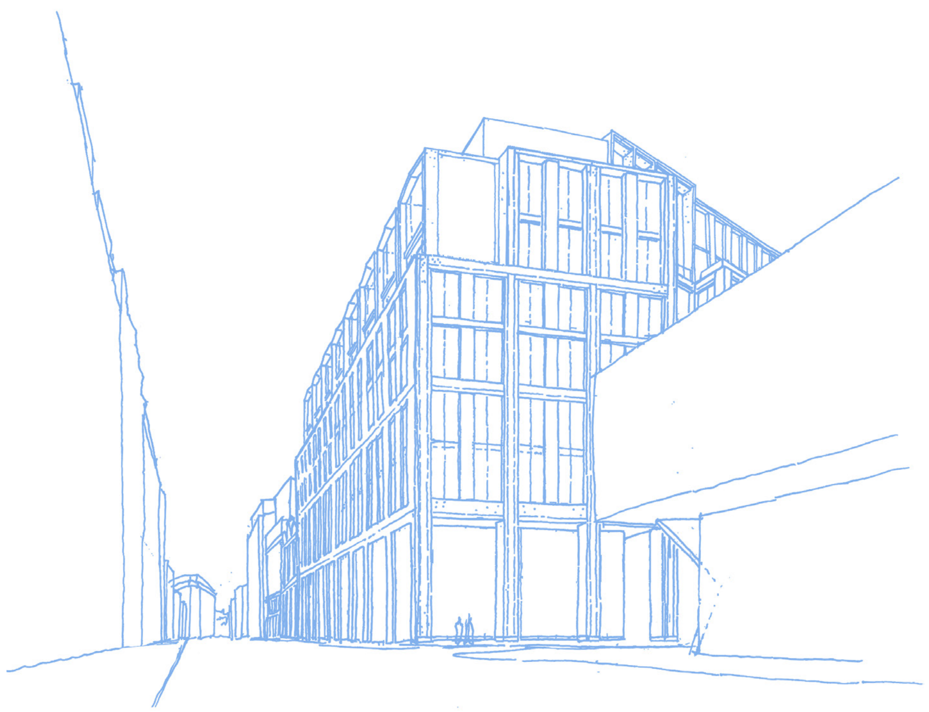
*Prepared by* GDM Partnership
*On behalf of* Royal London Mutual Insurance Society

# Energy Statement

Castlewood House & Medius House, WC1A



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# 1 INTRODUCTION

GDM Partnership Building Services Consultants Limited have been appointed by Royal London Mutual Insurance Society to undertake a LZC (Low and Zero Carbon) Technologies feasibility report at Castlewood House and Medius House.

This report assesses the feasibility of providing LZC technologies to the scheme and if LZC is appropriate for the project, this report will inform the design team of recommendations for the most appropriate LZC technology.

Viable LZC technologies have been assessed with due consideration to the following issues:

- Energy generated and $CO_2$ emissions reduction
- Payback period
- Local planning criteria
- Potential to export energy
- Any available grants (if applicable)

## 2 EXECUTIVE SUMMARY

This Energy Statement has been prepared by GDM Partnership on behalf of Royal London Mutual Insurance Society to provide a commentary on the sustainability energy issues for the proposed development at Castlewood House and Medius House. It sets out the energy efficiency and carbon reduction measures that will be incorporated into the development.

Energy efficiency measures will be implemented to provide carbon savings of approximately **35%** in comparison to a baseline building that is fully compliant with the standard set by Building Regulations Conservation of Fuel and Power.

The energy efficiency measures contained within this proposal include: improved fabric insulation; improved air tightness; high efficiency fans; high efficiency heating and cooling plant, heat recovery on ventilation systems and high efficiency lighting with daylight control. This will ensure the development achieves Part L 2013 compliance through energy efficiency measures alone.

The London Heat Map is an online tool which can be used to find opportunities for decentralised energy projects in London. This tool has been utilised to check if the development can connect into an existing distribution network. However currently there are no existing or proposed heat distribution networks in the vicinity and as such this option has been disregarded.

Combined heat and power engines are not viable for developments of this nature due to the low annual heating demand and there being no significant background heat demand during the summer. The viability of CHP (Combined Heat and Power) would be marginally increased were it to serve both Castlewood and Medius House, this is as a result of mixing two different heat load profiles. However, as discussed at the pre-app meeting with the GLA (Greater London Authority), the fact that the Castlewood and Medius buildings are separated by another building under separate ownership, it would not be practicable to install the necessary linking pipework, in view of the marginal benefit gained were they to be linked. As such we do not propose to utilise CHP. This combined with the lack of a district heating scheme means that the Clean (Supple Energy Efficiently) measures for this development are not viable It should therefore be noted that the carbon emissions at the end of the 'be clean' stage are identical to those being at the end of the 'be lean' with no further improvements achieved.

Photovoltaic collectors are compatible with the proposed building services solution albeit there is limited space available on the roof. With this in mind the extent of the PV array has been restricted to an area of 117m², with these being mounted directly above the mechanical plant room at Level 10.

Due to the development not reaching a carbon reduction target of 35%, a carbon offset payment will accommodate the additional 10.6%. With the London Borough of Camden carbon offset costing £90 per tonne Castlewood House's cost offset over a 30 year period is £139,070 which equals £4,636 per year.

### 2.1 GLA Table 3 (Castlewood House)

| GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House Development | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |
| Be Lean | 375.77 | 442.30 |
| Be Clean | 375.77 | 442.30 |
| Be Green | 368.43 | 442.30 |

### 2.2 GLA Table 4 (Castlewood House)

| GLA Table 4: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House Development | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 111.8 | 22.9% |
| Be Clean | - | 0.0% |
| Be Green | 7.3 | 1.5% |
| Total cumulative savings | 119.1 | 24.4% |

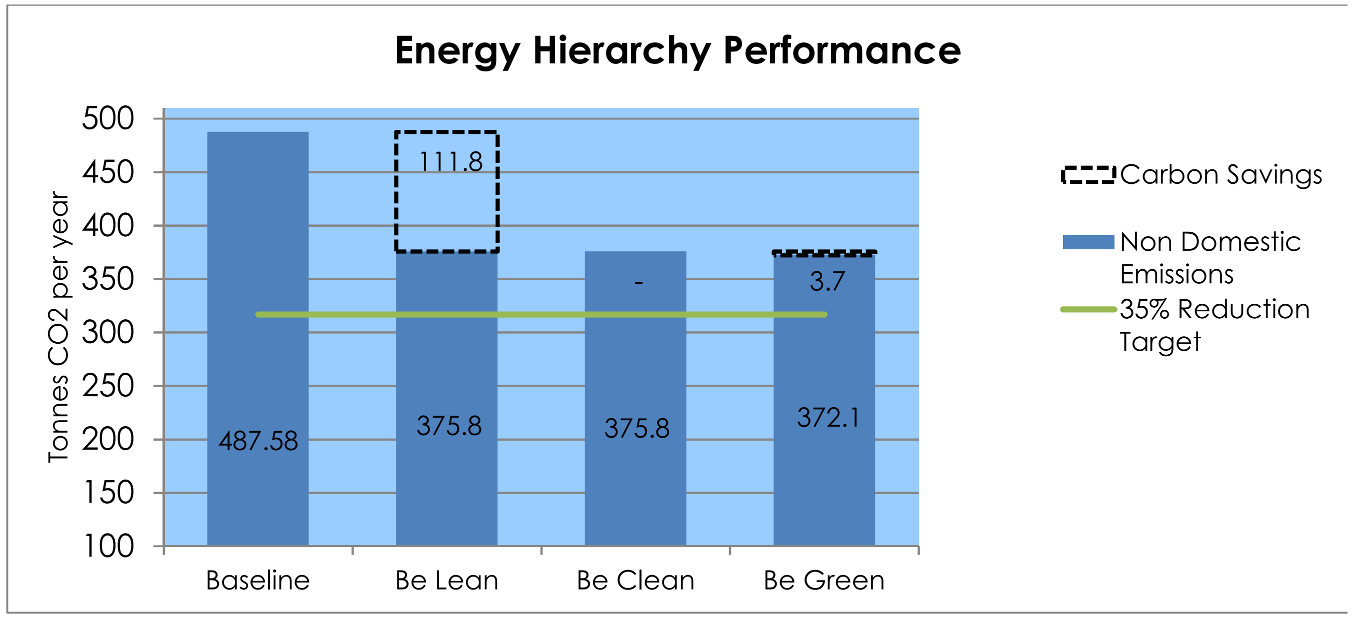
The above table indicates a 24.4% carbon dioxide reduction, as a result of the proposed Lean, Clean, and Green measures applied to Castlewood House only.

### 2.3 GLA Table 5 (Castlewood House)

| GLA Table 5: Shortfall in regulated carbon dioxide emissions | | |
|---|---|---|
| | Annual Shortfall (Tonnes $CO_2$) | Cumulative Shortfall (Tonnes $CO_2$) |
| Total Target Savings | 170.65 | |
| Shortfall | 51.51 | 1,545.22 |

The total site wide regulated carbon savings go beyond Part L 2103 Building Regulations through the combination of energy efficient design and renewable technologies is **24.4%.**

### 2.4 Energy hierarchy performance chart (Castlewood House)




### 2.5 GLA Table 1 (Medius House Refurbishment)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 1st-5th Floors | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 998.64 | 17.78 |
| Be Lean | 317.84 | 17.78 |

### 2.6 GLA Table 2 (Medius House Refurbishment)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 1st-5th Floors | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 680.8 | 68.2% |
| Total cumulative savings | 680.8 | 68.2% |

### 2.7 GLA Table 5 (Medius House Refurbishment)

| GLA Table 5: Shortfall in regulated carbon dioxide emissions | | |
|---|---|---|
| | Annual Shortfall (Tonnes $CO_2$) | Cumulative Shortfall (Tonnes $CO_2$) |
| Total Target Savings | 349.52 | |
| Shortfall | 0 | 0 |

### 2.8 GLA Table 1 (Medius House New Build)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 6th-7th Floors | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 9.11 | 5.12 |
| Be Lean | 8.71 | 5.12 |
| Be Clean | 8.71 | 5.12 |
| Be Green | 8.71 | 5.12 |

### 2.9 GLA Table 2 (Medius House New Build)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 6th-7th Floors | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 0.4 | 4.4% |
| Be Clean | - | 0.0% |
| Be Green | - | 0.0% |
| Total cumulative savings | 0.4 | 4.4% |

### 2.10 GLA Table 5 (Medius House New Build)

| GLA Table 5: Shortfall in regulated carbon dioxide emissions | | |
|---|---|---|
| | Annual Shortfall (Tonnes $CO_2$) | Cumulative Shortfall (Tonnes $CO_2$) |
| Total Target Savings | 3.19 | |
| Shortfall | 2.79 | 83.67 |

### 2.11 GLA Table 2 (Medius House New Build and Refurbishment)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 681.2 | 67.6% |
| Be Clean | - | 0.0% |
| Total cumulative savings | 681.2 | 67.6% |

### 2.12 GLA Table 5 (Medius House New Build and Refurbishment)

| GLA Table 5: Shortfall in regulated carbon dioxide emissions | | |
|---|---|---|
| | Annual Shortfall (Tonnes $CO_2$) | Cumulative Shortfall (Tonnes $CO_2$) |
| Total Target Savings | 352.71 | |
| Shortfall | 0 | 0 |

## 2.13 Total Site Wide Carbon Emissions Castlewood and Medius House (New Build and Refurbishment)

| | Total Regulated Emissions (Tonnes Co2/year) | Co2 Savings (Tonnes Co2/year) | Percentage Saving (%) |
|---|---|---|---|
| Baseline | 1495.33 | | |
| Be Lean | 702.31 | 793.02 | 53.03 |
| Be Clean | 702.31 | 0.00 | 0.00 |
| Be Green | 694.98 | 7.33 | 0.49 |
| Total cumulative savings | | 800.35 | 53.52 |

The above table indicates a 53.28% carbon dioxide reduction as a result of the proposed Lean, Clean, and Green measures applied to the whole development, including improvements made to the performance of the existing parts of Medius House, and as a result of the change of use from commercial to residential. It is apparent that the relative poor performance of Medius House in its existing form, which is not compliant with any current Part L regulations (noting that there is a requirement to demonstrate a baseline Part L compliance prior to applying and Lean, Clean, or Green Measures), it could be considered that there is some distortion to the development wide results.

## 2.14 Site Wide Carbon Emissions Castlewood and Medius House (New Build)

| | Total Regulated Emissions (Tonnes Co2/year) | Co2 Savings (Tonnes Co2/year) | Percentage Saving (%) |
|---|---|---|---|
| Baseline | 496.69 | | |
| Be Lean | 384.48 | 112.21 | 22.59 |
| Be Clean | 384.48 | 0.00 | 0.00 |
| Be Green | 377.14 | 7.33 | 1.48 |
| Total cumulative savings | | 119.54 | 24.07 |
| | | **Co2 Savings Off-Set (Tonnes CO2)** | |
| Off-Set | | 1806.55 | |

The above table indicates a 24.4% carbon dioxide reduction for the parts of the development that have a "baseline" that is compliant with current Part L regulations, i.e. the new build elements only.

# 3 BACKGROUND

This Energy Statement has been prepared by GDM Partnership on behalf of Royal London Mutual Insurance Society to provide a commentary on the sustainability energy issues for the proposed buildings at Castlewood House and Medius House. It sets out the energy efficiency and carbon reduction measures that will be incorporated into the development.

## 3.1 The Buildings

### 3.1.1 Castlewood House

Castlewood House, consist of the construction of a ten storey mixed use building, plus ground and two basement levels, including the provision of retail (Class A1 and/or A3) and office (Class B1) floor space.

### 3.1.2 Medius House

Medius House currently consists of retail at Ground and Basement level with the Basement level being used as the retail store area. The 1st to 5th floors currently consist of commercial office space, occupied by multiple tenants.

Medius House's proposed layouts consist of retail at Ground and Basement level. The remaining floors will consist of residential areas throughout 1st-5th floors along with a new two storey extension which will also incorporate residential units.

## 3.2 Planning Policy

### 3.2.1 Background

The London Borough of Camden's climate change policies are aligned with those set out in the London Plan. London Plan policy 5.2 requires that major developments meet the carbon dioxide emissions reduction target of 35%.

The carbon reduction target of 35% applies to both Castlewood House and Medius House.

The energy strategy will be developed in accordance with requirements of the London Plan and specifically the GLA Energy Team's Guidance Note 'Guidance on Preparing Energy Statements', March 2016.

Policies within Chapter 5 of the London Plan (March 2016) set out relevant design and climate change adaptation policies relating to developments, and establishes expectations for applicants' commitments in terms of $CO_2$ savings and measures proposed.

As required by the GLA's Guidance, after establishing the baseline energy demand and profile for the site, the strategy for the project will follow the Mayor's Energy Hierarchy (be Lean, be Clean and be Green) in appraising appropriate measures to reduce carbon emissions and other climate impacts from the development:

- Use Less Energy - 'Be Lean'
- Supply Energy Efficiently - 'Be Clean'
- Use Renewable Energy - 'Be Green'

The planning application is 'full' and, accordingly, the Energy Assessment is based on dynamic simulation modelling using software approved for the use in Building Regulations Energy Performance Calculations.

The London Plan policy 5.2 requires a saving of 35% regulated carbon savings against a 2013 compliant building.

### 3.2.2 The Energy Hierarchy

The Mayor's Energy Hierarchy is central to the climate change policies. The stages of the hierarchy are:

Use Less Energy/Reduce Demand- 'Be Lean'

- Reduce use through behavior change
- Improve insulation
- Incorporate passive heating and cooling
- Install energy efficient lighting and appliances

Supply Energy Efficiently - 'Be Clean'

- Use CHP and community heating and/or cooling
- Cut transmission losses through local generation

Use Renewable Energy - 'Be Green'

- Install renewables on site
- Import renewable energy

## 3.3 Structure of the Energy Assessment

This statement is structured to respond to the Energy Hierarchy following the GLA's guidance. The statement includes:

- An assessment of the baseline carbon emissions based on the target emission rate for the retail and commercial elements.
- A review of the energy efficient features incorporated into the design.
- An assessment of the feasibility of connecting to a district heating network or incorporating a combined heat and power system.
- A review of renewable energy technologies and their application for this development.
- Recommendations and commitments.

# 4 ENERGY CONSUMPTION AND CARBON EMISSIONS AT CASTLEWOOD HOUSE

Before energy efficiency measures are investigated, it is necessary to establish the baseline energy consumption of the scheme, for comparison and evaluation of the proposed carbon reduction measures.

The baseline case against which carbon savings are assessed is a new development designed to achieve the target emission rate calculated in accordance with Part L (2013) of the Building Regulations. This baseline case represents a typical new build arrangement; where electricity for the development is imported from the grid and space and heating water are provided by fossil fuel sources.

The on-site energy consumption associated with non-regulated uses (e.g. lifts, small power and information technology) is included in the baseline carbon emission analysis.

The following 'regulated' energy uses are considered in the baseline energy analysis.

- Space Heating/Cooling
- Water Heating
- Ventilation
- Fans, Pumps and Controls
- Lighting (internal)

## 4.1 Proposed Baseline Development

### 4.1.1 Summary of modelling inputs at Castlewood House Baseline Stage

| | | Baseline |
|---|---|---|
| U Values W/m²K | External Walls | 0.3 |
| | Floor | 0.22 |
| | Roof | 0.2 |
| | Glazing | 1.41 |
| | Air Permeability | 5 |
| Lighting | Electricity Power Factor | >0.95 |
| | Auto Presence Detection | For lighting data, please refer to the lighting table below |
| | Daylight Control | |
| | Luminaire Lumens/ Circuit Watt or W/m² | |
| | Lux Levels | |
| Air Side Config Office & Retail | DHW Type | Natural Gas |
| | Heat Source Type | LTHW Boiler |
| | Heat Recovery | Plate Heat Exchanger |
| | HVAC Type | Fancoil Systems |
| | Exchanger Efficiency | 0.7 |
| | AHU Extract SFP W/l/s | Office = 0.75, Retail = 0.7 |
| | AHU Fresh Air W/l/s | Office = 0.75, Retail = 0.7 |
| | Terminal Fan SFP W/l/s | Office = 0.4, Retail = 0.2 |
| Nat Vent Circulation | DHW Type | No water heating |
| | Heat Source Type | LTHW Boiler |
| | HVAC Type | Radiators |
| | Heating Type | Radiators |
| Mech Vent WC | DHW Type | Natural Gas |
| | Heat Source Type | LTHW Boiler |
| | Heat Recovery | Plate Heat Exchanger |
| | HVAC Type | Radiators |
| | Exchanger Efficiency | 0.7 |
| | Fresh Air Fan SFP W/l/s | 0.7 |
| | Extract Fan SFP W/l/s | 0.7 |
| | Heating Type | Radiators |
| Extract Only Retail Kitchen | DHW Type | Natural Gas |
| | Heat Source Type | LTHW Boiler |
| | HVAC Type | Radiators |
| | Design Flow Rate | 6.0 ACH |
| | SFP W/l/s | 0.7 |
| | Heating Type | Radiators |
| Heating Circuit | Fuel Source | Office = Electric, All Other = Natural Gas |
| | Heat Pump? | No |
| | Distribution Efficiency % | Office = 100, All Other = 95 |
| | SCOP % | Office = 100, All Other = 91, Retail = 95 |
| Cooling Circuit | Fuel Source | Grid Supplied Electricity |
| | SEER | 4.5 |
| | Distribution Efficiency % | 95 |
| DHW Circuit | Fuel Source | Retail = Electric, All Other = Natural Gas |
| | Heat Pump? | No |
| | Distribution Efficiency % | Retail = 90, All Other = 95 |
| | Efficiency % | Retail = 100, All Other = 91 |
| Renewables PV | Inclination | N/A |
| | Solar Reflectance | N/A |
| | Surface Area m² | N/A |
| | Efficiency % | N/A |
| | EPC | B35 |
| TER | kg.CO2/m².yr | 26.6 |
| BER | kg.CO2/m².yr | 26.3 |
| | Pass/Fail | Pass |

### 4.1.2 Lighting Input Table

| Zone | Presence Detection System | Daylight Control | Lm/W | Design Lux Level |
|---|---|---|---|---|
| **Showers** | Auto On / Auto Off | N/A | 65 | 100 |
| **Circulation** | Auto On / Auto Off | N/A | 70 | 100 |
| **Office** | Auto On / Auto Off | Photocell On / Off | 75 | 400 |
| **Plant** | Manual On / Auto Off | N/A | 65 | 200 |
| **Reception** | Auto On / Auto Off | N/A | 65 | 200 |
| **Toilet** | Auto On / Auto Off | N/A | 65 | 200 |
| **Retail** | Manual On / Auto Off | N/A | 65 | 600/150 |
| **Food Prep** | Manual On / Auto Off | N/A | 65 | 500 |
| **Comms** | Manual On / Auto Off | N/A | 65 | 100 |

### 4.1.3 Carbon Emissions at End of 'Baseline' Stage (GLA Table 3)

| GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |

Based upon the results of this model a target emission rate of 26.6 kg/m²/year has been identified as the baseline figure.

## 4.2 Be Lean – Reduce Energy Demand

This section outlines how energy consumption will be reduced through the introduction of Lean design measures.

This is achieved by passive measures and the introduction of more energy efficient plant and services. Any improvement achieved at this stage will affect the extent of measures or size of plant needed to address the subsequent 'be Clean' and 'be Green' stages, as necessary to target the 35% carbon saving over a Part L 2013 compliant building.

### 4.2.1 Summary of Modelling inputs at 'Be Lean' Stage

Below is a summary of the changes to the baseline inputs:

| | | Be Lean |
|---|---|---|
| U Values W/m²K | External Walls | 0.26 |
| | Roof | 0.18 |
| Air Side Config Office & Retail | Heat Recovery | Thermal Wheel |
| | Exchanger Efficiency | 0.75 |
| | AHU Extract SFP W/l/s | 0.7 |
| | AHU Fresh Air W/l/s | 0.7 |
| | Terminal Fan SFP W/l/s | 0.2 |
| Mech Vent WC | Heat Recovery | Thermal Wheel |
| | Exchanger Efficiency | 0.75 |
| Heating Circuit | Fuel Source | Natural Gas |
| | Heat Pump? | No |
| | Distribution Efficiency % | 95 |
| | SCOP % | 97 |
| Cooling Circuit | SEER | 5.6 |
| DHW Circuit | Fuel Source | Natural Gas |
| | Heat Pump | No |
| | Distribution Efficiency % | 95 |
| | Efficiency % | 97 |

For all inputs at 'Be Lean' stage please refer to Appendix A.

### 4.2.2 Lighting Input Table

| Zone | Presence Detection System | Daylight Control | Lm/W |
|---|---|---|---|
| Showers | Auto On / Auto Off | N/A | 70 |
| Circulation | Auto On / Auto Off | N/A | 70 |
| Office | Auto On / Auto Off | Photocell Dimming | 100 |
| Plant | Auto On / Auto Off | N/A | 70 |
| Reception | Auto On / Auto Off | Photocell Dimming | 70 |
| Toilet | Auto On / Auto Off | N/A | 70 |
| Retail | Manual On / Auto Off | N/A | 65 |
| Food Prep | Manual On / Auto Off | N/A | 65 |
| Comms | Manual On / Auto Off | N/A | 65 |

### 4.2.3 Conclusion

Based on the proposed systems the building emission rate is 22.9% lower than the baseline target emission rate. Dropping from 26.6 kg/m²/yr to a value of 20.5 kg/m²/yr.

The improvement results from implementing a broad range of measures, including:

- High efficiency lighting
- High efficiency fans
- Very high efficiency heating system

The 'Be Lean' measures provide a carbon reduction against the baseline L2A 2013 compliant building of 22.1% on regulated emissions.

### 4.2.4 Carbon Emissions at End of 'Be Lean' Stage (GLA Table 3)

| GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |
| Be Lean | 375.77 | 442.30 |

### 4.2.5 Carbon Emissions at End of 'Be Lean' Stage (GLA Table 4)

| GLA Table 4: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 111.8 | 22.9% |

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## 4.3 Be Clean – Supply Energy Efficiently

The next step in the Energy Hierarchy is the 'Be Clean' strategy of supplying the required energy as efficiently as possible.

Potential approaches include connecting the scheme to existing low carbon or CHP-led district energy networks, or if no existing schemes exist, investigating whether such networks are planned in the area and designing systems with the flexibility to connect to these in the future.

With or without a district energy system, the feasibility of CHP (combined heat and power). For larger developments the use of a site wide communal heating system should be provided if considered viable.

### 4.3.1 District Energy Networks

The London Heat Map has been reviewed to check if the development can connect into an existing distribution network. Currently there are no existing or proposed heat distribution networks in the vicinity and as such this technology has not been incorporated into the proposed scheme.

Notwithstanding the above space allocation will be given within the basement areas for future connections of a district energy network should this be viable in the future.

### 4.3.2 CHP

CHP engines are not viable for a development of this nature due to a low constant heat demand and there being no significant background heat demand during the summer.

The viability of CHP would be marginally increased were it to serve both Castlewood House and Medius House, this is as a result of mixing two different heat load profiles. However, as discussed at the pre-app meeting with the GLA, the fact that the Castlewood and Medius buildings are separated by another building under separate ownership, it would not be practicable to install the necessary linking pipework, in view of the marginal benefit gained were they to be linked.

As such we do not propose to utilise CHP.

### 4.3.3 Conclusion

The development will not be connected to a district heating network or be provided with a CHP engine and as such these Clean measures have not been adopted as part of GDM's proposals.

The carbon emissions at the end of the 'be clean' stage are identical to those at the end of the 'be lean' as indicated within tables GLA 3 and 4.

### 4.3.4 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 3)

| GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |
| Be Lean | 375.77 | 442.30 |
| Be Clean | 375.77 | 442.30 |

### 4.3.5 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 4)

| GLA Table 4: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 111.8 | 22.9% |
| Be Clean | - | 0.0% |

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## 4.4 Be Green – Renewable Energy

The third and final stage of the Energy Hierarchy - 'Be Green' is to review the potential of a range of renewable energy systems to serve the energy requirements of the site and thereby offset $CO_2$ emissions.

### 4.4.1 Summary of Modelling inputs at 'Be Green' Stage

| | | |
|---|---|---|
| **Renewables PV** | **Inclination** | 10 |
| | **Solar Reflectance** | 0.2 |
| | **Surface Area m²** | 117 |
| | **Efficiency %** | 18 |

### 4.4.2 Solar Water Heating

Solar thermal domestic hot water generation is technically viable for this development. However, installing a solar thermal system to serve the office toilets will not make a significant carbon saving as the domestic hot water demand is very low. This combined with the limited available space at roof level has resulted in this technology being excluded from the final design proposals.

### 4.4.3 Wind Power

It is recognised that wind generators are often associated with unacceptable visual and noise implications. Wind technology as a renewable energy source is not considered appropriate for this site as it is felt that the wind turbines would not be visually appropriate for this development and so this technology is being excluded from the final design proposals.

### 4.4.4 Biomass Heating

Biomass heating is not considered to be a suitable technology for urban locations. With local boilers in each unit biomass boilers would not be a viable solution due fuel distribution problems on the site. In addition, the boilers are often un-used due to maintenance issues, fuel supply issues, and operating costs and as such this technology is being excluded from the final design proposals.

### 4.4.5 Photovoltaics

PV Panels are a viable technology for this development and there is sufficient south facing flat roof area to provide a substantial PV array. The building is not significantly overshadowed so PV panels would get significant amounts of sunlight. There is limited space available on the roof. With this in mind the maximum PV array proposed is 117m².

### 4.4.6 Conclusion

Photovoltaic collectors are the only viable solution for the proposed development. Therefore, a PV array of 79m² has been incorporated into the 'Be Green' design proposal.

### 4.4.7 Carbon Emissions at End of 'Be Green' Stage (GLA Table 3)

| GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |
| Be Lean | 375.77 | 442.30 |
| Be Clean | 375.77 | 442.30 |
| Be Green | 368.43 | 442.30 |

### 4.4.8 Carbon Emissions at End of 'Be Green' Stage (GLA Table 4)

| GLA Table 4: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Castlewood House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 111.8 | 22.9% |
| Be Clean | - | 0.0% |
| Be Green | 7.3 | 1.5% |
| Total cumulative savings | 119.1 | 24.4% |

## 5 CONCLUSION – CASTLEWOOD HOUSE

Energy efficiency measures will be implemented to target carbon savings of 35% in comparison to a baseline building that is fully compliant with the standard set by Part L 2013. The energy efficiency measures include: improved fabric insulation; improved air tightness; high efficiency fans; high efficiency heat recovery heating and cooling plant, heat recovery on ventilation systems; high efficiency lighting with daylight control and a 117m² array of PV. This will ensure the development achieves significant carbon savings beyond part L 2013 compliance through energy efficiency and green measures.

GLA tables 3 and 4 show the savings in carbon dioxide achieved by the three steps. The total site wide regulated carbon saving through the combination of energy efficient design and renewable technologies is **24.4%.**

The London Heat Map has been utilised to check if the development can connect into an existing distribution network. However currently there are no existing or proposed heat distribution networks in the vicinity and as such this option has been disregarded.

Combined heat and power engines are not viable for developments of this nature due to the low annual heating demand and there being no significant background heat demand during the summer. As such we do not propose to utilise CHP. This combined with the lack of a district heating scheme means that the Clean measures for this development are not viable. It should therefore be noted that the carbon emissions at the end of the 'be Clean' stage are identical to those being at the end of the 'be Lean' with no further improvements achieved.

Photovoltaic collectors are compatible with the proposed building services solution albeit there is limited space available on the roof. With this in mind the extent of the PV array has been restricted to an area of 79m², with these being mounted directly above the mechanical plant.

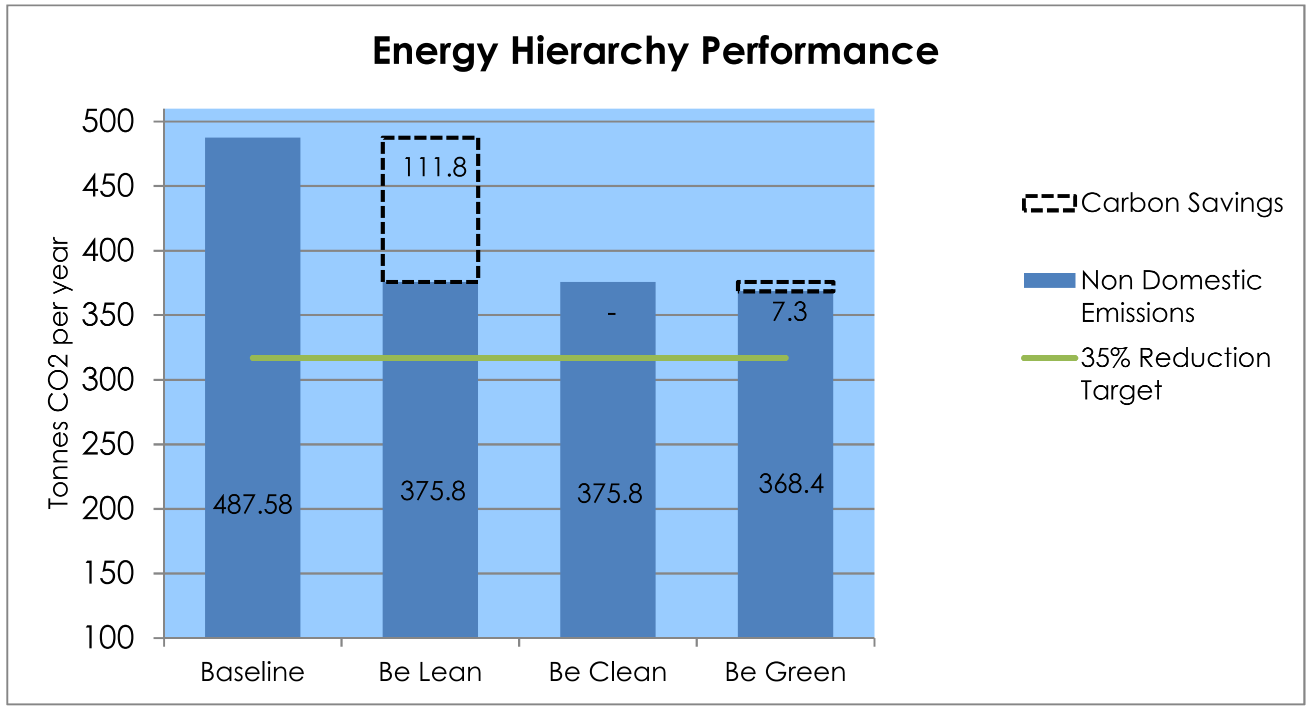
GLA Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

| Castlewood House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline | 487.58 | 442.30 |
| Be Lean | 375.77 | 442.30 |
| Be Clean | 375.77 | 442.30 |
| Be Green | 368.43 | 442.30 |

GLA Table 4: Carbon Dioxide Emissions from each stage of the Energy Hierarchy

| Castlewood House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
|---|---|---|
| Be Lean | 111.8 | 22.9% |
| Be Clean | - | 0.0% |
| Be Green | 7.3 | 1.5% |
| Total cumulative savings | 119.1 | 24.4% |

The above table indicates a 24.4% carbon dioxide reduction, as a result of the proposed Lean, Clean, and Green measures applied to Castlewood House only.




Due to the development not reaching a carbon reduction target of 35%, a carbon offset payment will accommodate the additional 10.6%. With the London Borough of Camden carbon offset costing £90 per tonne Castlewood House's cost offset over a 30 year period is £139,070 which equals £4,636 per year.

GDM PARTNERSHIP Sustainable Engineering

# 6 ENERGY CONSUMPTION AND CARBON EMISSIONS AT MEDIUS HOUSE

Medius House currently consists of retail at Ground and Basement level with the Basement level being used as the retail store area. The 1st to 5th floors currently consist of commercial office space, occupied by multiple tenants.

Medius House's proposed layouts consist of retail at Ground and Basement level. The remaining floors will consist of residential areas throughout 1st-5th floors along with a new two storey extension which will also incorporate residential units.

Due to the building being classed as a refurbishment no carbon emission target needs to be reached, instead the building needs to show that all refurbished areas need to comply with guidelines set out in Building Regulations Part L1B. Whilst the refurbished areas of Medius House have no carbon emission reduction targets, the emissions will be measured, and included within a separate BREEAM Refurbishment assessment.

However, the two storey extension of Medius House will be assessed against Building Regulations Part L1A.

## 6.1 Thermal Model Energy Calculations (1st-5th Floors)

Thermal calculations need to show that the proposed layouts for Medius House (1st-5th Floors) show an overall carbon reduction from the existing Medius House layouts. To do this it has to be assumed that the existing Medius House is also residential. This aligns with targets set out in the BREEAM Refurbishment assessment.

### 6.1.1 Building Fabric

The following building fabric U-Values were used in the SAP calculations:

| | | Existing | Proposed |
|---|---|---|---|
| U Values W/m²K | External Walls | 2 | 0.3 |
| | Floor | N/A | N/A |
| | Roof | 0.6 | 0.18 |
| | Glazing | 5.7* | 1.4** |
| | Air Permeability | 15 | 10 |

*G-Value – 0.84.
**G-Value – 0.63
The proposed U-Values below comply with standards set out in Building Regulations Part L1B.

### 6.1.2 Energy Efficiency Measures

- New Windows
- Uprated insulation to existing walls
- Uprated insulation to roof
- High efficiency central heating
- High efficiency lighting

### 6.1.3 Summary of Existing Inputs

| Service | Parameter | System |
|---|---|---|
| Ventilation | Type | Natural Ventilation with Extract |
| Space Heating | Type | Boiler |
| | Fuel | Mains Gas |
| | Efficiency Assumed | 78% |
| | Controls Units | Programmer and room thermostat |
| Hot Water | Source | From Main System |
| Thermal Bridging | Y-Value | Default Y-Values |
| Lighting | Standard Fittings | 100% |
| | Energy Efficient Fittings | 0 |

### 6.1.4 Summary of Proposed Inputs

| Service | Parameter | System |
|---|---|---|
| Ventilation | Type | Natural Ventilation with Extract |
| Space Heating | Type | Community |
| | Fuel | Mains Gas |
| | Efficiency Assumed | 96% |
| | Controls Units | Charging system linked to use, programmer & TRV's |
| Hot Water | Source | From Main System |
| Thermal Bridging | Y-Value | Approved Y-Values |
| Lighting | Standard Fittings | 0 |
| | Energy Efficient Fittings | 100% |

### 6.1.5 Carbon Emission Results

| Existing | SAP Rating | EI | DER (kg co2/m2/year) | Co2 Emission (kg/year) | CO2 Emission Rate (kg/m²/year) |
|---|---|---|---|---|---|
| 01 Apt 01 | 62 D | 58 D | 59.69 | 3057 | 56.68 |
| 01 Apt 02 | 62 D | 56 D | 50.02 | 4766 | 47.36 |
| 01 Apt 03 | 63 D | 60 D | 57.22 | 2958 | 54.53 |
| 02 Apt 01 | 51 E | 45 E | 79.54 | 4275 | 76.7 |
| 02 Apt 02 | 62 D | 56 D | 51.46 | 4673 | 48.73 |
| 02 Apt 03 | 66 D | 62 D | 48 | 3308 | 45.48 |
| 03 Apt 01 | 66 D | 64 D | 52.27 | 2742 | 49.19 |
| 03 Apt 02 | 64 D | 58 D | 48.31 | 4554 | 45.6 |
| 03 Apt 03 | 65 D | 62 D | 49.18 | 3202 | 46.67 |
| 04 Apt 01 | 60 D | 56 D | 62.31 | 3284 | 59.27 |
| 04 Apt 02 | 65 D | 60 E | 46.29 | 4345 | 43.5 |
| 04 Apt 03 | 65 D | 62 D | 49.04 | 3191 | 46.5 |
| 05 Apt 01 | 58 D | 52 E | 61.98 | 4283 | 59.11 |
| 05 Apt 02 | 56 D | 49 E | 59.94 | 5572 | 57.54 |
| 05 Apt 03 | 64 D | 62 D | 60.77 | 2457 | 58.06 |
| Total | | | 913.72 | 56667 | |

| Proposed | SAP Rating | EI | DER (kg co2/m2/year) | Co2 Emission (kg/year) | CO2 Emission Rate (kg/m²/year) |
|---|---|---|---|---|---|
| 01 Apt 01 | 83 B | 88 B | 18.84 | 900 | 16.68 |
| 01 Apt 02 | 83 B | 86 B | 17.2 | 1535 | 15.26 |
| 01 Apt 03 | 84 B | 89 B | 16.79 | 815 | 15.02 |
| 02 Apt 01 | 83 B | 88 B | 18.14 | 889 | 15.95 |
| 02 Apt 02 | 83 B | 86 B | 17.38 | 1473 | 15.36 |
| 02 Apt 03 | 84 B | 89 B | 15.11 | 983 | 13.51 |
| 03 Apt 01 | 83 B | 88 B | 18.14 | 889 | 15.95 |
| 03 Apt 02 | 83 B | 86 B | 17.43 | 1541 | 15.43 |
| 03 Apt 03 | 84 B | 89 B | 15.39 | 948 | 13.82 |
| 04 Apt 01 | 82 B | 87 B | 20.12 | 987 | 17.82 |
| 04 Apt 02 | 83 B | 86 B | 16.87 | 1480 | 14.82 |
| 04 Apt 03 | 84 B | 89 B | 15.44 | 949 | 13.83 |
| 05 Apt 01 | 82 B | 85 B | 20.07 | 1294 | 17.86 |
| 05 Apt 02 | 81 B | 84 B | 19.6 | 1706 | 17.62 |
| 05 Apt 03 | 82 B | 89 B | 19.56 | 746 | 17.63 |
| Total | | | 290.81 | 17135 | |

### 6.1.6 GLA Table 1 (Medius House Refurbishment (1st – 5th Floors)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 1st-5th Floors | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 998.64 | 17.78 |
| Be Lean | 317.84 | 17.78 |
| Be Clean | 317.84 | 17.78 |
| Be Green | 317.84 | 17.78 |

### 6.1.7 GLA Table 2 (Medius House Refurbishment (1st – 5th Floors)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House 1st-5th Floors | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 680.8 | 68.2% |
| Be Clean | - | 0.0% |
| Be Green | - | 0.0% |
| Total cumulative savings | 680.8 | 68.2% |

### 6.1.8 Conclusion

Energy efficiency measures have been implemented to provide the proposed refurbishment a 68.2% reduction in carbon emissions when compared against an existing residential model of Medius House.

## 6.2 Proposed Baseline Development (6th & 7th Floors)

### 6.2.1 Building Containing Multiple Dwellings

The London Plan states that ‘Major Developments’ are defined as more than 10 dwellings being constructed or if the area is more than 0.5 hectares. As Medius House (6th floor 3 apartments and 7th floor 2 apartments) would not come within either it is classed as a minor development and only needs to comply with Building Regulations.

Later within this report however, consideration is given to the combined carbon emissions for both Castlewood and Medius House (new and refurbishment).

### 6.2.2 Summary of modelling inputs at ‘Baseline’ Stage

| | | Proposed Baseline |
|---|---|---|
| **U Values W/m²K** | **External Walls** | 0.28 |
| | **Floor** | N/A |
| | **Roof** | 0.15 |
| | **Glazing** | 1.3 (G-Value – 0.6) |
| | **Air Permeability** | 3 |
| **Service** | | **System** |
| **Ventilation** | **Type** | Balanced (with heat recovery) |
| **Space Heating** | **Type** | Community |
| | **Fuel** | Mains Gas |
| | **Efficiency Assumed** | 94% |
| | **Controls Units** | Charging system linked to use, programmer and TRV’s |
| **Hot Water** | **Source** | From Main System |
| **Thermal Bridging** | **Y-Value** | Approved Y-Values |
| **Lighting** | **Standard Fittings** | 30% |
| | **Energy Efficient Fittings** | 70% |

### 6.2.3 Carbon Emissions at End of ‘Baseline’ Stage (GLA Table 1)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 9.11 | 5.12 |

Based upon the results of this model a target emission rate of 30.54 kg/m²/year has been identified as the overall baseline figure. This baseline figure is the total of the 5 Dwelling Emission Rates (DER’s) at Medius House.

## 6.3 Be Lean – Reduce Energy Demand (6th & 7th Floors)

### 6.3.1 Summary of modelling inputs at 'Be Lean' Stage

| | | Proposed Baseline |
|---|---|---|
| U Values W/m²K | External Walls | 0.25 |
| | Floor | N/A |
| | Roof | 0.15 |
| | Glazing | 1.2 (G-Value – 0.5) |
| | Air Permeability | 3 |
| Service | | System |
| Ventilation | Type | Balanced (with heat recovery) |
| Space Heating | Type | Community |
| | Fuel | Mains Gas |
| | Efficiency Assumed | 96% |
| | Controls Units | Charging system linked to use, programmer and TRV's |
| Hot Water | Source | From Main System |
| Thermal Bridging | Y-Value | Approved Y-Values |
| Lighting | Standard Fittings | 0% |
| | Energy Efficient Fittings | 100% |

### 6.3.2 Conclusion

Based on the proposed systems the building emission rate is 2.2% lower than the baseline target emission rate. Dropping from 30.54 kg/m²/yr to a value of 29.2 kg/m²/yr.

The improvement results from implementing a broad range of measures, including:

- High efficiency lighting
- Enhanced external wall U-Value
- Enhanced solar controlled glazing
- Improved heating efficiency

The 'Be Lean' measures provide a carbon reduction against the baseline L1A 2013 compliant building of 2.29% on regulated emissions.

### 6.3.3 Carbon Emissions at End of 'Be Lean' Stage (GLA Table 1)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 9.11 | 5.12 |
| Be Lean | 8.71 | 5.12 |

### 6.3.4 Carbon Emissions at End of 'Be Lean' Stage (GLA Table 2)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 0.4 | 4.4% |

## 6.4 Proposed Be Clean (6th & 7th Floors)

### 6.4.1 Summary of modelling inputs at 'Be Clean' Stage

| | | Proposed Baseline |
|---|---|---|
| U Values W/m²K | External Walls | 0.25 |
| | Floor | N/A |
| | Roof | 0.15 |
| | Glazing | 1.2 (G-Value – 0.5) |
| | Air Permeability | 3 |
| Service | | **System** |
| Ventilation | Type | Balanced (with heat recovery) |
| Space Heating | Type | Community |
| | Fuel | Mains Gas |
| | Efficiency Assumed | 96% |
| | Controls Units | Charging system linked to use, programmer and TRV's |
| Hot Water | Source | From Main System |
| Thermal Bridging | Y-Value | Approved Y-Values |
| Lighting | Standard Fittings | 0% |
| | Energy Efficient Fittings | 100% |

### 6.4.2 Conclusion

Due to a community heating network being used since the 'Baseline' Stage. No 'Clean' measures have been added to this stage.

The carbon emissions at the end of the 'be clean' stage are identical to those at the end of the 'be lean' as indicate within tables GLA 1 and 2.

### 6.4.3 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 1)

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 9.11 | 5.12 |
| Be Lean | 8.71 | 5.12 |
| Be Clean | 8.71 | 5.12 |

### 6.4.4 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 2)

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 0.4 | 4.4% |
| Be Clean | - | 0.0% |

## 6.5 Proposed Be Green – Renewable Energy (6th & 7th Floors)

The third and final stage of the Energy Hierarchy - 'Be Green' is to review the potential of a range of renewable energy systems to serve the energy requirements of the site and thereby offset $CO_2$ emissions.

### 6.5.1 Solar Water Heating

Solar thermal domestic hot water generation is technically viable for this development. However, installing a solar thermal system to serve the bathroom areas will not make a significant carbon saving as the domestic hot water demand is very low. This combined with the limited available space at roof level has resulted in this technology being excluded from the final design proposals.

### 6.5.2 Wind Power

It is recognised that wind generators are often associated with unacceptable visual and noise implications. Wind technology as a renewable energy source is not considered appropriate for this site as it is felt that the wind turbines would not be visually appropriate for this development and so this technology is being excluded from the final design proposals.

### 6.5.3 Biomass Heating

Biomass heating is not considered to be a suitable technology for urban locations. With local boilers in each unit biomass boilers are not a viable solution due fuel distribution problems on the site. In addition, the boilers are often un-used due to maintenance issues, fuel supply issues, and operating costs as such this technology is being excluded from the final design proposals.

### 6.5.4 Photovoltaics

PV Panels are a viable technology for this development, however, limited roof space is available. There is also a requirement to provide external communal space for development, therefore the proposed roof areas have been given over for this use. Any introduction of PV panels would have limited carbon savings benefit, and would have a detrimental impact on the communal space on the roof.

### 6.5.5 Conclusion

The development will not be using any of the renewable technologies listed above.

The carbon emissions at the end of the 'Be Green' stage are identical to those at the end of the 'Be Clean' stage as indicated within tables GLA 1 and 2.

### 6.5.6 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 1)

GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

| Medius House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline | 9.11 | 5.12 |
| Be Lean | 8.71 | 5.12 |
| Be Clean | 8.71 | 5.12 |
| Be Green | 8.71 | 5.12 |

### 6.5.7 Carbon Emissions at End of 'Be Clean' Stage (GLA Table 2)

GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy

| Medius House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
|---|---|---|
| Be Lean | 0.4 | 4.4% |
| Be Clean | - | 0.0% |
| Be Green | - | 0.0% |
| Total cumulative savings | 0.4 | 4.4% |

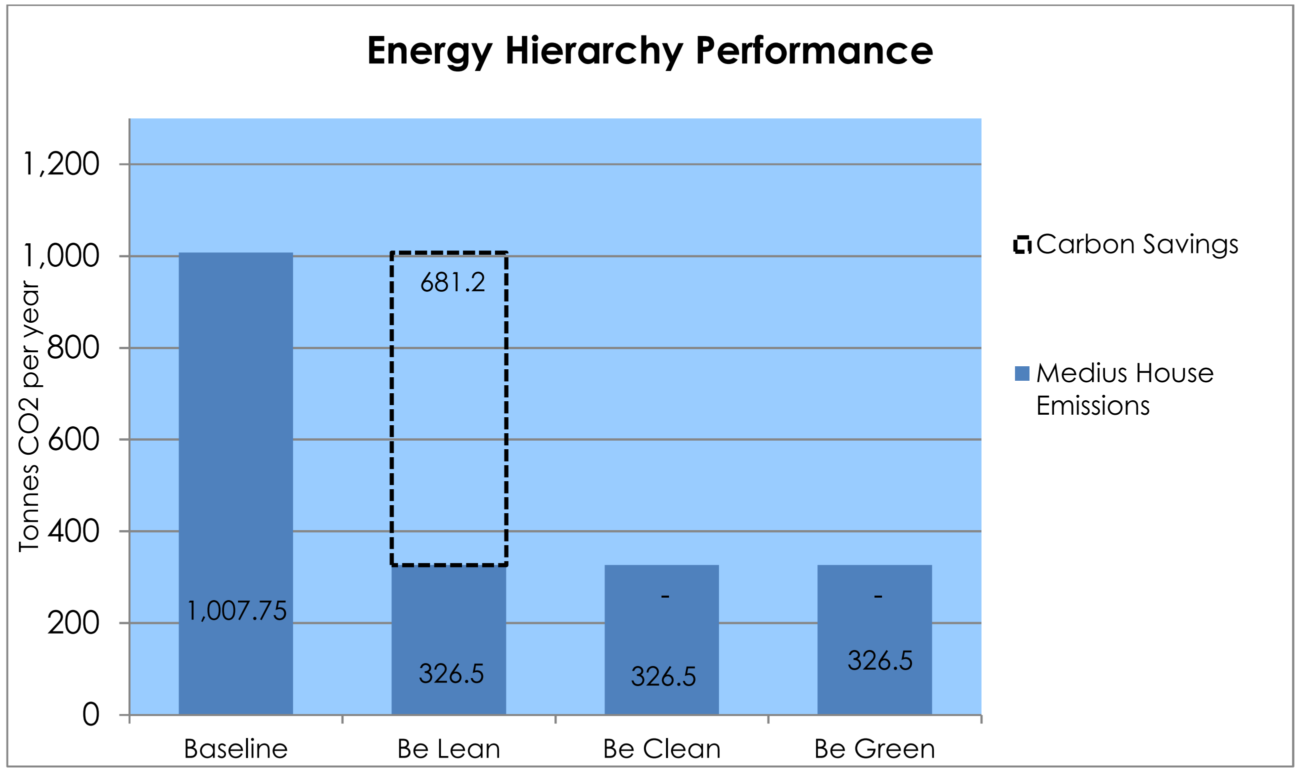
## 7 CONCLUSION – MEDIUS HOUSE

Energy efficiency measures will be implemented as part of the refurbishment in order to achieve significant carbon savings when comparing against the existing building. The energy efficiency measures include: improved fabric insulation; high efficiency fans; high efficiency heat recovery on ventilation systems; and high efficiency lighting with daylight control.

GLA tables 1 and 2 show Medius House's overall carbon dioxide savings when the refurbishment and new build are combined.

| GLA Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
| | Regulated | Unregulated |
| Baseline | 1007.75 | 22.90 |
| Be Lean | 326.55 | 22.90 |
| Be Clean | 326.55 | 22.90 |
| Be Green | 326.55 | 22.90 |

| GLA Table 2: Carbon Dioxide Emissions from each stage of the Energy Hierarchy | | |
|---|---|---|
| Medius House | Carbon dioxide savings (Tonnes $CO_2$ per annum) | Carbon dioxide savings (%) |
| Be Lean | 681.2 | 67.6% |
| Be Clean | - | 0.0% |
| Be Green | - | 0.0% |
| Total cumulative savings | 681.2 | 67.6% |



# 8 SITE WIDE CARBON EMISSIONS

## 8.1 Castlewood & Medius House (New Build & Refurbishment)

| | Total Regulated Emissions (Tonnes Co2/year) | Co2 Savings (Tonnes Co2/year) | Percentage Saving (%) |
|---|---|---|---|
| Baseline | 1495.33 | | |
| Be Lean | 702.31 | 793.02 | 53.03 |
| Be Clean | 702.31 | 0.00 | 0.00 |
| Be Green | 694.98 | 7.33 | 0.49 |
| | | **Co2 Savings Off-Set (Tonnes CO2)** | |
| Off-Set | | 0 | |

# 9 APPENDIX A CASTLEWOOD HOUSE ENERGY CALCULATION INPUTS

| | | Baseline | Be Lean | Be Green |
|---|---|---|---|---|
| U Values W/m²K | External Walls | 0.3 | 0.26 | 0.26 |
| | Floor | 0.22 | 0.22 | 0.22 |
| | Roof | 0.2 | 0.18 | 0.18 |
| | Glazing | 1.41 | 1.41 | 1.41 |
| | Air Permeability | 5 | 5 | 5 |
| Lighting | Electricity Power Factor | >0.95 | >0.95 | >0.95 |
| | Auto Presence Detection | For lighting data, please refer to the lighting table below | For lighting data, please refer to the lighting table below | For lighting data, please refer to the lighting table below |
| | Daylight Control | | | |
| | Luminaire Lumens/ Circuit Watt or W/m² | | | |
| | Lux Levels | | | |
| Air Side Config Office & Retail | DHW Type | Natural Gas | Natural Gas | Natural Gas |
| | Heat Source Type | LTHW Boiler | LTHW Boiler | LTHW Boiler |
| | Heat Recovery | Plate Heat Exchanger | Thermal Wheel | Thermal Wheel |
| | HVAC Type | Fancoil Systems | Fancoil Systems | Fancoil Systems |
| | Exchanger Efficiency | 0.7 | 0.75 | 0.75 |
| | AHU Extract SFP W/l/s | Office = 0.75, Retail = 0.7 | 0.7 | 0.7 |
| | AHU Fresh Air W/l/s | Office = 0.75, Retail = 0.7 | 0.7 | 0.7 |
| | Terminal Fan SFP W/l/s | Office = 0.4, Retail = 0.2 | 0.2 | 0.2 |
| Nat Vent Circulation | DHW Type | No water heating | No water heating | No water heating |
| | Heat Source Type | LTHW Boiler | LTHW Boiler | LTHW Boiler |
| | HVAC Type | Radiators | Radiators | Radiators |
| | Heating Type | Radiators | Radiators | Radiators |
| Mech Vent WC | DHW Type | Natural Gas | Natural Gas | Natural Gas |
| | Heat Source Type | LTHW Boiler | LTHW Boiler | LTHW Boiler |
| | Heat Recovery | Plate Heat Exchanger | Thermal Wheel | Thermal Wheel |
| | HVAC Type | Radiators | Radiators | Radiators |
| | Exchanger Efficiency | 0.7 | 0.75 | 0.75 |
| | Fresh Air Fan SFP W/l/s | 0.7 | 0.7 | 0.7 |
| | Extract Fan SFP W/l/s | 0.7 | 0.7 | 0.7 |
| | Heating Type | Radiators | Radiators | Radiators |
| Extract Only Retail Kitchen | DHW Type | Natural Gas | Natural Gas | Natural Gas |
| | Heat Source Type | LTHW Boiler | LTHW Boiler | LTHW Boiler |
| | HVAC Type | Radiators | Radiators | Radiators |
| | Design Flow Rate | 6.0 ACH | 6.0 ACH | 6.0 ACH |
| | SFP W/l/s | 0.7 | 0.7 | 0.7 |
| | Heating Type | Radiators | Radiators | Radiators |
| Heating Circuit | Fuel Source | Office = Electric, All Other = Natural Gas | Natural Gas | Natural Gas |
| | Heat Pump? | No | No | No |
| | Distribution Efficiency % | Office = 100, All Other = 95 | 95 | 95 |
| | SCOP % | Office = 100, All Other = 91, Retail = 95 | 97 | 97 |
| Cooling Circuit | Fuel Source | Grid Supplied Electricity | Grid Supplied Electricity | Grid Supplied Electricity |
| | SEER | 4.5 | 5.6 | 5.6 |
| | Distribution Efficiency % | 95 | 95 | 95 |
| DHW Circuit | Fuel Source | Retail = Electric, All Other = Natural Gas | Natural Gas | Natural Gas |
| | Heat Pump? | No | No | No |
| | Distribution Efficiency % | Retail = 90, All Other = 95 | 95 | 95 |
| | Efficiency % | Retail = 100, All Other = 91 | 97 | 91 |
| Renewables PV | Inclination | N/A | N/A | 10 |
| | Solar Reflectance | N/A | N/A | 0.2 |
| | Surface Area m² | N/A | N/A | 117 |
| | Efficiency % | N/A | N/A | 18 |
| | EPC | B35 | B27 | B27 |
| TER | $kg.CO_2/m^2.yr$ | 26.6 | 25.9 | 25.9 |
| BER | $kg.CO_2/m^2.yr$ | 26.3 | 20.5 | 20.1 |
| | Pass/Fail | Pass | Pass | Pass |
| | % Reduction | 1.13 | 22.93 | 24.44 |

# 10 APPENDIX B CASTLEWOOD HOUSE BRUKL REPORTS (FRONT PAGE ONLY)

## BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

**Castlewood House Baseline** As designed

Date: Wed Jan 11 16:24:01 2017

### Administrative information

**Building Details**

**Address:** .

**Certification tool**

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.0"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.0

**BRUKL compliance check version:** v5.2.g.3

**Owner Details**

**Name:**

**Telephone number:**

**Address:** , ,

**Certifier details**

**Name:**

**Telephone number:**

**Address:** , ,

### Criterion 1: The calculated $CO_2$ emission rate for the building should not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2$.annum | 26.6 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 26.6 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 26.3 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

### Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

**Building fabric**

| Element | $U_{a-Limit}$ | $U_{a-Calc}$ | $U_{i-Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.3 | 0.3 | External Wall |
| Floor | 0.25 | 0.22 | 0.22 | Exposed Floor |
| Roof | 0.25 | 0.2 | 0.2 | Roof |
| Windows***, roof windows, and rooflights | 2.2 | 1.41 | 1.47 | 03 Win 02 |
| Personnel doors | 2.2 | - | - | No personal doors in project |
| Vehicle access & similar large doors | 1.5 | - | - | No vehicle doors in project |
| High usage entrance doors | 3.5 | - | - | No high usage entrance doors in project |

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a-Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i-Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| m³/(h.m²) at 50 Pa | 10 | 5 |

## BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

**Castlewood House Be Lean Rev A** As designed

Date: Wed Jan 11 17:04:25 2017

### Administrative information

**Building Details**

**Address:** .

**Certification tool**

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.0"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.0

**BRUKL compliance check version:** v5.2.g.3

**Owner Details**

**Name:**

**Telephone number:**

**Address:** , ,

**Certifier details**

**Name:**

**Telephone number:**

**Address:** , ,

### Criterion 1: The calculated $CO_2$ emission rate for the building should not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2$.annum | 25.9 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 25.9 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 20.5 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

### Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

**Building fabric**

| Element | $U_{a-Limit}$ | $U_{a-Calc}$ | $U_{i-Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.26 | 0.26 | External Wall |
| Floor | 0.25 | 0.22 | 0.22 | Exposed Floor |
| Roof | 0.25 | 0.18 | 0.18 | Roof |
| Windows***, roof windows, and rooflights | 2.2 | 1.41 | 1.47 | 03 Win 02 |
| Personnel doors | 2.2 | - | - | No personal doors in project |
| Vehicle access & similar large doors | 1.5 | - | - | No vehicle doors in project |
| High usage entrance doors | 3.5 | - | - | No high usage entrance doors in project |

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a-Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i-Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| m³/(h.m²) at 50 Pa | 10 | 5 |

GDM PARTNERSHIP
Sustainable Engineering

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

## Castlewood House Be Green 117m2 PV

As designed

**Date:** Wed Apr 19 14:39:13 2017

## Administrative information

### Building Details

**Address:** ,

### Certification tool

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.0"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.0

**BRUKL compliance check version:** v5.2.g.3

### Owner Details

**Name:**

**Telephone number:**

**Address:** , ,

### Certifier details

**Name:**

**Telephone number:**

**Address:** , ,

## Criterion 1: The calculated $CO_2$ emission rate for the building should not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2$.annum | 25.9 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 25.9 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 20.1 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

## Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

### Building fabric

| Element | $U_{a-Limit}$ | $U_{a-Calc}$ | $U_{i-Calc}$ | Surface where the maximum value occurs* |
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| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
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