Low Carbon Fit Out Guide

Retail – 2012

LandSecurities

Low Carbon Fit Out Guide - Retail 2012

Foreword

The Low Carbon Fit Out Guide has been produced to provide guidance to retailers on how low carbon fit outs can be achieved in Land Securities' new and existing retail developments.

The Guide includes worked examples and technical analysis to illustrate the benefits, costs and efficiencies of a low carbon fit out. It has been drafted in collaboration with building services consultants Hoare Lea.

This document should be read in conjunction with project specific Fit Out Guides.

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Introduction

Land Securities are responsible for the development and operation of retail property assets throughout the United Kingdom. We recognise the need to put sustainability at the heart of the development process. However, our efforts are often limited by what we can inf uence when it comes to individual retail fit outs.

We believe that collaboration with retailers at the shop fit out design stage is essential if we are to maximise the potential opportunities for sustainable retailing. With this in mind, we developed the first edition of the Design Guide for Low Carbon Fit Out in 2010.

The aim being to share our knowledge and experience with retailers on how to achieve low carbon fit out.

Technology, legislation and best practice has moved on since 2010. We have therefore brought the guide up to date in this new 2012 version. We have taken the opportunity to improve the guide and ref ect on feedback that we have received from you, our customers. The new guide provides detailed practical guidance on how retailers can potentially reduce energy consumption by adopting best practice fit out design and specification, and effective energy management.

This document has been developed in collaboration with one of the UK's leading engineering design consultancies, Hoare Lea. They have drawn upon their wealth of experience in the retail sector to provide worked examples to illustrate the opportunities available to retailers by reviewing the current approach to fit out and comparing it with 'Best Practice'.

In this guide you will find:

Why Change?
Here we highlight the key drivers and benefits to retailers of adopting a low carbon approach to their fit out.

Our Shared Obligations
National policy and legislation changes mean that we have a shared interest in reducing carbon emissions from our operations. We identify why collaboration is essential between developers / landlords and occupiers to meet future regulatory and legislative requirements. Allowing us to demonstrate to our customers, shareholders and other stakeholders our joint commitment to Corporate Responsibility.

Lighting
Yes! You can still achieve your desired retail visual environment using energy efficient light fittings. Here we discuss the innovations required in the design, specification and operation. We go on to illustrate the recent advances in lamp technology that enable more energy efficient lighting systems in retail.

Heating, Ventilation and Air Conditioning
There is no "one size fits all" approach for energy efficient heating ventilation and air conditioning (HVAC) systems in retail but here we present some design and operational approaches that can save significant amounts of energy and cost.

Low Carbon Fit Out Checklist
This checklist is a tool to help you brief your fit out designers to achieve a more energy efficient outcome. Each question is a prompt for your design team to consider the key guidance messages in this document.

It is our intention to use this checklist as a tool during our fit out approval process to monitor whether you have taken this guidance into account in your fit out design and specification. The checklist will form an essential part of your submission to the Land Securities Retail Delivery Management team. It enables us to take a consistent approach to approving fit out proposals and highlights the low carbon solutions adopted, providing us with valuable feedback on the effectiveness of the guidance so that it can be improved in future.

BREEAM Green Building Guide
Here we provide guidance on how to fit out your retail units to achieve the best possible BREEAM rating. It should be reviewed by your design team and considered as a guide on how to improve the environmental performance of your retail space.

Schedule of Assumptions
For completeness we state the key assumptions that have been made in forming the analysis and examples in the document.

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Feedback

We are always eager to hear what you think about our publications. Please send any comments or suggestions to the contacts above so we can incorporate them in future editions.

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Why Change?

2

2.1 Introduction

Scientists generally agree that harmful greenhouse gas emissions need to be reduced to minimise the extent of climate change. Leading nations are collectively trying to combat this threat and protect the environment for future generations.

Businesses which rely on energy to operate are responsible for carbon emissions. At Land Securities we recognise the impact that our assets have on the environment and on climate change. We have a responsibility to conserve natural resources by delivering sustainable developments, encouraging the retrofitting of energy-efficient technology into existing buildings, and working with our retail occupiers to use our buildings as economically and efficiently as possible.

Land Securities are ISO 14001 accredited and have set targets to reduce energy consumption, carbon dioxide emissions, waste and water use. An example of our environmental commitments is our target to plant at least one hundred new trees for every tree cut down in the course of our development activities.

There are significant opportunities in our retail developments to work with retailers to reduce environmental impacts and this section looks at a number of drivers supporting the case for change.

If you would like to find out more about our environmental policies, objectives and targets then you can download our Corporate Responsibility Report at:
www.landsecurities.com/responsibility/our-environment

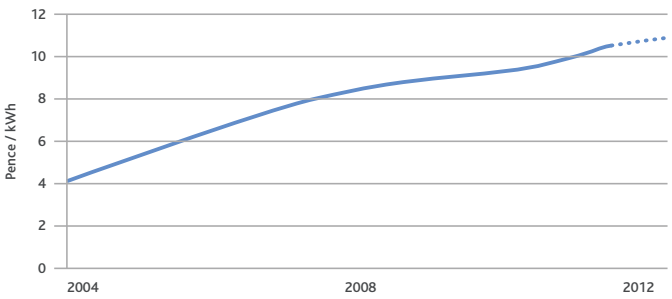
2.2 Rising Energy Costs

Rising energy tariffs in recent years mean that energy costs are one of the fastest growing cost burdens facing retailers. Designing and operating retail space to be as energy efficient as possible will be a way for retailers to manage their risk of exposure to these costs.

Monitoring energy bills and trends in energy use can help raise awareness and encourage energy management, leading to potential savings in annual energy costs. This combined with setting targets to improve performance is an essential first step in managing energy consumption.

Good housekeeping and management of energy can typically save 10% on annual energy bills. Sometimes savings of more than 20% have been reported, without additional expenditure on equipment.

Recent trends in the price of electricity in the UK



Electricity prices have more than doubled in the past 8 years

According to the Carbon Trust, a 20% cut in energy costs represents the same bottom line benefit as a 5% increase in sales.

Source: Retail Sector Overview, The Carbon Trust

Simple energy saving measures:

- Switch off lighting in staff and service areas when they are not occupied.
- Ensure sales area lighting is either switched off, reduced or limited to shop window display areas outside of normal trading hours.
- Check temperature set points on heating and cooling systems are optimised.
- Use high efficiency cooling equipment and minimise the use of air conditioning when feasible.
- Ensure over door heaters, if required, are effective, thermostatically controlled, and switched off when not needed.
- Check energy bills every month or quarterly and investigate any upward trends in energy use. Increases in energy use may show that time controls have been tampered with.
- Make staff aware of the need to avoid wasting energy by encouraging routines to generally switch equipment off or turn it down when not required.

2.3 The Cost of Carbon

The Carbon Reduction Commitment Energy Efficiency Scheme (CRCEES) is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organisations. The scheme features a range of reputational, behavioural and financial drivers, which aim to encourage organisations to develop energy management strategies that promote a better understanding of energy usage.

Land Securities, as well as many of our customers, are required to reduce carbon emissions and pre-purchase fixed price carbon credits to match predicted energy use. If agreed limits are exceeded additional carbon credits have to be purchased from others at a market price. Companies are ranked on their performance and the results are published annually in a league table. It is therefore in everyone's interest to work together to reduce energy consumption and carbon emissions.

The league table is published on the Environment Agency's website at https://crc.environment-agency.gov.uk

> Land Securities was ranked in the top 20% of companies in the 2010/11 CRC League Table

2.4 Improving the Retail Environment

A closely controlled environment and good lighting design can significantly improve the retail environment for the customer. These benefits are in addition to the savings that can be achieved from reduced energy use. Examples of best practice, illustrating how this can be achieved, are included in this document.

2.5 Customer Expectations

The general public is increasingly aware of the effects of climate change and other environmental impacts. This is inf uencing customer choice which has already been recognised by some of the leading retailers operating in the UK.

We believe there is an opportunity for retailers to offer customers a sustainable retail environment to align with the greater public awareness of the link between energy use and carbon emissions. This approach could be used to differentiate forward looking companies from others, making the sustainable retailer the 'retailer of choice'.

2.6 Reduced Installation Costs

Land Securities are mindful that one of the key considerations for many retailers is the cost of their initial shop fit out. However, adopting best practice does not always mean spending more money. A low carbon design can result in significant reductions in plant size or even remove the need for some equipment entirely, hence reducing installation costs and increasing retail space.

2.7 Building Regulation Compliance

Part L of the Building Regulations deals with the conservation of fuel and power in buildings and dictates the minimum standards that have to be achieved in new and refurbished buildings. Retailers and landlords have a combined responsibility to ensure that these standards are met in the fit out of retail space.

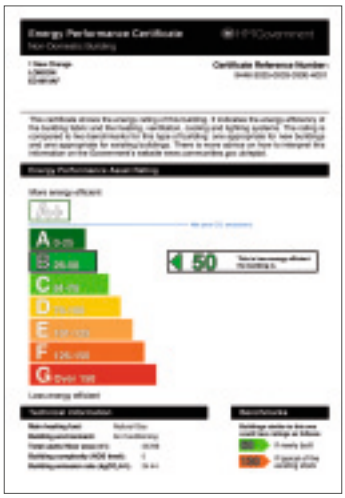
These regulations have become increasingly demanding and are regularly updated as the Government strives to meet binding targets to reduce the UK's carbon emissions.

Section 3 looks at 'our shared obligations' in this regard.

2.8 Energy Performance Certificates

Energy Performance Certificates (EPCs) show how efficiently a building is designed, and are required for all new property developments or when existing commercial properties are leased or sold.

The UK Government has recently proposed new legislation requiring all commercial properties to have a minimum EPC rating of E from 2018. Properties rated at F or G will not be permitted to be leased or sold after this date.

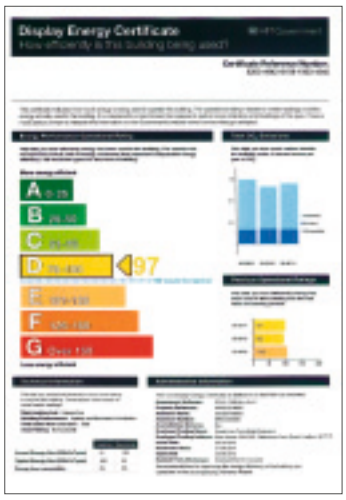


In a retail environment the EPC rating depends primarily on the efficiency of all the building services systems that have been installed. It takes into account the design performance of lighting, air conditioning and hot water systems etc.

2.9 Display Energy Certificates

Display Energy Certificates (DECs) are mandatory in large public buildings and it is anticipated that they could be required for commercial buildings in the future.

The DEC shows the actual measured energy consumption for a building or retail unit. By being displayed, it makes energy consumption of a retail unit visible to all staff and customers.



Currently DECs are only mandatory for public buildings but Land Securities are promoting their use in the retail sector, as they will help retailers understand how much energy is actually used. As part of our Corporate Responsibility Commitments, we have voluntarily provided DECs in our managed office portfolio.

We encourage our retailers to produce and present DECs in their units.

2.10 Our Commitments

Land Securities key sustainability commitments are listed on our company website and are included in the annual Corporate Responsibility Report.

Key environmental commitments relevant to retail properties include:

- All new developments to achieve BREEAM (2011) 'Very Good' rating with an aspiration for 'Excellent' where reasonably practicable.
- All new residential developments to achieve Code for Sustainable Homes Level 4.
- All new major developments to achieve FSC project specific certification.
- Achieve a diversion from landfill rate of 90% (by weight) of operational waste with a minimum of 70% recycled (by weight) by March 2015.
- New developments in 2012/13 to achieve a reduction in CO_2 emissions of 20% below Building Regulations Part L.
- Develop an "ultra-low carbon building" by 2018, with CO_2 emissions equivalent to a 50% reduction beyond Building Regulations Part L 2010.
- Ensure all buildings that are available for lease have an EPC rating of E or better by March 2017.
- Reduce water consumption by 10% by March 2016.
- Record zero environmental incidents.
- To apply Planet Positive Building Certification as a pilot study to the proposed Crawley development commencing on site in Autumn 2012 to ascertain the benefits when used in support of BREEAM Certification.

A copy of the full report can be found at:
www.landsecurities.com/responsibility/our-strategic-approach-to-cr

> Land Securities have reduced carbon emissions from their shopping centres by 7% between 2000 and 2011

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Our Shared Obligations

3

3.1 Introduction

The Government is committed to reducing UK greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels. The most significant greenhouse gas is carbon dioxide which arises from the combustion of fossil fuels during the generation of electricity, heat and other energy uses.

As a result of these policy aims, legislation is becoming increasingly onerous. Retail buildings will have to contribute their fair share of energy savings to reduce carbon emissions from new and existing developments.

The most notable regulatory changes impacting on the retail sector are the increasingly demanding requirements of Building Regulations Approved Document Part L and the inclusion of minimum BREEAM environmental standards as part of the planning approval process for new developments.

This section explains the impacts upon both retailers and Land Securities, highlighting the increased interdependence between landlord and retailer to meet legislative requirements and planning targets.

3.2 National and Local Planning Policy

National planning policy promotes sustainable development. One of the mechanisms a local authority can use for setting an environmental standard of performance is to require a retail developer to achieve a minimum BREEAM environmental assessment rating.

It is increasingly common that a commitment by developers to achieve a 'Very Good' or 'Excellent' BREEAM rating is required in order to obtain planning approval.

3.3 Building Regulations Approved Document Part L

'Part L' of the Building Regulations relates to energy use in new and refurbished developments. It is intended as the main vehicle to drive carbon reduction in the building sector, leading to 'zero carbon' commercial buildings from 2019. Part L sets out the minimum performance of the main elements of a building including the external envelope, plant and services. It requires compliance with five separate criteria, with criterion 1 and 2 being the most relevant to the design process.

Criterion 1 requires overall compliance with a carbon emissions limit, and criterion 2 sets out the minimum energy efficiency and performance standards of individual plant and equipment. For example, in a lighting installation, the design must meet the overall emissions limit and the individual light fittings must meet a minimum performance standard to fully comply with Part L.

Part L is revised on a regular basis, with the most recent revision published in October 2010. The next revision is planned for 2013, and it will be more onerous than the current 2010 version.

As part of the regulations approval process, Land Securities produce a Part L carbon emissions model for each of their new developments. The model makes general assumptions about the retailer's fit out designs to show that the development can meet the Part L Building Regulations requirements.

During the fit out stage, it is the retailer's responsibility to demonstrate Part L compliance for their unit. This can be achieved by either adopting the development performance assumptions made by Land Securities or by taking an alternative route to compliance. For example, a retailer could install more efficient fans and chillers to compensate for less efficient lighting than was initially assumed. Retailers may need to employ a specialist to provide advice on Part L compliance.

> It is a legal obligation for developers and retailers to demonstrate compliance with Building Regulations Part L

3.4 BREEAM

BREEAM is the most established and widely used environmental assessment tool in the UK. It is frequently referenced in local planning policies as a benchmark for the design, procurement and construction of retail buildings. It can also be used to assess refurbishments, fit out projects and buildings in use.

BREEAM is regularly updated and the current version for new buildings is BREEAM 2011.

Land Securities have set a target for all new developments and major refurbishments to achieve a 'Very Good' rating under BREEAM, with an aspiration for 'Excellent'.

It is only possible for Land Securities to achieve the required BREEAM rating if we have the cooperation of the retailers who occupy our developments. We have a joint responsibility to deliver the sustainability measures required.

To achieve the required BREEAM rating, typical measures that we would expect our retailers to adopt are:

- Complete the Building User Guide and provide training for all non-technical staff.
- Commissioning services at completion and again seasonally during the first 12 months of occupation.
- Install energy efficient lighting and services plant to meet Building Regulations requirements and to achieve the targeted BREEAM rating.
- Installing energy and water meters on the main plant items and for the larger units on the main zones.
- Locating air inlets far enough away from exhausts and other sources of pollution (e.g. car parks).
- Allowing sufficient space for recycled waste storage.
- Allowing sufficient space for staff amenities such as showers, lockers and changing areas for cyclists, if these are not already provided by Land Securities in the common areas.
- Selecting paints and finishes with low volatile organic compound (VOC) levels.
- Selecting the main building materials (shop front, ceilings, f oors, finishes etc.) with due consideration for their Green Guide rating, life cycle cost, robustness and responsible sourcing (e.g. FSC timber).

Each scheme will have its own characteristics and retailers should therefore refer to the particular requirements of their fit out design.

Refer to our Green Building Guide in Appendix 02

3.5 Collaboration is Essential

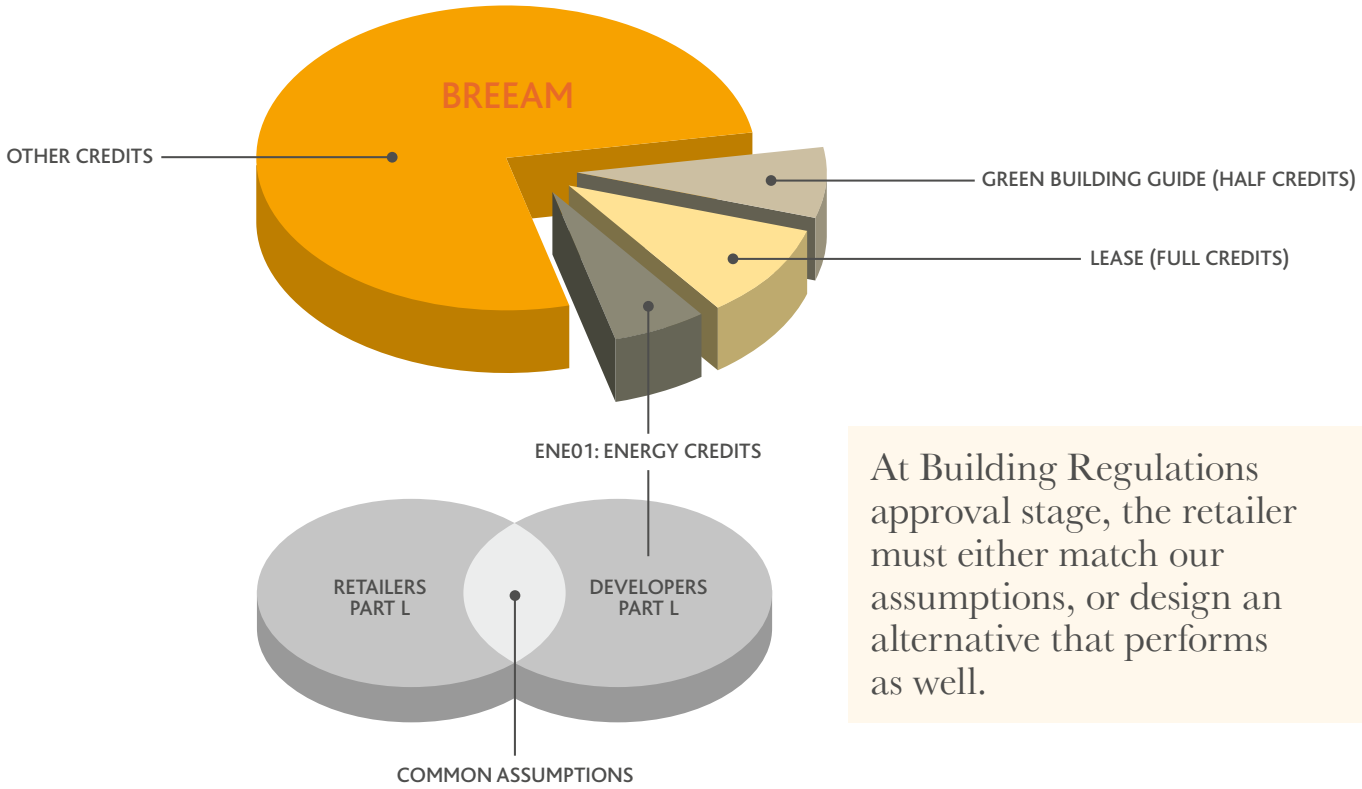
As described previously, in order to comply with Building Regulations and achieve the target BREEAM ratings collaboration is essential between the landlord and retailer in coordinating the base build design with the fit out design. This is illustrated in the diagram below.

There are two ways of achieving credits for certain issues in BREEAM, either through the inclusion of lease clauses relating to specific credits or by the use of a Green Building Guide to inf uence retailer design.

Appendix 02 shows a generic Green Building Guide which can be used to secure up to half of the available credits. Full credits can only be achieved if commitment is made to delivering the measures required within the lease.

> Achieving our BREEAM targets will not be possible unless we collaborate with retailers

Illustration to show areas of collaboration required to achieve BREEAM credits



> At Building Regulations approval stage, the retailer must either match our assumptions, or design an alternative that performs as well.

3.5.1 Greening Our Leases

In the majority of cases green lease obligations cover measures that are simply best practice and widely adopted.

Our leases recognise that the development and operation of retail space is complex with overlapping responsibilities, and that we need to cooperate with retailers to deliver truly sustainable buildings that are designed, constructed and operated as such.

Typically, our leases will seek to promote joint commitments for the landlord and retailer to achieve a good level of environmental performance (e.g. reduced energy use, minimum BREEAM targets, maximising waste recycling etc.)

3.6 Opportunities for Reducing Energy Use

The diagrams opposite illustrate the energy breakdown by 'end use' for typical A1, A3 and larger department store retailers. They have been derived using Part L 2010 modeling software.

It can be seen from the proportional split in the pie charts that the vast majority of energy is used by lighting and air conditioning (with the exception of A3 units). This is ref ected in the high proportion of electricity use traditionally found in non-cooking retail space.

3.6.1 Lean then Clean and finally Green

The approach to reducing energy use should follow the principles of "Be Lean, be Clean and finally be Green".

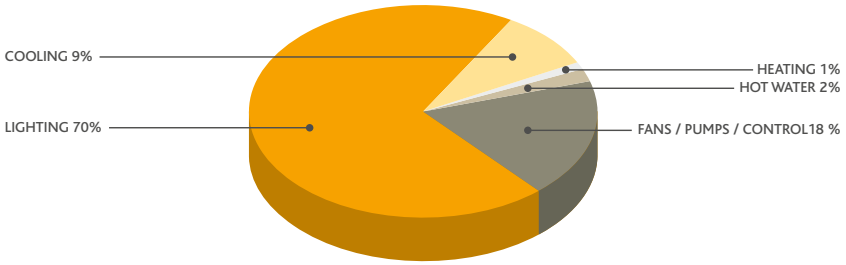
The primary focus for retail fit out design is to be energy efficient or "Lean". Energy consumption should be minimised through good design and the selection of efficient plant and equipment. Lighting, ventilation, heating and cooling systems provide the greatest opportunity for energy reduction and should be designed to operate as efficiently as possible. Sections 4.0 and 5.0 provide guidance on best practice low energy design for these systems.

Due to the high proportion of electricity use in retail further opportunities to reduce carbon emissions by using Clean or Green technologies need to focus on generating electricity. "Clean" energy sources such as local decentralised energy sources and combined heating and power (CHP) plant should be targeted next. Finally renewable or "Green" energy sources using photovoltaic (PV) panels and where practical wind turbines need to be investigated and included where viable. Conversely, heat generating technologies such as biomass boilers provide less of an opportunity to achieve carbon reductions due to the relatively low heat demand of retail developments.

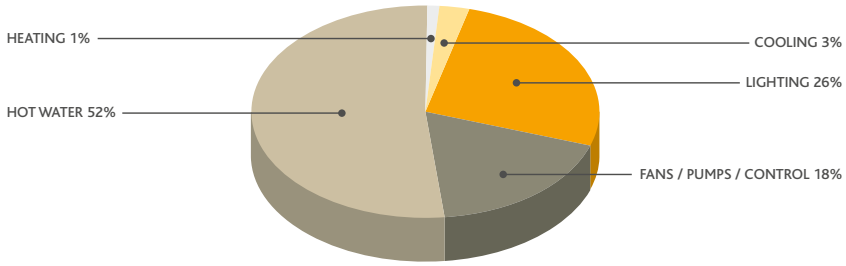
Food refrigeration is also a significant user of energy in some areas of retail particularly food retailing and supermarkets. However we felt that this was a specialist area relating to the goods sold rather than the building environment and therefore something best addressed by retailers themselves and is not covered in this guide.

> We encourage retailers to focus on energy efficient lighting and air conditioning design to reduce energy use and carbon emissions

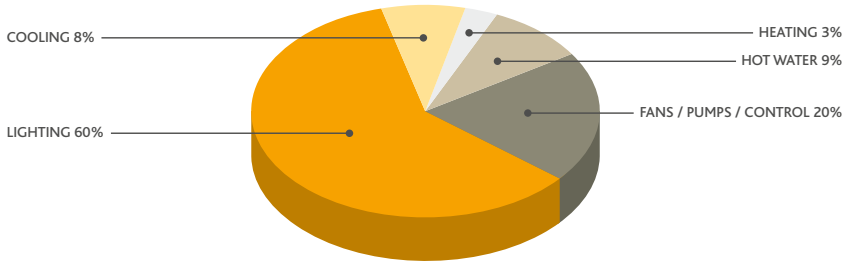
The figures below show the typical energy use for different types of modern retail applications (source: Hoare Lea)



Typical annual energy use for a modern small and medium sized retail unit (A1 Retail)



Typical annual energy use for a modern catering/food unit (A3 Retail)



Typical annual energy use for a modern Department Store

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Lighting

4

4.1 Introduction

Lighting is by far the largest contributor to carbon emissions in retail developments and therefore it offers the greatest opportunity to reduce carbon emissions through energy efficient design.

Lighting consumes energy directly through the electricity that it uses. A high percentage of the electricity used for lighting is emitted as heat. This heat needs to be removed by running cooling systems. A reduction in the energy consumed by lighting will directly reduce the energy consumed by associated cooling systems in a typical retail unit.

A well designed and energy efficient lighting design will therefore result in reduced cooling demands and smaller air conditioning plant. Lamp technologies are currently undergoing one of the largest changes for many decades, with the wide introduction and development of Light Emitting Diode (LED) technologies.
Part L of the Building Regulations are becoming more stringent, impacting upon lighting load densities. As a result, shop fit design will be required to address lighting design and lamp selection

> Retail lighting design will have to be more efficient to comply with the new Part L

4.1.1 More Stringent Requirements in Part L

Energy efficient lighting design presents the main opportunity for improvements within a retailers Part L appraisal.

Figures are declared in the Part L model for 'general/background' and 'display lighting'.

'General/background' lighting performance is defined in lighting density terms as circuit Watts per 100lux over the given area (W/m^2/100lux).

'Display lighting' performance is defined by a fixed lighting power density (W/m^2) and a minimum lamp efficacy. Efficacy is defined by the power (circuit Watts) required to achieve a particular light output (lumens) from the lamp (lumens/W).

The new 2013 Part L modeling software will undoubtedly result in more stringent lighting requirements. It is estimated that for 'general/background' lighting the power density targets will equate to 2.0 – 2.3 W/m^2/100lux. For 'display lighting' to meet the new requirements light fittings with an efficacy level in the region of 60-80lumens/W will have to be selected.

Therefore both the lamp selection and the lighting levels selected by the retailer will play a significant role in satisfying the Part L model.

4.1.2 The Lighting Energy Numeric Indicator

LENI is a term that will become very prominent in the next few years. It stands for Lighting Energy Numeric Indicator (LENI) and is a new method for calculating lighting energy consumption within buildings. It is defined in the EN 15193 European standard as the measure for annual energy consumed by lighting in a building.

According to the Government's Consultation, the new 2013 Part L of the Building Regulations is planning to adopt LENI as an alternative method for meeting the lighting energy efficiency requirements. The LENI method calculates the performance of lighting in terms of energy per square meter per year. This takes into account 'used' rather than 'installed' load; it ref ects actual energy usage and encourages the use of natural daylighting and lighting controls.

The proposed 2013 Part L sets maximum LENI figures depending upon hours of use and illumination levels within the space.

Because the LENI calculation takes into account efficiencies from lighting controls it is recommended that retailers undertake a LENI calculation for their fit out designs. The calculation method is included within most reputable lighting design calculation packages.

> Up to 70% of CO_2 emissions in retail can be generated by lighting alone

4.2 Design Guidance

4.2.1 Good Retail Lighting Design and Energy Efficiency

The nature of retail fit out design means that responsibility for the lighting can often sit across a number of different disciplines. The lack of a single point of responsibility means the energy efficiency message can be lost or diluted as it is communicated between designers.

The specification and selection of light fittings may end up as the responsibility of lighting designers, electrical engineers, retail designers, interior designers, shop fitters, lighting manufacturers and contractors.

The retailer should ensure that the lighting energy efficiency requirements are properly defined, from the Part L model, and accurately communicated to all the design team members that are involved in lighting design.

This section of the guide demonstrates, by examples, how good retail lighting design and energy efficiency can be achieved. The key principles are:

- Selecting the most efficient lamp and luminaire combinations
- Using lighting controls to ensure the lighting is only used when it is needed
- Carefully selecting and zoning the lighting levels to suit the shop f oor

4.3 Choose the Right Lamps

The energy efficiency and lighting performance of lamps varies across the many different varieties on the market.

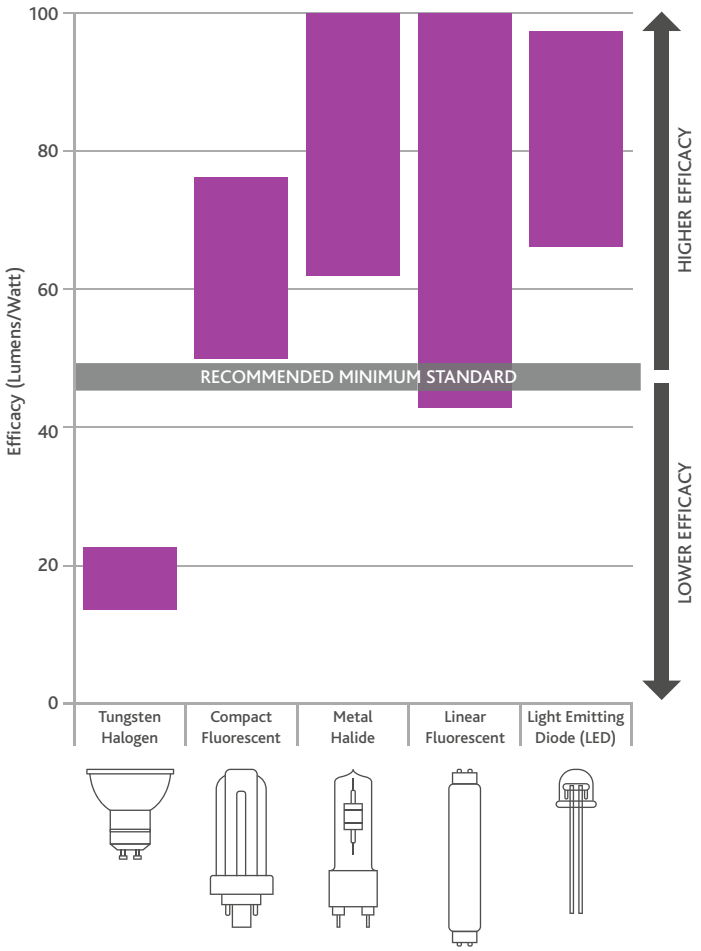
As part of national legislation tungsten based lamps are being progressively phased out. The GLS lamp has almost been removed from the market and there are now restrictions being placed on 12V tungsten halogen lamps, with future phase out likely.

LED sources are proving ideal replacements for tungsten lamps. Their small physical size allows luminaires to be produced of similar proportions to tungsten luminaires and performance of good quality LED luminaires is equivalent to or greater than tungsten.

LED lamp efficacies are in the order of 70-80 lumens/Watt and continually increasing, compared to 20 lumens/W typically achieved for tungsten lamps. Further information on LED lamps can be found in Section 4.5

Energy efficient lamps that are commonly used in retail lighting are:

- Ceramic Discharge Metal Halide (CDM)
- High Efficiency LED
- Compact Fluorescent
- Linear T5 Fluorescent



Each lamp has differing colour temperatures, colour rendering characteristics and energy performance levels. For this reason it is conceivable that a variety of lamp types might be desirable within a fit out.

> Tungsten Lamps are inefficient and should not be used

4.4 Lamp and luminaire combinations

4.4.1 Energy efficient luminaires

The energy performance of a lamp changes when it is incorporated into a luminaire. It is the energy performance of the lamp and luminaire combination that is important; there is no point in having a very efficient lamp in an inefficient luminaire.

4.4.2 Comparing Common and Best Practice

There is a myth in the lighting industry that you cannot achieve the same lighting effect with energy efficient lamps and luminaires.

> The same lighting effect can be achieved using more efficient lamps and luminaires

The images on the following pages present comparative examples of poor energy performing lamp and luminaire combinations with good practice energy efficient combinations. This demonstrates that the same lighting effect can be achieved along with considerable energy savings.

4.4.2 Comparing Common and Best Practice (continued)

Adjustable Downlights

Common Practice

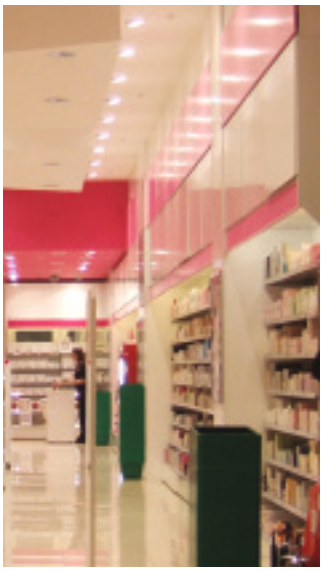
Tungsten halogen lamps are commonly used for these fitting types.

These provide an efficacy of 20-25lm/W

Best Practice

The same visual appearance can be achieved with the use of metal halide lamps. They provide a much higher output for less energy and have a significantly longer lamp life.

These provide an efficacy of >80lm/W



Downlights

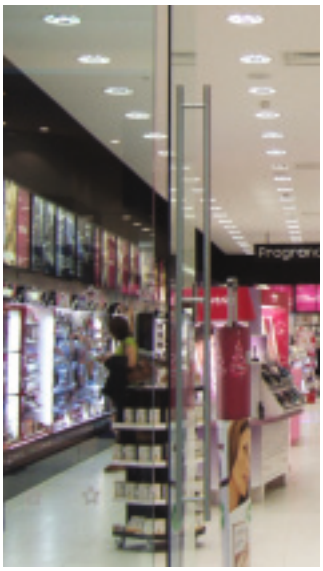
Common Practice

Simple fixed downlights are a common type within retail applications.

The light distribution from a halogen downlight is often tight and focused.

Best Practice

Compact Fluorescent downlights offer a more ambient distribution that can be controlled with attachments and ref ectors. Downlights that use a discharge source can achieve a range of beam angles.



4.4.2 Comparing Common and Best Practice (continued)

Adjustable Downlights

Common Practice

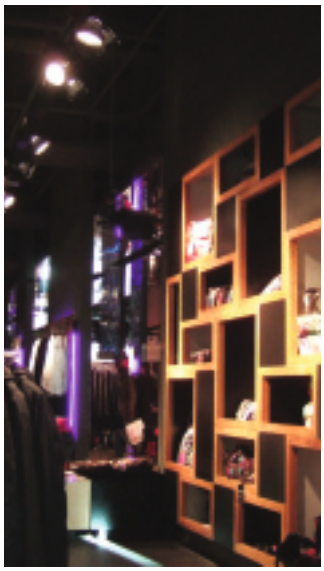
Tungsten halogen is the common lamp for these fitting types.

These provide an efficacy of 20-25lm/W

Best Practice

The same visual appearance can be achieved with the use of CDM lamps.

These provide an efficacy of >80lm/W



Feature Pendants

Common Practice

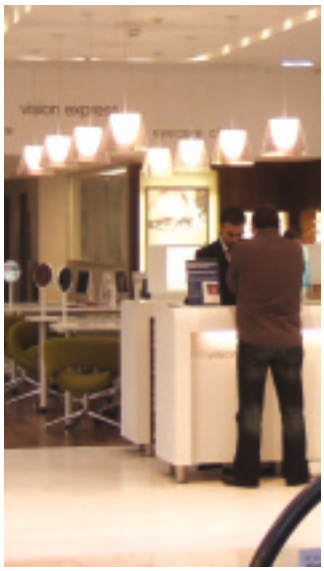
Traditionally, pendants use GLS or tungsten halogen lamps.

These provide an efficacy of 15-17lm/W

Best Practice

Compact f uorescent or discharge lamps provide a low energy equivalent.

These provide an efficacy of 60-80lm/W



4.4.2 Comparing Common and Best Practice (continued)

Linear Fluorescent

Common Practice

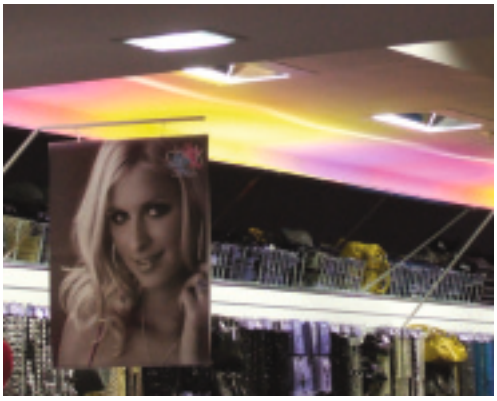
Fluorescent lighting can provide high illuminance levels very efficiently. The output of the selected luminaires can significantly affect this though, so careful selection needs to be considered.

Concealed Lighting

Common Practice

Concealed lighting allows for either a subtle wash, or dramatic effect to be applied to a surface without seeing the brightness of the light source.

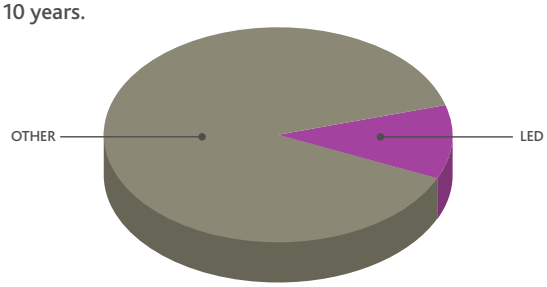
This effect can be achieved using linear f uorescent battens, cold cathode or LED systems. LED units allow simple colour changing within the outlet.



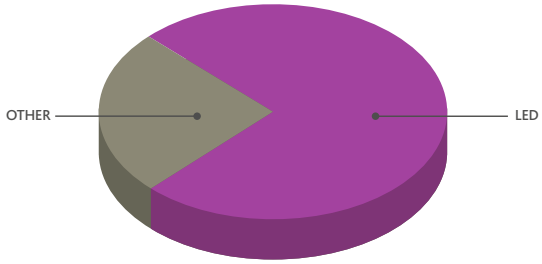
4.5 LED Lamps

4.5.1 Market Share

Market share of LEDs is expected to increase significantly over the next 10 years.



LED Market Share in 2012



LED Market Share by 2020

The recent technological advances in LED development has led to a growing interest in the potential for using white LEDs for illumination purposes in the retail environment.

LEDs provide a range of new opportunities, but their use requires a careful assessment of all aspects of the design. The nature of the LED lamp means that it may not necessarily be appropriate as a drop-in replacement for conventional lamps. The lighting design should be adapted to match the particular characteristics of the LED luminaires to be used.

4.5.2 Operational Benefits

In many instances the LED luminaire can provide a much more efficient and maintenance friendly alternative to traditional light sources.

Maintenance is an area where the LED source can provide a significant improvement over tungsten, with a typical quoted lamp life in the region of 50,000hrs.

This end of life figure is generally quoted as the point at which the light output has decreased to 70% of its initial value L70.

Performance figures are dependent upon the quality of the complete product, not just the LED chip. Just as important are the other components used to make up the LED luminaire, most notably the driver and heat-sink.

4.5.3 Lamp Selection

LEDs are available in different correlated colour temperatures (CCT) and these can vary from 2,300K (very warm in appearance) up to 10,000K (very cool in appearance). The highest luminous efficacies tend to be at the higher CCTs (cooler, bluer colour temperatures) but these colour temperatures may be undesirable for the application.

The Colour Rendering Index (CRI) of a lamp characterises how well it can reproduce the colours of various objects realistically and faithfully. Some LEDs may have a high CRI quoted, however phosphor-based white LEDs (especially high-CCT ones) tend to render red tones poorly. There is unfortunately a wide range of quality in the market place, so extreme care needs to be taken in the specification and selection of LED products.

In the right application and with careful thought LED luminaires now provide a viable alternative to traditional lamps. When considering higher output linear f uorescent or larger high intensity discharge lamps selection becomes less clear-cut.

In many environments the traditional high intensity discharge and T5 f uorescent lamp will still provide a more energy and cost efficient solution with higher luminaire lumens/circuit Watt (the actual amount of light emitted from a luminaire for energy consumed).

Top 5 Tips for Successfully Specifying LEDs

1. **Check the colour temperature**
   Often the cheaper yet better performing luminaires have a cooler colour temperature; aim to be within a range of 3000-4000°K; ensure consistent colour temperature is guaranteed.

2. **Ask about the guarantee/ warranty**
   Most reputable manufacturers are offering a 5 year guarantee on the whole luminaire, including the driver.

3. **Request performance information**
   How much light is actually leaving the luminaire.
   For most spaces Part L requires a lighting efficacy in excess of 55 lamp lumens / circuit-Watt.

4. **Check how well the LED renders the colours of the merchandise being sold**
   There are large variations of quality, request a sample luminaire.

5. **Think carefully before selecting the use of LED retrofit lamps**
   Although cheap and readily available the performance of these can vary significantly. Obtain samples before committing.

4.6 Retail Lighting Controls

Traditionally retail lighting controls have consisted of simple manual switching, reliant upon the shop f oor employees, to switch lights off. However, the proposed introduction of LENI as a means of complying with Part L of the Building Regulations indicates that the use of automatic energy efficient lighting controls will become increasingly important.

In retail the 3 key areas of lighting controls to consider are:

- Shop fronts
- Shop f oor
- Back of house

4.6.1 Shop Front Lighting Control

Shop front lighting control should be separated from the shop f oor lighting and put on time clock control to switch off during the night.

An additional enhancement could be to vary the shop front lighting depending upon the amount of daylight. External retail frontage does not require the same level of illumination at night as it does during the day. Therefore lower illumination levels and subsequently less power could be used at night whilst still providing high contrast and attracting custom. This should be adopted by all the retail outlets to ensure a consistency of approach.

4.6.2 Shop Floor Lighting Control

Shop f oor lighting should be controlled to ensure that it is off when the shop is not occupied. This can be achieved by a combination of timers, movement sensors and/or 'last person out' switches.

Traditionally shop f oor lighting remains constant throughout the day; this could be designed to react to external daylight conditions or customer use.

Whilst restocking the shop f oor, the illumination levels can be reduced, simply by switching off every other luminaire or a row of luminaires. The circuiting of the lighting should be designed to allow this to happen. Alternatively, more sophisticated means of control such as DALI could be used to achieve this.

4.6.3 Back of House Lighting Control

All back of house lighting should be automatically controlled by movement sensors to ensure that they are only used when required.

4.7 The Right Amount of Light in the Right Place

The key to energy efficient retail lighting design is to use the right amount of light in the right place at the right time.

The amount of light is defined by an illumination level measured in lux. Historically it has been common place for retailers to use ever increasing illumination levels as various areas of the shop compete for prominence. With the introduction of Part L of the building regulations and associated energy limits the emphasis for good retail lighting design is now to select lower illumination levels and to carefully select zones that create contrast. This is what is meant by the right amount of light in the right place.

Worked example 3 at the end of this section demonstrates how world class energy performance can be achieved using this approach.

4.8 Worked Design Examples

The following pages contain worked examples to illustrate what can be achieved with energy efficient lighting design.

The examples are based on a typical fashion retail unit and have been modelled using state of the art computer modeling software.

The three examples demonstrate an increasing level of energy efficiency. For comparison purposes we have labeled them as:

- Model 1: Current good practice
- Model 2: Best practice
- Model 3: World class practice

Lighting design and energy performance data are provided for each example with a summary of how the energy performance enhancements have been achieved. For each example we have assessed whether the energy performance is likely to comply with the forthcoming 2013 revisions to Part L of the Building Regulations.

4.8.1 Model 1: Current Good Practice 18W/m²

Model 1 forms the baseline for comparison with the following models. It is based upon a current, good practice retail lighting design.

This design uses metal halide track mounted spotlights coupled with fully recessed CDM downlights. This layout is typical of a lighting layout in a modern retail outlet.

The image (below) provides a visual indication of the lighting within the store. It gives details of the luminaires used and the resultant illumination levels.

Information relating to the energy use is tabulated to provide a benchmark against which the following two examples will be measured.

> Many retailers currently operate at loading intensities in excess of 35W/m²

Energy

	Total Load kW	Total Lumens	Loading Intensity W/m²	Display Lighting Efficacy Lumens/W	Background W/m²/100lux	Annual energy consumption kWh	Annual carbon emissions Tonnes CO_2	Annual energy cost £
	11	910,800	18	82	2.48	40,185	20.78	£4,420
% Improvement over Good Practice (Model1)	–	–	–	–	–	–	–	–

Part L 2013 Compliant?

X

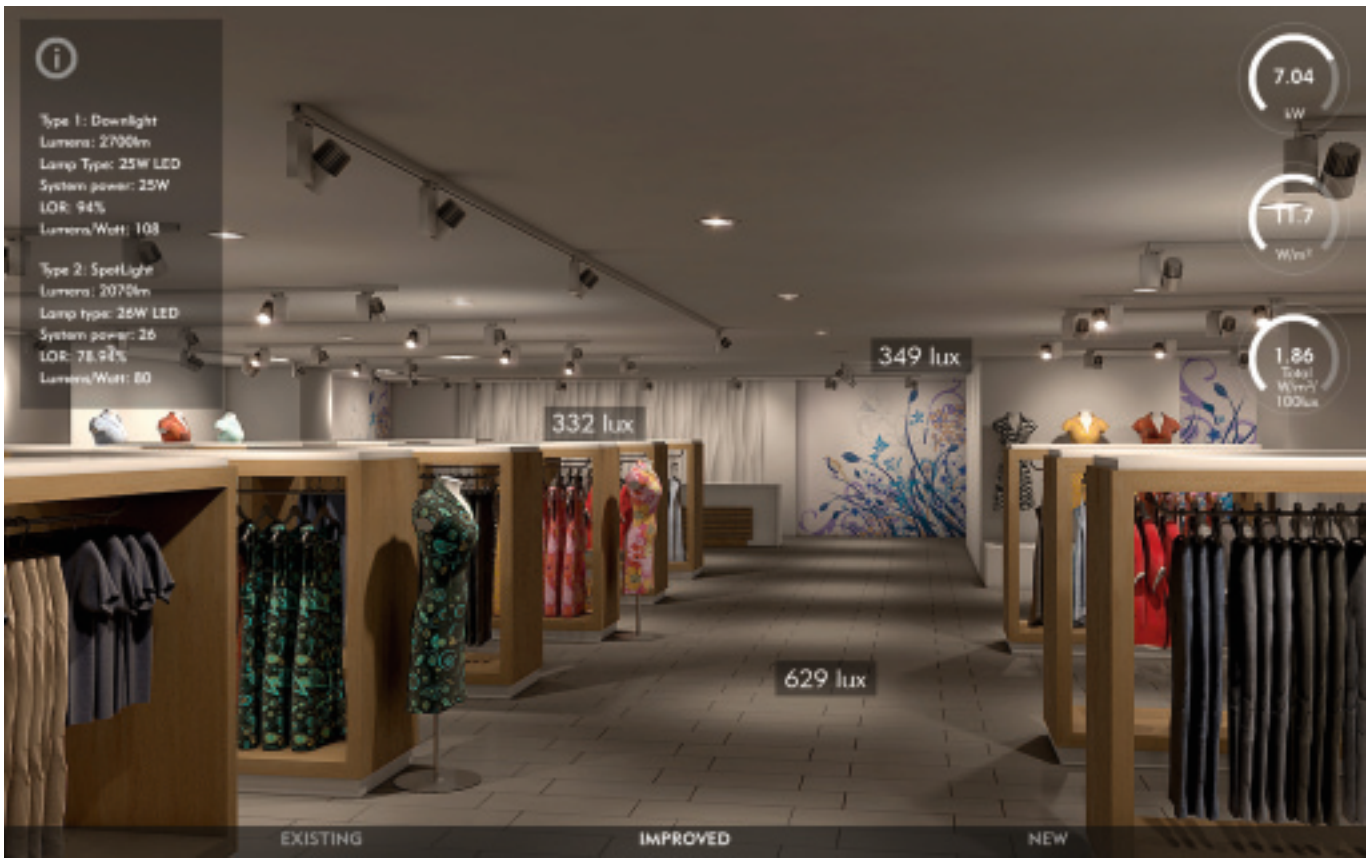
4.8.2 Model 2: Best Practice 11W/m²

1. Improved Lamp Selections

In Model 2 the same lighting layout has been adopted but the luminaires have been replaced on a like for like basis with more energy efficient alternatives. Both luminaire types use 35W CDM lamps. The spotlights and downlights have been replaced with an equivalent LED version.

Visually the space has a similar appearance, although the illumination levels have decreased slightly. This is because the LED spotlights do not have quite the same performance as the original CDM.

By using the energy efficient LED lamps the power consumption has been reduced.



Energy

	Total Load kW	Total Lumens	Loading Intensity W/m²	Display Lighting Efficacy Lumens/W	Background W/m²/100lux	Annual energy consumption kWh	Annual carbon emissions Tonnes CO_2	Annual energy cost £
	7.04	615,690	11	80	1.86	25,625	13.25	£2,820
% Improvement over Good Practice (Model1)	36%	32%	36%	–	25%	36%	36%	36%

Part L 2013 Compliant?

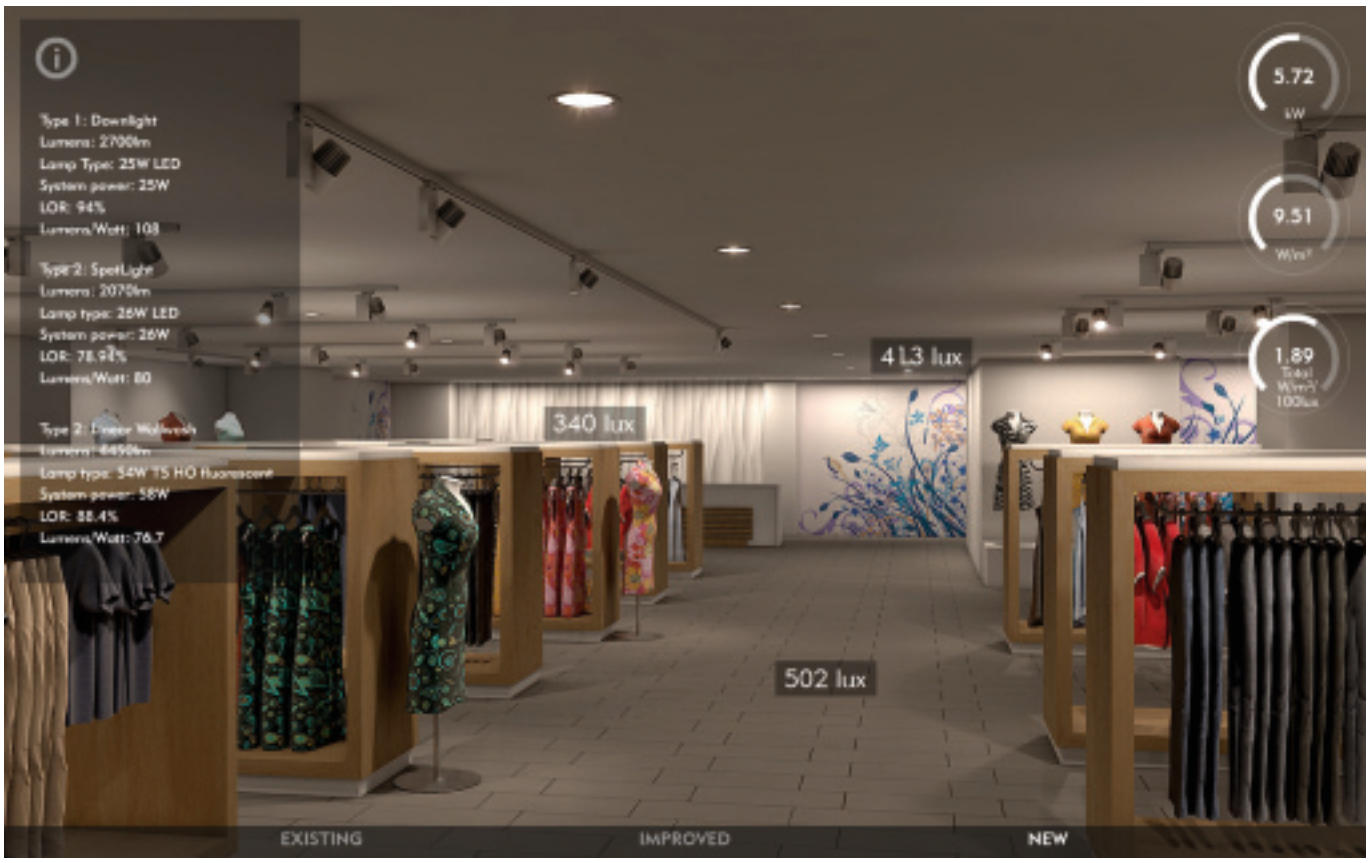
4.8.3 Model 3: World Class Practice 9W/m²

1. **Improved Lamp Selections**
2. **Efficient Design**
3. **Selective Zoning of Illumination Levels**

Similar luminaires have been used, but the wall display areas use a highly efficient traditional asymmetric linear T5 f uorescent luminaire. The spotlights and downlights use LED sources, in the same way as model 2.

The distribution of light in the space has been zoned to achieve illumination levels that give more emphasis to the vertical surfaces (walls and displays etc.) than the f oor.

The total energy consumption has further reduced along with the W/m². The W/m²/100lux however, has slightly risen due to the fact that the lighting is now primarily used to light the merchandise rather than the f oor.



Energy

	Total Load kW	Total Lumens	Loading Intensity W/m²	Display Lighting Efficacy Lumens/W	Background W/m²/100lux	Annual energy consumption kWh	Annual carbon emissions Tonnes CO_2	Annual energy cost £
	5.72	487,080	9	80	1.89	20,820	10.76	£2,290
% Improvement over Good Practice (Model1)	48%	46%	48%	–	24%	48%	48%	48%

Part L 2013 Compliant?

Low Carbon Fit Out Guide - Retail 2012

Heating, Ventilation and Air Conditioning

5

5.1 Introduction

This section provides guidance on achieving the most efficient air conditioning, heating and ventilation (HVAC) system in retail applications.

Energy efficiency can be improved and energy costs reduced by selecting appropriate air conditioning systems for a space.

In selecting the system the retailer should consider the type of retail unit, its operational profile and any centralised heating or cooling provisions made by the landlord.

The choice will be determined to a large degree by whether the retailer has their own plant space or not.

5.1.1 Landlords Provisions for Retailers

Before commencing the fit out design the retailer should ensure that they are familiar with the service connections provided to the shell which will vary from development to development.

The low carbon agenda and planning constraints are driving many new developments to provide centralised heating and cooling for retailers to connect to, which will affect the plant selections for the fit out.

Potential options for centralised servicing include:

- Condenser water loop (sometimes referred to as an ambient water loop)
- Chilled water connection
- Hot water connection

Details are usually provided by the landlord in a shell and core information pack with the most common provision being that of a condenser water loop.

The retailer will be charged by the landlord for the amount of energy (heating or cooling) taken from the centralised service, as for any other utility service. It is therefore important for the retailer to design an efficient system to optimise energy use.

5.1.2 Typical Air Conditioning Options for Retailers

A number of system options exist for retail units of varying sizes:

- Split system air conditioning (AC) units
- Fan coil units
- Variable refrigerant f ow (VRF) systems

Split System AC Units

Typical retailer size : 250m²-750m²

Split systems are a basic air conditioning system with indoor units providing conditioned air to control internal environmental conditions and external units to reject the heat from the system.

Split systems, whilst being relatively low cost to install, provide a poor solution as they result in poor energy performance and relatively high levels of carbon emissions as shown in the efficiency comparison table.

Split systems are not suitable where the landlord provides a centralised heating and cooling system.

Fan Coil Units

Typical retailer size : 250m²-2,000m²

Fan coil units incorporate heating and cooling coils to condition supply air. The units deliver supply air at high level to maintain comfort conditions within the retail unit.

Chillers are required to reject heat from the system in cooling mode, and boilers are required to supply hot water to the fan coil units in for heating. Fan coil units can also be used where a landlord provides the retailer with heating and/or chilled water connections fed from the landlord's centralised plant.

Variable Refrigerant Flow (VRF) Systems

Typical retailer size : 250m²-2,000m²

VRF systems are more advanced than split systems in that they provide better control and performance by varying the f ow of refrigerants through the system.

The systems can deliver heating and cooling from a single piped circuit via air cooled or water cooled condensers.

VRF systems offer a very good solution as they enable heat to be transferred between internal spaces as required and with very low energy input.

Water cooled VRF unit systems can be used where a landlord provides a retailer with condenser water connection fed from centralised plant.

Efficiencies Comparison

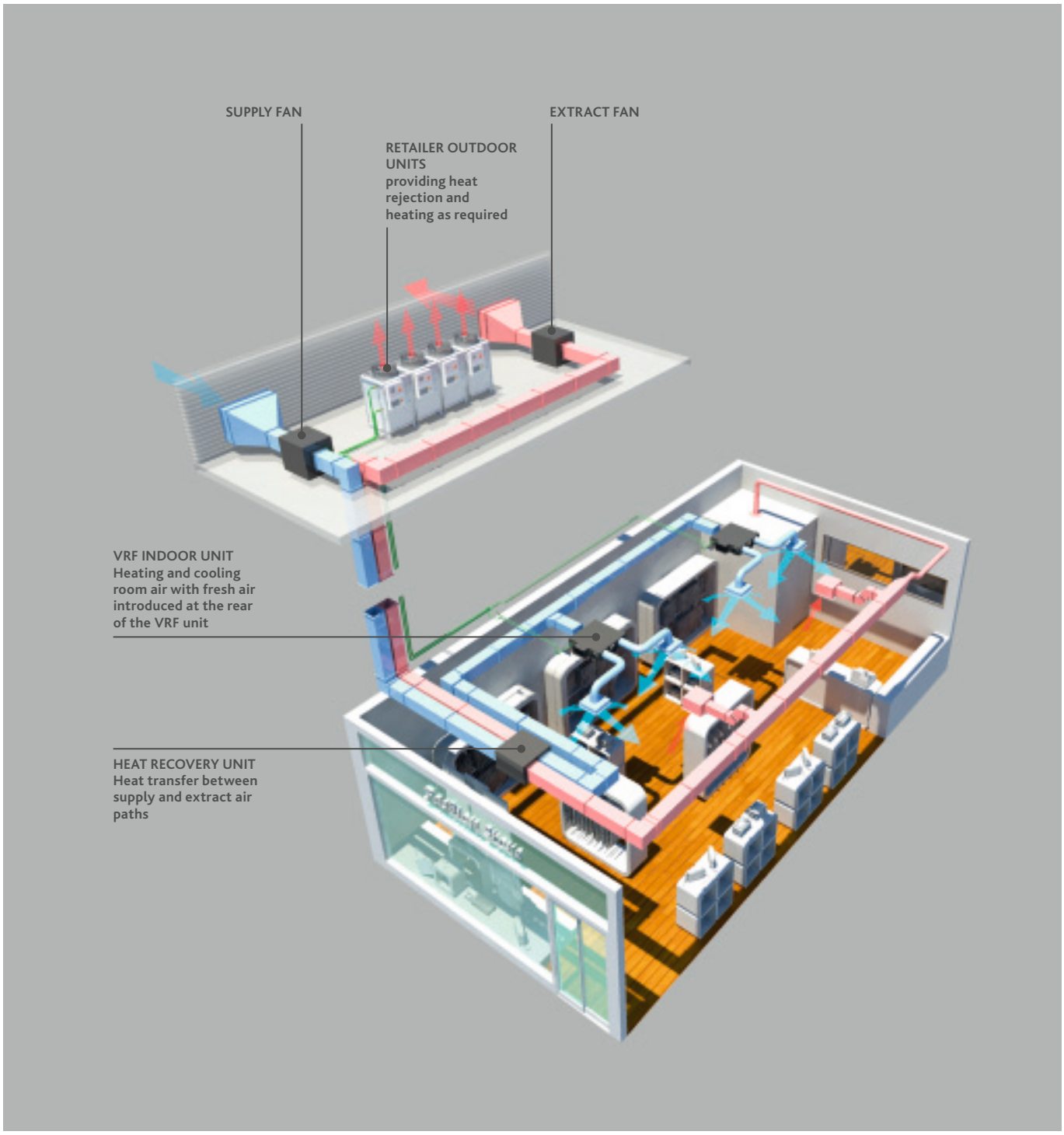
A typical 250m² retail unit located on an air conditioned mall was modelled to compare the performance of air conditioning systems. The table below shows the running costs and carbon emissions results during a year of operation.

	Split System	Air Cooled VRF	Water Cooled VRF
Running Cost	£960	£690	£870
CO_2 Emissions	4520kg	3230kg	4090kg

VRF systems can be up to 30% more efficient that split systems

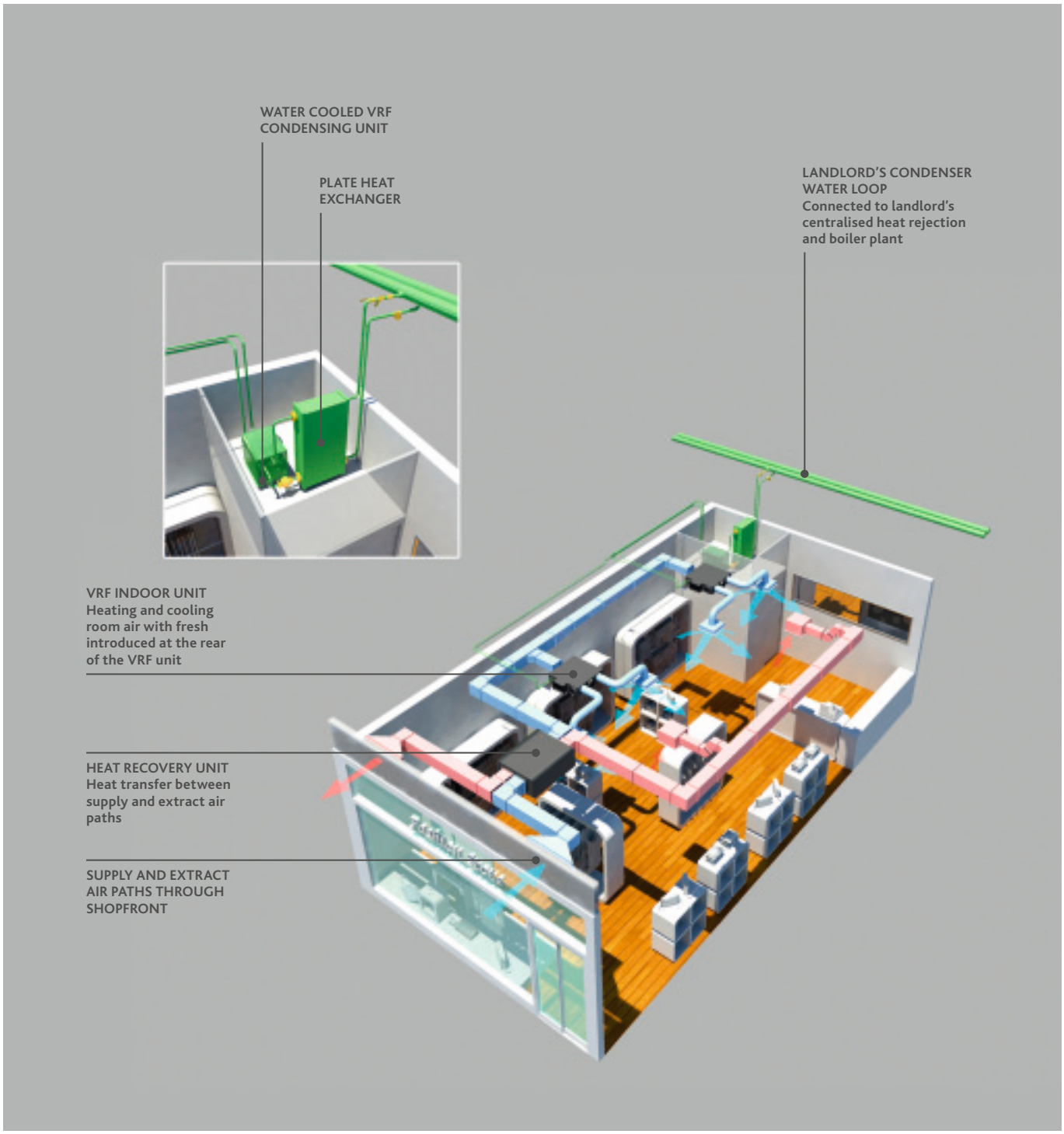
Ventilation, Heating and Cooling

Typical Retail Unit Installation with Retailer External Plant Space Provision



Ventilation, Heating and Cooling

Typical Retail Unit Installation Connected to a Landlords Condenser Water Loop



5.2 Air Conditioning System Design

5.2.1 Size the System to Suit the Actual Load

Sizing the air conditioning system to match the loads in the retail unit rather than oversizing the system will result in lower installation costs, more efficient operation and lower running costs.

5.2.2 Reduce the Electrical Demands

Reducing the electrical loads in a retail unit, such as lighting, will reduce the size of the air conditioning system. For further information refer to the section in this guide on lighting design.

Any reductions in electrical load must be taken into account in the sizing of the air conditioning system i.e. the air conditioning designer should reduce air conditioning loads in line with electrical loads.

5.2.3 Don't Just Use Rules of Thumb

Using rules of thumb or basing designs on previously poor performing retail unit specifications to size the air conditioning systems should be avoided. The system should be sized to suit the demand of the specific retail unit into which the system will be installed.

Design occupancy levels should not exceed 1 person per 5m^2 (rather than means of escape figures which may be a higher density than this)

5.2.4 Consider Diversity

Adding all peak loads together to obtain the maximum air conditioning load can result in system over-sizing. Consideration should be given to assessing when the peak load occurs i.e. peak external ambient conditions will occur in the summer whilst peak occupancy loads are likely to occur during the Christmas period.

The load imposed on the space by ventilation systems should be taken into account. For further information, refer to section 5.4.

5.2.5 Minimise Thermal Gains

Solar shading to shop-fronts will reduce solar gains within the retail unit and should be considered during the design stage.

5.3 Air Conditioning System Operation

5.3.1 Provide Suitable Control

The operation of the air conditioning systems should be automatically controlled to maintain the required temperatures for the occupied hours.

5.3.2 Centralise Control

Ideally plant should be controlled centrally so that all air conditioning equipment can be easily set or adjusted to suit occupancy requirements.

5.3.3 Optimise Run Times

Air conditioning run-times should be minimised as much as possible. The operating times should be set to match the occupancy and usage hours of the retail unit.

The space will usually maintain comfortable conditions for a reasonable period of time after the plant is automatically switched off.

Operating the air conditioning after-hours should be avoided to minimise energy consumption.

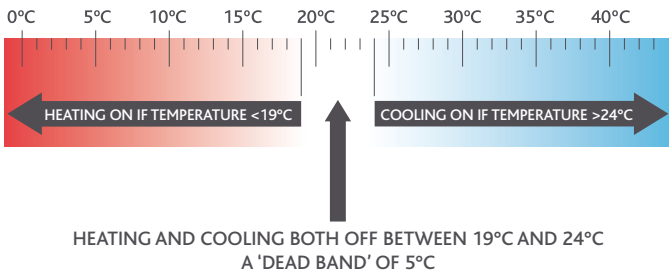
5.3.4 Optimise Temperatures

As a guide, the operation of the heating mode should only be activated once the temperature in the space drops to ≈19°C. Whilst the cooling mode should only be activated once the temperature rises to ≈24°C in the space. However, the specific set point temperatures will depend on the retail application.

This temperature range is known as the 'dead-band' and effectively prevents systems operating in heating and cooling mode at the same time. The wider the dead-band the more energy will be saved.

Occupant comfort should be considered when widening the dead-band beyond the suggested range above.

Diagram of 'Dead Band' control providing recommended temperatures (Source: The Carbon Trust – CTV001)



5.3.5 Shut the Doors

Windows and doors in air conditioned areas should be kept closed where possible. This should include closing doors to adjacent un-conditioned areas.

5.3.6 Make the Controls Easy to Understand

Staff turnover in retail can be high. Make sure system controls are intuitive and easy to understand so that staff awareness training is simple and brief.

> First year savings of up to 20% are achievable by increasing staff awareness of controls

5.4 Ventilation Systems

Due to the large variance in the number of people within a retail outlet at different times of the year fresh air volumes per person are lower than in other applications such as offices.

Fresh air for retail can be around 50% less than other applications.

5.4.1 Use the Correct Air Volume

The Chartered institute of Building Services Ventilation Guide recommends a fresh air ventilation rate of 1 l/s per m^2 of retail unit.

> Using the correct fresh air supply rate can save up to 50% in energy consumed

5.4.2 Size the Fans to Reduce Energy Consumed

The energy used in moving air through the ventilation system is limited by the Building Regulations. Ensuring that the fans are selected to improve upon these values will mean that the energy required to continually run the fans is minimised.

5.4.3 Use Variable Speed Drives

Where possible variable speed drives should be fitted to fans so that fan speed can be varied to suit ventilation demand.

This can be achieved by using sensors in the space that monitor air quality and vary the fan speed depending on theventilation requirements resulting in less air being supplied when there are fewer people in the space and hence reduced energy demand.

DC monitors consume less energy than AC motors for the same duty hence DC motors should be used where possible to reduce energy consumption.

5.4.4 Use Heat Recovery

Where air is extracted from the space then a heat recovery unit should be fitted to transfer heat and cooling from extract air to supply air.

Heat recovery units can recover 50-90% of the available energy in the extract air. Heat recovery can be achieved in a number of ways, for example by minimising fresh air and recirculating air to suit occupancy levels and by installing an air-to-air heat recovery unit or by installing a run-around coils.

The recovery of energy from the extract air will also reduce the load on the air conditioning plant.

	Without Heat Recovery	With Heat Recovery
Running Cost	£850	£190
CO_2 Emissions	4010kg	905kg

5.5 Over Door Heaters

Retailers should aim to avoid the installation of over door heaters through the use of revolving doors or lobbied entrances.

It is acknowledged that over door heaters can provide an effective barrier across shop doors where a retail unit faces onto an area that in winter could be at a lower temperature than the retail unit itself.

If essential to the climate control of a retail unit, over door heaters should be located to limit and offset the effect of cooler air entering the retail unit.

Typical over door heater unit

5.5.1 Shut the Doors

Retailers should consider keeping shop front doors closed during periods of extreme cold and heat as air entering the shop unit during these periods will impose significant heating/cooling loads on the retail unit's systems. This in turn will require the retail unit air conditioning system to work harder and therefore consume more energy.

5.5.2 Connect the Over Door Heater to the VRF System

If a VRF system is being used in the retail unit then it is possible to connect the over door heater to the VRF system.

An over door heater connected to a VRF system will have much lower running costs and generate far less carbon than an electric over door heater.

> Save up to 65% in both running costs and carbon emissions by using a VRF over door heater

A comparison of the different types of over door heater available is shown in the table below:

	Electric	LPHW Heating	VRF
Running Cost	£481	£230	£125
CO_2 Emissions	2260kg	990kg	580kg

Note that a heat recovery VRF system could reduce this figure close to zero as units towards the rear of the shop are likely to be in cooling mode all year round. The heat removed from the rear of the unit could therefore be discharged over the doors.

5.6 Kitchen Ventilation

This section of the guide has been compiled to provide guidance in reducing energy consumption by good practice design of kitchen ventilation systems and canopy design.

It is intended that the guide will augment comprehensive design information within HVAC, CIBSE and HSE design guides and can be used by retailers, restaurateurs' and specialists to create improved energy efficiency.

Kitchen ventilation systems are fundamental for controlling health and safety risks in kitchens, in addition to creating a safe and comfortable working environment by providing adequate ventilation.

5.6.1 Replacement Air

Supply air to the kitchen, to replace combustion and extract air, should be delivered by a dedicated air handling unit. In order to keep the kitchen under negative pressure for odour control the supply system should be sized to provide approximately 85% of the extracted air volume, with the remaining 15% being drawn from adjoining areas. This arrangement keeps the kitchen space under negative pressure to prevent the escape of odours.

It should be recognised increasing canopy extract rates also increase costs of make-up air.

In smaller kitchens sufficient replacement air can be drawn from the adjoining customer area. Cooling or heating delivered via the adjacent space can provide beneficial conditioning within the kitchen area as illustrated overleaf.

5.6.2 Odour and Noise Control

Local authority regulations relating to fire precautions, basement kitchens and odour control must be observed.

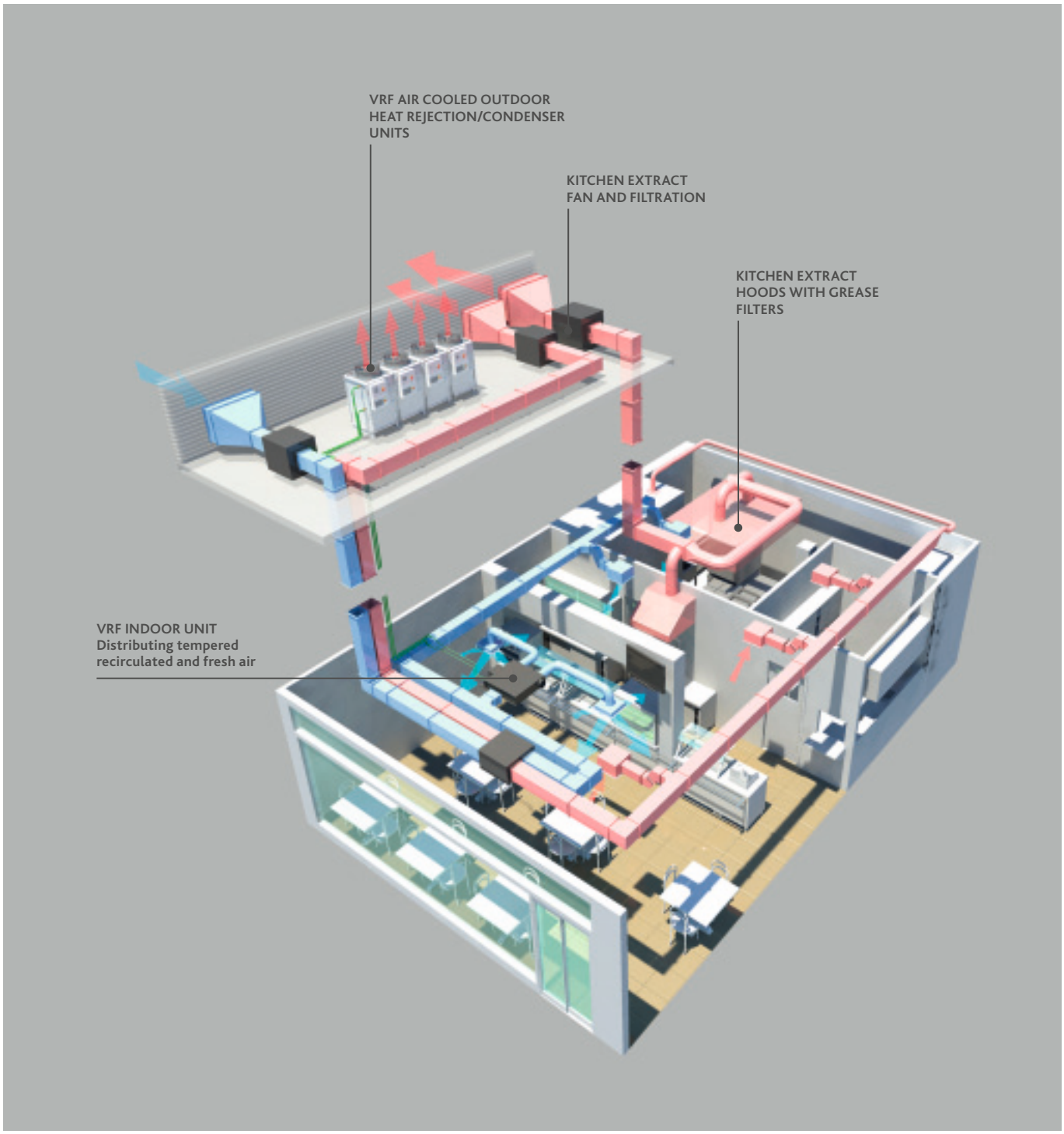
Land Securities require retailers to take appropriate measures to minimise risk of causing nuisance to adjacent properties and require the inclusion of specialist filtration to remove grease and odours, prior to discharging externally at high level.

Refer to the Retail Fit Out Guide for details of the noise and odour control requirements.

It should be noted that the inclusion of a discharge cowl is not recommended as they encourage down draughts and increase the potential of fumes re-entering the building

Restaurant Unit

Typical Shop Fit Installation



5.6.3 Group Cooking Appliances and Equipment

By grouping appliances according to heat and fume production, it is possible to reduce ventilation rate and the extract canopy size.

Canopies can be split in sections via dividing plates and where a particular item of equipment requires a particularly high extract rate this can be dedicated to the specific section of the canopy. Where practical, place heavy-duty appliances such as char-broilers in the centre of a hood section, rather than at the end.

5.6.4 Use the Right Canopy Style

The adopted geometry and style of the canopy inf uences the resultant extract volume requirements, and therefore has an impact on energy consumption.

Wall-mounted canopies function effectively with a lower exhaust f ow rate than a single-island canopy. An island canopy is more sensitive to surrounding air movement.

Low level canopies are often the most energy efficient as they require lower air f ow rates for the same canopy area i.e. typically 80% of the exhaust rate of a wall mounted canopy.

Providing side panels and a canopy that overhangs the cooking equipment is a relatively inexpensive way to improve efficiency and reduce total exhaust air f ow rate. One of the greatest benefits of end panels is to mitigate the negative effect that cross drafts have on extract canopy performance.

5.6.5 Use Variable Speed Fans

Advances in kitchen extract systems has resulted in the increasing adoption of variable air volume (VAV) kitchen extract systems serving kitchen canopies.

In instances where appliances are idle for much of the day reducing fan speed can significantly reduce energy consumption. Supply and extract fan energy is reduced together with the energy associated with heating and cooling the supply air.

A VAV kitchen extract system is controlled by varying fan speed (supply and extract) according to ventilation requirements which is determined by demand sensors in the kitchen extract canopy. A minimum f ow rate should be provided to the extract system to ensure that the canopy grease filters are effective and avoid grease build up on the internal services of the extract ductwork.

> Energy savings for a VAV system can be as much as 40-60%

5.6.6 Size the Extract System to Suit the Load

To create an effective low energy ventilation system requires the balancing of fumes, vapours and heat extracted through the canopy, with the replacement air supplied to the space. This will optimise systems efficiency and occupancy comfort.

The following steps should be adopted to develop an effective kitchen ventilation system design.

- Establish position and duty classification of the appliances
- Determine the preferred appliance layout for optimum exhaust ventilation
- Select hood type, style and features
- Size exhaust airf ow rate
- Select make up air strategy, size airf ow rate and layout diffusers.

Where possible, introduce a proportion of the supply air through the face of the canopy as this can increase the air velocities across the canopy and maximise overall system performance.

The amount of air to be extracted from the space directly inf uences the size and energy consumption of the extract fan. Therefore, it is always best to calculate the extract air quantity by first understanding the air inlet requirements of specific appliances to be used, not by simply using general advice on air changes alone. This will help to avoid over sizing the system or providing inadequate ventilation.

Avoid using rule of thumb design or provision of general extract rates as a basis of design. Accurately assessing the extract rate dependent on kitchen equipment and intensity of use significantly improves the energy efficiency and environment within the kitchen area.

The comparison table illustrates that by using the rule of thumb method, capital costs can increase by 25% and energy consumption by 36%.

	Common Practice : Rule of Thumb	Recommended Method : Equipment Details
Ductwork Cost	£13,739	£10,822
Fan Cost	£1,470	£1,300
Energy Consumption P/A	9,858kWh	7,229kWh
Energy Cost P/A	£1050	£795
Carbon Emission P/A	5100Kg	3740Kg

> Using the 'Rule of Thumb Method', extract volumes can be overestimated by up to 80%

5.7 Post Installation

5.7.1 Maintain the System

A well maintained system performs more efficiently than a poorly maintained one.

A maintenance contract should be entered into to ensure that manufacturers recommended maintenance is carried out at regular intervals by trained technicians. This will ensure that the performance of the system is kept at its optimum and that the controls strategy is current and working to your benefit.

5.7.2 Set Targets

Knowing the amount of energy a good practice air conditioning system will consume allows targets to be set at design stage and for monitoring systems performance.

> A target of 150kWh/m^2/annum is realistic for most retail operators

These figures include all energy consumed within a retail application and will vary depending on the particular application.

5.7.3 Monitor Energy Consumption

Metering should be provided where possible to monitor the energy consumed by the air conditioning system to allow comparison against targets. Awareness of the costs will increase the focus on reducing the energy consumed.

Where energy consumption is high, adjustments can be made to temperature set points and time clock settings to optimise systems performance and reduce energy consumption.

Monitoring energy consumption can also assist in identifying maintenance issues that need to be addressed.

5.7.4 Make it Part of Staff Performance Reviews

Retailers have found that as much as 20% energy reduction can be achieved by introducing an employee awareness scheme combined with including reporting on a stores energy performance in staff performance reviews.

> Failure to maintain plant can increase energy consumption by 60%

Appendices

1. Low Carbon Fit Out Checklist

2. BREEAM Green Building Guide

2. Schedule of Assumptions

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Appendix 01 – Low Carbon Fit Out Checklist

Why Change?		Yes/No	Comments
01	First fit out: Have you instructed a competent person to produce a Display Energy Certificate within 12 months of occupation? (See 2.9)		
02	Re-fits and units occupied for at least 12 months: Do you have a Display Energy Certificate no older than 12 months and carried out by a competent person, and is it displayed visibly (to staff and customers) in your unit? (See 2.9)		

Our Shared Obligations		Yes/No	Comments
03	Did you use the Land Securities assumptions for your Part L carbon emissions model or did you take an alternative approach? (See 3.3)		
04	Did you undertake your own BREEAM assessment? If so what rating did you target and what rating did you achieve? (See 3.4)		
05	Have you contributed to the Building User Guide for your staff? (See 3.4)		
06	Has your fit out installation been tested and commissioned by a competent person? (See 3.4)		
07	Do you plan to re-commission and further optimise the fit out systems again within 12 months of occupation? (See 3.4)		
08	Does your lighting system meet the BREEAM requirements? (See 3.4)		
09	Have you checked that energy and water meters are installed for major energy and water uses? (See 3.4) (Note: Please add details of what meters are provided in the comments section)		
10	Have you checked that air inlets for any ventilation systems that have been installed for your fit out are at least 10 meters away from exhausts or other sources of pollution (e.g. car parks)? (See 3.4)		
11	Have you provided a suitable dedicated space for the storage of waste and recyclables? (See 3.4) (Note: Please state how much space you have allocated and what types of waste can be sorted, e.g. cardboard, paper, glass and plastic)		
12	If you are responsible for providing staff amenities, do you have showers, lockers and changing areas for cyclists? (See 3.4) (Note: please state what staff amenities you have provided and what you consider to be provided in common areas by the landlord)		
13	Have you used paints with low volatile organic compound (VOC) content? (See 3.4)		
14	Have you specified materials for your shop fit out with due consideration for the Green Guide rating, life cycle cost, robustness and responsible sourcing? (See 3.4) (Note: please specify what measures you have taken to use sustainably sourced materials)		
15	Is your timber sustainably sourced from recycled and/or FSC certified source of origin? (See 3.4)		
16	Have you used the guidance contained in the Green Guide in Appendix 02? (See 3.5) (Note: If you have not please list the sections that have not been used and why?		
17	Have you read and complied with the requirements in the lease for sustainable fit out? (See 3.5.1)		

Lighting		Yes/No	Comments
18	Have you installed energy efficient lighting in accordance with the good practice guidelines in this document? (See 4.0)		
19	What figure have you used for general / background lighting in W/m²/100lux? (see 4.1.1) (Note: please also state lux level used)		
20	What power density have you used for display lighting in W/m²? (see 4.1.1)		
21	What LENI figure have you calculated for the lighting in kWh/m²/year? (see 4.1.2)		
22	Did you appoint a single point of responsibility for communicating the lighting energy efficiency criteria to the design team? ? (See 4.2.1)		
23	Are all the lamp types from the recommended list? (See 4.3) (Note: If not then list lamp types used)		
24	Did you install Shop Front lighting controls and what type? (See 4.6.1)		
25	Did you install shop floor and re-stocking lighting controls and what type? (See 4.6.2)		
26	Did you install back of house lighting controls and what type? (See 4.6.3)		

Heating Ventilation and Air Conditioning		Yes/No	Comments
27	What type of air conditioning system did you select? (See 5.1)		
28	Did you size your air conditioning system to meet the actual load with diversity? (See 5.2)		
29	Did you provide centralised controls for the air conditioning system and have the run times been optimised? (See 5.3)		
30	Did you optimise your temperature control band? (See 5.3.4)		
31	Are the air conditioning controls easy to understand? (see 5.3.6)		
32	Has the retail ventilation system been designed in accordance with good practice of 1 litre/sec per m²? (See 5.4.1)		
33	Did you use variable speed drives for fans and pumps? (See 5.4.3)		
34	Did you include heat recovery within the design? (See 5.4.4)		
35	Did you include over door heaters and if so are they VRF? (See 5.5)		
36	Is your kitchen supply air sized to provide at least 85% of the extracted air volume, in line with the guidance in this document? (See 5.6.1)		
37	Have you arranged cooking appliances to reduce the extract air volumes? (See 5.6.3)		
38	Did you use variable speed kitchen extract? (See 5.6.5)		
39	Did you size the extract system to suit load? (See 5.6.6)		
40	Have you entered into a maintenance contract that focuses on energy efficiency? (See 5.7.1)		
41	Have you set the energy targets for the shop in kWh/m²/year? (See 5.7.2) (Note: Please state your target)		
42	Have you put in place systems to record and monitor energy consumption? (See 5.7.3)		
43	Will you include energy performance as part of you staff annual reviews? (See 5.7.4)		

Appendix 02 – BREEAM Green Building Guide

1.0 Introduction

The Green Building Guide is a formal, but non-legally binding document, providing guidance to the retailer on carrying out their fit out in a manner that upholds the BREEAM criteria. The guide encourages retailers to play their role in maintaining and improving the overall buildings environmental performance. As part of the retail unit documentation, the landlord will provide the retailer with a copy of this Green Building Guide.

The following guidance *must* be reviewed by the retailer.

This document is based on BREEAM New Construction 2011 Technical Manual version 2.0 and applies specifically to the retail criteria.

This document specifically gives guidance and recommendations for the following BREEAM credits:

Health and Wellbeing

Issue ID	Issue	Credits(s)
Hea 01	Visual Comfort	Pre-requisite Glare Control and View Out
Hea 02	Indoor Air Quality	VOCs (Specification) VOCs (Measurement)
Hea 03	Thermal Comfort	Thermal Modeling Thermal Zoning and Control Strategy
Hea 04	Water Quality	Minimising risk of Contamination and Provision of Drinking Water

Energy

Issue ID	Issue	Credits(s)
Ene 02	Energy Monitoring	Monitoring of Major Energy Consuming Systems
Ene 03	External Lighting	External Lighting Specification
Ene 04	Energy Efficient Cold Storage	Refrigeration Design, Install and Commissioning Indirect Greenhouse Gas Emissions Savings
Ene 05	Energy Efficient Transportation Systems	System Analysis and Strategy Transportation Features
Ene 06	Energy Efficient Equipment	Small Plug in Power and Catering Equipment

Water

Issue ID	Issue	Credits(s)
Wat 02	Water Monitoring	All criteria
Wat 03	Water Leak Detection and Prevention	Flow Control Device to Each WC Area

Materials

Issue ID	Issue	Credits(s)
Mat 04	Insulation	Embodied Impact, Insulation Index Responsible Sourcing
Mat 05	Designing for Robustness	All criteria

Pollution

Issue ID	Issue	Credits(s)
Pol 01	Impact of Refrigerants	Global Warming Potential Leak Detection and Prevention
Pol 02	NOx Emissions	NOx Emissions Levels
Pol 04	Reduction of Night Time Light Pollution	External Lighting Specification
Pol 05	Noise Attenuation	Noise Impact Assessment and Attenuation Measures

2.0 Health and Wellbeing

The following section provides guidance with the intent of improving the health and wellbeing of the retail staff and customers.

Hea 01 Visual Comfort

The retailer should consider the following measures to improve the visual comfort within their area.

High Frequency Ballasts

It is recommended that all f uorescent and compact f uorescent lamps are fitted with high frequency ballasts.

High frequency ballasts increase the frequency of the power coming from the grid (50Hz) to a frequency optimising the performance of f uorescent lamps, typically around 30 kHz.

There are several advantages to running f uorescent lamps at higher frequencies:

- At 30 kHz, the frequency of re-ignition of a f uorescent lamp is too quick to be detected by the human eye, therefore reducing visible f icker.
- 30 kHz is above the audible range of the human ear, therefore avoiding the buzzing noise from low quality main frequency ballasts.
- Finally, the luminous efficacy of f uorescent lamps increases with frequency; it can be improved by up to 10% when they are running at 30 kHz compared to those operating at 50 Hz.

Glare Control and View Out

Glare control should be considered as part of the retailers fit out and it is recommended that a glare control strategy is developed in tandem with the lighting strategy to ensure that glare is minimised whilst avoiding potential conf ict with the lighting control systems, therefore avoiding higher than expected energy consumption.

It is recommended that desk areas (where provided) are located within 7m of a wall which has a window or permanent opening that provides an adequate view out (e.g. visible landscape or buildings at seated eye level through an external window, not an internal view across the room or a view of just the sky).

For good practice, it is recommended that the following areas are compliant with the following standards and guides:

Area	Specified in Accordance to
All Internal Relevant Building Areas	CIBSE Code for Lighting 2009
Areas Where Computer Screens are Regularly Used	CIBSE Lighting Guide 7
External Lighting	BS5489-1:2003+A2:2008 Lighting of roads and public amenity areas.

Hea 02 Indoor Air Quality

The retailer should consider implementing the following measures to improve indoor air quality within their area.

Minimising Sources of Air Pollution: VOCs (Specification)

Volatile Organic Compounds (VOCs) are emitted by a wide array of products. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, glues and adhesives, Urea-formaldehyde foam insulation (UFFI), pressed wood products (hardwood plywood wall paneling, particleboard, fibreboard) and furniture made with these pressed wood products.

It is recommended that all decorative paints and varnishes, and other finishing products listed, where specified by the retailer, meet the requirements listed in the table below:

Minimum Performance Requirements

Product	European Standard	Emission Level
Decorative paints and varnishes	BS EN 13300:2001 referred to the criteria of Decorative Paint Directive 2004/42/CE	VOC (organic solvent) content (Testing req. 6), requirement for Phase 2. Fungal and algal resistant.
Wood Panels • Particleboard • Fiberboard including MDF • OSB • Cement-bonded particleboard • Plywood • Solid wood panel and acoustic board	EN 13986:2004	Formaldehyde E1 in accordance with EN 13986:2004 Annex B Verify that regulated wood preservatives are absent as defined by the standard.
Timber Structures • Glued laminated timber	EN 14080:2005	Formaldehyde E1 (Testing req 1)
Wood flooring • e.g. parquet flooring	EN 14342:2005	Formaldehyde E1(Testing req 1) Verify that regulated wood preservatives are absent and of the minimum content.
Suspended ceiling tiles	EN 13964:2004	Formaldehyde E1 (Testing req 1) No asbestos.
Flooring adhesives	EN 13999-1:2007	Verify that carcinogenic or sensitising volatile substances are absent (Testing req. 2-4).
Wall-coverings • Finished wallpapers • Wall vinyl's and plastic wall coverings • Wallpapers for subsequent decoration. • Heavy duty wall-coverings • Textile wall-coverings	EN 233:1999 EN 234:1997 EN 259:2001 EN 266:1992	Formaldehyde (Testing req. 5) and Vinyl chloride monomer (VCM) (Testing req. 5) release should be low and within the EN standard for the material. Verify that the migration of heavy metals (5) and other toxic substances are within the BS EN standard for the material.
Adhesive for hanging flexible wall coverings	BS 3046:1981	No harmful substances and preservatives used should be of minimum toxicity
Testing requirement: 1. EN 717-1:2004 2. EN 13999-2:2007 - Volatile Organic Compounds (VOCs) 3. EN 13999-3:2007 - Volatile aldehydes 4. EN 13999-4:2007 - Volatile diisocyanates 5. EN 12149:1997 6. BS EN ISO 11890-2:2006		

Minimising Sources of Air Pollution: VOCs (Testing)

It is recommended that formaldehyde concentration level is measured after the retail fit out is complete (but pre-occupancy). Good practice and adherence to the above standards should result in a concentration level less than or equal to 100µg/m^3 averaged over 30 minutes.

The total volatile organic compound (TVOC) concentration is measured post construction (but pre-occupancy) and found to be less than 300µg/m^3 over 8 hours, in line with the Building Regulation requirements.

Where levels are found to exceed these limits, it is recommended that the project team undertakes measures in accordance with the Indoor Air Quality plan (where available), to reduce the TVOC and formaldehyde levels to within the above limits.

The testing and measurement of the above pollutants should be in accordance with the following standards where relevant:

- BS EN ISO 16000-4: 2004 Diffusive sampling of formaldehyde in air.
- EN ISO 16000-6 VOCs in air by active sampling.
- BS EN 16017-2: 2003 VOCs - Indoor, ambient and workplace air by passive sampling.
- BS EN ISO 16000-3: 200136 formaldehyde and other carbonyls in air by pumped sampling.

Hea 03 Thermal Comfort

To ensure the retail fit out provides a comfortable thermal environment for the building users it is recommended that thermal modeling is carried out using software in accordance with CIBSE AM11 Building Energy and Environmental Modeling, 1998.

The thermal modeling should demonstrate that the fit out design and services strategy can deliver thermal comfort levels in occupied spaces in accordance with the criteria set out in CIBSE Guide A Environmental Design (2007) or another appropriate industry standard.

For larger retail units, a full dynamic thermal analysis may be appropriate. However, for smaller and more basic building designs with less complex heating / cooling systems, an alternative less complex means of analysis may be appropriate.

For good practice it is recommended that the retailer's area complies with any requirement, in terms of "time out of range" (TOR) metric, from an appropriate industry standard (e.g. CIBSE Guide A) OR where there is no appropriate industry standard available or TOR recommendation made, a building services engineer confirms that the TOR is acceptable for the purpose and function of the building.

The time of range (TOR) describes the amount of time (hours) the temperature within the retail areas, during the hours of occupation, are outside of an acceptable temperature range (as defined in an appropriate industry standard), determined via building simulation/ modeling (in accordance with relevant BS, EN, ISO compliant methods) or direct measurement (in the case of an occupied building).
If thermal modeling analysis is completed as recommended above, it is advised that the analysis should inform the temperature control strategy for the fit out and the users.

The strategy for proposed heating / cooling system(s) should consider the following:

- Zones within the building and how the building services could efficiently and appropriately heat or cool these areas e.g. the different requirements for the central core of a building compared with the external perimeter adjacent to the windows.
- The amount of occupant control required for these zones, based on the requirements of the retailer, including consideration of:
- Retailer knowledge of building services.
- Occupancy type, patterns and room functions (and therefore appropriate level of control required).
- How the retailer is likely to operate/interact with the system(s) e.g. likeliness to open windows, access TRV's on radiators, change air conditioning settings etc.
- The retailer expectations (e.g. this may differ in the summer and winter; people tend to accept warmer internal conditions in the summer) and degree of individual control (i.e. obtaining the balance between occupant preferences, for example, some occupants like fresh air and others dislike drafts).
- How the proposed systems will interact with each other (where there is more than one system) and how this may affect the retailer and other building user's thermal comfort.
- The need or otherwise for an accessible building user actuated manual override for any automatic systems.

Hea 04 Water Quality

The retailer should consider the following measures to improve water quality within their area.

Building Services Water Systems: Minimising Risk of Contamination

To minimise the risk of Legionnaires' disease it is recommended that all water systems in the building are designed in compliance with the measures outlined in the Health and Safety Executive's "Legionnaires' disease - The Control of Legionella Bacteria in Water Systems". Approved Code of Practice and Guidance, 2000 and, where relevant other industry/sector best practice guidance.

Where humidification is required, a failsafe humidification system is recommended.

Building occupants: Provision of fresh drinking water

It is recommended that fresh drinking water is provided for the retailer's staff in each kitchenette or in a suitable location on each f oor level through either:

- Chilled, mains-fed point-of-use water supply.
- Point-of-use water coolers.

3.0 Energy

The following section describes measures the retailer could consider as part of the retailer fit out of the retail space to improve the energy performance of their area.

Ene 02 Energy Monitoring

As part of the retail fit out it is recommended that the following major energy consuming systems (where present) are monitored using either a Building Energy Management System (BEMS, a central computer controlling, monitoring and optimising building services and systems such as heating, air-conditioning, lighting and security) or separate accessible energy sub-meters with a pulsed output to enable future connection to a BEMS:

- Space Heating
- Domestic Hot Water
- Humidification
- Cooling
- Fans (major)
- Lighting
- Small Power (lighting and small power can be on the same sub-meter where supplies are taken at each f oor/department).
- Other major energy-consuming items where appropriate.

The end energy consuming use should be identifiable to the retailer through labeling or data outputs.

Ene 03 External Lighting

The following external lighting minimum standards are provided as recommended guidance for the retail fit out of the building (where applicable). It is anticipated that the retailer fit out may only specify signs, uplighting and lighting controls.

External Light Fittings	Luminous Efficacy (lamp lumens/ circuit Watt)	Lamp Colour Rendering Index (Ra)	Lamp Wattage (W)
Building, Access Ways and Pathways	50	> 60	N/A
Car Parking Areas	70	> 60	N/A
Signs and Uplighting	60	N/A	> 25

It is recommended that external light fittings are controlled through a time switch, or daylight sensor, to prevent operation during daylight hours. A suitable method to ensure this is to specify a daylight sensor override on a manually switched lighting circuit.

Ene 04 Energy Efficient Cold Storage

Note: This guidance is only applicable to retail spaces that include cold storage units (e.g. the storage and refrigeration of food).

It is recommended that if the retailer specifies a refrigeration system for use within their area, its controls and components should be designed, installed and commissioned as follows:

- In accordance with the Commercial Refrigeration Code of Conduct for Reducing Carbon Emissions Commercial Refrigeration Code of Conduct for Reducing Carbon Emissions.
- Use robust and tested refrigeration systems/components, normally defined as those included on the Enhanced Capital Allowance (ECA) Energy Technology Product List www.eca.gov.uk or an equivalent list.

To demonstrate best practice it is advised that the refrigeration plant is commissioned to comply with the following criteria:

- An appropriate project team member(s) should be appointed to monitor and programme; pre-commissioning, commissioning and, where necessary, re-commissioning on behalf of the retailer.
- The cold storage unit should be included in the commissioning schedule and commissioning is to be carried out in line with current Building Regulations, BSRIA and CIBSE guidelines and/or other appropriate standard, where applicable.
- The retailer's contractor should take account of the commissioning responsibilities and the Landlords criteria within their main programme of works.
- A specialist commissioning manager should be appointed during the design stage (by either client or contractor) for complex cold storage systems and the scope of their responsibility could include:

- Design input: commissionability design reviews.
- Commissioning management input to construction programming.
- Commissioning management input during installation stages.
- Management of commissioning, performance testing and handover/post-handover stages.

With reference to The Carbon Trust Refrigeration Road Map the installed refrigeration system should demonstrate a saving in indirect greenhouse gas emissions (CO_2) with respect to the 'baseline' building through specification of technologies described in 'CO_2 saving options available when designing a new store/retail concept'.

For further information please refer to:
www.carbontrust.com/resources

Ene 05 Energy Efficient Transportation Systems

The retailer should consider the following transportation efficiency measures when (and if) specifying lifts, escalators and moving walkways as part of their fit out.

Transportation Demand Analysis

It is recommended that an analysis of the transportation demand and usage patterns for the retail space has been carried out by the retailers design team to determine the optimum number and size of lifts (including counter-balancing ratio), escalators and/or moving walks.

In order to compare strategies it is recommended that the energy consumption is estimated for at least one of the following:

- At least two types of system (for each transportation type required)
- An arrangement of systems (e.g. for lifts, hydraulic, traction)
- A system strategy which is 'fit for purpose' (scheduling)

To demonstrate best practice, the lift/escalator/moving walk system/ strategy with the lowest energy consumption should be specified.

Energy Efficient Lifts

For lifts, of the following energy-efficient features, it is recommended that the three that offer the greatest potential energy savings are specified (following the transportation demand analysis above):

- The lifts operate in a stand-by condition during off-peak periods. For example the power side of the lift controller and other operating equipment such as lift car lighting, user displays and ventilation fans switch off when the lift has been idle for a prescribed length of time.
- The lift car uses energy-efficient lighting and display lighting i.e. an average lamp efficacy, across all fittings in the car, of >55 lamp lumens/ circuit watt and lighting switches off after the lift has been idle for a prescribed length of time.
- The lift uses a drive controller capable of variable-speed, variable-voltage, variable-frequency (VVVF) control of the drive motor.
- The lift has a regenerative drive unit so that any energy generated by a traction lift (due to running up loaded to less than the counterbalancing ratio or running down loaded to more than the counter balancing ratio) or by a hydraulic lift (due to running down) is returned back to the electricity utility supplier or used elsewhere in the building.

Energy Efficient Escalators and/or Moving Walks

For best practice it is recommended that the retailer specifies any escalators and/or moving walks installed as part of the fit out with either of the following:

- It is fitted with a load sensing device that synchronises motor output to passenger demand through a variable speed drive. OR
- It is fitted with a passenger sensing device for automated operation (auto walk), so the escalator operates in stand-by mode when there is no passenger demand.

Ene 06 Energy Efficient Equipment

It is anticipated that the significant majority of the unregulated energy consumption within the retail area will be from small power/plug in equipment (i.e. as cash registers) and kitchen and catering facilities (kitchenettes for staff or larger equipment for A3 retail units).

It is recommended that the retailer considers the following criteria when specifying the appliances as part of their fit out.

Function	Criteria
Small Power/ Plug In Equipment	It is recommended that office equipment, domestic scale white goods and supplementary electric heating qualifies for one of the following: • Enhanced Capital Allowance Scheme (i.e. is on the Energy Technology Product List, ETPL) • The Energy Star labeling scheme rating • Procured in accordance with the Government Buying Standards • Identified as products with at least a 'green tick' standard on the Buying Solutions website.
Kitchen and Catering Facilities	Energy efficiency measures the retailer could implement are outlined in the following sections of CIBSE Guide TM50: • Section 8 (Drainage and kitchen waste removal) • Section 9 (Energy controls - specifically controls relevant to equipment) • Section 11 (Appliance specification, fabrication specification - not utensil specification) • Section 12 (Refrigeration) • Section 13 (Ware washing: dishwashers and glass washers) • Section 14 (Cooking appliance selection) • Section 15 (Water temperatures, taps, faucets and water saving controls)

4.0 Water

The following section describes water related measures the retailer could consider as part of the retailer fit out of the retail space.

Wat 02 Water Monitoring

To ensure water consumption can be monitored and managed, and therefore encouraging reductions in water consumption, it is recommended that the retailer specifies the following water monitoring equipment as part of the retailer fit out:

- A water meter on the mains water supply to the retail area; this includes instances where water is supplied via a borehole or other private source.
- Water-consuming plant or retail areas, consuming 10% or more of the retailer's total water demand, are either fitted with sub meters or have water monitoring equipment integral to the plant or area.
- Meters (and sub-meter where applicable) should be specified with a pulsed output to enable connection to a Building Management System (BMS) for the monitoring of water consumption.

Where a BMS exists on-site as part of the wider retail area, the retailer should attempt to connect the water monitoring meters to the site-wide BMS system.

Wat 03 Water leak detection and prevention

To prevent minor water leaks it is recommended that one of the following types of f ow control device is fitted to each WC area/ facility to ensure water is supplied only when needed:

- A time controller i.e. an automatic time switch device to switch off the water supply after a predetermined interval.
- A programmed time controller i.e. an automatic time switch device to switch water on and/or off at predetermined times.
- A volume controller i.e. an automatic control device to turn off the water supply once the maximum preset volume is reached.
- A presence detector and controller i.e. an automatic device detecting occupancy or movement in an area to switch water on and turn it off when the presence is removed.
- A central control unit i.e. a dedicated computer-based control unit for an overall managed water control system, utilising some or all of the types of control elements listed above.

5.0 Materials

The following section describes material related measures the retailer is recommended to consider implementing as part of the retailer fit out.

Mat 04 Insulation

The retailer should consider the following insulation information when (and if) specifying insulation as part of their fit out.

Embodied Impact

It is recommended that any new insulation specified for use within the following building elements is assessed in terms of its embodied environmental impact:

- External walls
- Ground f oor
- Roof
- Building services

The Green Guide rating for the thermal insulation materials is considered good practice in the industry to determine the environmental impact. Green Guide ratings for thermal insulation can be found at: **www.thegreenguide.org.uk**

To demonstrate good practice, the Insulation Index for the building insulation should be at least 2. To calculate the Insulation Index please refer to the following methodology:

For each type of thermal insulation used in the relevant building elements, the volume weighted thermal resistance provided by each type of insulation can be calculated as follows:

= Total volume of insulation used (m^3) / Thermal conductivity (W/m.K)

The volume weighted thermal resistance for each insulation material is then multiplied by the relevant Green Guide point(s) from the following table to give the Green Guide Rating corrected value:

Green Guide Rating	Point/Element
A+	3.0
A	2.0
B	1.0
C	0.5
D	0.25
E	0.0

To calculate the Insulation Index, the sum of the Green Guide rating corrected values for all insulating elements is divided by the sum of the volume weighted thermal resistance values.

Responsible Sourcing

It is recommended that at least 80% by volume of the thermal insulation used in the building elements (as previously identified) should be responsibly sourced e.g. each insulation product manufacturer could operate an Environmental Management System (EMS) or achieve certification with the BRE's BES6001 product/ standard specification.

The table below shows the key processes and supply chain processes required for common insulation products.

Material	Key Process	Supply chain processes
Foam Insulation	Insulation manufacture	Principal Polymer production, e.g. Polystyrene, MDI , Phenolic resin or equivalent
Stone wool, glass & cellular glass made using < 50% recycled input	Product manufacture	Any quarried or mined mineral over 20% of input
Wool	Product manufacture	Wool scouring
Products using > 50% recycled content except those using timber	Product manufacture	Recycled content by default
Timber-based insulation materials including those using recycled timber	Product manufacture	Recycled timber by default, all other timber from one of the recognised timber certification schemes (e.g. FSC).
Other renewable-based insulation materials using agricultural by-products (e.g. straw)	Product manufacture	By-product manufacture by default
Any other product	Product manufacture	1 or 2 main inputs with significant production or extraction impacts should be identified

Mat 05 Designing for Robustness

When considering the retail fit out, it is recommended that the spaces within the retail area are identified (both internal and external) where vehicular, trolley and pedestrian movement are likely to occur.

The fit out design should consider suitable durability and protection measures or design features/solutions to prevent damage to the vulnerable parts of the retail area. It is recommended that this includes, but is not necessarily limited to:

- Protection from the effects of high pedestrian traffic in main entrances, public areas and thoroughfares (corridors, lifts, stairs, doors etc.)
- Protection against any internal vehicular/trolley movement within 1m of the internal building fabric in storage, delivery, corridor and kitchen areas.
- Protection against, or prevention from, any potential vehicular collision where vehicular parking and maneuvering occurs within 1m of the external building façade for all car parking areas and within 2m for all delivery areas.

It is anticipated that suitable durability and protection measures to vulnerable parts of the retail area would include:

- Corridor walls specified to Severe Duty (SD) as per BS 5234-2BS 5234-2.
- Protection rails to walls of corridors.
- Kick plates/impact protection (from trolleys etc.) on doors.
- Hard-wearing and easily washable f oor finishes in heavily used circulation areas (i.e. main entrance, corridors, public areas etc.)
- Designing out the risk without the need for additional materials specification to protect vulnerable areas.

In sales areas, where customer goods trolleys will be used, it is recommended that protection is provided to vulnerable parts of the building (such as glass curtain walling etc.) within 1m of trolley movement.

6.0 Pollution

The following section describes pollution mitigation measures the retailer is recommended to implement as part of the retailer fit out specification.

Pol 01 Impact of Refrigerants

Note: Where the retail area does not require the use of refrigerants within its installed plant/systems this guidance is not applicable.

Refrigerant Use within the Retail Area

Consideration should be given to the specification, use and maintenance of systems containing refrigerants due to their potentially high Global Warming Potential (GWP).

Hydrocarbons and ammonia-based refrigerants have low or zero GWP and are therefore preferred long-term options. These are now widely available and are valid alternatives to HFCs in all buildings, provided health and safety issues are fully addressed.

There are three main types of refrigerants:

1. Hydrogenated Fluorocarbon Refrigerants (HFCs) are made up of hydrogen, f uorine, and carbon. Because they do not use a chlorine atom (which is used in most refrigerants) they are known to be one of the least damaging to our ozone.

2. Hydrogenated Chlorof uorocarbon Refrigerants (HCFCs) are made up of hydrogen, chlorine, f uorine, and carbon. These refrigerants contain minimal amounts of chlorine; they are not as detrimental to the environment as some other refrigerants.

3. Chlorof uorocarbon Refrigerants (CFCs) contain chlorine, f uorine and carbon. These refrigerants carry high amounts of chlorine so they are known for being the most hazardous to the ozone layer.

Global Warming Potential (GWP) is defined as the potential for global warming that a chemical has relative to 1 unit of carbon dioxide, the primary greenhouse gas. In determining the GWP of the blowing agent, the Intergovernmental Panel on Climate Change (IPCC) methodology using a 100-year Integrated Time Horizon (or ITH) should be applied.

The following table lists substances which are capable of acting as refrigerants. Many are not currently used as such and some have been phased out and withdrawn from the market. The asterix (*) denotes refrigerants that have an ozone depleting potential (ODP) greater than 0 and are illegal for new installations.

Ozone Depleting Potential (ODP) is the ratio of the relative amount of degradation to the ozone layer caused by a particular substance relative to the calculated depletion for the reference gas CFC 11 (ODP = 1.0).

Refrigerant	GWP	Refrigerant	GWP
R11 (CFC-11) *	4000	R32 (HCFC-32)	580
R12 (CFC-12) *	8500	R407C (HFC-407)	1600
R113 (CFC-113)	5000	R152a (HFC-152a)	140
R114 (CFC-114) *	9300	R404A (HFC blend)	140
R115 (CFC-115)*	9300	R410A (HFC blend)	3800
R125 (HFC-125)	3200	R413A (HFC blend)	1900
Halon-1211	n/a	R417A (HFC blend)	1770
Halon-1301	5600	R500 (CFC/HFC) *	1950
Halon-2402	n/a	R502 (HCFC/CFC) *	6300
Ammonia	0	R507 (HFC azeotrope)	5600
R22 (HCFC-22) *	1700	R290 (HC290 propane)	3800
R123 (HCFC-123) *	93	R600 (HC600 butane)	3
R134a(HFC-134a)	1300	R600a (HC600a isobutane)	3
R124 (HCFC-124) *	480	R290/R170 (HC290/HC170)	3
R141b (HCFC-141b) *	630	R1270 (HC1270 propene)	3
R142b (HCFC-142b) *	2000	R143a (HFC-143a)	4400

The Global warming potential (GWP) values in the above table are based on best available data at the time of writing and are based on a 100-year time horizon. Other published data may be based on different time horizons.

It is recommended that where air-conditioning or refrigeration systems are installed the refrigerants used should have a Global Warming Potential (GWP) no greater than 10.

To further demonstrate good practice for the systems using refrigerants, the retailer could specify that the refrigerants have Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_2e) of ≤1000 $kgCO_2e/kW$ cooling capacity.

For further information regarding this target please consult the BREEAM 2011 New Construction Technical Guidance Manual as referenced at the beginning of this document (Pol 01 Impact of Refrigerants, Page 309-315) for a detailed calculation methodology and definitions.

As guidance, the following principles are recommended for consideration when specifying systems with refrigerants, to reduce the Direct Effect Life Cycle CO_2 equivalent emissions:

- Minimise Refrigerant Global Warming Potential (GWP, see previous notes).
- Minimise Refrigerant Charge (the mass of refrigerants used in the system).
- Minimise Refrigerant losses (leakage, purge release, service release and failure release).

Preventing Refrigerant Leaks

To reduce the impact of refrigerants (where specified) leaking into the environment when leaks occur, the following options are recommended for specification:

- Systems using refrigerants can be contained in a moderately air tight enclosure (or a mechanically ventilated plant room), and equipped with an automated permanent refrigerant leak detection system covering high-risk parts of the plant.
- A refrigerant leakage/charge loss detection system.

It is recommended that the refrigerant detection system (if) specified by the retailer includes the following features:

- The automatic shutdown and pump down of refrigerant occurs on the detection of refrigerant leakage/charge loss.
- Automatic pump-down to either a separate storage tank or into the heat exchanger where automatic isolation valves are fitted to contain the refrigerant once fully pumped down.
- The alarm threshold that triggers automatic pump down upon detection of refrigerant in the plant room/enclosure is set to a maximum of 2000ppm (0.2%).
- Use a robust and tested automated permanent refrigerant leak detection system, normally defined as that included on the Enhanced Capital Allowance (ECA) Energy Technology Product List (or an equivalent list).

Pol 02 NOx Emissions

Where the retailer specifies and installs plant to meet the retail area's heating and cooling demand it is recommended that the heating and cooling plant, under normal operating conditions, have a dry NOx emission level (measured at 0% excess O_2) less than 100mg/kWh for good practice. For best practice this figure should be below 40mg/kWh.

Where the heating and cooling systems specified by the retailer are electrically driven (e.g. air source heat pumps) the targets in this guidance are considered unattainable as the NOx emissions attributed to grid electricity are considered significant.

Pol 04 Reduction of Night Time Light Pollution

Note: Where no external lighting is specified by the retailer as part of their fit out, this guidance is not applicable.

It is recommended that the external lighting strategy (where specified) is designed in compliance with Table 1 (and its accompanying notes) of the ILE Guidance notes for the reduction of obtrusive light, 2005.

To demonstrate good practice, all external lighting (except for safety and security lighting) should be able to be automatically switched off between 2300hrs and 0700hrs. This can be achieved by providing a timer for all external lighting set to the appropriate hours.

If safety or security lighting is provided and will be used between 2300hrs and 0700hrs, it is advised that this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 1 of the ILE's Guidance notes, for example by using an automatic switch to reduce the lighting levels at 2300 or earlier.

If the retailer specifies illuminated advertisements, it is recommended that they are designed in compliance with ILE Technical Report 5 – The Brightness of Illuminated Advertisements 2001 Pol 05.

Pol 05 Noise Attenuation

Note: Where there are no noise sensitive areas or buildings within an 800m of the retail area this guidance is not applicable.

It is recommended that a noise impact assessment in compliance with BS 7445:1991 is carried out (if not done so already) and the following noise levels measured/determined:

- Existing background noise levels at the nearest or most exposed noise-sensitive development to the retailer's area or at a location where background conditions can be argued to be similar.
- The rating noise level resulting from the new noise-source.

The noise impact assessment should be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body (e.g. the Institute of Acoustics).

The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, should be a difference no greater than +5dB during the day (0700hrs to 2300hrs) and +3dB at night (2300hrs to 0700hrs) compared to the background noise level.

Where the noise source(s) from the proposed site/building is greater than the levels described, it is recommended that measures are installed to attenuate the noise at its source to a level where it will comply.

Appendix 03 – Schedule of Assumptions

The following design assumptions have been used in the comparative tables within this document.

Energy Source	Cost
Electricity	11.0p/kWh
Gas	4.5p/kWh

Source	Carbon Content
Electricity	0.517g CO_2/kWh
Gas	0.194g CO_2/kWh

The figures used for the fan coil unit system assumes conventional generation of heating and chilled water (gas boilers and electric chillers). These figures could be improved with the use of CHP (combined heat and power) and/or absorption chillers (Trigeneration) to provide a lower carbon solution.

Capital cost figures are for installation within the shop unit only and exclude costs of landlords systems i.e. it excludes such items as plate heat exchangers.