We know it is possible to reduce these costs without compromising these conditions, but the question is, how long will it take to make these reductions and by what means can they be achieved? Lighting can be operated more efficiently in its total use; there can be programmes to switch it off when it is not needed, and they can be easily achieved. Lighting can be differentiated in various areas in terms of local need, there is no need to supply the same illumination in every building module. In certain buildings this may not be easy, though in new constructions good results can be achieved. Building lighting into office furniture gives a further potential for savings, since lighting needs can be more precisely linked to the task.

These, in conjunction with increasing efficacy of the lighting equipment offset the effects of rising costs of electricity, and, as stated earlier, while there is never any benefit in compromising good working conditions, there is a neglected light source which must be more widely used, namely natural daylight, though attention must be paid to methods of minimising the effects of solar gain and heat losses, perhaps by the use of modern double-glazing techniques.

Lighting as a major consumer of electricity

Although the cost of providing good lighting is a very small part of the total cost of running an office building, it is often the largest single consumer of electrical energy, in spite of the increase in the use of electrically operated machinery. Consequently, the improvements that have taken place in the past few years in both the technology of light sources and their associated control components as well as the developing lighting design techniques form major areas of cost saving. Both these factors have had their effect in the nature and design of the lighting hardware currently on the market and consequently on the thought leading to the development of new products and techniques for the future.

Phosphor research has led to the development of fluorescent tubes consuming less power for equivalent light output to those they replace, and there is a distinct tendency towards the use of high pressure sodium lamps in offices, either in conventional ceiling mounted luminaires, or to provide an indirect lighting component from 'torchères' to supplement task lighting from low wattage fluorescent tubes mounted close to the surface of the desk. Both improvements in lamp efficacy and these new techniques can result in greater illuminance for a given energy consumption but the main emphasis should always be put on control and optimisation of energy usage.

Some new lighting techniques

Running parallel with the development in lamp technology, new lighting techniques and equipment have come into use. Low brightness luminaires often with batwing photometric distributions have been widely specified because of the improved seeing conditions they produce, in addition, there has generally been a move towards the specification of higher light output ratios for luminaires and this in turn has meant the wider specification of low brightness reflector systems with their highly efficient optical reflectors.

These systems can vary from the highly efficient vaulted ceilings utilizing surface mounted luminaires, to the considerably more versatile linear recessed lighting units, with provision to include air diffusion equipment in a fully co-ordinated design. In addition they will usually provide for the integration of other mechanical services if necessary, such as sprinklers, fire detectors, loud speakers and emergency lighting fittings and so on.

Where full modular co-ordination is necessary, the use of a system such as Programme 2 may be considered, offering as it does a high degree of

The 'Thermalux' ceiling in Crawley sports centre admits natural daylight, diffuses the light from an array of fluorescent tubes after dark and reduces heat gains and losses from the glass structural roof above it. Air-supply diffusers can be seen mounted on the walls immediately below it.

Very large structural coffers, each with a louvered lighting fitting placed centrally in it, are a striking feature of the new Chatham office of Lloyds of London. Louvered 'batwing' fittings 'complete the squares' and allow partitions to be inserted without detracting from the lighting. Air is injected through the slotted supporting members beside them and exhausted through them and through the square luminaires in the coffers.

engineering control, as well as superior levels of visual satisfaction, complimenting the architect's total building design.

Techniques of energy control

The control of energy is probably the most significant single development to date and must continue into the future providing as it does the basic element of continuous, comfortable and secure environmental conditions for the building's occupants. Good conditions are primarily secured by the control of temperature and humidity, but they can also include lighting, electrical distribution, fire warning systems and communications in the total system of building management.

Computer based control systems are becoming common, and these should be able to be adjusted manually or in accordance with a pre-arranged programme to take account of seasonal changes in temperature and illuminance. The control system should provide for the operation of the installation in the most economical manner and provide the user with a continuous record and analysis of cost.

Future developments

What of the future as far as IED is concerned? Surely the lessons learnt in the past ten years are not going to be wasted. The advent of low energy lighting systems based upon a variety of techniques varying from the provision of low levels of general background lighting topped up by individual luminaires fixed on or adjacent to the work station will not radically alter the proven techniques of integration. Indeed, the technical difficulties involved in installing such a system in an existing office are considerably greater than those of putting in an integrated ceiling system. As stated above there are already on the market several systems in which varying degrees of integration has been carried out by the system manufacturer and the client can specify these systems with their pre-determined performances under widely varying condition of use with confidence.

The central console of a computerised control system for a major building complex. Using the computer memory to produce a visual display of the system, the operator can then programme the computer.
Photograph by courtesy of Johnson Control Systems and the National Westminster Bank Ltd.

Day-lighting considerations

It certainly appears that a far greater provision of daylight compared to that in the earlier IED schemes will continue in the future, although it must be remembered that very large windows present their own problems of glare, solar heat gain, not only in summer, but in the winter months when the sunlight strikes the side of the building at angles not far distant from the normal. The economics of daylighting are by no means so well established or so easy to assess as those of artificial lighting and it is always possible that a return to the windowless or virtually windowless buildings of the early seventies may occur. There are, of course, installations such as the EEB control room illustrated, where a windowless room is needed for special reasons and here ventilation is also essential, but whatever design option is chosen for any given interior the choice is bound to be influenced by a wide range of factors.

Statutory regulations and new technology

These factors will include statutory regulations, dealing with the thermal characteristics of the structure, affecting almost certainly the percentage of glazing and consequently the provision of daylight. Regulations controlling the use of energy to provide the maximum permitted levels of heating and cooling within the space are also under consideration.

The changing lighting needs brought about by the use of new technology in the office, for example the use of word processors, visual display units (VDUs) and other similar equipment must also be considered. Some types of visual display equipment are especially apt to reflect lighting, thus reducing the visibility of the image in the screen. The careful positioning of light sources, which can overcome this, is seldom possible in a general lighting scheme.

Conclusion

The elaboration of engineering services within a building is likely to increase rather than diminish, especially as energy costs continue to rise increasing the need for more effective control. All these factors will lead to a changing pattern of design, but the fact remains that integrated engineering design will become more important than ever as the years go by.

Air-conditioning is a 'must' in this continually manned windowless control room of the EEB at Brentwood, Essex. Air is injected through conventional air diffusers and exhausted through the fluorescent luminaires.

In the Programme 2 ceiling at the Halifax Building Society's premises at Slough, air is supplied through the supporting grid and exhausted through the luminaires.

Dans cette édition

Depuis leur lancement, il y a à peu près dix ans, les lampes au sodium à haute pression, utilisées d'abord pour l'éclairage de la voie publique ont trouvé de très nombreuses applications, dans les installations de projecteurs, l'éclairage des intérieurs industriels et même des domaines aussi divers que l'éclairage des bureaux, quelques applications dans les cathédrales, et l'éclairage des piscines. La réduction des puissances nominales des lampes a facilité la construction d'appareils d'éclairage appropriés pour le marché commercial et il est certain qu'à mesure que l'on développera des lampes de plus petite puissance la gamme des applications se trouvera encore élargie.
Les problèmes techniques posés par la fermeture du tube à l'arc ont été résolus par la construction monolithique qui évite la nécessité de chapeaux métalliques et cette méthode de construction a pratiquement éliminé les difficultés initiales. Ces difficultés aléatoires sont typiques de tout nouveau type de lampe à son lancement mais, à mesure que l'on identifie les causes de ces problèmes et qu'on les élimine, la courbe de durée utile s'améliore et les lampes SON de 400W et 250W atteignent maintenant 10.000 heures avec un pourcentage d'échecs qui est négligeable. On a constaté que l'emploi d'un amorceur extérieur améliorait les chances d'une longue durée utile des lampes en réduisant le nombre de pièces à l'intérieur de l'ampoule, chacune desdites pièces constituant une cause éventuelle d'échec.
Les essais de durée utile sur des rampes en laboratoire et dans des situations sélectionnées d'éclairage de la voie publique et d'éclairage industriel que l'on peut contrôler avec précision constituent la source d'informations la plus efficace sur la durée utile des lampes et la production de lumière, mais une étude des installations effectuée au hasard peut produire des renseignements importants sur la réaction des clients à l'égard d'une lampe nouvelle. Une étude de cette nature confirme les caractéristiques d'une durée utile exceptionnellement longue liée à un excellent maintien de la luminosité pour la lampe SON.

La Basilique de St. Joseph à Montréal est, peut-être, l'église la plus célèbre de l'Amérique du Nord. Maintenant, avec ses nouveaux projecteurs conçus par le spécialiste célèbre de l'éclairage tchécoslovaque, Miroslav Pflug, elle domine la ville la nuit aussi bien que le jour.
L'effet produit par l'éclairage a été décrit comme un "coucher de soleil gelé" alors que les derniers rayons du soleil couchant dorent la façade de cette grande construction, l'éclairage par projecteurs prenant la relève imperceptiblement de sorte que la forme gigantesque semble flotter au-dessus de la ville assombrie.
Le problème de l'entretien des projecteurs, au nombre de près de 300, nécessaires a été résolu par l'emploi de projecteurs Thorn CSI 1000 PAR. Sans réflecteurs à maintenir en parfait état de propreté, cette lampe à décharge très puissante metalliques en unité scellée est aisément installée et remplacée et projette un faisceau de lumière concentré. On utilise des filtres de couleur montés sur des grilles concentriques pour simuler l'éclairement du couchant ou pour produire un éclairage d'ambiance. Ces filtres sont rouges, verts, bleus et jaunes et sont aménagés en batteries pouvant atteindre le nombre de 52, dans les proportions de dix-sept blancs, seize en jaunes, huit rouges et bleus et quatre verts. On obtient ainsi aisément les changements de couleurs.
Comme le soleil se couche à une heure différente et en un point de l'horizon différent chaque soir, on a installé un ensemble d'ordinateur perfectionné qui est sans doute le plus complexe du monde en son genre. La commutation est programmée en millisecondes sur une période de quatre ans (pour tenir compte des années bisextiles). En cas de panne de courant, un régulateur fonctionnant sur batteries prend le système en charge, de sorte qu'il n'y a pas de risque d'erreur dans le temps. Pour éviter la production d'étincelles, on a recours à la commutation par semi-conducteurs.
La responsabilité de la construction et de l'installation est revenue à M. I. Kokur. La société Thorn est fière de préciser que sa lampe unique à réflecteur aux iodures de faible emcombrement (CSI) est au coeur de l'une de ces magnifiques installations d'éclairage par projecteurs.

La Cathédrale d'York, la grande cathédrale anglicane de la province du nord de l'Angleterre, est l'une des glorieuses cathédrales gothiques de l'Europe, sa collection de vitraux ne le cédant qu'à celle de la Cathédrale de Chartres. Le renouvellement de l'éclairage de la nef a été complété récemment sous la direction de M. Charles Brown, architecte et métreur de la structure de la cathédrale.
L'éclairage électrique original, installé au début de ce siècle, était constitué par des chandeliers suspendus à des mâts se projetant du triforium; il était éblouissant et complètement inadéquat comme moyen permettant de révéler l'architecture.
Un critère de construction important stipulait que, comme les sièges de la nef sont parfois retournés pour des concerts, l'éclairage ne devait pas être éblouissant quand on le considérait de cette direction. De plus, les sièges des nefs latérales font face à la section centrale de la nef, de sorte qu'il était important d'éviter l'éblouissement provenant des installations d'éclairage montées dans le triforium situé en face.
On a effectué un certain nombre d'essais, dont des installations expérimentales de lampes à décharge aux iodures métallique et au sodium haute pression, et le choix a porté finalement sur l'emploi de lampes aux halogènes-tungstenes dans des projecteurs Sunspots, montés dans le triforium, pour éclairer la section principale, du sol en combinaison avec l'éclairage indirect existant de la voûte principale par des projecteurs 'Haline'. Le choix des projecteurs 'Sunspot' a été largement influencé par leurs petites dimensions qui permettaient de les cacher facilement et par la grande variété des angles de faisceaux que l'on pouvait obtenir. Les voûtes des nefs latérales sont éclairées par des lampes PAR de 150W, avec des lampes aux halogènes-tungstenes du type linéaire dans des projecteurs 'Sunflood' produisant un éclairage complémentaire pour les occasions spéciales.
L'installation est commandée d'un tableau de commutation monté sur la pile sud-ouest de la croix. Ce tableau comporte un panneau de programmation, montrant divers aménagements de commutation pour des occasions spécifiques.

La plupart des lampes fluorescentes courantes ont un diamètre de tube de 38 mm et sont désignées sous le nom de T12; il y a un tube de diamètre plus petit (26 mm) que l'on rencontre assez couramment et qui porte le nom de T8. Cette classe de tubes attire aujourd'hui un grand intérêt à cause du développement de phosphores nouveaux produisant des bandes de lumière essentiellement rouge, bleue et verte au lieu des halophosphates classiques qui produisent un spectre continu. La lumière rouge, verte et bleue est produite respectivement par l'oxyde d'ytrium, l'aluminate de magnésium et l'aluminate de magnésium au barium, le premier et le dernier activés par l'europium et le second par la cerium et le thallium. On peut améliorer leurs propriétés de rendu de couleur et l'aspect de couleur du tube en les déposant sur une couche d'un halophosphate déposé précédemment. Utilisés sous la forme d'un tube T8, pour réduire la quantité de phosphore, et avec un remplissage de krypton au lieu de l'argon habituel, les tubes Polylux donnent une amélioration d'environ 50% en termes d'efficacité avec un rendu des couleurs meilleur qu'avec la plupart des tubes classiques.
L'emploi de tubes T8 avec un remplissage de krypton a été élargi aux tubes utilisant le revêtement d'halophosphate classique, améliorant l'efficacité lumineuse en réduisant la consommation de courant. Ces tubes Pluslux et les tubes Polylux encore plus efficaces doivent être utilisés sur un circuit à starter.

Le facteur qui a dominé la construction des bâtiments au cours des dix dernières années est la nécessité de conserver l'énergie et ceci devient apparent quand on compare les anciens concepts de service d'ambiance à ceux d'aujourd'hui. Il y a dix ans, il était courant que le pourcentage des surfaces vitrées par rapport aux surfaces des murs fût de 10 à 15% et que l'éclairage artificiel fournît des éclairements de 1.000 lux; aujourd'hui, les surfaces vitrées peuvent atteindre 50% des surfaces des murs et l'on compte sur un facteur de lumière du jour de 2%, tandis que l'éclairement artificiel est de l'ordre de 750 lux.
Bien que l'éclairage représente généralement le plus gros facteur individuel de consommation d'électricité dans un bâtiment administratif, de sorte que l'on accorde de plus en plus d'attention à l'emploi de sources de lumière de plus en plus efficaces et que l'on a même vu des lampes au sodium haute pression dans des bureaux, le coût relatif de l'éclairage par rapport aux salaires et émoluments et même aux autres services et approvisionnements et au coût de la surface au plancher atteint à peine 0,5%. Toutefois, l'éclairage constitue un outil essentiel sans lequel il serait impossible de travailler, de sorte que les économies qui réduisent l'efficacité des conditions d'éclairage sont de fausses économies. Les techniques nouvelles et la nouvelle technologie des lampes ont permis de régler l'énergie utilisée pour l'éclairage très précisément et la coordination de l'éclairage avec le chauffage, l'aération et la climatisation apporte une contribution considérable.
Pour l'avenir, une utilisation encore plus grande de la lumière du jour semblerait vraisemblable, mais il est toujours possible, du fait du gain solaire marqué dans les bâtiments situés dans les hautes latitudes nordiques, que l'on assiste à un retour aux bâtiments virtuellement sans fenêtres du début des années 1970. La complexité des services électriques à l'intérieur d'un bâtiment est susceptible de croître et, à mesure que ceci se produira, il faudra accorder encore plus d'attention au coût et à la conservation de l'énergie.

In dieser Ausgabe

Seit Natriumdampf-Hochdrucklampen erstmals vor ca. zehn Jahren in der Straßenbeleuchtung auftauchten, hat sich das Anwendungsgebiet beträchtlich erweitert. Heute findet man diese Lampen in Flutlicht-Anlagen, Industriebeleuchtungsanlagen und selbst als Büroraumbeleuchtung, in einigen Fällen sogar in Kirchen und Schwimmbädern. Die allmähliche Senkung der Wattleistung ermöglichte die Konzeption von Leuchtkörpern für den Verbrauchermarkt, und zweifellos werden sich im Verlauf der Weiterentwicklung der schwächeren Lampen weitere Einsatzmöglichkeiten finden.

Die technischen Probleme, die mit dem Abschmelzen der Brenner verbunden waren, sind inzwischen durch die einteilige Bauweise gelöst, wodurch die Endkappen aus Metall nicht mehr erforderlich sind. Auf diese Weise ist ein vorzeitiger Ausfall der Lampe heute praktisch ausgeschlossen. Das gelegentliche vorzeitige Versagen ist typisch für jede neue Lampenart, die neu auf den Markt kommt. Sobald jedoch die Ursachen hierfür bekannt und beseitigt sind verbessert sich die ebensdauer, sodaß 400W und 250W SON-Lampen abgesehen von seltenen frühzeitigen Ausfällen heute eine ebensdauer von 10.000 Betriebsstunden erreichen. Es hat sich außerdem gezeigt, daß die Anordnung des Zündgerats außerhalb der Lampe ebenfalls zur Verbesserung der ebensdauer beiträgt, weil somit weniger Teile innerhalb der Lampe ausfallen können.

Ebensdauer und leistung der Lampen lassen sich am zweckmäßigsten erproben am Schaltrahmen im Labor sowie in einzelnen Straßenbeleuchtungszonen und Industriebeleuchtungssystemen, wo die Bedingungen exakt zu steuern sind. Dagegen läßt sich die Kundenreaktion auf die neue Lampe besonders gut durch Stichproben bei Installationen erfassen. Eine derartige Untersuchung hat bestätigt, was man sich hinsichtlich besonders langer ebensdauer und gleichbleibender Beleuchtungsintensität der SON-Lampe anfänglich versprochen hat.

Die Basilika von St. Joseph in Montreal ist wahrscheinlich das bekannteste Kirchenbauwerk in Nordamerika. Mit der neuen, vom bekannten tschechischen Beleuchtungsfachmann Miroslav Pflug konzipierten Flutlichtbeleuchtung beherrscht das Bauwerk heute das Stadtbild bei Nacht ebenso wie bei Tag.

Der Beleuchtungseffekt wurde als ein "festgehaltener Sonnenuntergang" bezeichnet, da die Flutlichtbeleuchtung unmerklich eingeschaltet wird, sowie die letzten Strahlen der untergehenden Sonne die Fassade des imposanten Bauwerks in ein goldenes Licht tauchen, daß die gigantische Silhouette über der dunklen Stadt zu schweben scheint.

Das Problem des Einsatzes von fast 300 Flutlicht leuchten wurde durch den Thorn PAR 64 CSI Strahler ideal gelöst. Diese Metall-Halogen-Dampflampe mit einem hochintensiven "sealed-beam" Lichtstrahl ohne Reflektoren (also kein Reinigungsproblem) ist leicht zu installieren und auszuwechseln und richtet einen konzentrierten Lichtstrahl auf das Beleuchtungsobjekt. Um einen Sonnenuntergangseffekt oder besonders stimmungshafte Effekte zu erzielen, werden Farbfilter auf konzentrischen Rahmen montiert. Diese roten, grünen, blauen und gelben Filter werden in Reihen von bis zu 52 Stück montiert, wobei siebzehn weiße auf sechzehn gelbe, acht rote und blaue und vier grüne Filter kommen. Auf diese Weise lassen sich die Farbnuancen problemlos regulieren.

Da die Sonne jeden Abend zu einem anderen Zeitpunkt und an einer anderen Stelle am Horizont untergeht, wurde eine komplizierte Computerschaltung installiert — wahrscheinlich die komplizierteste Computeranlage dieser Art, die es momentan auf der Welt gibt. Die Schaltung ist auf vier Jahre programmiert (um das Schaltjahr zu berücksichtigen). Bei einem Netzausfall schaltet sich automatisch ein batteriebetriebenes Hauptschaltgerät ein, daß das Zeitprogramm nicht beeinträchtigt wird. Zur Verhinderung von Funkenbildung hat die Steuerung verwendet man Halbleiter elemente.

Für die Konzeption und Installation der Steuerung war Mr. I. Kokur verantwortlich. Und Kern dieser phantastischen Flutlichtbeleuchtung bildet die CSI Reflektorlampe von Thorn.

Das Münster van York die anglikanische Kathedrale der nordenglischen Provinz, ist eine der bedeutendsten gothischen Kathedralen Europas. Seine Glasmalerei wird nur durch Chartres übertroffen. Das neue Beleuchtungssystem für das Kirchenschiff wurde vor kurzem unter der Leitung von Mr. Charles Brown, Architekt des Münsters fertiggestelt.

Die erste elektrische Beleuchtung, die Anfang dieses Jahrhunderts installiert wurde, bestand aus Hochdruck an Stangen aufgehängte zhängeleuchten die aus dem Triforium ragten. Das Licht war keineswegs blendfrei und zur angemessenen Ausleuchtung des Bauwerks völlig ungeeignet.

Ein wesentlicher Gesichtspunkt, der bei der Neukonzeption der Beleuchtung zu berücksichtigen war, bestand darin, daß die Beleuchtung das Publikum auch dann nicht blenden sollte, wenn die Sitze im Kirchenschiff gelegentlich für Konzerte umgestellt werden. Außerdem sind die Sitze in den Seitenschiffen zur Mitte hin gerichtet, sodaß auch die Beleuchtung im gegenüberliegenden Triforium blendfrei sein mußte.

Eine Reihe von Probe-Beleuchtungen wurden durchgeführt, unter anderem mit Natriumdampf Hochdruck und Metalldampfhalogenlampen und Metallstrahllampen. Schließlich fiel die Wahl auf Wolfram-Halogenlampen, die in "Sunspots" so im Triforium installiert wurden, daß sie die Hauptbodenfläche beleuchteten, in Verbindung mit der vorhandenen indirekten Beleuchtung des Hauptgewölbes durch "Haline" Flutlichter. Die "Sunspots" wurden vor allem deshalb installiert, weil sie klein genug waren, daß man sie leicht kaschieren konnte und weil sie eine Lichtabstrahlung in einem besonders großen Winkelbereich ermöglichten. Die Gewölbe in den Seitenschiffen werden mit 150W PAR-Lampen, sowie linearen Wolfram-Halogenlampen mit "Sunflood"-Effekt für besondere Anlässe, beleuchtet.

Die Beleuchtung wird von einer Schaltkonsole am südwestlichen Pier des Kreuzgangs aus gestenert. Hierzu gehört eine Programmtafel mit verschiedenen Beleuchtungsanordnungen für besondere Anlässe.

Die meisten serienmäßigen Leuchtstofflampen haben einen Röhrendurchmesser von 38 mm und tragen die Bezeichnung T12, gelegentlich findet man auch Röhren mit kleinerem Durchmesser (26 mm) und der Bezeichnung T8. Diese Röhre wird heute immer interessanter, weil neue Phosphorstoffe entwickelt wurden, die statt der herkömmlichen Halophosphate mit dem kontinuierlichen Spektrum vorwiegend rotes, blaues und grünes Licht abgeben. Rotes, grünes und blaues Licht erhält man mit Yttriumoxid, Magnesiumaluminat und Barium-Magnesiumaluminat, der erstere und letztere Stoff wird durch Euporium und der zweite durch Cerium und Thallium aktiviert. Ihre Farbweidergabe eigenschaften und die Lichtfarbe der Röhre Können dadurch verbessert werden, daß die Stoffe auf eine Grundschicht Halophosphat aufgeschichtet werden. In einer T8 Röhre — um die Phosphormenge herabzusetzen — und mit einer Kryptonfülling statt der üblichen Argonfüllung geben Polylux Röhren eine um 50% bessere Farbwiedergabe und bessere Leuchtfarben als die meisten herkömmlichen Leuchtstoffröhren.

Der Einsatz von T8-Röhren mit Kryptonfüllung erstreckt sich nun auch auf Röhren mit der herkömmlichen Halophosphat-Beschichtung, wobei die Lichtansbeute verbessert und der Stromverbrauch gesenkt wird. Diese Pluslux und die noch wirtschaftlicheren Polylux-Röhren können nur in Starterschaltung behieben werden.

Der bestimmende Faktor in der Architektur der letzten zehn Jahre waren energiesparende Maßnahmen, und dies tritt deutlich hervor, wenn man die umweltfreundlichen Konzeptionen der ersten Stunde mit den heutigen Konzeptionen vergleicht. Vor zehn Jahren ein Verhältnis von 10 bis 15 Prozent zwischen Wand- und Fensterfläche und eine künstliche Beleuchtung mit einer Intensität von 1000 Lux durchaus üblich; heute nehmen Fenster eher 50% der Wandfläche ein, und man arbeitet mit einem Tageslichtfaktor von 2%, während die Stärke der künstlichen Beleuchtung ca. 750 Lux beträgt.

Wenn auch der Hauptstromverbrauch in einem Bürogebäude normalerweise auf Beleuchtung entfällt, sodaß man immer wirksameren Lichtquellen Beachtung schenkt und selbst Hochdruck-Natriumdampflampen in Büroräumen installiert werden, machen die Beleuchtungskosten im Vergleich zu Personalkosten und selbst anderen Dienstleistungs-und Materialkosten sowie den Mietkosten pro m² kaum 0,5% aus. Beleuchtung ist jedoch ein wesentliches Betriebsmittel, ohne das es einfach nicht geht, sodaß jede Kosteneinsparung, die eine Verschlechterung der Sichtverhältnisse mit sich bringt, die Arbeitsleistung beeinträchtigt. Durch neue technische Entwicklungen und neue Lampentechnik kann nun die für die Beleuchtung erforderliche Energie äußerst exakt reguliert werden, und eine entsprechende Koordinierung von Beleuchtung und Heizung, Belüftung und Klimaanlage wirkt sich ebenfalls kostengünstig aus.

Die Zukunft wird wahrscheinlich eine noch intensivere Nutzung des Tageslichts bringen, jedoch besteht immer die Möglichkeit (aufgrund des merklichen solaren Energiegewinns in nördlichen Breiten), daß man wie Anfang der siebziger Jahre wieder fast fensterlos baut. Die elektrischen Installationen im Gebäude werden wahrscheinlich immer komplizierter, und im Verlauf dieser Entwicklung wird man die Energiekosteneinsparung bei der Planung immer mehr berücksichtigen müssen.

En esta edición

Desde su introducción hace cerca de diez anos, las lámparas de sodio de alta presión usadas al principio para la iluminación de las calles han encontrado muchas aplicaciones en iluminación proyectada, iluminación de interiores industriales e inclusive en campos tan diversos como la iluminación de oficinas, catedrales y piscinas. La reducción en las tasas de las lámparas ha facilitado el diseno de luminarias adicionales para el mercado comercial, y no hay duda que conforme se desarrollan las lámparas con menos potencia la gama del uso se extenderá todavía más. Las dificultades técnicas del sellado del tubo de arco se han vencido por medio de la construcción monolítica que elimina la necesidad de tapas de metal y este método de construcción ha eliminado practicamente los fracasos iniciales. Estos fracasos al azar son típicos de cualquier tipo nuevo de lámpara en su introducción, pero conforme se identifican y corrigen las causas de los fracasos, la curva de vida útil mejora y las lámparas de SON de 400W y 250W llegan ahora a las 10.000 horas con un pequeno porcentaje de fracasos. El uso de una cebador externa ha mejorado las posibilidades de larga vida útil de la lámpara reduciendo el número de componentes dentro de la bombilla y que cada uno de estos es una causa en potencial de fallos.

Las pruebas de vida útil en laboratorios y en iluminación de calles seleccionada como también en situaciones industriales sobre las que se puede mantener un control exacto, son la fuente más efectiva de informaciones sobre la vida de una lámpara y su rendimiento. Sin embargo, una investigación al azar de las instalaciones puede suministrar informaciones importantes sobre las reacciones de los clientes ante una nueva lámpara. Esta investigación justifica las afirmaciones de larga vida útil, junto con mantenimineto excelente de lúmenes hechas por la lámpara SON.

La Basílica de San José en Montreal es quizá la iglesia más famosa de Norteamérica. Ahora, con su nueva iluminación proyectada disenada por el famoso especialista en iluminación checo, Miroslav Pflug, domina la ciudad día y noche.

El efecto producido por la iluminación se ha descrito como una "puesta de sol congelada" cuando al dorar los últimos rayos del sol poniente la fachada del gran edificio la iluminación proyectada se aduena de la escena de forma imperceptible de manera que la gigantesca forma parece flotar sobre la ciudad obscurecida.

El problema de mantanimientede las casi 300 luces proyectores se resolvió por medio del uso de la lámpara Thorn PAR 64 CSI. Sin necesidad de limpiar reflectores esta poderoso lámpara halidometálica con haz sellado se instala con facilidad y lanza un haz de luz concentrada. Los filtros de color montados en celosías concéntricas se usan para simular el brillo de la puesta del sol o la iluminación adecuada. Estas son rojas, verdes, azules y amarillos y se disponen en bancos de hasta 52, en la proporción de diecisiete blancas, dieciséis amarillos, ocho rojas y azules y cuatro verdes. De esta forma se obtienen con facilidad los cambios de color. Como el sol se pone a horas diferentes y en lugares diferentes del horizonte todas las tardes, se instaló un sistema elaborado de computadora que es tal vez el más avanzado en su género del mundo. La conmutación se programa en milesegundos durante un período de cuatro anos (para considerar el ano bisiesto). En caso de fallo del suministro, se acciona un controlador maestro accionado por baterías a fin de que no exista el riesgo de anular la sincronización. Para evitar las chispas se emplea conmutación por elementos sólidos.
El diseno e instalación del equipo de control fue responsabilidad del Sr. I. Kokur. Thorn tiene el orgullo de declarar que el corazón de una de estas magníficas instalaciones es su lámpara reflectora "Compact Source Iodide" (CSI).

La Catedral de York, la catedral metropolitana anglicana de la provincia en el norte de Inglaterra, es una de las grandes catedrales góticas de Europa. Su colección de vitrales es inferior solamente a la de Chartres. La iluminación nueva de la nave se ha completado recientemente bajo la dirección del Sr. Charles Brown, Arquitecto y Encargado de la estructura de la Catedral.

La iluminación elétrica original, instalada al principio de este siglo, consiste de lámparas colgadas de postes que sobresalen del triforium. Esta iluminación cegaba y no era adecuada para revelar la arquitectura. Una consideración importante fue que, como los asientos de la nave se invierten ocasionalmente para conciertos, la iluminación no debe cegar al ser vista en esta dirección. Además, los asientos en los pasillos miran al área central de la nave de forma que se tomaba importante evitar el deslumbramiento del equipo de iluminación montado en el triforium del lado opuesto.

Se llevaron a cabo varias pruebas, incluyendo instalaciones de lámparas de descarga multi-vapor y de sodio de alta presión, y finalmente se escogió la alternativa de las lámparas de tungsteno halógeno en proyectores tipo "Sunspots" montadas en el triforium, para iluminar el área principal del suelo, combinadas con la luz indirecta existente de la bóveda principal por medio de proyectores "Haline". La selección de "Sunspots" fue influenciada en gran parte por su tamano pequeno, que permite que se coloquen en lugares escondidos, y por la gran gama de ángulos de viga que se puede obtener. Las bóvedas de los pasillos se iluminan con lámparas PAR 150W, mas lámparas lineares de tungsteno halógeno en "Sunfloods" suministrando iluminación adicional para ocasiones especiales.

Le instalación se controla por medio de cuadro de distribución montado en el muelle sudoeste del crucero. Esta incorpora un cuadro de programación mostrando las varias disposiciones de conmutación para ocasiones específicas.

La mayoría de las lámparas fluorescentes normales tienen un diámetro de tubo de 38 mm y se conocen como T12. Existe uno de diámetro más pequeno (26 mm) el cual es bastante común y se llama T8. Se ha demostrado actualmente un gran interés en esta clase de tubo debido al desarrollo de nuevos fósforos que producen bandas de luz predominantemente rojas, azules y verdes en vez de los halofosfatos convencionales que producen un espectro continuo. La luz roja, verde y azul es producida respectivamente por el óxido de itrio, aluminato de magnesio y aluminato de magnesio de bario. La primera y la última son activadas por el europio y la segunda por el cerio y talio. Sus propiedades productoras de colores y la aparencia del color del tubo se puede mejorar depositándolo en una capa previamente tendida de un halofosfato. Usados en un tubo T8, para reducir la cantidad de fósforo y con un relleno de kriptón en vez del argón normal, los tubos Polylux muestran un mejoría de cerca del 50% en eficacia con mejores colores que la mayoría de los tubos convencionales.

El uso de tubos T8 con relleno de kriptón se ha extendido a tubos que usan capas convencionales de halofosfatos mejorando la eficacia luminosa y reduciendo el consumo de corriente. Estos "Pluslux" y los tubos "Polylux" más eficientes se deben accionar en un circuito tipo "starter".

El factor dominante en el diseno de edificios durante los últimos diez anos ha sido la necesidad de conservar energía, y esto se torna aparente cuando comparamos los primeros disenos de servicios ambientales con los de la actualidad. Hace diez anos era común la baja proporción de ventanas a pared de un 10 al 15% y que la iluminación artificial suministrase hasta 1000 lux; actualmente, las áreas de las ventanas son probablemente el 50% de las paredes y se espera un factor de luz del día del 2%, mientras que la iluminación artificial es del orden de 750 lux.

A pesar de que la iluminación es el mayor consumidor individual de electricidad en un edificio de oficinas, de forma que la atención se concentra cada vez más en fuentes de luz de creciente eficacia e inclusive se han visto lámparas de sodio de alta presión en oficinas, el costo relativo de la iluminación comparado con los salarios y otros servicios y suministros, o el coste del espacio, es solamente un 0,5%. Sin embargo, la iluminación es una herramienta esencial sin la cual el trabajo se torna imposible de forma que los ahorros que reducen la efectividad de las condiciones visuales son contraproducentes. Nuevas técnicas y la tecnología de las lámparas han hecho posible controlar la energía usada para la iluminación de forma exacta y la coordinación de la iluminación con la calefacción, ventilación y aire acondicionado ayuda sobremanera.

Parece ser que en el futuro es posible un mayor suministro de luz del día, pero siempre existe la posibilidad, debido a la marcante ganancia solar en los edificios de las altas latitudes norte, de un retorno a los edificios virtualmente sin ventanas del principio de la década del 70. La elaboración de servicios eléctricos dentro de un edificio posiblemente aumentará y conforme sucede se dará mayor atención al coste y conservación de energía.

Nel questa edizione

UN DECENNIO DI SON 2

D. C. Peach

Dalla loro comparsa sul mercato all'incirca dieci anni fa, le lampade al sodio ad alta pressione usate inizialmente nell'illuminazione stradale hanno trovato numerose applicazioni nell'illuminazione a proiezone, nell'illuminazione di ambienti industriali e nei campi più svariati come l'illuminazione di uffici, cattedrali e piscine. La riduzione della potenza delle lampade ha facilitato la realizzazione di apparecchi d'illuminazione adatti alla commercializzazione ai mercati commerciali e non si può dubitare che con la realizzazione di lampade di minor potenza il campo d'impiego sarà ancora più vasto.

Le difficoltà tecniche di sigillare il tubo di scarica sono state superate grazie alla costruzione monolitica che permette di eliminare gli zoccoli di metallo; inoltre, tale metodo di costruzione ha quasi praticamente eliminato i guasti prematuri. Qualche guasto prematuro e casuale si verifica sempre con la diffusione di lampade di nuovo tipo, ma poichè le cause dei guasti vengono identificate e corrette, migliora la curva di durata e le nuove lampade SON da 400 e 250 watt arriveranno adesso alle 10.000 ore con una percentuale trascurabile di guasti. L'impiego di un accenditore esterno ha migliorato la durata di vita della lampada grazie alla riduzione del numero di componenti all'interno della stessa, ciascuno dei quali rappresenta una causa potenziale di guasto.

Le prove di durata in laboratorio ed in certe situazioni d'illuminazione stradale ed industriale che si prestano ad un attento e preciso controllo costituiscono la fonte più precisa d'informazioni sulla durata della lampada e sulla sua resa luminosa, ma un'indagine casuale delle installazioni può dare importanti informazioni sulle reazioni del cliente di fronte alla nuova lampada. Un'indagine del genere ha confermato le dichiarazioni di lunghissima durata e l'ottimo mantenimento di luminosità che costituiscono il pregio delle lampade SON.

ILLUMINAZIONE THORN NEL NUOVO MONDO 8

Stewart Fraser

La Basilica di St. Joseph di Montreal è forse la chiesa più famosa di tutto il Nord America. Con la nuova illuminazione dell'esterno realizzata dal famoso specialista cecoslovacco Miroslav Pflug, essa domina ora la città non solo di giorno ma anche di notte.

L'effetto prodotto dall'illuminazione è stato definito come un tramonto quando gli ultimi raggi del sole calante indorano la facciata del grande edificio in quel momento l'illuminazione entra impercettibilmente in gioco cosicchè la forma gigantesca della chiesa sembra librarsi sopra la città oscura.

Il problema della manutenzione dei quasi 300 corpi luce necessari per l'impianto è stato risolto grazie all'uso di gruppi Thorn CSI PAR 64. Senza riflettori da pulire, questa potentissima lampada a ioduri metallici con ottica sigillata viene montata e sostituita con grande facilità e proietta un fascio di luce concentrata. Appositi filtri colorati montati su supporti permettono di simulare i riflessi del tramonto o produrre effetti speciali. I filtri di color rosso, verde, blu e giallo sono disposti in batterie che ne contengono fino a 52, nelle proporzioni seguenti: diciassette bianchi e sedici gialli, otto rossi e blu e quattro verdi. In questo modo è facile effettuare i cambiamenti di colore desiderati.

Dato che il sole tramonta in momenti e punti diversi ogni sera, è stato installato un computer (probabilmente il più sofisticato del genere nel mondo) che programma l'accensione delle luci in millisecondi per un periodo di quattro anni, tenendo conto anche dell'anno bisestile. Nell'eventualità di una mancanza di corrente, un gruppo di comando a batteria interviene automaticamente per non perdere la precisione dei tempi. La commutazione impiega dispositivi a stato solido per evitare scintille all'accensione.

La progettazione e l'installazione dell'impianto di comando sono state curate da Mr. I. Kokur. La Thorn è orgogliosa che il cuore di uno splendido impianto di illuminazione come questo sia la sua eccezionale lampada CSI (Compact Source Iodide).

ILLUMINAZIONE DELLA NAVATA DELLA CATTEDRALE DI YORK 14

C. Brown e D. Stallworthy

York Minster, la cattedrale anglicana metropolitana delle province settentrionali dell'Inghilterra, è uno dei più grandi monumenti gotici d'Europa, e le sue vetrate sono seconde solamente a quelle di Chartres. Il rinnovo dell' illuminazione della navata è stato completato di recente sotto la guida di Mr. Charles Brown, architetto e sovrintendente della fabbrica della cattedrale.

La prima illuminazione elettrica, installata all'inizio del secolo, era costituita da lampadari sospesi a tiges sporgenti dal triforio; era abbagliante e del tutto inadeguata a mettere in risalto l'architettura.

Per il nuovo impianto, data che i sedili della navata sono ogni tanto girati in occasione di concerti, si era stabilito che la luce non doveva essere abbagliante guardando da quella direzione. Inoltre, i posti nelle navate laterali sono rivolti verso l'area centrale della navata, per cui era importante evitare anche l'abbagliamento provocato dalle luci montate nel triforio di fronte.

Vennero fatte numerose prove, compresa l'installazione provvisoria di lampade al sodio ad alta pressione e ioduri metallici, e la scelta ricadde infine sulle lampade al tungsteno-iodio in proiettori "Sunspot", montati nel triforio, per l'illuminazione del pavimento principale, in combinazione con l'esistente illuminazione indiretta della volta principale mediante proiettori 'Haline' tipo flood. La scelta dei Sunspot è stata dettata in larga misura dalle loro ridotte dimensioni che permettono di nasconderli facilmente, e dall'ampia gamma di angolazioni del fascio luminoso che si possono ottenere. Le volte delle navate laterali sono illuminate da lampade PAR da 150W, con illuminazione supplementare per le occasioni speciali mediante lampade lineari al tungsteno-iodio in riflettori tipo SUN. L'impianto è comandato da un quadro generale, montato nel pilastro di sud-ovest dei bracci della croce, che incorpora anche un quadro di programmazione che mostra le varie combinazioni possibili nelle diverse occasioni.

PERCHÈ LE LAMPADE T8? 19

B. J. Cannell e P. W. Ranby

La maggior parte delle normali lampade fluorescenti hanno un tubo da 38 mm. di diametro e sono denominate T12, mentre il tubo di minore diametro (26 mm) è poco usato ed è denominato T8.

Oggi però si registra un notevole interesse verso questo tipo di tubo in seguito alla messa a punto di nuovi fosfori, che producono bande di luce prevalentemente rossa, blu e verde invece dei convenzionali alofosfati che danno uno spettro continuo. La luce rossa, verde e blu è prodotta rispettivamente dall'ossido di ittrio, alluminato di magnesio e alluminato di bario magnesio, di cui il primo ed il terzo sono attivati dall'europio ed il secondo dal cerio e tallio. Le proprietà di resa dei colori e l'aspetto del tubo per quanto concerne il colore possono essere migliorati depositandoli su uno strato di alofosfato deposto in precedenza. Usandoli nei tubi T8 per ridurre la quantità di fosforo, e con riempimento di cripton invece del più consueto argon, i tubi Polylux danno un miglioramento di efficienza del 50% circa, con una miglior resa cromatica rispetto alla maggior parte dei tubi convenzionali.

L'impiego di tubi T8 riempiti di cripton si è esteso anche ai tubi che hanno il convenzionale rivestimento di alofosfato, migliorando l'efficienza luminosa e riducendo il consumo di corrente. I tubi Pluslux e quelli ancora più efficienti Polylux devono essere adoperati con un circuito ad accensione con starter.

ILLUMINAZIONE E CONSERVAZIONE D'ENERGIA 25

Ian Maclean e Richard Springford

Il fattore predominante nella progettazione degli edifici negli ultimi dieci anni è stata la necessità di conservare energia, come risulta evidente da un confronto dei progetti dei servizi di un tempo con quelli di oggi. Dieci anni fa era normale un rapporto tra la superficie delle finestre e quella della parete molto basso, anche del 10-15%, con un'illuminazione artificiale dell'ordine di 1000 lux. Oggi è più comune che l'area di finestra sia un buon 50% della parete e si prevede un fattore di luce diurna del 2%, mentre l'illuminazione artificiale è dell' ordine di 750 lux.

Benchè l'illuminazione sia di solito la voce più grande per quanto riguarda il consumo di elettricità in un palazzo per uffici, per cui l'attenzione si concentra sempre più sulle fonti luminose più efficienti, col risultato che si sono viste negli uffici anche lampade al sodio ad alta pressione, il costo relativo dell'illuminazione in confronto ai salari, stipendi, altri servizi, materiali di consumo nonchè costo immobiliare al metro quadrato, arriva a malapena allo 0,5%. Però la luce è uno strumento essenziale, senza il quale sarebbe impossibile lavorare, per cui ogni risparmio che riduce l'efficacia della visibilità è controproduttivo. Nuove tecniche e tecnologie delle lampade hanno permesso di regolare l'energia usata nell'illuminazione con un alto grado di precisione, ed il coordinamento dell'illuminazione col riscaldamento, ventilazione e coll'aria condizionata è die grandissima utilità.

Sembrerebbe che in futuro si tenderà ad utilizzare sempre di più la luce diurna, ma c'è sempre la possibilità, per via del forte sfruttamento solare negli edifici alle elevate latitudini settentrionali, di un ritorno alle costruzioni practicamente prive di finestre dei primi anni 70. Il grado di elaborazione dei servizi elettrici negli edifici tenderà semmai ad aumentare, e di conseguenza si dovrà fare sempre più attenzione al costo ed alla conservazione dell'energia.

i detta edition

TIO ÅR MED SON 2

D. C. Peach

Då högtrycksnatriumlamporna introducerades för ungefär tio år sedan användes de främst till gatubelysning. Sedan dess har många nya och vitt skilda användningsområden tillkommit som t ex fasadbelysning, belysning i industri- och kontorslokaler, idrottsanläggningar, kyrkor m.m. De minskade lampdimensionerna har underlättat utformningen av armaturer anpassade till de olika marknadskraven. Det är ingen tvekan om att allteftersom lampor med mindre effekter konstrueras kommer SON-lampornas användsområden att ytterligare breddas.

De tekniska svårigheter som är förbundna med att försluta urladdningsröret har övervunnits och några metallsocklar erfordras ej. Barnsjukdomar kan förekomma i alla nya lamptyper men allteftersom felorsakerna identifieras och åtgärdas förbättras livslängd och kvalitet. SON 400W och 250W har efter 10 000 timmar en obetydlig felprocent.

Numera används ett separat driftdon som reducerar antalet komponenter i lampan. Eftersom varje detalj kan ge upphov till fel har lampans livslängd kunnat ökas avsevärt.

Det bästa sättet att få information om lampornas prestanda och livslängd är att prova dem i laboratorier samt i utvalda industrilokaler och vägbelysningsavsnitt d v s belysningssituationer som noggrant kan kontrolleras. En översikt av utvalda installationer kan ge värdefulla upplysningar om hur marknaden reagerar inför en ny lampa. En sådan översikt bekräftar att SON-lampan verkligen har den exeptionellt långa livslängd och utmärkta ljusbeständighet som utlovas.

THORN BELYSNING I NYA VÄRLDEN 8

Stewart Fraser

St. Joseph's Basilika i Montreal är kanske den mest berömda kyrkan i Nordamerika. Med sin nya fasadbelysning, som utformats av den välkände tjeckiske specialisten Miroslav Pflug, dominerar den nu staden både på natten och dagen. Belysningen sägs likna en kvardröjande solnedgång. Den stora byggnadens fasad förgylls av den nedgående solen, som omärkligt följs av fasadbelysningen, så att det ser ut som den gigantiska konturen svävar över den mörknande staden.

Underhållsproblemet med de närmare 300 strålkastarna har lösts genom att anläggningen är baserad på Thorns CSI-lampor. Denna effektiva metallhalogenlampa ger en koncentrerad ljuskägla och är enkel att installera och byta ut, eftersom den är av typ PAR 64 och inte har några reflektorer som skall hållas rena. Färgfilter monterade på koncentriska bländskydd används för att simulera solnedgång eller för att åstadkomma en stämningsfull belysning. Dessa filter är röda, gröna, blå och gula och placerade på ramper om upp till 52 stycken — i proportionen sjutton vita till sexton gula, åtta röda och blå, samt fyra gröna. Det är alltså enkelt att byta färg. Eftersom solen går ned olika tider och vid olika punkter på horisonten varje kväll, har man installerat ett avancerat datasystem. Kanske det mest komplicerade i sitt slag i världen. Omkopplingen är programmerad i millisekunder över en period på fyra år (inklusive skottår). Vid ev. strömavbrott, inkopplas ett batteridrivet styrorgan, för att undvika risk för felaktig tidsberäkning. Utformningen och installationen av kontrollutrustningen har gjorts av Mr. I Kokur.

BELYSNING AV LÅNGSKEPPET I YORK MINSTER 14

C. Brown och D. Stallworthy

Katedralen i York, York Minster, är den anglikanska kyrkans största katedral i norra England och en av Europas stora gotiska katedraler. Dess samling av målade glasfönster överträffas endast av den som finns i Chartres. Belysningen i långskeppet har nyligen renoverats under ledning av arkitekten Charles Brown.

Den ursprungliga elektriska belysningen som installerades i början av detta sekel bestod av lampor som hängde ned från stolpar som stack ut från triforiet. Ljuset var skarpt och bländande och otillräckligt för att man skulle kunna se arkitekturen.

En viktig faktor vid omplaneringen var att belysningen från långskeppet inte fick blända, eftersom bänkarna där ibland vid konserter vänds åt andra hållet. Dessutom vetter bänkarna i sidoskeppen mot långskeppets mitt och därför var det viktigt att undvika bländning från armaturerna i triforiet mittemot.

Man utförde ett antal prover, inklusive försöksinstallationer med högtrycksnatrium- och metallhalogenlampor. För allmänbelysningen valde man slutligen i triforiet halogenlampor i Sunspot-strålkastare i kombination med den befintliga indirekta belysningen av huvudvalvet med Haline-strålkastare. De främsta orsakerna till att man valde Sunspot-strålkastare var dels det lilla formatet — de kunde lätt döljas — dels det faktum att ljuset kunde riktas åt många olika håll. När man vid speciella tillfällen behöver extra ljus belyses valven över sidoskeppen av 150W PAR-lampor, kompletterade med linjära halogenlampor i Sun-strålkastare.

Installationen kontrolleras från en strömpanel monterad på en huvudpelare. Panelen har bl a en programtavla som visar olika kopplingsanordningar för speciella ändamål.

VARFÖR T-8 LAMPOR? 19

B. J. Connell och P. W. Ranby

De flesta standardlysrör har en rördiameter på 38 mm och betecknas T12. Ett nytt rör med den mindre diametern 26 mm förekommer nu tämligen allmänt och kallas T8. För närvarande är denna sorts rör föremål för stort intresse. Detta beror på utvecklingen av nya fosfortyper som ger band med övervägande rött, blått och grönt ljus — sk 3-bandsrör — i motsats till standardrörens vanliga halofosfater som ger ett kontinuerligt spektrum. Rött, grönt och blått ljus får man av resp. yttriumoxid, magnesiumaluminat och bariummagnesiumaluminat. Det förstnämnda och det sistnämnda är aktiverade av europium och magnesiumaluminatet av cerium och tallium. Deras färgåtergivningsegenskaper och färgton förbättras genom ett underliggande halofosfatskikt. När 3-bandspulvren används i ett T8-rör — minskas fosformängden och med en kryptonfyllning — i stället för den vanliga argonfyllningen uppvisar de ca 50% större effektivitet och bättre färgåtergivning än de flesta vanliga rör.

Kryptongas används nu också i de nya sk smala standardrören i kombination med den vanliga halofosfatbeläggningen. Detta har resulterat i ökat ljusutbyte och minskad energiförbrukning. Dessa Plusluxrör och de ännu mer effektiva 3-bands-lysrören Polylux fungerar i alla armaturer med tändarstart — ejs RS eller SRS kopplingar.

BELYSNING OCH ENERGI 25

Iain Maclean och Richard Springford

Under de senaste tio åren har utformningen av byggnationer dominerats av behovet att spara energi. För tio år sedan var det vanligt att proportionen mellan fönster- och väggareal var så låg som 10 till 15% och att konstgjord belysning gav ljusvärden på 1000 lux. Idag uppgår fönsterarealen vanligen till 50% av väggarealen och man räknar med en dagsljusfaktor på 2%, medan den konstgjorda belysningen uppgår till omkring 750 lux.

Trots att belysningen vanligen står för den största elförbrukningen i ett kontorshus är den relativa belysningskostnaden jämfört med löner, tjänster, material och hyra, knappt 0,5%. Idag satsar man mer och mer på effektiva ljuskällor t o m högtrycksnatriumlampor kan förekomma i kontorslokaler. Belysning är en nödvändig förutsättning utan vilken det skulle vara omöjligt att arbeta och besparingar som minskar belysningseffektiviteten förfelar sin verkan. Ny teknik och lampteknologi har möjliggjort mycket noggrann kontroll av den energi som går åt till belysning. Koordination med värme, ventileringoch luftkonditionering har stor betydelse.

Det är högst troligt att man vid framtida byggnationer kommer att lägga allt större vikt vid dagsljus. Man kan antagligen vänta sig mer avancerade tillämpningar av el inom en byggnad och större vikt kommer att läggas vid energikostnader och -sparande.

Thorn Lighting Limited
UK Regions

Belfast
Prince Regent Road, Castlereagh
Belfast BT5 6QR
Telephone 0232-54122
Telex 74695 TLLBft G

Birmingham
Thorn House, Aston Church Road
Saltley Trading Estate, Birmingham B8 1BE
Telephone 021-327 1535
Telex 337435 TLLBhm G

Cardiff
Thorn House, Penarth Road
Cardiff, Wales CF1 7YP
Telephone 0222-44200
Telex 49334 TLLCdf G

Glasgow
Thorn House, Lawmoor Street
Glasgow G5 0TT
Telephone 041-429 6222
Telex 777930 TLLGlw G

Leeds
Thorn House, 3 Ring Road
Lower Wortley, Leeds LS12 6EJ
Telephone 0532-636321
Telex 55110 TLLLds G

London
Victoria Trading Estate, Victoria Way
Charlton, London SE7 7PA
Telephone 01-858 3201 (order office) or
01-858 3281 (all other enquiries)
Telex 896171 TLLChn G

Manchester
Thorn House, 2 Claytonbrook Road
Clayton, Manchester M11 1BP
Telephone 061-223 1322
Telex 668642 TLLMcr G

Reading
10 Richfield Avenue, Reading RG1 8PA
Telephone 0734-53257
Telex 849269 TLLRdg G

Government Contracts & Order Office
Progress House, Great Cambridge Road
Enfield EN1 1UL
Telephone 01-363 5353
Telex 263201 TEIEnf G

Theatre Lighting Division
Angel Road Works, 402 Angel Road
Edmonton, London N18 3AJ
Telephone 01-807 9011
Telex 23157 Thlite

Airfield Lighting Division
Angel Road Works, 402 Angel Road
Edmonton, London N18 3AJ
Telephone 01-807 9011
Telex 23157 Thlite

Head Office and Showroom
Thorn House, Upper Saint Martin's Lane
London WC2H 9ED
Telephone 01-836 2444
Telex 24184/5 TEILdn G

1976
THE QUEEN'S AWARD FOR EXPORT ACHIEVEMENT

THORN LIGHTING
A member of the Thorn/EMI Group

Thorn Lighting Limited
Overseas Companies

Australia
Thorn Lighting Industries Pty Limited
210 Silverwater Road, Lidcombe
New South Wales 2141
Telephone 648-8000
Telex 22350 Thornlit Sydney

Austria
Thorn Licht GmbH
Erzherzog-Karl-Strasse 57, A-1220 Wien
Telephone (0222) 23 35 71
Telex 76128 Thorn WA

Belgium
SA Thorn Benelux NV
Vierwinden, 11
1930 Zaventem
Telephone 02/720.91.00/721.02.73
Telex 62410 thorn b

Canada
Thorn Lighting Canada Limited
1400 Meyerside Road, Mississauga,
Ontario L5T 1H2
Telephone (416) 677-4248
Telex 06-968569 Thorn Msga

Denmark
Thorn Lampe A/S
Fabriksparken 4, DK-2600 Glostrup
Telephone (02) 45 25 33
Telex 33533 Thorn DK

France
Thorn Electrique SA
26 Rue de la Baisse, 69625 Villeurbanne
Telephone (78) 84 04 90
Telex 380.900 Thornlec VILRB

Germany
Thorn Licht Beleuchtungsges mbH
Borsteler Chaussee 287, 2000 Hamburg 61
Postfach 610560
Telephone 040 58 01 31
Telex 214743 Thor D

Ireland
Thorn Lighting Limited
320 Harolds Cross Road, Dublin 6
Telephone 961877
Telex 4596 Torn El

Italy
Societa Industriale Vicentina Illuminazione SpA
Casella Postale 604, 36100 Vicenza
Telephone (010 39444) 59 5100
Telex 480049 Sivitaly

Societa Italiana Distribuzione
Articoli Illuminazione SpA
55 Via Venezia, 35100 Padova
Telephone 49 661 633/661 609
Telex 430359 SIDAI PD

New Zealand
Thorn Electrical Industries (NZ) Limited
PO Box 15150, 13a Veronica Street, New Lynn
Auckland 7
Telephone 871. 169
Telex NZ2648

Norway
Norske Thorn A/S
Postboks 7065, Pilestredet 75c, Oslo 3
Telephone (02) 46 98 40
Telex 16928 Atlas N

South Africa
Thorn Lighting (SA) (Pty) Limited
PO Box 43075
corner Watt and Edison Streets
Industria TvL
Telephone 839 2434
Telex J 0149

Sweden
Thorn Belysning AB
Anderstorpsvägen 4, Box 4203, 17104 Solna
Telephone (08) 83 41 00
Telex 10106 Thornab S

USA
Thorn Lighting Inc
Thorn House
23 Leslie Court, Whippany, New Jersey 07981
Telephone 201 386 9525
Telex 710 986-8249 Thorn USA WIPY

Thorn Lighting Limited
International Division
Head Office & Showroom
Thorn House, Upper Saint Martin's Lane
London WC2H 9ED
Telephone 01-836 2444
Telex 24184 TEILdn G
Cables Eleclampo WC2