Foreword

The beauty, quality and rich heritage of the buildings of Mayfair and Belgravia are cause for admiration and delight. The Estate was carefully planned to create the finest locations in London and it has evolved in response to the particular demands and aspirations of its original and current, past and present occupiers. Now we share a similar responsibility to respond to the needs and concerns of today’s and tomorrow’s occupiers. We need to take account of world-wide concerns about a planet in a dramatic state of flux which places demands on us all to address substantial environmental and social issues.

While significant progress has been made in improving the sustainability of new buildings, improving the environmental performance of existing buildings, and particularly historic buildings, has proved to be much more challenging. It is for this reason that we decided to produce this simple guide designed for building owners who may be contemplating renovating their property, either in part or in whole, who want to be able to improve the environmental performance of their building but are not quite sure where to start or what to prioritise first.

While this toolkit is not intended to be a comprehensive guide to retrofitting your property, we hope that both you and your appointed consultants will find it helpful in assessing your options and opportunities. Many of the techniques, products and approaches illustrated in the guide have been used by Grosvenor on its own development projects and refurbishment schemes and we would be delighted to have input into, and to receive feedback on, your own projects.

Nigel Hughes, FRICS
The Estate Surveyor, Grosvenor
January 2013
The sketch above is intended to demonstrate the potential pitfalls to occupant comfort when a refurbishment comprises only minimal interventions to fabric, and where the original services are retained. Inefficient old buildings are of primary concern, especially where existing single-glazed windows are not upgraded as this can allow for draughts and cold spots. Noise pollution, lack of occupant control over internal temperatures and the presence of harmful emissions from fabrics and finishes are also common problems.

This second sketch demonstrates the enhanced environment that can be created through a carefully planned and managed sustainable refurbishment. Unwanted noise, draughts and cold spots are eliminated through high quality building fabric. Occupant control over internal temperatures is provided through thermostats and local controls. Services have been upgraded to incorporate efficient appliances and renewable technologies, thus reducing the overall energy demand of the home.
1.0 Executive Summary

Introduction

Refurbishments to properties present ideal opportunities to take advantage of sustainable technologies that not only improve the environmental performance of a building but also benefit the occupants in terms of thermal comfort, user control, lighting, acoustics, aesthetics, health considerations and financial value. The aim of this document is to inform residents of Grosvenor’s London estate of the key sustainable measures to consider when undertaking residential refurbishments.

The document is broken down into a ‘toolkit’, with advice specific to building elements such as windows and walls, as well as lighting or electrical systems. For each element, design considerations and sustainable product solutions are provided, incorporating best practice guidelines for sourcing where relevant. Case studies describing Grosvenor schemes that have taken advantage of sustainable solutions have also been provided, to convey an understanding of how these can be implemented in historic properties within conservation areas such as Mayfair and Belgravia.

For a site-specific solution, design development with qualified professionals is necessary to ensure that the approach is appropriate to the location and site-specific factors such as occupant profile and historic features. The refurbishment of residential property on the estate is also subject to the Grosvenor approvals process as well as a large number of local and national regulations, the most relevant of which are outlined in the appendices at the end of the guide. A glossary and references to relevant publications have been provided, as well as a description of BREEAM Domestic Refurbishment, a widely recognised certification scheme for sustainable projects.

This document is to be treated as a guide only; it is not prescriptive. Its employment does not guarantee approval of alterations from Grosvenor or any other statutory body. Grosvenor does not take any responsibility for the effectiveness of measures outlined in this guidance document.
The following section is broken down into the key elements of refurbishment and describes the opportunities available for making improvements that will benefit the occupant and improve the environmental performance of the building. For each topic (see opposite), a flowchart of considerations is provided, leading to a set of product solutions where relevant. In some instances, permission from the Local Authority is required for undertaking certain works; this has been highlighted where applicable. With respect to listed buildings, the Local Authority treats each case on merit and it is important to consult with the local planning officer when making alterations beyond simple cosmetic maintenance.

Where appropriate, the options have been split into ‘passive’ and ‘active’ measures. ‘Passive’ measures are changes to the building that can generally work without an energy supply, such as insulation; ‘active’ measures usually require a form of energy to function, such as a gas boiler and radiators. It is often preferable to implement passive measures first, as this will enable the building to stabilise and self-regulate, as opposed to relying heavily on an active energy source.

The case studies have been included to provide examples of where sustainable measures have been incorporated into refurbishment works. Some are located on the Grosvenor estate and have achieved certification under the BREEAM or EcoHomes environmental assessment scheme, a description of which can be found on page 45. Others are located in historic environments elsewhere in London. The case studies are located on the following pages:

12 Wilton Mews 10
11 Grosvenor Crescent Mews 12, 18, 23
15 Passmore Street 14, 16
Insulated roof space 20
Heritage Windows 22
117E Eaton Square 23
147 & 149 Ebury Street 24
Secondary glazing 26
100 Prince’s Road 28
3-10 Grosvenor Crescent 32
58 Park Street 36
10 Hawthorn Road 40
120 Mount Street 41

The sketch above lists the pages covering the key aspects of refurbishment in the report. Interspersed within these are case studies of various Grosvenor and non-Grosvenor properties.
When upgrading the lighting and electrical systems, what measures can be implemented to provide occupant benefit and save energy?

**Passive measures:**

1. **Using daylight**
   - Aside from saving energy, daylight is known to have a positive impact on health and wellbeing. It is possible to optimise daylight levels by painting window sills and openings white and by ensuring window openings are free from obstruction. Consider installing conservation-style roof lights to bring daylight into stairwells and roof spaces and using light reflecting paint on walls to reduce the need for electrical lighting.

2. **Monitor usage**
   - Real time electricity consumption can be easily determined through the installation of a fixed energy monitor in a visible location within the property.
   - Devices can display current and historic energy use in kilowatt-hours, as well as current and projected costs and associated levels of carbon emission.
   - Packages are now available that also allow users to view their consumption data online.

3. **Smart controls**
   - Introducing a central switching unit for the household lighting and electrical system can allow increased occupant-control over lighting and energy as well as reducing waste levels. These ‘power down’ switches can be located at the front door, to enable users to turn off non-essential electricals when exiting the home, leaving important appliances such as fridges and freezers on.

**Active measures:**

4. **Replacement of lighting**
   - Consider replacing traditional household bulbs with high performance, energy efficient alternatives.
   - Traditional filament bulbs and halogens can easily be replaced with highly efficient LED lamps, which emit between 60 and 70 lumens per Watt. These products give the same colour rendering and dimmability of traditional bulbs, but use much less power.

5. **Get the right mix**
   - Choose lighting carefully, or consult a lighting designer to ensure the right combination of task, feature and ambient lighting is created.
   - Look for products with a colour rendering index (CRI) of 80+ for a warm light in living and bedrooms, and around 70 for a cooler light in kitchens and bathrooms. On light bulb packaging this information is displayed as a colour scale, with an indicator showing the Kelvin value of the bulb. The lower this value, the warmer the light.

6. **Efficient appliances**
   - The EU Energy Efficiency label gives information on a product’s performance, with a rating from A+++ to D. Best practice appliances come with the following ratings:
     - Fridge-freezers: A++
     - Dishwashers: A+
     - Washing machines: A+++ 
     - Washer-dryers: A
     - Dryers: A
     - Ovens: A
     - Microwave: A
Current supply-chains mean that products are available that not only accommodate personal taste but also minimise environmental impacts; an example of this is the wide availability of sustainably-sourced timber. In addition, modern labelling conventions can enable consumer-awareness of the presence of potentially harmful Volatile Organic Compounds (VOCs).

Repair and renewal works do not normally require consent from Grosvenor where identical materials and finishes are being used. Minor alterations including new kitchens, bathrooms and cupboards are also exempt from the approvals process.

For listed buildings, permission is required for any internal works beyond simple redecoration. The removal or alteration of historic features such as panelling, cornicing or ceiling roses is generally prohibited and their maintenance should be carried out by an experienced professional. In addition, Grosvenor’s External Appearance Policy outlines the requirements for external paint finishes on the estate; see page 42 for more information.

2.2 Redecorating and Choosing Materials

When redecorating and choosing materials, what environmental standards are available to set the bar for sourcing materials and products?

Internal finishes:

1. Paint
   Microporous paints are ideal for use in older houses where they will help prevent high internal moisture levels. They are also safe for use in children’s and family rooms due to their low VOC (see glossary) content.
   Consider both plant-based water-borne and plant-based solvent borne paints for best results. These paints can also be used for woodwork and metal.

2. Floor finishes
   Select floor finishes made from natural or recycled materials and that have a low VOC content. Low-VOC adhesives are also widely available.
   Natural coverings made from wool, coir, jute and seagrass are among the best available options. Consider those which demonstrate quantifiable environmental data, based on ISO 14040:2006. Note that where synthetic materials are used, VOC emissions from finishes and adhesives are at their highest in the days immediately following installation.

Structural materials:

3. Joinery
   Timber finishes and furniture that come FSC (Forest Stewardship Council) or PEFC (Programme for the Endorsement of Forest Certification) certified are sourced legally and sustainably. Where MDF (Medium Density Fibreboard), plywood or particle board is used in joinery, specify products that have low VOC contents and are pre-cut to avoid high levels of dust or harmful irritants inside the property.

4. Timber
   When specifying timber products, it is possible to ensure it comes from legal and sustainable sources by requesting a copy of the Chain of Custody Certificate from the contractor.
   This certificate is the paperwork which traces the handling of the timber back to its origin, through the various stages of felling, manufacturing, sales and distribution, and proves that the timber was sourced legally.

5. Concrete
   The carbon emissions associated with concrete production can be reduced through various measures:
   Concrete that uses recycled aggregates is a lower carbon option than that which uses virgin aggregates. In addition, industrial by-products such as fly-ash from power stations can be used in concrete mixes as a cement replacement product, for example GGBS or PFA.

6. Stone
   Consider purchasing recycled/reclaimed stone for use as a building material within the structure of an extension or rebuild, or as a finishing material either internally or externally. Recycled aggregates are ideal as a sub-base for larger building projects and have the same properties as freshly extracted minerals. Often, reclaimation yards or architectural salvage companies offer reclaimed stone products.
Case Study: 15 Passmore Street

Client or developer: Grosvenor Britain & Ireland
Architect: GRA Architecture
Contractor: Grangewood
Environmental Consultant: Eight Associates

This terraced house on Passmore Street has achieved an ‘Excellent’ EcoHomes rating (see glossary). The scheme benefits from secondary glazing to the front windows and extensive insulation to the roof, where eight photovoltaic (PV) panels are also sited to generate a substantial amount of the household’s electricity.

Lighting and appliances were carefully selected to marry comfort and energy efficiency. The luxurious sanitaryware is water-efficient and a discrete water butt collects rainwater for use in the garden.

All the timber used on site was responsibly sourced and certified by the FSC. In addition, the contractor diverted 95% of waste from landfill by recycling or re-using ‘waste’ materials on nearby sites.

The image below shows the discrete location of the photovoltaic panels on the roof of the property, carefully angled to optimise their exposure to the sun.

Eight photovoltaic panels mounted on the roof of 15 Passmore Street have generated 1000 kWh of electricity worth £460 in one year, saving 591 kilograms of carbon dioxide.

“It also makes me feel good to reduce my carbon footprint.”

-resident of 15 Passmore Street

The rear extension at 15 Passmore Street benefits from high performance insulation, double glazed doors and a skylight. A water butt collects rainwater for use within the garden.

“The higher quality insulation keeps it cool in the summer and warm in the winter.”

-resident of 15 Passmore Street

The flooring in the living area of 15 Passmore Street was constructed using FSC-certified timber. Energy efficient LED lighting was used to create a soft, warm glow and paints and varnishes from Dulux contained low levels of VOCs.

“It also makes me feel good to reduce my carbon footprint.”

-resident of 15 Passmore Street

Grosvenor implemented green solutions throughout the house including solar panels, LED lights and energy saving exhaust fans.”

-resident of 15 Passmore Street
Upgrading the Heating and Plumbing Systems

Eventually, central heating systems need replacing due to the installation of new pipework alongside old and tinkering over time. When replacing boilers and pipework, it is possible to implement measures that give greater user control of temperatures in rooms, as well as improving the efficiency of the overall system.

Central heating is a post-war invention. In 1955, only 5% of UK homes had central heating systems. By 1975, central heating was present in 50% of homes and in 2001, the figure stood at over 90% (source: BRE report BR435, 2001).

The addition of a boiler flue constitutes an alteration to the external appearance of a building in a conservation area. Planning permission from the Local Authority is required for new boiler flues, as is direct consent from Grosvenor.

If changes are being made to the heating and plumbing systems, what are the opportunities for making environmental improvements?

1. Reducing demand

   There are a number of passive measures that can be introduced without building works to reduce heat loss. Consider installing draught-proofing to windows, doors and chimneys and fitting draught excluders to letter boxes to retain heat and reduce the need for central heating.

2. Insulating hot water elements

   Think about adding insulation to hot water cylinders and pipework to make sure heat is only being delivered where it is needed, reducing levels of wasted energy.

   Installing a 75mm thick insulating jacket to the hot water cylinder and insulating direct hot water pipework will cut heat loss and reduce waiting times for hot water to be delivered to the taps.

3. Walls, floors and roof alterations

   If considering more invasive work as part of a refurbishment such as structural alterations, investigate the possibility of upgrading windows or installing insulation to walls, floors and roofs in order to improve the property’s overall thermal performance. See sections 2.8, 2.9, 2.14 and 2.15 for further information.

4. Metering

   It is possible to install heat meters to the gas supply. This will allow monitoring of usage over time and identify any periods of unusually high consumption, which could indicate a leak or fault within the system. Energy monitors will also serve to verify that the energy company’s meter is functioning correctly.

   Devices can display current and projected consumption and associated levels of carbon emission.

5. Controls

   Look into improving heating controls to ensure heat is being generated at the right time of day and the right zones/floors for the occupants. In addition, consider having the heating system serviced by a Gas Safe registered engineer to ensure that it is functioning correctly and that no energy is being wasted.

   Controls such as Thermostatic Radiator Valves (TRVs) or programmable room thermostats ensure constant heating levels that are tailored to each room.

6. Replacement

   Consider replacing the existing boiler with an A-rated condensing system boiler, or for small properties, a combi-boiler to supply hot water on-demand. At the same time, consider installing solar water heating panels to the roof; these connect to the hot water tank and can provide a significant portion of a household’s hot water demand.

   Choose a boiler with an efficiency of at least 87% and Nitrous Oxide (NOx) emissions of less than 50 mg/kWh.
If upgrading water fittings, what efficient measures can be implemented without compromising comfort?

Water efficiency:

1. Taps & showers
   Consider selecting water efficient products for sinks and showers.
   A five minute power shower can use as much water as an average bath. Efficient, aerated shower heads can have a flow rate of as little as 9 litres per minute (even with a large showerhead of 240mm diameter), compared to 18 litres for a traditional fitting. Aerated, low flow taps can have a flow rate of as little as 5 litres per minute, compared to 12 litres for a traditional tap.

2. WCs
   Low flush/dual flush WCs reduce the average volume of water used for flushing. Alternatively, installing a cistern displacement device in an existing WC will save on average 1-2 litres per flush. Low flush/dual flush WCs enable a lower flushing volume of 3 litres, as well as the standard 6 litres of non-dual flush models.

3. Domestic appliances
   When replacing appliances, consider water efficient products recognised by the Energy Saving Trust Recommended labelling scheme.
   Recommended washing machines can have a maximum consumption of 40 litres per cycle. Recommended dishwashers can use a maximum of 12 litres per cycle for a standard sized machine; this can be over 85% less than hand washing.

Water supply:

4. Water butts
   Where properties feature external space, rainwater can be collected for external irrigation by attaching a water butt to the downpipe of a property’s guttering.
   Water butts can have a capacity of between 100 and 200 litres, dependent on the size of the area to be irrigated. Units can be flat against a wall, or be located within a planter. As well as plant irrigation, the water can be used for car washing and cleaning outdoor areas.

5. Water recycling
   More advanced forms of water recycling can provide sufficient water for a large portion of internal, as well as external use. ‘Greywater’ systems use waste water from the bath, shower and wash hand basin, and redistribute it to non-drinking water outlets such as WC flushing, plant irrigation and clothes washing.
   Rainwater systems are preferable to greywater, as these use disinfectants which can overburden the sewage system.

6. Water metering
   To monitor water consumption, a water meter can usually be installed by the water company in a visible location in the property. Water meters provide a visible display of water consumption to allow levels to be monitored over time. They can display the volume of water used instantaneously or historically at 30 minute intervals.
   Note that installation of a water meter may have an effect on the tariff used to determine bills.
Choosing a Contractor

As a potential client, it is possible to choose the contractor who will undertake the building works based on their track record for environmental awareness and experience. In addition, requirements can be placed on the contractor to reduce wastage, recycle, and minimise energy and water usage, all of which will have a positive financial impact on the scheme.

In March 2012, the UK construction industry employed around 2.04 million people; equivalent to around 6.4% of all workforce jobs nationwide. Of the contracts that create this level of employment, around a fifth came from private housing projects, such as the refurbishments we are concerned with in this document.

Since 2008, it has been a legal requirement that all contracts in England with a value of over £300,000 have a Site Waste Management Plan (SWMP) in place. For those over £500,000 a more detailed set of procedures is required. The implementation of SWMPs ensures that waste is dealt with in a responsible manner, thereby reducing the cost of waste disposal and subsequent levels of fly-tipping. See the section on Waste Management opposite for more information.

When choosing a contractor, what are the points to look out for and what environmental standards can be requested of them?

Design stages:

1. Initial questions
   Consider writing up a list of questions to ask potential contractors at the initial stages. These might include the following:
   - How do they minimise/recycle demolition and site waste?
   - Do they take steps to prevent pollution?
   - Do they operate an Environmental Management System (EMS) such as ISO 14001?
   - Do they employ local labour? How do they train their staff to be environmentally responsible?

2. Assess experience
   At the same time look at the portfolio of work of potential contractors, to assess their expertise/experience in conducting sustainable refurbishments. For example, those with relevant experience in sustainable refurbishments may have worked on insulating solid-walled houses, or on new-build sustainable projects.

3. Third party audit
   Consider contractors who are registered with the Considerate Constructors Scheme. The CCS is an independent, not-for-profit organisation, whose code of practice covers environmental considerations, as well as management, efficiency and neighbourliness. Where contractors are not registered themselves, the site can be registered before the commencement of works with the same implications.

Construction requirements:

4. Best practice
   It is possible to make sure contractors are following best practice pollution prevention guidelines by looking at guidance from the Environment Agency.

5. Waste management
   Contractors are legally required to produce a Site Waste Management Plan (SWMP) to show which materials are being sent to landfill, and which are being re-used or recycled. Request that at least 85% of waste is diverted from landfill and re-used or recycled. This can be reviewed by an assessor during the course of site works by reviewing the site waste management plan every 2-3 months, a legal requirement on all projects.

6. Commissioning and testing
   Following completion, the "as-built" performance of the project can be tested to ensure projected levels of efficiency are being achieved. Proper commissioning of services, followed by airtightness testing, and thermographic imaging will ensure the correct settings and demonstrate the building’s performance.
Case Study: Heritage Windows

Client: Grosvenor Britain & Ireland  
Architect: David Morley Architects  
Contractor: Grangewood  
Sustainability Consultant: Eight Associates

The window of a ground floor room of this mid-terrace Georgian property has been upgraded with three different types of glazing: single glazing with new panes, slimline double glazing and vacuum double glazing, in order to compare their performance in a heritage setting.

The large image below shows the thermal performance of the three types of glazing. The single glazing (1) has the brightest colour, signifying higher heat transmittance therefore a greater degree of heat loss. The double glazing systems, (2) and (3) have darker colours indicating lower heat losses than the single glazing. The smaller images below left show the window before refurbishment, the surface temperature readings of the glazing and the window in its surrounding context.

Draught-proofing

The diagram to the right demonstrates the location of draught-proofing within a traditional timber sash window.

The first image shows the location of the detail, highlighted in green.

The detail to the right shows the location of draught-proofing both within the upper bar of the lower sash at mid-rail, and a weatherfin set within the sash box itself.

1. Location of detail within the sash window
2. Location of fin set into window frame between sliding elements
3. Location of mid-rail brush

The top floor apartment at 117 Eaton Square benefited from a range of environmental upgrades, include extensive draught-proofing to the windows using the Ventrolla perimeter sealing system.
Upgrading Windows in a Conservation Area

Windows play a vital role in buildings by providing natural light and acting as the main source of fresh air. However, their noise and heat loss properties create potential weak spots in the building with regards to occupant comfort. Windows are also a vital part of historic streetscapes; upgrading them with regard to their heritage context is vital and consultation with the Local Planning Authority is required before making changes.

It is possible to determine the approximate age of Georgian terraced houses by the position of the sash windows within the brickwork. Those with a visible sash box (outer frame) which is flush with the facade were generally built before 1709, after which time the building regulations prescribed that windows should be set back by 4 inches, as this would help prevent the spread of fire. A further revision to the regulations in 1774 required the sash box to be hidden behind the brickwork altogether; these examples also tend to exhibit thinner glazing bars.

For flats or maisonettes in a non-listed building within a conservation area, planning permission will be required for alterations where the appearance of the building is affected. Double glazing is permitted development for unlisted houses, although confirmation is to be sought from the Local Authority prior to commencement, and Grosvenor approval will be required. Replacement windows within existing brickwork should be timber-framed, and the glazing bars should match the pattern of the original windows.

Achieving an EcoHomes ‘Very Good’ rating, the scheme at 147 and 149 Ebury Street saw the upgrading of windows to the main elevation. Where windows were retained, secondary glazing was applied to the interior surface to reduce heat loss and noise pollution.

If upgrading the windows in a conservation area, what are the design considerations and consequent options?

**Design considerations:**

1. **Understand the location**
   - Mayfair and Belgravia are both conservation areas and thus have their own specific planning restrictions. It is important therefore to gain an understanding of local characteristics and to evaluate the condition of existing windows both on the property and in the surrounding area, to gain an awareness of suitable solutions.

2. **Identify criteria**
   - What are the main reasons for upgrading the windows? Possible selection criteria can include: acoustic properties, heat loss properties, security considerations, openness and aesthetic appearance. Solutions can be tailored according to these priorities.

3. **Ventilation**
   - In comparison to new buildings, traditional buildings typically require greater levels of air infiltration to deliver fresh air and remove moisture. Replacing traditional, single-glazed windows with double-glazing can reduce the ability of air to permeate the external envelope. Where this is the case, double-glazing which incorporates trickle vents in the frame can be installed, which can provide a low level of ‘background’ ventilation.

**Product solutions:**

**Slimline double glazing**

These units are constructed using narrower spaces (between the two panes of glass) than standard double glazing units and are an effective solution for achieving high thermal and acoustic performance standards within a heritage context.

Glazing with an air gap of 3mm can achieve a thermal transmittance, or ‘U-Value’ of 1.4 W/m²K; a value similar to that of a standard wide-framed, double glazed unit. Note that the lower the U-Value, the better its insulating properties.

**Slimline double glazing in existing frames**

This option uses the same slim double glazing as the previous option, but individual panes are inserted into existing frames without noticeably changing the appearance of the glazing bars. This is a high-performance option for situations where the existing frames are to be retained, although the sashes may require re-balancing with additional weights.

Systems of this kind typically achieve U-Values of 1.9 W/m²K.

**Triple glazing**

High specification triple glazing can reduce heat loss by up to a third in comparison with double glazing, as well as providing excellent acoustic properties. These units use three panes of glass and two air gaps filled with an inert gas such as argon to achieve the best possible insulating properties whilst still allowing high levels of daylight into the property. Currently, this solution is unlikely to be approved on the Grosvenor estate, but may be allowable in some instances.

High performing triple glazing will typically achieve a U-Value of 0.8 W/m²K, or below.
Upgrading Windows of a Listed Property

It is recognised that listed buildings used for residential purposes will change over time as opposed to monuments that will be preserved as far as possible in their existing state. On this basis, it is possible to upgrade windows and enjoy the associated benefits, in conjunction with respecting and conserving the historic environment.

The UK’s oldest functioning window frame is estimated to have been constructed around a thousand years ago. Located in the wall of a Saxon church in Berkshire, the window had been concealed by Victorian renovations until it was discovered by a workman in 2010.

Listed building consent must be sought from the Local Authority to legally proceed with the installation of secondary glazing, and approval from Grosvenor is also required. This is looked on favourably in a residential context so long as the glazing bars/divisions on the secondary glazing system align with those of the existing window. Currently, replacement with double glazing is accepted only in special cases, and is generally not permissible on listed properties.

The image to the right demonstrates how secondary glazing is designed to match the pattern of glazing bars on the original, single-glazed window. In this case, the secondary glazing itself is double-glazed to ensure maximum insulation from noise and protection against heat loss.

If upgrading the windows of a listed property, what are the additional design considerations and consequent options?

Design considerations:

1. Planning requirements
   - In general, secondary glazing is the only alteration to windows permissible in listed properties.
   - Other options for the rear such as double glazing may be possible in some circumstances, depending on the condition of nearby properties. Contact the local planning officer for site-specific guidance on what is allowable.

2. Secondary glazing
   - Secondary glazing retains the original single glazing whilst giving the thermal performance of double glazing. Its installation also negates the need for draught-proofing, as systems are made to fit the existing frames perfectly.

3. Identify criteria
   - Consider the range of secondary glazing options and identify the attachment mechanism that is most suitable for the property. Important questions to ask are: do the windows remain openable for fresh air? Do the shutters maintain functionality or are they permanently closed? Do the windows exhibit any unique features such as ironmongery that will obstruct secondary glazing?

Product solutions:

Draught-proofing
   - The simplest and least invasive method of upgrading listed windows is by installing draught-proofing. This can take the form of removable products attached to the beading, or permanent ‘brushes’ fitted to the inside of the frame opening by way of grooves routed into the timber. Products can also be sourced and fitted to doors, letter boxes and other openings to increase comfort and reduce heating demand. Avoid self-adhesive draught-proofing as this comes off very easily.

Removable secondary glazing
   - Secondary glazing refers to the installation of an additional layer of transparent material behind the existing window pane. Where conservation issues prevent nails or screws being used to attach systems to the window frame itself, removable panes can be applied using magnetic strips or other adhesive, and can be used during the winter months and removed when the weather gets warmer.

Fixed secondary glazing
   - Where allowable, secondary glazing can be fixed using nails or screws to the sash box or beading of a window, and can be single or double glazed. Systems can be designed so that the rails and bars align with the existing window, preserving the external appearance and giving high thermal performance values.
Case Study: 100 Princedale Road

Client and developer: Octavia Housing
Architect: Paul Davis and Partners
Contractor: Princedale EcoHaus
Sustainability Consultant: Eight Associates

An exemplar sustainable refurbishment, this pre-1919 terraced house in Holland Park has achieved Passivhaus certification, a comfort-based energy assessment. The family of four who currently occupy the property benefit from a 70% reduction in energy bills and excellent thermal comfort levels.

The building is fully insulated and triple glazing has been installed. The house’s fresh air passes through an underground heat exchanger, where it is preheated or pre-cooled depending on the season, and is then filtered before being distributed to each room, ensuring a stable internal temperature.

There are three solar thermal panels on the roof that provide 80% of the direct hot water for showering, baths and washing up. The building is in a conservation area and the key element to negotiate with the Local Authority was the triple glazing. These are designed to match the appearance of the existing windows when closed.

100 and 102 Princedale Road where families in the houses benefit from insulation and upgraded windows to the whole of the house. These measures have been implemented without significantly altering the appearance of the streetscape.

Post-occupancy monitoring at Princedale Road

A study was conducted on Princedale Road, examining the performance of three houses of similar geometry and occupancy, each refurbished to a different standard. These included a ‘typical scheme’ (above in grey) which met current Building Regulations but went no further, a Decent Homes Plus standard refurbishment (above in yellow) which took insulation and airtightness considerations into account, and the aforementioned Passivhaus scheme, displayed in green.

It was found that the Passivhaus performed better than the Decent Homes Plus and the typical scheme in multiple ways, including water and energy use, thermal comfort and indoor air quality. Final energy demand was reduced by 83% in the Passivhaus and 46% in the Decent Homes Plus scheme in comparison to the typical scheme.

The carbon emission performance of the Passivhaus scheme achieved 60% less than the control scheme or Typical Scheme with no significant measures. The energy bills were 60% lower in the Passivhaus and the thermal comfort benefits were significant – the average internal temperature during the winter months in the Passivhaus was 20.8 degrees compared to 16.4 degrees in the Typical Scheme.
Passive and Active Ventilation

A supply of fresh air is important to the well-being of building occupants, particularly during the summer when temperatures are high, but also during winter when inside air can become stale. There are a number of options for bringing fresh air inside. Mechanical Ventilation with Heat Recovery (MVHR) is an advanced, low energy system which ensures constant internal temperatures.

One of the very first ‘forced air’ ventilation systems is still in existence at St. George’s Hall in Liverpool. Designed by Scottish scientist and inventor David Boswell Reid, the system used coke and steam-fired boilers to warm and circulate fresh air through a series of ducts and tunnels, hidden within the building’s floor and walls.

Standards regarding levels of ventilation are covered by Part F of the UK Building Regulations. Where work is being done to historic buildings and those within conservation areas, the aim should be to improve ventilation levels as far as reasonably possible with regards to the property’s significance. Guidance can be sought from English Heritage and through the BS 7913 document Principles of the Conservation of Historic Buildings in the development of appropriate ventilation strategies.

What opportunities are there for effectively providing fresh air to living spaces?

Passive measures:

1. Single-sided and cross-ventilation
   Ensuring a clear passage of air through opening windows on two sides of a property may provide adequate ventilation. Where the building has only one aspect, sash windows which open top and bottom allow a certain degree of control. This is useful in evacuating water vapour from kitchens and bathrooms quickly (see opposite).

2. Trickle ventilation
   Where windows are being replaced, consider installing frames with built-in trickle vents, which are an effective means of supplying background ventilation where rooms are already fitted with sealed chimneys, new doors and double glazing. It should be noted that while this measure is compatible with Continuous Mechanical Extract (see below), trickle vents will reduce the effectiveness of Mechanical Ventilation with Heat Recovery.

Active measures:

3. Passive stack ventilation (PSV)
   A PSV system draws air through the house by means of wind cowls installed on the roof, which ‘pull’ stale air out of the house through ducts in the walls and ceilings, to be replaced with fresh air drawn in through vents in the walls without the need for electricity. In historic buildings these systems can be integrated with existing chimney flues, and the cowl made to resemble a traditional chimney pot.

4. Mechanical extract (ME)
   Mechanically driven, localised ventilation is particularly beneficial in areas such as kitchens and bathrooms, where it removes high levels of moisture and other pollutants. Systems can be manually controlled or automated, triggered by heat, pollutant or humidity sensors.

   To comply with building regulations, extractors in kitchens should be capable of drawing air out at a rate of 30 litres per second. For bathrooms this is 15 litres per second.

5. Continuous mechanical extract (CME)
   Mechanical ventilation with heat recovery (MVHR)
   This system uses an ‘always on’, centrally located ventilator to draw fresh air in through trickle vents in the building’s external envelope, expelling the exhaust air through ducting in the roof and walls. CME can be combined with Passive Stack to create an ‘Assisted Passive Stack Ventilation’ system, where the mechanical unit is activated when wind levels are too low to be effective.

   This system uses a centrally located unit to transfer the heat from extracted air to incoming fresh air, thereby creating a pleasant environment with a constant internal temperature. Domestic heat exchangers can have an efficiency of 88%, meaning the majority of exhausted heat is recovered by the unit for the purpose of warming the incoming air.
Comfort Cooling

The aim of installing comfort cooling is to control internal temperatures for thermal comfort purposes; typically a user will set a temperature of 21 degrees centigrade, plus or minus 2 degrees, although we would recommend a higher setting on warmer days to reduce energy consumption. Traditional buildings have variations in temperature depending on external environments that exceed this range by 3 or 4 degrees.

Before installing comfort cooling, there are a number of passive measures that can be implemented to reduce, or even eliminate the demand for it (see opposite page). Once these have been addressed, consider installing comfort cooling to the main rooms only, such as living rooms and bedrooms. In addition, consider using a prominently-placed energy meter to monitor the amount of electricity used.

Planning permission will be required when installing comfort cooling equipment externally and listed buildings will require consent for any internal alterations. Internal alterations to non-listed buildings in conservation areas are permitted development. A Grosvenor license will also be required.

Internal shutters at 310 Grosvenor Crescent refurbished and developed by Grosvenor, can be used to keep direct sunlight out during prolonged periods of hot weather, thereby reducing the need for active cooling within the property.

Before considering comfort cooling systems, what opportunities are there to cool naturally?

Passive measures:

1. Natural ventilation
   Often a good supply of fresh air will be sufficient to cool down an interior on warm days. This can be achieved through ensuring adequate levels of single-sided or cross-ventilation. See the previous section for more information on how to make ventilation work effectively using sash windows.

2. Shading
   Consider restoring existing shutters to south-facing windows to block heat gains in the summer months. Venetian blinds angled so as to block the sun's rays will have the same effect and will also allow a degree of daylight into the room. In addition, planting trees in back gardens can block heat gains during the summer, whilst allowing light through in the winter when the leaves have fallen. Note that external shutters are generally not allowable on the estate.

3. Passive internal gains
   Consider installing energy efficient lighting and appliances, as traditional or outdated installations often emit a lot of heat, thus increasing the need for cooling. In addition, switching off computing and audio visual equipment at the wall will prevent unwanted heat gains caused while devices are left on standby.

Active measures:

4. Phase change board
   Phase change material absorbs heat energy when the ambient temperature increases, and releases it again when the temperature falls. At between 5 and 15mm thick, these materials can be applied to ceilings, and help to maintain a constant internal temperature during the summer, when outdoor temperatures can be high.

5. System performance
   If you do choose to install a refrigerant cooling system, consider those which incorporate thermostats and time switches to ensure it is only used when needed. Look at units with a high coefficient of performance (COP) of 3.5, a low global warming potential (GWP) and a refrigerant leak detection system.

6. External equipment
   Refrigerant cooling systems require equipment to be sited both in and outside of the property. Close consultation with a design professional can ensure the equipment is located where it will neither cause an adverse visual impact on the building/ surroundings nor contribute to noise pollution.
Upgrading a Roof or Building a Mansard

Homes without sufficient insulation lose around a quarter of their heat through the roof. In addition, inhabitable roof spaces (such as a mansard or loft conversion) can become uncomfortably warm in the summer months. Installing insulation is an excellent way to improve a property’s efficiency, resulting in a more stable internal temperature and a reduced reliance on heating sources or comfort cooling.

The roof can be used as an area to locate renewable energy technologies such as solar thermal and photovoltaic panels. Although these can be installed in many different orientations, they will work most efficiently when situated on a south-facing roof at a pitch of 30 degrees, where the sun’s rays are not obstructed by trees or other buildings.

Local Authority advice is required for installation of equipment, which can be an issue for listed buildings and those within conservation areas such as Mayfair and Belgravia. Listed buildings will require permission for alterations of any kind, and planning permission is required when installing solar panels that add 150mm over the existing building line on a non-listed building in a conservation area.

The diagrams below demonstrate the issues presented by traditional mansard roof construction, and how these issues can be addressed through good design.

Active measures:

1. **Slate reclamation**
   - Retaining original slate or sourcing second-hand tiles from reclamation yards reduces the impact of mining, and preserves the historic character of conservation areas.

   In addition to slate, reclamation yards are an excellent source of heritage building elements such as brick and stone, as well as period features such as porcelainware and ironmongery.

2. **Roof lights**
   - As mentioned in the section on upgrading the lighting and electrical systems, roof lights are an excellent way to bring natural light into hallways, corridors and rooms in the roof. Units can be installed at both pitched and ‘flat’ orientations, and be operated both manually and automatically by switches and rain sensors.

   Special ‘conservation roof lights’ are available, which are designed to replicate traditional Victorian units and are more suited to heritage projects.

3. **Green roofs**
   - These can vary from simple grass/sedum coverings to elaborate roof gardens. Green roofs offer a range of advantages, including: improved thermal insulation, better acoustics, improved privacy, improved rainfall run-off attenuation, reducing demand on drainage systems. They are also aesthetically pleasing and improve levels of biodiversity.

   Typically, a substrate of 100mm is required to absorb sufficient water and allow plants other than sedum to thrive.

4. **Air source heat pump**
   - Air source heat pumps can be used for both heating and cooling the internal environment. As a heater this technology is able to produce several units of heat for every unit of electricity they consume. Equipment is sized both inside the building and outside at roof level. Note also that the external equipment generates a degree of noise, and can be troublesome for neighbours.

   Consider units with a high coefficient of performance (COP) of at least 3.5.

5. **Solar thermal panels**
   - These are an effective means of supplementing a home’s hot water demand. Water is pumped through roof-mounted panels where it is heated by the sun’s rays before being passed through a coil in the property’s hot water cylinder.

   5m² of solar thermal panels will provide a significant portion of the hot water demand of a three bedroom house. There are 2 types of thermal panel - flat and evacuated tube; the latter can be used where the roof orientation is not ideal as the fins can be turned towards the sun.

6. **Photovoltaics (PVs)**
   - Roof-mounted solar panels can provide a property with its own on-site energy supply. An array of cells convert sunlight into electricity, and can even work on cloudy days.

   A 15m² photovoltaic array will provide a significant portion of the electricity demand of a three bedroom house. Where the generated electricity is not used, this is exported into the national grid. In addition the owner of the panels is paid a set number of pence per kilowatt hour through the Feed in Tariff (see glossary).

When upgrading a roof or building a mansard, what additional environmental measures can be implemented?

Passive measures:

- **Slate reclamation**
- **Roof lights**
- **Green roofs**
- **Air source heat pump**
- **Solar thermal panels**
- **Photovoltaics (PVs)**
Thermally Upgrading the External Walls

Achieving stable thermal comfort levels is beneficial in all rooms, and of particular importance in areas where vulnerable people, such as the elderly or small children, spend time. Insulating a room will enable stable temperatures across the whole space and prevent the occurrence of cold spots, whilst reducing reliance on heat sources.

Due to their age, the vast majority of properties in Mayfair and Belgravia are of solid brick wall construction, and do not feature cavity walls like modern buildings. Insulation must therefore be applied directly to the wall, generally on the inside. In terms of heat loss, an insulated solid brick wall will perform five times better than an un-insulated one. In addition, a double-glazed window loses half the heat of a single-glazed window, which in turn loses 17 times more heat than an insulated wall!

In solid brick walled buildings, the introduction of internal insulation makes a significant change to how the building fabric is able to respond to variable internal and external environments. The use of products that are ‘vapour closed’ (which means that water vapour can not pass through) creates a vapour barrier in the building that had not previously existed. Their installation is therefore to be carried out following either a condensation risk analysis by an expert, or with regard to the relevant Agreement Board’s instructions and standards. The use of vapour open, hygroscopic and capillary active insulation is an alternative option for internal insulation; these products work with the building fabric by allowing vapour to move within the material whilst retaining heat.

The top floor apartment at 58 Park Street, developed by Grosvenor, benefits from whole house insulation, including the existing walls and roof. The floor was acoustically insulated as a further apartment is located below. Secondary glazing was added to the existing windows to ensure an efficient fabric throughout. Energy efficient lighting and appliances were provided. Water efficient and high comfort showers were provided. The contractor recycled contractor waste and achieved a score of 30 out of 40 on the Considerate Constructors Scheme. The scheme achieved an EcoHomes ‘Excellent’ rating.

When thermally upgrading the external walls, what is the decision-making process and what are the options available?

Design Considerations:

1. Are you insulating a single room or the whole house?
   If it is not practical to insulate the whole property simultaneously, there are significant benefits to be gained from insulating a single room. This is particularly true of spaces where thermal comfort is an issue, such as family rooms and children’s bedrooms.

2. Designer’s brief
   Before going to planning, it is important to be confident that the designer’s brief is clearly defined to include wall insulation at an early stage in order to effectively address technical issues. Ensure that reasonable consideration is given to the impact on existing features, loss of floor area, cold bridges, ventilation, and both surface and structural moisture levels.

3. Specialist insulation contractors
   The process of insulating internally requires specialist skills that a small to medium contractor may not be able to provide. Insulation specialists can be sub-contracted to effectively install insulation and ensure it performs to its full specification, and minimise thermal bridging (see glossary). Request either BBA approval, a guarantee or a condensation risk analysis.

Product solutions:

Wood fibre insulation
Solid wood fibre insulation is manufactured into rigid boards through the compression of processed wood; its breathable properties make it a good choice for historic buildings. Typically, an additional wall thickness of 75mm is required for a solid brick wall to achieve heat loss values compliant with Building Regulations.

Aerogel insulation
Available as either a flexible ‘blanket’ or composite boards, aerogel is an extremely thin insulation and an excellent solution where reduced thicknesses are required, or where bulkier products such as wood fibre would not be appropriate. An additional thickness of 30mm is required to comply with Building Regulations.

Spray foam insulation (Polyurethane/PU)
For small spaces where maneuverability is an issue, such as small gaps around windows, polyurethane spray foam provides a useful insulation solution. This insulation is sprayed from a flexible nozzle connected to a pressurised container, and slowly expands to fill the gap, hardening within a few minutes. Where used in bulk, an additional thickness of 50mm of polyurethane is required to comply with Building Regulations.
Holistic Sustainable Refurbishment

Taking a holistic approach to refurbishment is the ideal way to implement sustainability measures that complement each other. As a client, it is possible at early stages to analyse the potential benefits of environmental measures in terms of thermal comfort, acoustic performance, health considerations and monetary value, to make informed decisions.

Buildings with an Energy Performance Certificate Rating of F and G will no longer be rentable following the introduction of new legislation in 2011, with effect from 2018. Currently, around 700,000 rented homes fall under these ratings, and will need to be refurbished if they are to be suitable for letting.

The Local Authority Planning Officer will look favourably on applications with supporting evidence that environmental improvements are being made. In certain instances, typically for major developments, there are planning requirements for sustainability such as meeting a BREEAM (Building Research Establishment Environmental Assessment Methodology) target. For further information on Westminster City Council and the Royal Borough of Kensington and Chelsea’s requirements, see section 4.3.

If targeting a complete holistic refurbishment, what is the initial process at the onset of the project?

Preparation:

1. Set a brief
   When considering such a project, the first port of call is likely to be an architect, a building surveyor or an accredited designer. Prepare a project brief with their guidance and ensure that this is tailored towards achieving sustainable refurbishment with broad objectives for where improvements should be made. They will also act as ‘agent’ when it comes to consulting additional professionals.

2. Sustainability workshop
   Shortly after, it is possible to hold a sustainability workshop to discuss sustainability strategies with the designers. Consider bringing in a sustainability consultant to facilitate the meeting, and assess together the feasibility of implementing a wide variety of measures in the property.

3. Investigate options
   Together, the design team are likely to come up with a series of options for combinations of sustainable measures, which will deliver various levels of increased sustainability at a range of costs. Spend some time assessing which options are right for the property, and whether or not to proceed.

Design:

4. Set specific targets
   With the range of options in mind, it can then be decided down which avenue to proceed. Be clear with the design team on what targets should be met such as specific reductions in energy demand or carbon emissions. It is also possible to use an external assessment method such as BREEAM to set a holistic performance target. See page 46 for further information.

5. Planning
   It is important to decide upon all sustainability measures pre-planning, so as to be able to inform Grosvenor and the Local Authority of any proposed changes in the external appearance of the building that may take place.

6. Design development
   It may be advantageous to use a sustainability tracker to ensure that the targets that have been set are being met by the design team. This will detail all sustainability measured with the objective of ensuring implemented and retained throughout the project.

Completed in 2009 by Grosvenor Britain & Ireland. The whole-house refurbishment of 11 Grosvenor Crescent Mews was the first to achieve an EcoHomes ‘Excellent’ rating on the Mayfair and Belgravia estate. The building fabric was upgraded with internal wall insulation to the front and rear elevations, secondary glazing throughout and floor and roof insulation. The heating and hot water is provided by an efficient gas boiler. The lighting is energy efficient with compact fluorescent lamps (CFLs) used for 75% of all lighting. The ventilation is provided by extractor fans in the kitchen and bathrooms, as well as openable windows. All appliances are energy efficient. All timber was FSC certified.
Standards, Regulations and Appendices

Case Study: 10 Hawthorn Road

Client or developer: Metropolitan
Architect: Anne Thorne Architects
Services Engineer: King Shaw Associates
Contractor: Sandwood Construction
Sustainability Consultant: Eight Associates

Located in the Campsbourne conservation area, this terraced Edwardian three-bedroom house has been refurbished, resulting in an 80% reduction in carbon emissions when compared to the building prior to works.

The walls and roof are insulated with welsh sheep's wool, triple glazing was specified to the front and rear elevations and a mechanical ventilation system provides the rooms with fresh air, which is pre-warmed with heat recycled from the extract air.

All lighting, appliances and sanitaryware have been chosen for comfort and efficiency, resulting in significant energy and water savings. Three solar thermal panels on the roof generate direct hot water.

The Local Authority was supportive of the scheme and although the building is in a conservation area, the new triple glazed windows were not thought to harm the streetscape.

The scheme was part of the Retrofit for the Future Competition and as monitored achieved an 80% carbon emissions reduction over the existing building.

The apartment at 121 Mount Street, developed by Grosvenor, achieved an EcoHomes 'Very Good' rating. The refurbishment involved upgrading the heating and plumbing systems with a new Vaillant system boiler along with thermostats and thermostatic radiator valves. The building fabric was repaired and secondary glazing was installed to all the windows. All lighting and appliances are energy efficient.

The following section provides a summary of the standards and regulations applicable to sustainable refurbishments.

Contents

3.1 Grosvenor's Approvals Process 42
3.2 Planning and Listed Buildings Consent 43
3.3 Building Regulations Part L1B 44
3.4 BREEAM Domestic Refurbishment 45
3.5 Government Funding: Green Deal 46
Grosvenor’s Approvals Process

Background
The standard Grosvenor lease for flats and houses prohibits any alterations that affect the structure or architectural appearance of the property. Notwithstanding this restriction, alterations may be permitted subject to certain procedures and conditions. For freehold properties, Grosvenor approval to alterations is required under the terms of the Grosvenor Belgravia (or Grosvenor Mayfair) Estate Management Scheme.

The reason alterations are controlled and regulated is for the long-term preservation of the external appearance of the buildings, to ensure the highest standards of workmanship are implemented and that the buildings remain structurally sound.

Criteria
Works which do not require consent are those of repair or renewal where identical materials are being used, internal or external redecorations (in line with Grosvenor’s requirements regarding the colour and type of paints used externally), new cupboards and new kitchens or bathrooms where the existing service connections are re-used.

Consent is always required for the following:

- Converting a garage into a living room if it is the only garage at the property and capable of taking a medium-sized car
- Installing or adapting windows or doors (including garage doors) that are unsympathetic to the Conservation Area
- Building on more than 50% of the original size of the garden
- Erecting mansard extensions in certain mews
- Works that adversely affect the light or amenity of neighbouring properties
- Linking two houses laterally to create a single house (mews houses may be linked to the main house -as in Chester Square and Eaton Mews South
- Constructing sub-basements generally, save swimming pool excavations below lower ground floor level
- Converting a garage into a living room if it is the only garage at the property and capable of taking a medium-sized car

Consent is unlikely to be granted for the following:

- Converting pavement vaults or underground rooms into living accommodation (other than utility rooms, bathrooms, stores etc.)

Approvals process
The first step is normally to appoint an architect, chartered building surveyor or accredited designer to prepare concept drawings. Once these have been prepared, contact with Grosvenor can be made to establish whether the principles of the proposal are likely to be acceptable. If they are, or agreed modifications are made, then suitable architectural drawings of a scale of not less than 1:50 should be prepared and submitted for formal approval, together with an estimate of the cost of works up to builder’s finish, i.e. without decorations or furnishings. In the case of leasehold properties, the drawings should be submitted to Grosvenor prior to making contact with the Local Authority for planning and listed building consents, along with the Application Form for Landlord’s Consent to Carry Out Alterations. In determining whether and upon what conditions consent should be granted, Grosvenor will take into account not only the proposed works themselves, but also the extent and nature of recent works carried out at the property and any current or proposed works in the vicinity. This may mean that if approved, works may need to be phased or delayed in order not to cause unnecessary disturbance to nearby occupiers.

If the flat or house in question has an intermediate landlord between the residents and Grosvenor, residents must obtain their agreement before discussing with or submitting approvals to Grosvenor. This is because the occupation is an agreement between the resident and the Head lessee and not a direct agreement with Grosvenor. Normally, the intermediate landlord will agree to the resident discussing proposals directly with Grosvenor, but this is not always the case.

If the proposals involve adding floor area or substantially enhancing the value of the property, there may be a capital payment implication. In this case the Grosvenor Asset Manager will assess any appropriate payments before approval to the works is granted.

The letter that they send will give conditional consent, subject to compliance with certain conditions, which must be dealt with before the works start (conditions precedent) such as approval fees, insurance and planning consent, and other conditions that are relevant once the work has started, such as compliance with statutory health and safety regulations, working hours and behaviour on the building site. If a license for alterations is required, then this must be completed before works start.

Depending on the type of works there are three different types of approval:

- Letter and approved drawings - used for straightforward works that do not involve and increase in floor area, change of uses, terraces or air conditioning
- Grosvenor license (prepared by Murray Birrell Ltd) - this is used where there are reinstatement or renovation provisions for roof terraces, air conditioning or temporary works. Licenses may also be required for freehold approvals.
- Solicitor’s license - for major works (including those smaller ones involving additional floor areas), any change of use or where a premium is payable.

Fees
Approval fees are based on a scale, whereby charges are based on the cost of proposed works to a builder’s first fix finish (e.g. plasterboard but not decorated, without cover plates to light switches and socket outlets).

If the property in question is within a privately owned Grosvenor Mews, there will also be a minimum £500 (excl. VAT) fee to cover additional costs incurred for the cleaning of surface water gullies at the end of the works.

Depending on the complexity of the works, fees will also be payable to a Grosvenor appointed structural engineer, services engineer or acoustic engineer, who will assess, review and comment on the proposals prior to commencement of the works. All of these fees are paid directly to the individual consultant and are based on the cost of works.

If a license for Alterations is required there will be additional fees. For in-house licences (e.g. for the use of a roof terrace of up to 50 m²) an additional fee of between £150-£250 is required. For all other Licenses for Alterations, our solicitor’s, Boodle Hatfield, bespoke fees must be met.

A refundable deposit of £500 is required for all approvals. The deposit, plus interest, is returned once ‘as-built’ drawings have been provided at the completion of the works. Depending on the complexity of the proposed works, a further damage deposit may be requested. The deposit, plus interest, will be refunded after the works have been completed. However, if the works are poorly managed and damage occurs, we may compensate neighbours for such sums as we estimate to be the loss they suffer.

A variety of standard literature is available upon request from the local Grosvenor Office Contact, including:

- The Grosvenor Specification, with which all works should comply;
- Fee scales applicable to approvals;
- Guides for scaffolding, ‘soft strip’ satellite dishes, external decorations and colour schemes for mews properties;
- The Freehold Estate Management Schemes.
### Planning and Listed Buildings Consent

#### Background

Combined, Westminster City Council and the Royal Borough of Kensington and Chelsea cover an area of over 3,000 hectares, and are home to some of the most socially, politically and architecturally significant sites in the country, including the Portman, Cadogan, Crown and Grosvenor Estates. Over three quarters of both boroughs fall within conservation areas, and around 20,000 buildings listed form the make up of their built environment.

The districts of Belgravia and Mayfair were designated as conservation areas in the late 1960s, and are together home to around 10% of Westminster’s listed buildings, with a significant number in the Royal Borough of Kensington and Chelsea. A building’s listed status or location within a conservation area has a dramatic effect on the freedom the owner has to make alterations. Being within conservation areas, the Grosvenor Estate is subject to stringent planning regulations, which aim to ensure the long-term survival of the area’s specific atmosphere.

#### Conservation areas

Conservation area status is principally designated in order to prevent the whole or part-demolition of listed buildings and the felling of trees. However, applications for planning permission in such regions are also subject to additional scrutiny.

#### Listed buildings

Where a building is listed, the Local Authority must grant permission before any modification, extension or demolition works can legally be carried out. In many cases, specialist knowledge must also be sought prior to commencement to ensure the proper preservation of historic architectural detailing. Building works must safeguard historic fabric and features of interest and restore any significant features damaged in the course of alterations. See the further reading section at the end of this document for links to additional information.

#### Westminster Environmental Policy

Whilst keen to preserve the borough’s historic character, Westminster City Council is also aware of the environmental issues facing its residents. The Westminster City Council Environment Policy was first drafted in 2007, and stipulates the application of “high standards of sustainability to building developments and refurbishments,” as well as clauses referring to improvements in pollution levels, low-carbon transport, the protection of biodiversity and compliance with environmental laws.

Westminster makes specific reference to high quality alterations and extensions to existing buildings in its Policy CS27, Design of the Local Development Framework Core Strategy:

“Development must incorporate exemplary standards of sustainable and inclusive urban design and architecture. In the correct context, imaginative modern architecture is encouraged provided that it respects Westminster’s heritage and local distinctiveness and enriches its world-class city environment.

Development should:

- Reduce energy use and emissions that contribute to climate change during the lifecycle of the development, in line with national and regional standards as a minimum; and
- Ensure the reduction, reuse or recycling of resources and materials, including water, waste and aggregates

This will include providing for an extended life-time of the building itself through excellence in design, quality, high quality durable materials, efficient operation, and the provision of high quality floorspace that can adapt to changing circumstances over time.”

The City Council also published a supplementary guidance document entitled “Retrofitting Historic Buildings for Sustainability” in March 2012, which details various approaches to adapting listed buildings and those located in conservation areas. The document can be viewed online at http://transact.westminster.gov.uk, and includes maps outlining the location of conservation areas.

#### RBKC Environment Strategy

The Royal Borough of Kensington and Chelsea (RBKC), which is home to a number of streets in Belgravia, also acknowledges the need to address environmental sustainability. The RBKC’s Environment Strategy document focuses on development and construction among several areas.

The RBKC’s Policy CE1: Climate Change addresses the environmental criteria to be considered when determining planning applications. All subterranean development must now achieve an Ecohomes ‘Very Good’ rating, comprising at least 40% of energy and water credits, or equivalent under BREEAM Domestic Refurbishment.

### Building Regulations Part L1B

#### Introduction

The Building Regulations are a set of legal, government-approved documents, which set out the requirements for building works in terms of their construction, performance and safety standards; there are 14 documents in all, labelled Part A to Part P. Part L deals with the conservation of fuel and power, and is subdivided into four sections dealing with dwellings and non-dwellings, both existing and new.

Part L1B aims to ensure that addition and alteration works to existing, self-contained dwellings promote the conservation of fuel and power, and mitigate the levels of CO₂ emission they could potentially cause. The document applies to the replacement and renovation of thermal elements (walls, floors and roofs), the construction of extensions, the alteration of controlled fittings (windows, doors and roof lights) and material changes of use, such as loft or garage conversions.

#### Technical information

Part L1B specifies a set of thermal transmittance values, which must be achieved when installing, replacing or upgrading the components listed above. The Local Authority’s Building Control Department, to whom application for Building Control Approval is made to verify the compliance of architectural details and specifications, oversees implementation of the regulations. In most cases, both Planning Approval and Building Control Approval must be granted for works to legally proceed.

#### Regulations and traditional buildings

The Building Regulations make allowances for listed properties or those located in conservation areas such as Mayfair and Belgravia. As stated in the Communities and Local Government (DCLG) guidance document Planning for the Historic Environment, in such cases Local Authorities should assist applications for alteration in finding feasible solutions, which enhance energy efficiency and increase resilience to climate change, whilst preserving historic fabric as far as practicable.

#### Future updates to the Building Regulations

The DCLG issued a document detailing proposed changes to Part L1B at the beginning of 2012, which are likely to be effective from 2013. These call for raised standards of thermal transmittance and airtightness, as well as the introduction of additional sustainable measures to buildings where other works are being carried out. The document will also set out more specific requirements with regards to historic and listed buildings, which will no longer be classed as exemptions from the regulations; guidance on energy standards will be provided by English Heritage. For full details of the proposed changes please see the document 2012 consultation on changes to the Building Regulations in England, section 2, available at www.communities.gov.uk.
BREEAM Domestic Refurbishment

Introduction
Coversing a wide range of environmental issues such as energy use, water conservation and the responsible sourcing of materials, BREEAM (Building Research Establishment Environmental Assessment Methodology) is an internationally recognised measure of a building's environmental performance. BREEAM is divided into a family of methodologies tailored to different building types, with the Domestic Refurbishment system being used to assess works to existing homes. The required standards for BREEAM are formulated using up-to-date science, and in all cases go above and beyond current Building Regulations.

The scheme acts as an environmental auditing system and is applied from project inception to completion, with third party certification being issued at design and post-construction stages.

Process
Starting at early design stage, a licensed professional will consult with the design team to advise on what environmental measures are achievable, based on the scope of the project. A target rating will then be chosen from the five available benchmarks, which range from ‘pass’ to ‘outstanding’, and a design stage certificate issued in anticipation of work to be carried out. Throughout the duration of the project, the assessor will liaise with the design team to obtain information on the project specification, and conduct site visits to ensure the intended measures have been implemented. Following completion, the assessor will conduct a post-refurbishment review and issue the final certificate in recognition of the building’s overall performance.

Benefits
As a widely used third party assessment method, BREEAM has created a common language for construction professionals working in sustainability. The introduction of the BREEAM Domestic Refurbishment scheme means that listed and historic buildings can now benefit from this mode of evaluation, and can attain the same environmental credentials as new buildings.

The increasing popularity of BREEAM certification has given rise to a mode of comparison for sustainable buildings, giving recognition to environmental innovation and rise to a mode of comparison for sustainable buildings, giving recognition to environmental innovation and the immediate costs. Repayments are then made through electricity bills, which are attached to the property and thus passed on to any future owners.

Government Funding: Green Deal

Introduction
The United Kingdom is subject to ambitious carbon emission reduction targets under the Climate Change Act 2008 that stipulate a reduction in carbon emissions of 34% by 2030 and 80% by 2050, based on 1990 levels, according to Department of Energy & Climate Change website: www.decc.gov.uk. As it is estimated that approximately 33% of our annual CO₂ emissions are down to the energy generated to provide heating and hot water to British homes, the Green Deal is keen to focus on reducing demand in this area.

The Green Deal is a government initiative intended to enable home and business owners to introduce ‘green measures’ to their properties with no up-front costs, to help towards meeting these targets. The Green Deal will provide individual loans to finance the installation of efficient heating and hot water equipment, insulation, double glazing and on-site energy generation systems.

Opportunities for residents
Where interested in taking advantage of the Green Deal loan, consumers can contact a Green Deal Assessor, an accredited consultant who will undertake a survey to establish the property’s current energy performance levels and assess its suitability for green measures. The assessor will create a full report using energy modelling software, and identify what financial savings can be made over a given period of time.

The Green Deal Advisor will then create a shortlist of suitable products, from which the consumer can choose a measure or combination of measures to be installed. Having gained consent to proceed, the Green Deal Provider then informs the consumer’s energy supplier, who provide the capital outlay on the condition that the expected long-term savings exceed the immediate costs. Repayments are then made through electricity bills, which are attached to the property and thus passed on to any future owners.

Further sources of information
The Green Deal is being launched in conjunction with the Energy Company Obligation, or ECO, which will ensure ‘hard-to-treat’ areas (conservation areas and listed buildings, for example) requiring specialist measures such as solid wall insulation, will still be eligible for funding. This is particularly relevant to Mayfair and Belgravia, where the majority of properties are of solid wall construction.

Green Deal Advisors are certified through Gemserv, the Green Deal Oversight and Registration Body who are responsible for the registration of assessors, installers and providers. A full list of accredited professionals can be viewed at www.greendealorb.co.uk.
Further Reading

Grosvenor Environment Review 2011
by Grosvenor
A guide to Grosvenor’s commitment to creating and managing well-designed environmentally-sustainable buildings and places.

Recommended books

Environmental Design Pocketbook
by Sofie Pelsmaker (2012)
This book provides a useful one-stop summary of sustainable, low-energy building design.

Residential Retrofit - 20 Case Studies
by Marion Baai (2013)
This book is a collection of case studies that were part of the Retrofit for the Future competition.

Sustainable Construction
by Sandy Hallidy (2007)
Sustainable Construction is a groundbreaking book to help achieve practical, inexpensive, sustainable buildings.

Websites: consents

English Heritage
www.english-heritage.org.uk
The website has information on Conservation Areas and Listed Buildings. English Heritage advises on how to get the most out of our heritage for the current generation, while also ensuring its protection for the next generation.

The Royal Borough of Kensington and Chelsea
www.rbkc.gov.uk
The Royal Borough of Kensington and Chelsea Council website with useful links on planning, conservation and sustainability.

Westminster City Council
www.westminster.gov.uk
Westminster City Council has extensive information on sustainability.

Websites: sustainable refurbishment

BREEAM Domestic Refurbishment
www.breeam.org
BREEAM is a design and assessment method for sustainable buildings (See section 3)

Changeworks Heritage
www.changeworks.org.uk
Changeworks is a leading environmental charity that helps people live and work in a more sustainable way.

Department of Energy and Climate Change (DECC)
www.decc.gov.uk
DECC is the government’s department that is responsible for national energy provisions and the country’s policy responses to climate change.

Energy Saving Trust
www.energysavingtrust.org.uk
Energy Saving Trust is a non-profit organisation that helps the promotion of sustainable energy including energy efficiency measures.

Environment Agency
www.environment-agency.gov.uk
Environment Agency is a Non-departmental public body that has the responsibility for the environment, food and rural affairs.

Forest Stewardship Council (FSC)
www.fsc.org
FSC is a Non-Governmental Organisation that has been established to promote sustainable management of forest globally.

Good Homes Alliance
www.goodhomes.org.uk
Good Homes Alliance is made up of companies, professional and experts in the built environment that build and promote sustainable homes and communities.

Prince’s Foundation
www.princes-foundation.org
The Prince’s Foundation is an educational charity that promotes the practice of traditional urban design and architecture whilst putting the communities at the heart of the design process.

Technical guidance

Centre for Sustainable Energy (CSE) & Bath Preservation Trust (BPT)
Warmer Bath: A guide to improving the energy efficiency of traditional houses in the City of Bath by Will Anderson CSE, & Joanna Robinon BPT (2013) www.cse.org.uk
This guide is was product from the Low Carbon Bath project and is a guidance to respond to how low carbon future may be achieved by owners of properties built before 1919.

Retro Expo
www.retro-expo.co.uk
Retro Expo is an annual exhibition and conference dedicated to low carbon retrofit of existing buildings held at the end of October at the NEC Birmingham.
Glossary of Terms

**Aerated water fittings**
These allow air to flow in with the water to reduce the amount of water flowing through the tap or shower head, reducing water demand and creating a softer, more even spray.

**BREEAM**
The Building Research Establishment Environmental Assessment Method is designed to help construction professionals understand and mitigate the environmental impact of the developments they design and build. Certified buildings are awarded a pass, good, very good, excellent or outstanding rating.

**Chain of Custody (CoC) Certification**
This method verifies that timber has been sustainably sourced; certification means that products can be traced from one supplier to another, back through the supply chain to a forest that is certified by the Forestry Stewardship Council (FSC).

**Conservation Area**
This method verifies that timber has been sustainably sourced; certification means that products can be tracked from one supplier to another, back through the supply chain to a forest that is certified by the Forestry Stewardship Council (FSC).

**Considerate Constructors Scheme**
A voluntary nationwide plan set up by the construction industry to improve its performance. Sites and companies that register with the Scheme are monitored alongside a Code of Considerate Practice, designed to promote best practice that goes beyond statutory requirements.

**Building Regulations Part L**
The part of the Building Regulations concerned with the conservation of fuel and power. The document is divided into four sections, with Part LIII being that concerned with residential refurbishment projects.

**Decent Homes**
Government scheme that intends to ensure all homes are weather tight, warm and have modern facilities.

**EcoHomes**
An Environmental rating system for homes in the UK and part of the Building Research Establishment's suite of environmental tools. The scheme was replaced by BREEAM Domestic Refurbishment in 2012.

**Energy Performance Certificate (EPC)**
A document that gives information on how much energy supplied to the building is used and how much is wasted. Can be used to make a home more energy efficient and reduce energy costs. All homes bought, sold or rented require an EPC.

**Energy Saving Trust Recommended**
This is a product labelling scheme, which recognises products that are the most energy efficient on the market. The scheme is designed to allow consumers to make an informed decision when choosing new domestic appliances.

**Environment Agency**
Part of the Department for Environment, Food and Rural Affairs (DEFRA), the Environment Agency is concerned with environmental improvements and protection in England and Wales, and also promotes sustainable development.

**Environmental Management System (EMS)**
A framework used to manage environmental impacts through organisational policies.

**�� ISO 14001**
The Environmental Management Standard of the International Standards Organisation

**Feed-in Tariff (FIT)**
This is an energy policy by which renewable energy producers are paid a certain number of pence per kilowatt hour of electricity they generate and fed into the national grid.

**Green Deal**
A government initiative to enable home and business owners to introduce ‘green measures’ to their properties with no up-front costs. Loans are granted on the condition that repayments will be equal to or less than the savings calculated through the implementation of ‘green measures’, with repayments made through energy bills attached to the property. For more information see www.decc.gov.uk.

**Listed Buildings**
Properties considered to be of significant historic or architectural interest, protected by English Heritage. If a building is listed, then the Local Authority must grant permission for any changes to the building before they can legally be carried out. For more information see www.english-heritage.org.uk.

**Passivhaus Scheme**
A voluntary standard devised by the German Passivhaus Institut for homes with particularly low energy requirements. The Passivhaus scheme takes a ‘fabric first’ approach, paying particular attention to insulation and airtightness. For more information see www.passivhaus.org.uk.

**Photovoltaic Panels**
Rooftop mounted panels that convert solar radiation into electrical power.

**Planning Permission**
A form of approval, which must be sought from the Local Authority for planned developments to legally go ahead. Please note that Planning Permission is different from Building Regulations Approval, which is also generally required.

**Structural Moisture**
Otherwise known as structural dampening or interstitial condensation, this occurs when moisture accumulates within the fabric of a building, giving rise to a number of issues such as damp or rot. This in turn can compromise the stability of structural elements.

**Thermal Bridge**
A point in a building’s external envelope, through which heat can be transferred by conduction from inside to outside, or vice versa.

**Thermal Comfort**
A person’s perceived contentment with the temperature levels in their immediate environment.

**Thermal Performance**
Otherwise known as the U-Value, thermal performance is a measure of how quickly a building element (roof, floor, wall, window or door) loses heat to the outside.

**Thermostatic Radiator Valve (TRV)**
A self-regulating valve that is fitted to a radiator to regulate the temperature of a room by changing the flow of water to the radiator according to the air temperature.

**Underground Heat Exchanger**
Equipment which transfers the energy in the ground directly underneath (or adjacent to) a property into the heating and ventilation systems, reducing the need for active heating.

**Volatile Organic Compounds (VOCs)**
Organic chemicals contained within myriad building products, which release easily into the atmosphere and can in some cases cause health problems. An example compound is formaldehyde.
Sustainable Refurbishment Questionnaire

Please complete, detach and return this form as part of your application for approval from Grosvenor. Please note that completion does not guarantee that measures will be permitted, either from Grosvenor or from the Local Authority.

**Development details**

Contact name: 

Contact address: 

Address of development (if different from above): 

Contact telephone number: 

Brief description of development works: 

**Lighting and Electricals (page 10)**

Will the following be implemented?

<table>
<thead>
<tr>
<th>Item</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy display device (electricity)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Central ‘power down’ switch located by front door</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Energy efficient lighting throughout</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Energy efficient domestic appliances</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Photovoltaic (PV) panels</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not: 

**Heating and Plumbing (page 16)**

Will the following be implemented?

<table>
<thead>
<tr>
<th>Item</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy display device (heating and hot water)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Localised controls (room thermostats / TRVs)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Insulation to hot water cylinder (where present)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Insulation to all pipework</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Efficient gas condensing boiler</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not: 

**Windows (pages 24-27)**

Are/will the windows to front elevations be:

<table>
<thead>
<tr>
<th>Type of window</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-glazed, with draught-proofing</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Single-glazed, without draught-proofing</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Double-glazed using standard units</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Double-glazed using slimline units</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Upgraded using secondary glazing</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not: 

**Decorating (page 12)**

Will the following be implemented?

<table>
<thead>
<tr>
<th>Item</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>All timber FSC certified</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>All paint with low VOC content</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>All carpets with low VOC content</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>All finishes sourced from the UK</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not: 

**Contractor (page 10)**

Will the following be required of the contractor?

<table>
<thead>
<tr>
<th>Item</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register with Considerate Constructor’s Scheme</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Divert 90% of waste from landfill to recycling</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Commissioned services following completion</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Thermographic survey of new insulation</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not: 

FRONT REAR
### Water fittings (page 18)

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device to monitor/record water consumption</td>
<td>Y/N</td>
</tr>
<tr>
<td>Water efficient shower of &lt;12 litres/min flow rate</td>
<td>Y/N</td>
</tr>
<tr>
<td>Water butt for external irrigation with rainwater</td>
<td>Y/N</td>
</tr>
<tr>
<td>Greywater recycling system for WC flushing</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### Upgrading existing elements

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation to existing walls (whole house)</td>
<td>Y/N</td>
</tr>
<tr>
<td>Insulation to existing walls (proportion of house)</td>
<td>Y/N</td>
</tr>
<tr>
<td>If yes to either, is the insulation vapour-permeable?</td>
<td>Y/N</td>
</tr>
<tr>
<td>Insulation over 200mm to existing roof</td>
<td>Y/N</td>
</tr>
<tr>
<td>Insulation to existing floor</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### Ventilation (page 30)

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trickle vents to windows</td>
<td>Y/N</td>
</tr>
<tr>
<td>Are chimneys blocked up?</td>
<td>Y/N</td>
</tr>
<tr>
<td>Whole house mechanical ventilation with heat recovery (MVHR)</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### Roof upgrade or extension (page 34)

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar thermal panels for water heating</td>
<td>Y/N</td>
</tr>
<tr>
<td>Air source heat pump</td>
<td>Y/N</td>
</tr>
<tr>
<td>Green roof of minimum 75mm substrate</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### Overheating / cooling

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficient lighting and appliances</td>
<td>Y/N</td>
</tr>
<tr>
<td>Functioning internal shutters</td>
<td>Y/N</td>
</tr>
<tr>
<td>Phase change board</td>
<td>Y/N</td>
</tr>
<tr>
<td>Refrigerant cooling systems</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### On-site energy generation (other)

**Will the following be implemented?**

<table>
<thead>
<tr>
<th>Item</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground source heat pump</td>
<td>Y/N</td>
</tr>
<tr>
<td>Combined heat and power</td>
<td>Y/N</td>
</tr>
<tr>
<td>Connection to potential future district heating facility</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

Please provide reasons why or why not:


### Acknowledgments

Content and drawings provided by Eight Associates Sustainability Consultants.

Eight Associates specialise in the delivery of sustainable buildings, both in the UK and abroad. They are BREEAM Accredited Professionals and have unparalleled experience in eco-ratings, while their interactive approach to sustainable design, energy modeling and renewable energy technologies results in truly low-impact buildings.

Photography provided by Nick Ingram at InArc Ltd.

Nick Ingram is a photographer specialising in architecture and interiors. His current client base includes some of the UK’s premier architects, interior designers, surveyors, property developers and high end estate agents, as well as a number of design and PR agencies.

Grosvenor is a privately-owned property group, with offices in 19 of the world’s most dynamic cities. Our future success is tied to the sustainable growth of the cities in which we have a presence. We have a vested interest in the future shape of the urban landscape and aim to help create and manage attractive and vibrant cities in which people choose to work and live.

With thanks also to:

Peter Guthrie
Michael Popper
Lucy Pedler
“This is an impressive document that manages to combine readability with technical substance - which is a rare feat.”

Peter Guthrie, Professor of Engineering for Sustainable Development, University of Cambridge

“I’m delighted to support this very practical guide to improving the environmental performance of period residential property. The sector is without doubt a difficult one to tackle, however Grosvenor are certainly best placed to do so and have managed to address the varied and often complex issues in an easily understood, practical way.”

Keith Budgen, Executive Programme Director, Better Buildings Partnership

“The Grosvenor estate’s ‘Toolkit for Going Green’ stands out amongst the growing number of guides for sustainable refurbishment. With its emphasis on tackling the refurbishment of historic buildings, the Toolkit gives clear, concise and practical advice to both developers and residents of Grosvenor’s large estate of properties in conservation areas.”

Lucy Pedler, Director of the Green Register and Archipelago Architects

Further information

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