Building Energy Efficiency Disclosure Act 2010 –

Tenancy Lighting Energy Efficiency Assessment

Options paper – for Consultation

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1. Policy Background

1.1 Commercial Building Disclosure Policy

The Consultation Regulatory Impact Statement (RIS) and Regulatory Document were released for public comment on 18 December 2008. These documents made the case for improving transparency of energy efficiency information in the commercial office sector of the Australian property market. Key points being:-

- information asymmetry exists where the owner typically has much more information on the energy efficiency of the building than the prospective tenant or new owner;
- split incentives exist where the owner supplies most of the equipment for central services and lighting but the tenant is the perceived beneficiary ; and
- organizational failures where information asymmetry and split incentives exist within a firm preventing implementation of energy efficiency improvements in commercial buildings.

The documents noted that it is difficult for prospective tenants and buyers to accurately assess the energy efficiency of a building by inspection alone without the cooperation of the owner. This differs from their ability to assess other features of a building such as location, fit out, parking, public transport etc that may contribute to purchase decisions.

The Consultation documents proposed requiring both a NABERS Energy Base Building Rating and a NABERS Energy Tenancy Rating on sale or lease of commercial office space as the base option for Mandatory Disclosure. This included cost estimates of ~$4000 for the Base building energy assessment and ~$1500 for the energy tenancy rating, based on information from NABERS administrators. An additional option was to require annual tenancy assessments.

The Consultation RIS referred to the McKinsey report that highlighted the significant cost effective opportunities for greenhouse gas abatement in the commercial building sector by improving commercial air handling, air conditioning and lighting. The McKinsey report estimated that the building sector in Australia could reduce emissions by 60 Mt of CO_2e per annum by 2030 at a negative cost of $130 per tonne. It also referred specifically to tenant lighting as an example of the split incentives of owners and tenants where the owner pays the cost of installation but the tenant receives the benefit of operating efficiencies.

The RIS concluded that there was a case for government intervention to address the information asymmetries and split incentives. These disadvantage the buyer in particular but also result in a poorly performing market where owners do not receive adequate recognition for investing in energy efficiency improvements.

1.2 Tenancy Lighting Disclosure – Policy Development

The NABERS Energy tenancy assessments proposed in the Consultation RIS had two main objectives:-

- To inform future tenants of the likely energy efficiency of tenancies available on the market, and
- To maximize the energy efficiency of tenancies on the market through making information available to prospective tenants (and encouraging voluntary improvements).

Industry response to these documents expressed concern that the energy efficiency of the past tenancy was not a good indication for the incoming tenancy due to a number of factors such as fit-out, equipment and operational decisions outside the owner's control.

An industry roundtable on 18 March 2009 including representatives from key property, services and energy efficiency organizations proposed and discussed alternatives to the NABERS tenancy assessment. A number of options ranging from no tenancy assessment, to voluntary tenancy assessments, self assessed tenancy ratings, modelled tenancy ratings based on a standard fit out, mandatory annual tenancy assessments, and minimum energy performance ratings for fitouts were considered. The last three of these are outside the scope of the RIS and would have required considerable additional cost and time to develop. Successful implementation of voluntary or self assessed ratings options would rely on there being a majority of well informed tenants. It has already been established that this is not the case in the market. So these options do not address the information asymmetry or provide sufficient coverage to affect the market as required.

Removing the tenancy assessment entirely and only including a base building or whole building NABERS Energy rating in the disclosure obligations would provide only part of the energy efficiency information that would assist buyers to make a decision. While it is the part that most benefits the property owners in terms of positioning their assets in the market, it only partially addresses the information asymmetry and does not address the other main reason for government intervention in the market. That is, relating to the split incentives preventing energy efficiency improvements where the tenant is perceived to be the main beneficiary.

None of the above options were considered appropriate. However, there was general agreement from this industry workshop and the consultation phase that disclosure of descriptive information on the lighting system, lighting controls and possibly tenant controlled air-conditioning at the time of sale or lease would be useful and complementary to other disclosure obligations. Subsequent consideration focused on the tenant lighting system and controls as the most cost effective approach.

Consequently, the Decision RIS and regulation documents released in November 2009 included a requirement for tenant lighting details as well as the NABERS Base building energy rating on sale or lease. "The RIS examined the 'problem' requiring government action, the objective of government action and three basic options that could be pursued. It concluded that mandatory disclosure of NABERS Energy base building star ratings, tenant lighting details, and general guidance on energy efficiency opportunities for buildings being sold or leased over 2000 m^2 Net Lettable Area (NLA) is the most cost-effective option." A cost estimate of $1500 on average for a lighting assessment (based on estimates from NABERS administrators) was included in the decision RIS. The RIS also concluded that it was not cost effective or practical for prospective tenants or purchasers to undertake tenancy assessments.

The decision RIS and regulatory documents reiterated the case for government intervention on the grounds of redressing the information asymmetry and split incentives existing in the commercial property market. It restated the McKinsey report conclusions that there were significant abatement opportunities in the commercial property sector, including the potential for improvements in tenancy lighting. It referred to the benefits of providing tenancy information to prospective tenants and buyers and also referred to the Warren Centre High rise project Stage 1 Sydney DEWHA

> 'Buildings perform better where all members of the building management chain feel they can influence building energy efficiency.'

Processes were put in place in November 2009 to begin development of a suitable methodology to assess the tenancy lighting for the purposes of the Building Energy Efficiency Disclosure Act. When the Act was passed on 24 June 2010, it included an amendment providing for a transition period of 12 months from 1 November 2010 before full implementation of the disclosure requirement for tenancy lighting. This was specifically to allow for further development of the methodology and industry consultation.

Key Points

- *Government intervention in the market is considered the most effective method to address issues of information asymmetry and spit incentives between owners and tenants.*
- *Disclosure of NABERS Energy base building star ratings, tenant lighting details, and general guidance on energy efficiency opportunities for buildings being sold or leased over 2000 m^2 Net Lettable Area (NLA) was determined to be the most cost-effective option*
- *A transition period of 12 months was agreed to in order to allow sufficient time to develop a methodology to assess tenancy lighting and consult with industry.*

1.3 Benefits of Energy Efficiency Improvements – Tenancy Lighting

Australia's National Greenhouse Gas Inventory 1990, 1995, 1999 End Use Allocation of Emissions Vol 1 (2002) reported that commercial buildings were responsible for about 10% of Australia's greenhouse gas emissions in 1999. This was an increase of 2.5% over the 1990 contribution.

The Tenant Energy management handbook- your guide to saving energy and money in the workplace, published in 2000 by the NSW (then) Sustainable Development Authority in conjunction with the Property Council of Australia and the Commonwealth Department of Industry, Science and Resources, reported that tenancy lighting was responsible for 67% of tenancy energy use and that tenants directly consumed 48% of the energy used in a typical commercial office (the remaining 52% of the energy provided the heating, cooling and other services commonly associated with base building energy use). At the time this was published, tenancy lighting was responsible for 32% of commercial office building energy use. Technology improvements in the interim may have changed that proportion slightly, perhaps reducing it a little. Nevertheless, lighting remains a significant proportion of overall energy use in commercial offices.

This suggests that a conservative 30% improvement in the energy efficiency of lighting in the Australian commercial sector would result in about a 1% reduction in greenhouse gas emissions.

The McKinsey & Company *An Australian Cost Curve for Greenhouse Gas Reduction* 2008 identified commercial lighting efficiency as one of several greenhouse gas abatement options incurring *negative* cost. This report also identifies motor systems and commercial air handling, which are the province of building owners, as even more cost effective abatement options. An indication of the energy efficiency of commercial building motor systems and air handling systems is captured by disclosure of the NABERS Energy base building rating. While the return may be significant, the capital investment and time required to make modifications to these systems require long term planning by owners and is not influenced by addressing information asymmetry or split incentives in the industry.

Improving energy efficiency of tenancy lighting requires much less capital and in practice is done quickly, often at the time of sale or lease. The Tenancy Lighting Guide (DCCEE 2010) notes that energy savings of 20 – 70% can be achieved in a typical office with payback periods of around 5 years, depending on the current installation and usage patterns. The payback period for a lighting energy efficiency upgrade could be well within the term of a typical '3x3' lease (three years with a three year option) in the Australian market.

Key Points

- *Greenhouse emissions from commercial buildings were estimated to be approximately 10% of total emissions in 1999.*
- *Commercial lighting efficiency was noted as one of several greenhouse gas abatement options incurring negative cost to owners/managers/Australian economy.*
- *Given the relatively low capital cost and faster implementation of lighting, pay back period on investment can be less than 5 years, with energy savings in the order of 20-70%.*

1.4 Benefits of Disclosure of Tenancy Lighting Energy Efficiency Information on Sale or Lease

In general, tenants are responsible for paying directly for the 'tenant light and power' they use in their operations, unless the lease arrangement is for a gross lease where the owner includes these services in the fixed rent. In any case, the tenant effectively pays for the operation of the office lighting system and it is in their interests to understand the relative energy efficiency of the system and whether any lighting controls will be available and readily adapted to operate efficiently for their particular needs.

Information on the efficiency of existing lighting can be valuable to prospective tenants or purchasers to guide decisions, not only of whether to take the space as offered but whether to negotiate on options for improvement with the owner. For example, The Department of Veterans' Affairs successfully negotiated with the owner of Lovett Tower during the lease renewal process to upgrade the lighting system from 17.5 W/m^2 to 6.5W/m^2 by replacing lamps and control gear but retaining the expensive luminaires. This resulted in an improvement of 63% in energy efficiency (Tenancy lighting guide DCCEE 2010) and corresponding reduction in energy consumption.

It is a misconception that improving energy efficiency of office lighting only benefits the tenant. There are both direct and indirect benefits to the owner. Building and lighting engineers speak of the 'virtuous cycle' where improving the energy efficiency of the lighting also reduces the load on the heating and ventilation system and so reduces the power consumption of the central services provided by the owner. Information on the energy efficiency of the office lighting system is directly valuable to a new owner considering purchasing a building. An inefficient lighting installation is a potential liability that may require additional funds and time to remedy before the space is suitable for future tenants. Indirect

benefits of providing more desirable tenancy space are expected to increase as the market becomes more aware of the benefits of leasing more energy efficient space.

Lighting is used as a negotiating point between owners and prospective tenants. Owners finding it difficult to lease a space often upgrade lighting systems (not necessarily with a focus on energy efficiency) to attract tenants. On the other hand, some lease arrangements may include 'make good' clauses requiring tenants to remove lighting they have installed and return the space to how it was originally let. This has sometimes resulted in removal of energy efficient lighting. Make good clauses can also be satisfied by the tenant agreeing a cash equivalent with the owner who may not necessarily apply this to restoring the lighting to 'as was'. There can be considerable loss of embodied energy in unnecessarily changing lighting with new tenancies. Government 'Green leases' consider these issues and do not allow 'make good 'clauses that would require reducing the energy efficiency of tenancy lighting at the end of a lease.

Key Points:

- Tenants effectively pay for the operation of the office lighting system and therefore it is in their interests to understand the relative energy efficiency of the lighting system.
- Data outlining the efficiency of existing lighting can be valuable information to prospective tenants or purchasers when negotiating with the owner or lessee.
- Energy efficient lighting not only benefits tenants but reduces the load on heating and ventilation systems and so reduces the power consumption of the central services provided by the owner.

2. Tenancy Lighting Energy Efficiency Methodology

2.1 Scope of the Act

The Building Energy Efficiency Disclosure Act 2010 applies to all commercial office buildings over 2000m^2. This will include a number of older buildings that have not previously been assessed under the voluntary NABERS scheme. To ensure that the greatest benefits are achieved from implementation of the Act, any methodology being developed for the tenancy energy lighting assessment must be capable of applying to most of the disclosure affected buildings. It is intended that the disclosure obligations for tenancy energy lighting will encourage improvements in this area.

The most reliable assessment is a visual confirmation of the lighting actually installed, undertaken by a trained, independent assessor. This approach would require minimal additional documentation beyond what will be required for the NABERS Energy rating and may be applied even where information on lighting plans and fittings have been misplaced or differ from what is actually installed. However, as for the NABERS Energy rating, owners will find that the assessment can be conducted more quickly if as much information on the lighting system as possible is provided to the assessor in advance of the site visit.

2.2 What Needs to Be Assessed?

The Tenancy Lighting Energy Assessment is intended to provide information on the energy efficiency of the office lighting that might reasonably be expected to remain if the building is sold, let or sublet. This is information that is not readily apparent from a visual inspection by an uninformed prospective purchaser or tenant.

Factors contributing to the overall energy efficiency of office lighting include the type of lamps, the number of lamps in the area, the nominal power of the lamps and the type of ballast (power use varies with the type). The presence of effective lighting controls or other systems that may reduce the power consumption, either by reducing the voltage to the lamps (dimming) or by reducing the time the lamps are operating may also contribute to improving overall energy efficiency. Time operated controls such as motion sensors, timer switches and some daylight controls do not alter the operating energy consumption of a particular lamp but rather reduce the overall amount of energy required to conduct business in the premises by turning lights off when they are not required. They have the same proportional effect on reducing overall energy consumption when used with energy efficient lamps as they do with inefficient lamps.

The Building Energy Efficiency Disclosure Act 2010 is not the only legislation that applies to commercial office buildings in relation to lighting. For example, the *BCA 2010 Building Code of Australia Class 2 to Class 9 Buildings Volume 1* outlines maximum power density for artificially lit offices. This requires lighting in new buildings or major refurbishments to be a maximum of 9 W/m^2 if lit to 200 lux or more, and a maximum of 7 W/m^2 if artificial illumination is less than 200 lux. The BCA requirements are considered achievable in normal circumstances and are less stringent than the current industry 'best practice'. In addition, the Australian and New Zealand Standards, *AS/NZS 16800.2.2:2008 Interior and workplace lighting – Specific applications _ Office and screen based tasks*, recommends illuminance of 160 lux for background lighting and 320 lux for task lighting for general office typing, reading and writing.

It is recognized that lighting systems are designed to provide adequate lighting throughout the life of the installed lamps and that light output may decrease by up to 25% as lamps age.

Assessments of tenancy lighting for the Building Energy Efficiency Disclosure Act 2010 will provide indicative information on the energy efficiency of the lighting. This will be reported as W/m^2 determined from identifying the nominal power consumption of the installed lamps and their associated ballasts and the area covered by the open plan office space or a representative sample of that area.

There is no provision or expectation that these assessments will confirm whether the office lighting meets the Australian and New Zealand Standards for illuminance or any OHS requirements for office use. These aspects of office lighting may, in part, be ascertained by visual inspection by prospective purchasers or tenants, whereas the energy efficiency cannot.

2.3 Options for Assessing Tenancy Lighting Energy Efficiency

The question then arises of what constitutes 'office lighting' and what it is sufficient to assess to provide prospective owners and tenants with a basic understanding of what they would be accepting if they take up the space. The building owner provides a basic ceiling grid lighting system that may include variations for corridor, amenity areas and other facilities. The owner or tenant may also modify some of the basic lighting grid for feature lighting, individual offices, meeting and conference rooms and other office support facilities. Tenant modifications are undertaken with the consent of the owner.

Option 1. – Close inspection of all the office lighting and lighting control effectiveness.

Certainly, the most accurate lighting energy assessment would include all the luminaires, lamps, ballasts and active control systems.

A methodology was developed for such an assessment early in 2010. This methodology required assessment of the lighting in all parts of the tenancy that could be used as an office, including individual offices and meeting rooms. It required a close physical examination of the ballasts and lamps in situ that involved partial removal of diffusers and ladder access to the ceiling. It also included a check on the functionality of the lighting controls that required manipulating the office lighting for a period.

This methodology would produce an accurate lighting energy assessment of the power density of the tenancy and an estimate of the reduction in power consumption due to the operation of the lighting controls. In this methodology, calculation of the effectiveness of the lighting controls necessarily relied on assumptions about the operating hours and business practices of the tenant since it is not possible in a 'once off' spot assessment to evaluate such long term operations.

While technically sound, this methodology would be relatively time consuming and costly as well as potentially disruptive for existing tenants. It would require an assessor, probably an electrician and facility manager to be on hand during the entire assessment. This methodology was not specifically costed and a simpler, more cost effective approach was sought to fulfil the disclosure requirements of the Act.

Option 2. – Visual assessment of the open plan office lighting and presence of lighting controls.

In general, the open plan office lighting system underpins the overall lighting solution, and is typically the primary determinant of the lighting energy consumption for a tenancy. The fitout of features such as individual offices, conference rooms and other facilities can vary with the needs of the tenant. While some changes to the lighting may have been made to suit the tenant, it is often the case that lighting in these areas is still based on the original ceiling grid with only minor additions or variations in placement of luminaires. Generally, these areas contribute only a small proportion of the total energy consumption of tenant lighting. It could be argued that the lighting of the open plan area of an office is a reasonable proxy for the whole and, in most cases an assessment of the energy efficiency of the open plan area would not differ significantly from an assessment of the whole area.

A draft methodology (Attachment A) was developed to provide a simpler assessment of the nominal power density of the open plan ceiling grid lighting system and to identify lighting controls that may be present, but not to assess the effectiveness of these controls. While included in the net lettable area, small private offices, meeting rooms, reception areas, entrance foyers, conference rooms, hallways, etc are not included in this lighting assessment. Emergency lighting is not included in the assessment, nor is the energy consumption that heat from lighting equipment may induce in the building's air-conditioning system.

This methodology requires visual inspection, by an independent assessor, of the installed luminaires, lamps ballasts and controls in the open plan area of the office. The number, type and power of the lamps in a specified area of the identified functional spaces (as defined by the NABERS data rules) are recorded. The assessor may determine an area by measuring the ceiling grid or counting regularly spaced ceiling tiles for the area or by measuring a 'representative area' that includes all the lamp and luminaire types in the same proportions as for the whole grid. The number and type of luminaires, lamps, lamp power and ballasts in that area are recorded. In a similar manner to the previous methodology, the lamp and ballast information is converted to a total power for the given area and reported as this power density for the space.

A number of alternative approaches were included in this methodology to enable as much as possible of the inspection to be conducted from floor level. This reduced the need for close visual inspection of ceiling fittings requiring ladder access and the potential disruption to tenants. The draft methodology proposed a method to determine the type of ballast, and hence its power consumption, by turning lights off and observing whether there was flickering

when the lights were turned back on. This was also intended to reduce the need for close ceiling inspection and removal of diffusers.

This methodology also includes a nominal measure of illuminance to be conducted in a similar manner as the NABERS Tenancy rating illuminance measurements taking ten readings at desktop level in the open plan area during the assessment. For the NABERS tenancy rating methodology, the illuminance measures are an indication of the suitability of the lighting for office use. This is beyond the scope of the tenancy lighting energy assessment and the illuminance measures are included here as a flag to check that low power density has not been achieved at the expense of light quality.

The methodology still allows for the possible need to inspect ceiling fittings where assessment from floor level is not possible and in some cases to require a hand held power meter to assess the power consumption of unusual fittings. However, it is expected that this would only be necessary in a small number of cases and it may be possible to offer some alternatives, albeit with less confidence in the quality of the assessment than that of the independent inspection. These will be discussed in a later section of the paper.

This methodology was trialed in a number of office buildings in southern Queensland and Sydney from August to October 2010 to test the efficacy and cost effectiveness and to provide information to refine and finalize the rules. The trial was also designed to assist in identifying particular aspects to be included in the assessor training material.

2.4 Outcomes of the On-site Trial of the Draft Methodology

The trial was conducted on twelve tenancies across eight buildings of various ages, size, fitouts, floor plans, tenancy arrangements and lighting systems. Of necessity, the trial was not able to test the time required to arrange access since the owners of the trial sites had all agreed to participate. In practice, this will vary and will depend to some extent on the relationship between the owner and tenants and whether any specific provisions have been made in leasing arrangements to ensure that this can occur smoothly.

The trial was conducted by certified NABERS assessors using a spreadsheet reporting system that was developed as an interim measure (Attachment B). This was more time consuming than the final system where actual recording and reporting will be via on-line access to the NABERS secure assessor's site. For most cases, this will enable more efficient mechanisms to select the appropriate description from a specified list rather than the assessor writing a description from scratch. This will be quicker and will enhance consistency in the reporting.

The assessors conducting the trial received a minimal amount of training through discussion of the information required and application of the techniques with a lighting expert. The first couple of assessments were effectively 'on the job' training and they continued to develop

skills throughout the trial. The limited training did not compromise the results of the trial assessments in any way. The assessment reports were independently reviewed and the energy efficiency assessments were found to be valid.

The assessors' experience in conducting the trial was also intended to assist in developing training materials by identifying areas that required clarification and refining terminology in the technical rules. Some of the trial sites deliberately involved unusual floor plates and lighting systems to test the flexibility of the rules and highlight potential circumstances where the rules may not give sufficient guidance or where additional time may be required to conduct the assessment. The issues identified by the assessors are being taken into account in developing the training program and refining the rules.

While not included in the draft, use of an electronic 'ballast detector' was also included in the trial. These devices remotely detect the oscillating frequency of the ballast and so can discriminate between electronic and magnetic ballasts. If effective, they would eliminate the need to physically inspect ballasts or to disrupt tenants by turning off the lights.

2.4.1 Trial outcomes – Ballast identification

Some types of lamps have integral ballasts and the power drawn by these is included in the nominal wattage of the lamp. Ballasts not integral to the lamp draw power in addition to the nominal wattage of the lamp and this must be accounted for in assessing the lighting energy efficiency. Older T12 types of lamps operate on magnetic ballasts while newer T5 lamps only operate on electronic ballasts.

Magnetic ballasts draw more power than electronic ones. The design of the luminaire and the installation can sometimes obscure the ballast in the fitting and make it difficult to determine the type by observation from the floor level. Magnetic ballasts cause lights to flicker for a short time when the power is switched on.

While it is possible to identify the ballast type from the light flicker, several of the trial sites did not have manual light switches on the floor and so it was not possible to readily turn the lights off as proposed by the draft methodology. The lighting was controlled by a timing system integrated with the building management system and it would have required liaison with the building manager and additional time to assess the ballasts by this method.

In all but one case the assessors were able to correctly identify the ballasts by using the hand held device from floor level to detect the oscillating frequency. In one instance involving a T5 retrofit adapter where the old ballast had been left in place, the device registered a magnetic ballast although the installation company confirmed that an operational electronic ballast had been fitted. As T5 lamps only operate with an electronic ballast, this aberration did not affect

the correct calculation of the power density for this tenancy. However, the information will be included in the assessor training to alert them to this possibility.

It was apparent from the trial that using the ballast detector device could effectively eliminate the need to use ladders to inspect the ballast in ceiling fittings and to turn off the lights in order to determine the ballast type. This reduces the time required to do the assessment and also the potential for disruption to tenants. These devices are relatively inexpensive (from ~$100 -$400) and training in their use could easily be incorporated into an assessor training program for the lighting assessment.

2.4.2 Trial outcomes – Lamp identification and power

In most instances, the type and wattage of the lamps in the operational luminaires was easily identified by observation from the floor and the assessors considered that it was not necessary to turn off the lights in order to identify the lamps. On some occasions the assessors found the writing on the lamps difficult to read, however, they were able to make out the nominal wattage information either directly or by using the magnification on a camera. Lighting engineers also advised that they often used sunglasses and binoculars to make reading information on lamps easier. In one tenancy, the lamps had been carefully installed with the 'writing' facing upwards and so not visible from the floor. The assessors took some time but eventually found one with the writing facing down so they could read the wattage. Had this not been possible, they may have had to resort to obtaining a ladder and attempting to read the lamp from higher up or even turning off the lights so the diffuser could be removed. While this unusual circumstance did not result in the need to access the lamps directly, it nevertheless illustrates that there may be some circumstances where this may be necessary to obtain an assessment and that this option should be retained in the rules as an option if other, less intrusive, processes fail.

Alternatively, lamp wattage may have been obtained from spare lamps on site or from lamp purchase information available from the facility manager, tenant or owner. The draft rules do not currently allow for these options. Although the confidence in the accuracy of the assessment would be reduced slightly, it may be possible to consider these options as part of a hierarchy of information sources for the lighting assessment. With an appropriate note indicating the source of the information, such an assessment would still provide useful information to prospective purchasers and tenants and would be less costly than the more accurate alternative.

Opalescent diffusers can obscure the type of lamp and the wattage information printed on it as well as in some cases giving an impression of multiple lamps in the luminaire when there may only be one. This type of fitting was identified as potentially presenting some practical difficulties for assessors.

One trial site had suspended luminaires of various lengths, fitted with several combinations of twin T5 lamps of three different wattages. Though the diffusers were not transparent, the length of the lamps was sufficient to indicate the wattages in this instance and there were a few diffusers that had been displaced sufficiently to confirm this. In addition, a store of replaced lamps provided further confirmation of the lamp wattages.

As no other opalescent diffusers were encountered in the trial and this was known to be a potential issue for lighting assessments, the assessors undertook additional tests on a more traditional opalescent diffuser. With assistance from a lighting expert, they determined that by using an extendable rod to push the diffuser up against the lamps while they were turned on, the number of lamps could be identified and the type could be identified as T5 or T8/T12 from the width of the body of the lamp. For a particular type of lamp, the length generally indicates the wattage, although confirmation using alternative sources of information would be preferable.

While this approach would not provide an assessment with the same degree of confidence as would be obtained by removing the diffuser and making a direct observation, again it may be considered a sufficient indication of the energy efficiency of the lighting. Alternatively the owner could be given an option of:-

- possibly engaging an electrician to undertake a direct assessment of the lamps,
- providing information on the lamp type and power from other sources,
- accepting the assessment obtained by the proposed 'push up' method, or
- accepting a default 'worst case' nominal power estimate for the fitting, equivalent to say three T12 lamps with magnetic ballast.

The first option would be the most accurate but also the most expensive. In any case, a note of the method used would provide a potential owner or tenant with an indication of the degree of confidence attached to the assessment while still providing a reasonable indication of the energy efficiency of the lighting.

The trial demonstrated that there are some circumstances where, for practical reasons, the assessment requires a little more time than normal and some cases where professional application and possibly consideration of alternative, slightly less desirable methods may be necessary to complete a lighting assessment. However, such circumstances were not common and could be ameliorated by the owner and possibly facility manager or tenant providing the assessor with as much relevant information as possible before the on site assessment.

The trial did not encounter any circumstances where an assessment could not be completed. However, the rules should include a category of 'Not Assessable' with an accompanying comment outlining why. This is to accommodate situations where, for example, the light fittings may be absent.

There are a number of issues surrounding 'make good' clauses and conducting an appropriate lighting assessment. Realistically, an assessor can only conduct an assessment on what is present at the time of the assessment. For commercial reasons, owners may want these processes to be conducted in advance of a lease being terminated so that an offer can be made to the market. In these circumstances, it is proposed that assessors conduct the assessment on a given day and make the report. If a 'make good' clause is included in the lease, the assessors will also include an estimate of the illumination power density of the intended 'made good' system as part of the BEEC application. This will enable both owners and prospective tenants to assess the energy efficiency benefits or otherwise of enforcing that clause.

2.4.3 Trial outcomes – Lighting controls

The trial demonstrated that movement sensors and daylight sensors could readily be identified if present in the tenancy. Many of the sites clearly had timer controls, identified by the absence of manual switches. One tenancy also had installed a voltage reducer on the electrical risers which was not apparent from observation of the open plan area alone. Examples of these will be included in the assessor training.

As a 'spot' assessment, it is not possible for the tenancy lighting assessment to fully identify all types of lighting controls by observation alone. In particular, it is not possible without adding considerably to the time required for the assessment, to identify whether lighting controls such as time schedulers and daylight sensors are functioning as intended or whether integrated lighting control systems would be available to incoming owners or tenants as part of the sale or lease.

The tenancy lighting assessment methodology identifies the nominal power density of the system and makes no provision for adjusting the energy consumption in line with any lighting controls that may be present. However, the presence of controls is indicated on the assessment and potential owners and tenants may choose to use this information to enquire further as to ensuring the effectiveness and future availability of these controls. Again, any information about the lighting controls that can be provided to the assessor beforehand will improve the quality of the assessment. This will also reduce the on-site time as the assesors will be alerted to the type of controls to expect.

2.4.4 Trial outcomes – Area measurement

Assessors had been provided with floor plans and NLA data before undertaking the assessments. In most instances, they undertook the lighting assessments the first time they

visited the site. In some cases they had previously undertaken NABERS energy ratings on the sites.

Initially, assessors found it took a little time to identify a suitable, representative area in which to conduct the assessment. This was confounded in some cases by unusually shaped floor plates and non rectangular ceiling grids. The draft methodology was based on the standard rectangular building. The trial has highlighted the need to include examples of 'non standard' buildings in the training program so that assessors are alerted to the possibility and given some direction on how to proceed. The unusual shape did not prevent the assessment but did require some additional time to work out the sample area.

The methodology allows a number of options to measure the area to be assessed and also the ceiling grid or luminaire spacing. These include tape measure, measuring wheel (for floor or ceiling), laser pointer (with built in triangulation preferable for measuring the ceiling grid) and counting regular ceiling tiles. Some of these are more intrusive for tenants than others but all proved effective. The least intrusive and quickest was probably the laser pointer. Effective use of this can be readily included in the assessor training for those unfamiliar with its use.

One of the tenancies in the trial consisted mainly of individual offices with little open plan area. In this instance, the assessors were able to identify sufficient open plan area without disturbing the occupants of the offices and completed the assessment on this basis.

However, it raises the question of how to treat tenancies where there is limited open plan area. It was also apparent during the trial that in many instances, the assessors were able to see the ceiling grid through glass office partitions and/or open doors. This would be sufficient to enable inclusion of these areas in the assessment without disturbing the occupants or adding to the time taken to complete the assessment. In these instances also the presence of the office partitions resulted in minimal variation in the placement of the luminaires and inclusion of the offices would not have changed the outcome of the assessment. Provision of floor layout information and information on the reflective ceiling grid before the on site visit would assist assessors to develop an appropriate approach, particularly where there are a large number of single offices.

For completeness and to give prospective purchasers or tenants an indication of how much of the space was actually assessed, it is suggested that BEEC also report the proportion of the office space that is open plan. If more than the open plan area were to be assessed, then the BEEC should report the area that was assessed.

It is also recognized that in some tenancies there may be limited open plan and it may not be possible for assessors to include offices without entering each office. In this case, the options may be:-

- undertake an assessment of a sample of the offices with the agreement of the owner,

- obtain information on the lighting system from tenants, facility managers or owners and note that the assessment was made in this way (lower confidence in its quality), or
- report the assessment as 'not assessable' due to insufficient open plan area.

The first option would be more time consuming but more accurate. The last would not provide the prospective purchaser or tenant with any effective information on the energy efficiency of the tenancy lighting but may prompt a discussion with the owner.

2.4.5 Trial outcomes – Illuminance measures

As noted previously, the illuminance measures included as part of the tenancy lighting assessment are not intended to provide any indication of the suitability of the space for particular office work. The methodology here does not comply with the Australian and New Zealand standards for illuminance measures. The Australian Standard requires measurement of artificial lighting at night to remove the effect of daylight on the measurements. A number of other factors affect the measure of light levels. These include the position of the sensor relative to the light source, the angle of the sensor, proximity of reflective surfaces (including the assessors clothing), colour of surrounding fixtures and floor coverings as well as time of day and year.

The methodology used in the trial required taking ten illuminance measurements in the area being assessed. For those sites that were assessed as having the lowest illumination power density, the illuminance measures did indicate the energy efficiency had not been achieved by excessively reducing the light levels.

However, there was considerable variation within the ten measurements made for each area. It is apparent that considerable training would be required to improve the consistency of the illuminance measurements but it is debatable whether this would improve the value of the tenancy lighting energy assessment since the illuminance measure is only intended as a check on the validity of low power density assessments. It is possible that the same outcome for potential owners and tenants may be achieved by including a note to the effect that, if the assessment indicates a low power density, they should check that the illuminance levels are suitable for their purpose.

It is also possible that potential purchasers and tenants will be unclear as to the meaning of the illuminance measurements in the context of a tenancy lighting energy assessment and may interpret this, incorrectly, as somehow providing endorsement of the quality of lighting system as a whole, rather than an indication of its energy efficiency.

Alternatively, it may be possible to include an option in the methodology for the owner to engage a lighting professional to conduct the illuminance measurements according to the

Australian and New Zealand standards so that the outcome could be regarded as an indication of the quality of the lighting system. This would go beyond the intent of the legislation to provide information on the energy efficiency of the office space. Using the Australian Standard methodology would, of necessity, be more expensive due to the requirement to conduct the assessment at night by a highly trained professional, probably accompanied by the facility manager. The estimated increase in costs is 2 – 3 times the estimate for the proposed methodology. Owners or prospective tenants or purchasers may choose to undertake such an assessment independently of the requirements of the legislation.

The third option is to remove the requirement to measure the illuminance as part of the lighting energy efficiency assessment altogether. This would reduce the cost of the assessment through a small reduction in the on-site and reporting time required but also through reducing the assessors overheads (suitable light meters cost $2 – 3000 and require calibration at approximately $500 a year) and training required. However, removing the illuminance measures would leave open the possibility that low power density areas may not be suitable for operation as an office without supplementary lighting. It is proposed to include a statement of the Australian Standards recommended illuminance for background lighting and general office tasks on the BEEC. If illuminance measures are removed from the assessment, the BEEC could also include a note suggesting the prospective owners and tenants check that the light levels are suitable for their needs. A simple walk through may be sufficient, or some may decide to obtain a full light quality assessment.

2.4.6 Trial outcomes – Time required

One of the key purposes of the on-site trial was to provide an indication of the time required (as a proxy for cost) to undertake the tenancy lighting assessment. Assessors set their own fees, depending on their expertise and view of the complexity of the task. The lighting assessment proposed is a less complex procedure that the NABERS Energy ratings. However, hourly rates for the lighting assessment would be comparable to those of the NABERS energy assessment or possibly less as companies may choose to assign this work to less experienced assessors. An indicative cost for such professional services is in the order of $1000 – 1500 a day.

The sites assessed ranged in size from about 2,500 m^2 to 18,000 m^2 and included sites with from one to four tenancies. The average on site assessment time was 2.5 hours. The facility manager was only required to provide initial access and assist if the assessors were unable to locate specific controls. However, some chose to accompany the assessors for part of the time.

The assessors were asked to note the time required for each of the key components of the on site assessment and the reporting component. For the trial, the assessors generally took one

set of illuminance readings for each sample area and did not repeat these on subsequent floors with the same lighting system.

They estimated that the site inspection is broken into 5 sub-components:

1) *Initial inspection and establishing the assessment method* (Grid or Representative Area): 30 minutes for a building or tenancy of 3 – 6 levels.
2) *Identifying the luminaries, lamps and ballasts* in the area and the number and wattage of each lamp: 30 minutes.
3) *Measuring the sample area*
    a) Measuring the assessed area, marking it on a plan and counting the luminaries : 30 minutes per representative area; or
    b) Mapping the grid and measuring between the luminaries (if required): 30 minutes
4) *Inspecting subsequent levels* to confirm they are identical to the initial Area: 10 minutes each.
5) *Taking illuminance readings* and marking the location of each reading on a floor plan: 15 minutes per set of readings.

In addition, writing up the spreadsheet and necessary administration work to submit an application and keep records was estimated to require 2-2 ½ hours. Some of this was done on site during the trial.

From these estimates, it is expected that the average assessment would take about a day of an assessor's time. Several of the trial assessments were conducted by two assessors on site and some of the time was devoted to training and discussing options of how to proceed. While appropriate for the trial to help identify as many practical issues as possible, the assessment time in these circumstances was longer than would be expected for a fully trained assessor conducting an assessment for a client and could be considered a 'worst case' estimate.

As discussed above, the reporting system for the trial was rudimentary and it is expected that the final system will be more efficient. In addition, the trial also deliberately included a number of unusual buildings to test the range of the methodology. These required on site time to adjust the detailed approach. The assessor's response to those will guide development of the training materials and provide examples to assist future assessments.

It was also apparent from discussions throughout the trial that the time required for the later assessments was less than the earlier ones as the assessors acquired experience in applying the methodology. In addition, when a tenancy had different lighting systems installed on different floors, the assessors required less time to identify the area to be assessed and count the lights in the second system as there were at least some similarities in the floor plate and lighting grid between floors. It is expected that fully trained assessors would require less time

for the assessment than the times taken for the trial assessments, particularly for assessing subsequent floors in the same building.

This has implications for the time that may be required to assess a large building with multiple tenancies and lighting systems. Extrapolating from the above information, a rough estimate of time required to assess a 40 story building with the same lighting on all floors is about 1 day on site plus half a day write up. The same building with different lighting systems on each floor, requiring 40 sample areas to be identified and counted may take 4 – 5 days, depending on the complexity of the system. These scenarios represent two possible extremes of lighting fit outs for buildings so the average would be somewhere in between.

The cost of a NABERS Energy assessment on such a building would be towards the upper end of the range ($10,000 or more). From the above estimates, the lighting assessment would be considerably less than this. Note also that a full lighting assessment of all the floors of the building would only be required for a sale or if the whole building was being offered for lease in the same year. While it is apparent that many owners may choose to maintain a current NABERS Energy rating for the property at all times, it may not be necessary or cost effective to apply the same approach for the tenancy lighting assessments.

In the first example above, for a large building with a simple lighting system throughout, there may be only a few hundred dollars difference in cost between assessing the tenancy lighting of the entire building and assessing only part of it. However, in the second example with many different lighting systems, the cost difference could run into thousands of dollars. For complex buildings with many different lighting systems, it may not be cost effective for owners to assess all the tenancy lighting on an annual basis in case there is an opportunity for a rapid sale. The characteristics of the individual properties should guide such business decisions.

One of the trial tenancy lighting assessments was conducted in conjunction with a NABERS Energy rating. This was included to provide some indication of whether it would be more cost effective to conduct the assessments at the same time. The outcome was inconclusive. While the travelling time to the site overall was reduced and the introduction discussion with the facilities/building manager was reduced a little, the assessors found that the equipment required on site and the complexity of the tasks to be conducted on site at the same time increased. They also found that the facilities/building manager tended to allocate more of their time to the assessment. The facilities manager was only required to provide access and for security purposes to enable the assessors to conduct the lighting assessment. For most of the other sites, the facilities manager continued with other duties once the assessors were underway. However, when the assessments were combined, the facilities manager tended to accompany the assessors throughout.

2.4.7 Summary of trial assessments

While the purpose of the trial was to assess the practical application of the methodology, the range of illumination power densities determined for the sites provides an interesting indication of the potential for improvement in this area. The results are summarised below in a similar form to that proposed for the BEEC. The identity of the building is not included as the trial was conducted on a commercial in confidence basis and some additional descriptive information on the site is provided to indicate the range of the property types that were assessed. The assessment characteristics for each site are also included.

Tenancy Lighting Energy Efficiency Assessment – Trial Assessments

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 1. 15 years old, unrefurbished Ground Floor	1,311	**12.8**	95%	577	2 Manual Switches		**Site 1** 2 floors 1 assessor 3 sample areas 3 hours
Site 1. 15 years old, unrefurbished First Floor	1,323	**10.4**	95%	375	3 Manual Switches		
Site 2. 20 years old, unrefurbished Level 4-16	979	**11.8**	37%	568	4 Manual Switches	Non rectangular floor plate	**Site 2** 17 floors 1 assessor 1 sample area 3.5 hours
Site 2. 20 years old, unrefurbished Level 17,18	668	**n/a**	**n/a**	**n/a**		Not assessed – no open plan area or under refurbishment	
Site 2. 20 years old, unrefurbished Ground Floor	562	**n/a**	**n/a**	**n/a**		No assessable area	
Site 2. 20 years old, unrefurbished Mezzanine Floor	1,164	**n/a**	**n/a**	**n/a**		No assessable area – meeting rooms and cafe	
Site 2. 20 years old, unrefurbished Lower Ground Floor	571	**n/a**	**n/a**	**n/a**		No assessable area - No open plan area	

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 3. 8 years old, mostly original Tenancy 1. Level 14, 15, 17, 18	1,207	11.3	21%	327	Automatic TImer	Non rectangular floor plate	**Site 3, Tenancy 1** 4 floors 2 assessors 2 sample area 2 hours on site
Site 3. 8 years old, mostly original Tenancy 2. Level 20, 22,32, 33	1,207	10.5	22%	475	Automatic Timer		**Site 3, Tenancy 2** 4 floors 2 assessors 1 sample area 2 hours on site
Site 3. 8 years old, mostly original Tenancy 3. Level 26, 27, 29, 30	1,207	15.5	16%	399	Manual Switches		**Site 3, Tenancy 3** 4 floors 2 assessors 1 sample area 2 hours on site
Site 4 10 years old, pre refurbishment, vacant Ground Floor	977	5.1	100%	339	Lighting controlled by 12 switches	Lighting installation was the same on each floor and only one set of illuminance measures were recorded at the site	**Site 4** 3 floors 2 assessors 1 sample area 1.5 hours on site
Site 4 10 years old, pre refurbishment, vacant Level 1	1,055	5.1	80%	339	Lighting controlled by 12 switches		

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 4 10 years old, pre refurbishment, vacant Level 2	1,108	5.1	100%	339	Lighting controlled by 12 switches		
Site 5 45 years old, refurbished 15 years Tenancy 1 Level 36	1,032	12.1	85%	597	Time clock with push button over ride	Non rectangular floor plate and lighting grid	**Site 5, Tenancy 1** 2 floors 2 assessors + 1 2 sample area 2 hours on site
Site 5 45 years old, refurbished 15 years Tenancy 1 Level 37	1,032	12.1	39%	617	Time clock with push button over ride	Non rectangular floor plate and lighting grid	
Site 5 45 years old, refurbished 15 years Tenancy 2 Level 43, 44, 45, 46	1,032	9.1	25%	343	Building Management	Non rectangular floor plate and lighting grid	**Site 5, Tenancy 2** 5 floors 2 assessors + 1 2 sample area 2 hours on site
Site 5 45 years old, refurbished 15 years Tenancy 2 Level 42	1,032	6.8	9%	389	Building Management Voltage reducer	Non rectangular floor plate and lighting grid	

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 6 25 years old, refurbished 8 years Ground Floor	223	8.6	100%	348	4 Manual Switches	vacant	**Site 6** 3 floors 2 assessors 2 sample area 1.5 hours on site
Site 6 25 years old, refurbished 8 years Level 6 & 7	625.1	18.7		511	Time clock with A/H over ride.	% Open plan area not determined	
Site 7 3 years, new Level 5	1,703.0	11.3		502	CBUS controlled by BMS	Lighting installation was the same on each floor Only one set of illuminance measures was recorded	**Site 7** 6 floors 1 assessor 1 sample area 1.5 hours on site
Site 7 3 years, new Level 4	1,701.5	11.3		502	CBUS controlled by BMS		
Site 7 3 years, new Level 3	1,713.5	11.3		502	CBUS controlled by BMS		
Site 7 3 years, new Level 2	1,714.5	11.3		502	CBUS controlled by BMS		
Site 7 3 years, new Level 1	1,717.5	11.3		502	CBUS controlled by BMS		

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 7 3 years, new Ground Floor	1,324.0	11.3		502	CBUS controlled by BMS		
Site 8 30 years old, various T5 upgrade Level 23, 14, 13, 12	939.9	8.0	42%	394	Motion Sensor Light Control system	Assessment conducted in conjunction with NABERS Energy rating	**Site 8** 19 floors 1 assessor 4 sample area 6 hours on site (Lighting was only assessed on 14 floors but NABERS Energy rating was assessed on the whole building)
Site 8 30 years old, various T5 upgrade Level 22, 21	939.9	9.4	39%	357	Motion Sensor Light Control System	Assessment conducted in conjunction with NABERS Energy rating	
Site 8 30 years old, various T5 upgrade Level 19, 20	939.9	7.9	25%	345	Manual Switches	Assessment conducted in conjunction with NABERS Energy rating	
Site 8 30 years old, various T5 upgrade Level 11	927.6	8.0	43%	394	Motion Sensor Light control	Assessment conducted in conjunction with NABERS Energy rating	

Functional Space Description	NLA – Space per flr (m^2)	IPD Open Plan area (W/m^2)	Approx % Open Plan	Average Lux	Lighting Control Systems	Comments	Trial Assessment charateristics
Site 8 30 years old, various T5 upgrade Level 10, 9, 8, 7, 6	773.2	8.5	41%	450	Motion Sensor Light Control	Assessment conducted in conjunction with NABERS Energy rating	

3. BEEC - NABERS Energy Rating and Tenancy Lighting Assessment

The following is a mock up of the proposed NABERS Energy rating and Tenancy lighting energy assessment outputs that will be reported in the BEEC. The data is ficticous and illustrative of a range of possible options only.

The information on interpretation of the lighting controls reported provides a brief description of the controls, how they may operate and comment on effective use. The comment matching the controls that have been identified as part of the assessment will be included in the BEEC. This information will assist prospective tenants and owners to consider whether the building's existing lighting controls will suit their business practices and patterns of out-of-hours use. Lighting controls may require some adjustment and/or staff education to ensure their most effective operation.

BUILDING ENERGY EFFICIENCY CERTIFICATE

Prepared in accordance with the *Building Energy Efficiency Disclosure Act 2010*

Building details:-

Building name: ACME Towers

Company name: ACME Property Limited

Building address 100 Example Street
Sydney NSW 2000

Rating scope: Base building

Rating area: 12,800m^2

Hours of operation: 65 p/w

Certificate reference number:

20101234

Issue date: 1 July 2011

Expiry date:

30 June 2012

NABERS Energy Rating

NABERS ENERGY

This building has achieved a 4 star
NABERS Energy rating

Building Consumption Details

For the period: 1 October 2009 to 30 September 2010

Total emissions: **1,261,298 kg CO_2-e p.a.**

Emissions intensity: **98.5 kg CO_2-e/m^2 p.a.**

Energy intensity: **394 MJ/m^2** of energy

This building purchased: 5% Green Power

- reducing its greenhouse gas emissions by **58,418 kg CO_2-e p.a.**
- improving its star rating to **4.5 stars**

Building assessor details:- **Assessor name:** John Smith **Business name:** Energy assessors **Building address:** 12 Example Street Sydney NSW 2000 **Assessor number:** XYZ01234	About NABERS Energy ratings: 1 Star – Poor performance 2 Star – Below average performance 3 Star – Good performance 4 Star – Very good performance 5 Star – Excellent performance

Tenancy Lighting Energy Efficiency Assessment

Tenancy Lighting assessor details:

Assessor name: Bill Light

Business name: Energy assessors

Building address 12 Example Street
Sydney NSW 2000

Assessor number: XYZ06789

Date of assessment: 12 October 2011

IPD (Illumination Power Density) is the nominal power consumed per square metre by the installed lighting.

An IPD of 6 - 8 W/m^2 is considered industry best practice for office lighting at the time this certificate was issued.

IPD greater than 12 W/m^2 suggests excessive lighting power consumption with potential for improvement in energy efficiency.

Functional space description	*NLA of space m^2*	*IPD Open Plan area (W/m^2)*	*% Open Plan*	*Average lux*	*Lighting Control Systems*	*Comments*
Ground Floor East (Office A)	*1,053.2*	***15.0***	*40*	*638*	*Tenant controlled timer Manual switches*	
Ground Floor West (Office B)	*969.5*	***13.0***	*25*	*550*	*Reset timer system*	
Level 1 East	*1,454.5*	***13.0***	*75*	*780*	*No timer system Daylight sensor*	
Level 1 West	*1,454.5*	***10.0***	*35*	*510*	*Occupancy sensor Tenant controlled timer system*	
Level 2 East	*1,543.0*	***11.0***	*40*	*520*	*Voltage reduction Daylight sensor Occupancy sensor*	*The assessment was undertaken during the expiring tenancy. The lease includes a 'make good clause'. A desk assessment of the lighting to be 'made good' indicates an* ***expected IPD of 15 W/m^2****.*

Functional space description	*NLA of space* m^2	*IPD Open Plan area* *(W/m²)*	*% Open Plan*	*Average lux*	*Lighting Control Systems*	*Comments*
Level 2 West	*1,543.0*	***15.0***	*67*	*780*	*Occupancy sensor*	
Level 3 East	*1,553.5*	***8.0***	*58*	*400*	*Centrally controlled timer No manual switches Daylight sensor Occupancy sensor*	*Task lighting on workstations not included in assessment*
Level 3 West	*1,553.5*	***6.0***	*53*	*350*	*Integrated system controlled offsite No Manual switches Daylight Sensor*	
Level 5 East	*1,553.5*	***N/A***			*Daylight sensor Occupancy sensor*	*Lighting assessment was not possible due to absence of ceiling lights A desk assessment of the lighting to be 'made good' indicates an* ***expected IPD of 14 W/m²****.*

Information about interpreting Tenancy Lighting Energy Efficiency Assessment

Australian Standards* recommends illuminance of 160 lux for background lighting and 320 lux for task lighting for general office typing, reading and writing. Low lux levels may suggest that the installed ceiling lighting may be insufficient for office work and that additional lighting may be required. High lux levels may suggest excessive lighting and power consumption with potential for improvement in both energy efficiency and amenity. Prospective tenants or owners should check that the lux levels of the lighting system are fit for their requirements.

Or if lux measurements are not included

Australian Standards* recommends illuminance of 160 lux for background lighting and 320 lux for task lighting for general office typing, reading and writing. Prospective tenants or owners should check that the light levels are fit for their requirements.

Fully functioning lighting control systems may reduce the power consumed during office operation by up to 30% by reducing the amount of time the lights are on or reducing the power drawn by dimming lights when not required. This tenancy lighting energy assessment has identified lighting controls that

are present but has not verified their functionality. Prospective tenants or owners should check the ongoing functionality of the lighting control systems, their ability to be modified if required and whether their use will require additional arrangements with external managers.

Control systems identified:-

- *Manual switches* for lighting on/off may control whole floors or there may be several zones on each floor. Matching the area controlled by the switches with actual occupancy will maximize effectiveness. Staff education may also be required.
- *Timer system* lighting controls may be fully automatic on and off, set by either the building management system or a local scheduler, or may require manual switching on then automatic switch off after a preset time. Manual overrides for afterhours use may or may not be present. Time schedulers and/or override systems may control whole floors or there may be several zones on each floor. Timer switches improve energy efficiency by preventing unnecessary operation of lights, particularly afterhours. Matching the 'lighting on' time and the area controlled by manual 'on' and/or override switches with actual occupancy will maximize effectiveness. Staff education may also be required.
- *Occupancy sensors* may automatically switch lights on when occupancy is detected by movement, sound or other means or may require lights to be switched on manually. In either case, lights are switched off some time after the last occupancy is detected. Occupancy sensors may control whole floors or there may be several zones on each floor. Occupancy sensors improve energy efficiency by preventing unnecessary operation of lights afterhours and during normal working hours. Matching the sensitivity of the detector as well as the area controlled by each sensor with actual business operations will maximize effectiveness. Staff education may also be required.
- *Daylight sensors* either dim or switch off perimeter lighting when there is sufficient available daylight and switch on lights or increase light output when available daylight is reduced. Daylight sensors improve energy efficiency by reducing the amount of artificial lighting required for office tasks during normal hours. Matching the sensitivity of the daylight detector with the needs of the occupants will maximize effectiveness.
- *Dimmer systems* may automatically adjust the light output to meet preset light levels or may be manually adjusted. Dimmer systems may control all lights on the floor, lights within a particular zone or individual lights. Dimmer systems may compensate for initial over illumination of new lamps in systems designed for the reduced end-of-life lamp output. Dimmer systems may be connected to a DALI control system allowing individual control of each light. Dimmer systems improve energy efficiency by reducing the power consumption of artificial lighting required for varying office tasks. Understanding the area controlled by each manually operated switch and any control system operating in conjunction with the dimmer system will increase effectiveness. Staff education may also be required.
- *Voltage reducers* may be installed on one or more circuits. They reduce the power consumed by the lights by reducing the input voltage of the circuit. This may result in reduced lamp life.
- *Integrated lighting control systems* may be used in conjunction with any other lighting controls as an overarching management of the system. These systems may be operated by the building management system either on site or remotely. Prospective tenants or owners should check their continuing access to such systems post transaction.

AS/NZS 16800.2.2:2008 Interior and workplace lighting – Specific applications _ Office and screen based tasks

Comments

Task lighting - Some ceiling lighting installations are designed to work in conjunction with task lighting associated with individual workstations. This may belong to the current tenant. Prospective tenants or owners should check what lighting is being offered as part of this transaction.

Absence of lights – Absence of ceiling lighting at the time of the assessment may indicate that the owner is undertaking a refurbishment. This could provide an opportunity for negotiation regarding the replacement lighting to be offered.

Make Good Clause – Where a 'make good clause' exists in the current lease arrangement, the expected IPD of the lighting to be 'made good' is reported as well as the IPD of the lighting present when the offer is made to the market. Prospective purchasers and tenants should consider the relative value of these systems for their future purposes.

Disclaimer

The information and suggested solutions (the materials) contained in this certificate are not legal advice and should not be taken to indicate the Commonwealth's commitment to a particular course of action. Different solutions and outcomes may apply in individual circumstances. The Commonwealth recommends that users exercise their own skill and care with respect to their use of the materials and that users carefully evaluate the accuracy, reliability, currency, completeness and relevance of the materials for their purposes. The Commonwealth does not guarantee the accuracy, reliability, currency or completeness of, the materials, and assumes no legal liability or responsibility for the information contained in the materials. Appropriate independent and professional advice relevant to your own particular circumstances should be sought if you consider the materials could be potentially relevant to you.

Authority

The NSW Department of Environment Climate Change and Water as the administrator of NABERS is the issuing authority for the Building Energy Efficiency Disclosure Act 2010. NABERS is an initiative of the Australian, state and territory governments. The *Building Energy Efficiency Disclosure Act 2010* is administered by the Australian Government Department of Climate Change and Energy Efficiency.

Further information is available at: www.cbd.gov.au

4. Conclusion and summary

The outcome of the trial of the draft NABERS Energy tenancy lighting assessment rules shows that a meaningful assessment of the tenancy lighting may be undertaken within an acceptable cost range as identified in the RIS (~$1500) for all except the largest, most complex buildings. The on site assessment is sufficiently robust to accommodate all types and ages of buildings and the on-site work may be conducted with minimal disruption to occupants and minimal risk of damage to people and property.

The trial also indicated considerable variability in the tenancy lighting energy efficiency of the commercial office market. This was not necessarily related to age of the building or how recently the lighting had been upgraded. This reinforces the benefit of conducting tenancy lighting energy assessments to provide information to both existing owners and prospective tenants or to new owners. The information from the tenancy lighting energy assessment and the additional interpretive information on the existing lighting in the BEEC, along with the Energy Efficiency Guidance material also supplied as part of the BEEC will assist prospective tenants and owners to engage with this aspect of the property and encourage energy efficiency improvements in the long term.

The trial also indicated a small number of technical areas where alternatives to the draft method may be required in order to provide an effective lighting energy assessment in some cases. Some of these alternatives may increase costs and some offer slightly less accurate but still informative reports on the energy efficiency of the property for prospective tenants and owners.

This paper outlines several areas where specific industry input will assist in considering these options and help guide the final decision on refining the NABERS Energy tenancy lighting assessment rules. These include:-

Options for ballast detection

- Use ballast detector
- Switch lights on/off and not presence or absence of flicker
- Visual inspection of in situ ballast

Options for determining lamp power and number

- Direct observation from the in situ lamp(s)
- When direct observation is not possible:-
  - Information from other identified sources in order of acceptance:- spare lamps, purchase information, documents from facility manager, tenant or owner and note on the assessment
  - Engage electrician to assess the lamps and note on the assessment
  - Default to ‘worst case’ nominal lamp power and/or lamp number and note on the

assessment

Options for handling 'make good' clauses

- Assess the existing lighting on a given (reported) day and include an estimate, based on the information provided (lease clause?) of the IPD of the expected 'made good' lighting in the comments section
- Assess the existing lighting and note the existence of a 'make good' clause yet to be enforced

Options for lighting control information

- A list of proposed summary information on possible lighting controls that may be identified as part of the tenancy lighting assessment is provided in the BEEC mock up in the previous section. Views on the completeness of the list and the information provided would be appreciated. The information will be printed on the BEEC and so is intended to be a concise indication of key points for the benefit of prospective tenants or owners. It is not intended to be a full description or tutorial on use of the lighting controls.

Options for area measurement

- Assess the open plan area
- When limited open plan area is available:-
  - Include a number of offices where the lighting is readily visible from the floor (transparent partitions or open doors)
  - Assess a sample number of offices with permission of the owner and tenant to access them directly
  - Use information from other identified sources in order of acceptance:- spare lamps, purchase information, documents from facility manager, tenant or owner and note this on the assessment
  - Report as 'not assessable' due to insufficient open plan area.

Options for illuminance measurement

- Do not include on site illuminance measurements but include a statement of Australian Standards recommended illuminance for background and general office tasks
- Include 10 lluminance measurements on each sample area as per the trial
- Include the option for an owner to engage a lighting professional to conduct illuminance measurements according to the Australian Standard methodology.

5. Provision of comments

This options paper outlines the context of the Tenancy Lighting Energy Efficiency Assessment requirement in the Building Energy Efficiency Disclosure Act 2010 and the development of an appropriate, cost effective methodology that can be applied to lighting assessments for commercial office buildings. It includes the outcomes of a trial of the draft methodology undertaken to assist in

refining the methodology and to identify practical options that would enable application of the methodology to the bulk of the sector.

It is intended that the methodology provide prospective owners and tenants with verifiable, indicative information on the energy efficiency of the lighting that is expected to remain in the office space.

This document has been provided to a number of relevant commercial sector organizations and professional groups primarily to seek views on the above options for practical assessment methods and any other technical aspects of the methodology. Comments on other aspects of the NABERS Energy Tenancy Lighting Assessment Rules and reporting documentation in relation to the lighting assessment for the Building Energy Efficiency Disclosure Act 2010 are also welcome.

The document may be distributed to other interested parties on the understanding that it is a consultation document and does not represent a final version of the methodology.

Comments will be considered in finalizing the methodology to be applied to Tenancy Lighting Energy Efficiency Assessments required to fulfil the disclosure obligations under the Building Energy Efficiency Act 2010.

Please provide comments by e mail to :-

Kay.Abel@climatechange.gov.au

By close of business Wednesday 16 February 2011.

Attachment A

NABERS Energy Tenancy Lighting Assessment Rules for Offices – Draft Version 9.1 June 2010

Attachment B

NABERS Energy Tenancy Lighting Assessment Rules for Offices – Draft assessment form June 2010