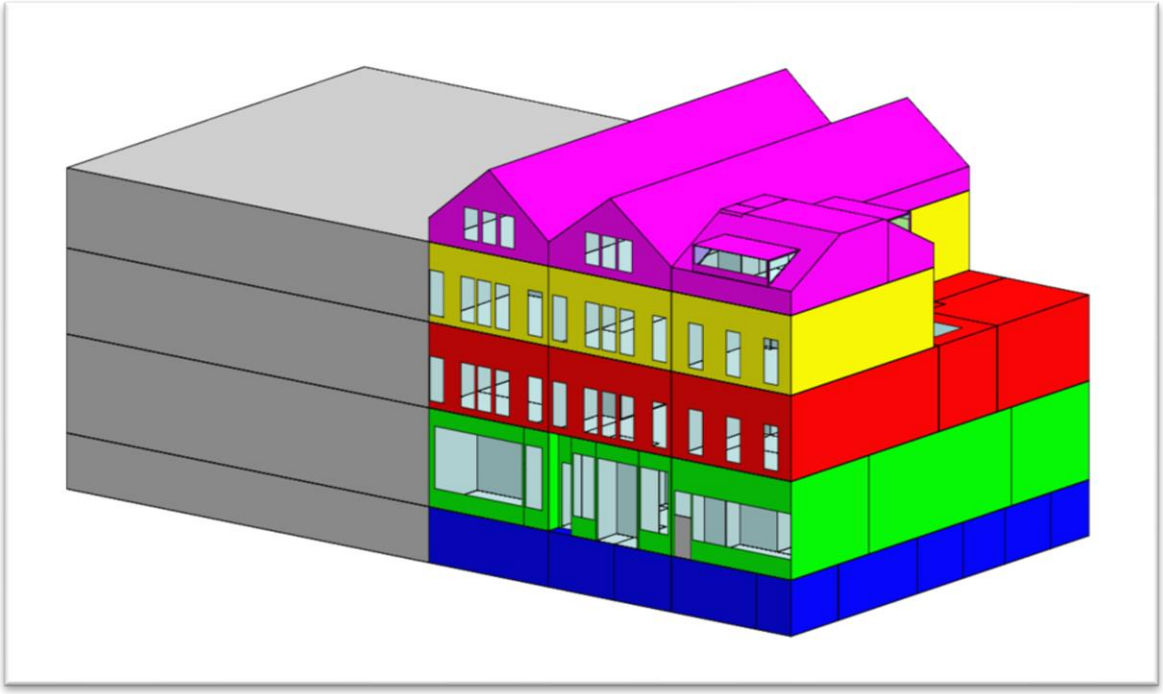
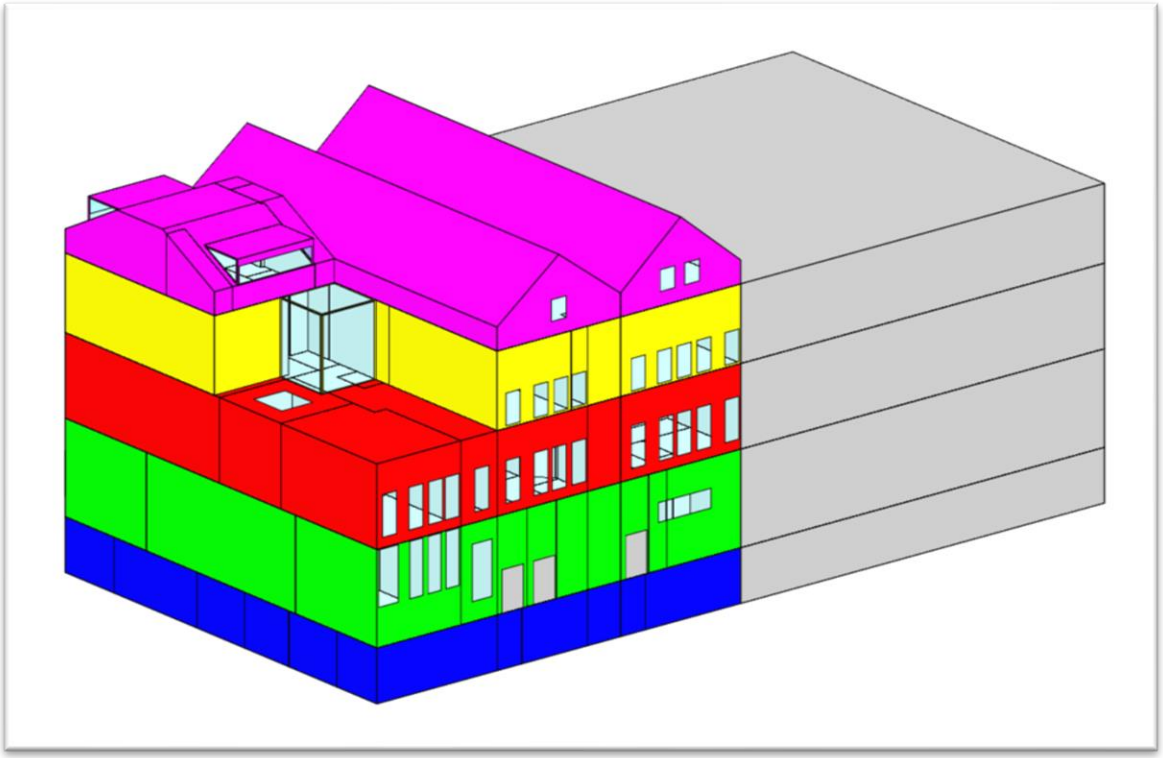
JRB ENVIRONMENTAL DESIGN LTD.

M&E BUILDING SERVICES CONSULTING ENGINEERS

# 102 – 104 Abbey Road
# Sustainability Report



102-104 Abbey Road, Barrow-in-Furness
North West England, England, LA14 5QR, United Kingdom



## DOCUMENT ISSUE RECORD

| DATE | REVISION | NOTES / COMMENTS | AUTHOR |
|---|---|---|---|
| Dec 2021 | Rev - | Preliminary Issue | JRB EDL |

## INDEX

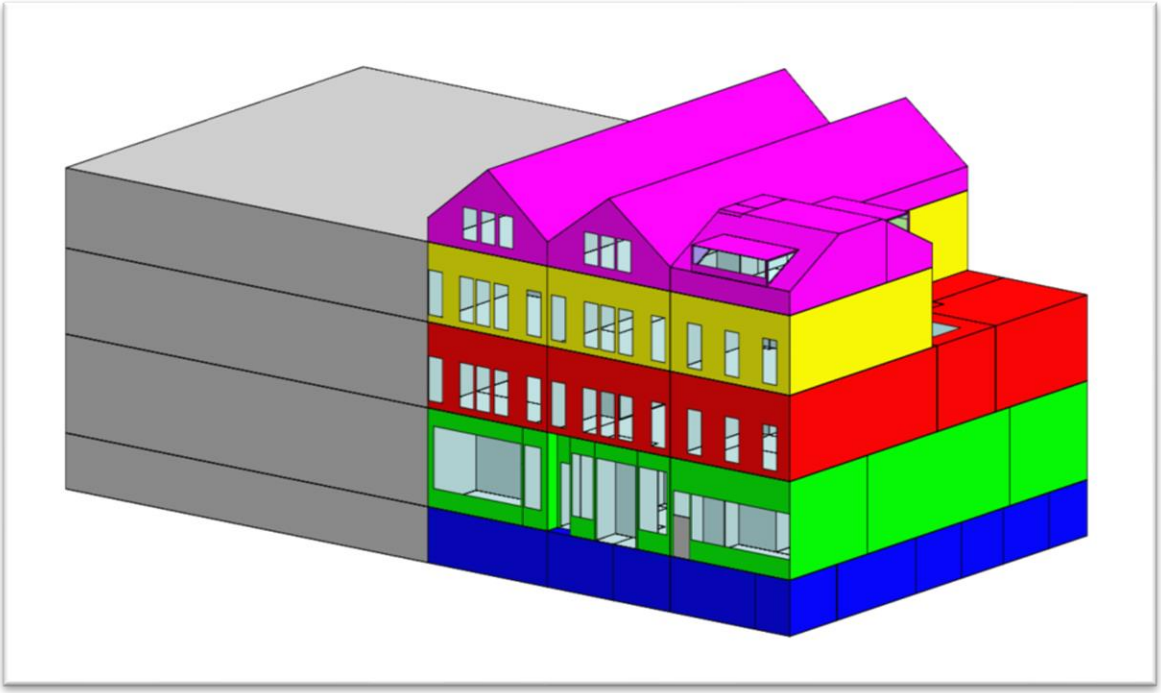
# 102 – 104 Abbey Road
# Sustainability Report

## 1- Project Description

The project comprises of an existing building at 102-104 Abbey Road, Barrow-in-Furness. The building encompasses various areas such as offices, workshops, performance stages, seating, eating and drinking facilities. Limited information of the existing building elements are known therefore National Calculation Method (NCM) default values have been used as the basis of the calculations.

## 2- Model Visualisation

The digital model was produced based on the Architects design layouts and site photos.



## 3-Scope of the Report

### Objectives

The objective of this report is to make an initial assessment of the buildings energy consumption and carbon dioxide emissions. This will provide a basis to model various alterations to the existing building fabric and mechanical and electrical building services to demonstrate the environmental impacts.

### Relevant Regulations & Standards

The thermal modelling has been carried out using software selected and applied in accordance with CIBSE AM 11 Building Energy and Environment Modelling to provide full dynamic thermal analysis.

As the building is existing and limited details of the existing building are know, details from the National Calculation Method (NCM) schedules have been used.

## WEATHER

The Chartered Institution of Building Services Engineers (CIBSE) weather files (Test Reference Year, TRY and Design Simulation Year, DSY) are used mainly to show compliance with UK Building Regulations. They contain whole-year weather variables for various locations throughout the UK designed for use in dynamic thermal simulation.

CIBSE Manchester weather data has been used in this calculation as this location is the closest to the project location.

## GEOMETRY

The building geometry was gained from the architects drawings which we received in AutoCAD format, these were then converted into DWF format and inserted into the modelling software. Section and External Elevation drawings were available from the architect that detailed the floor levels and heights of the glazing and doors. The building orientation was determined by using an online free map services.

## CONSTRUCTION DETAILS

The initial construction details have been provided by the architect setting out the U Values that are to be used within the modelling software.

Fabric U Values Summary (W/m².K):

NCM basement floor (0.58): LONDON CLAY- 750 mm, Brick slips- 25 mm, Cast concrete- 100 mm, Flooring screed- 50 mm.

NCM basement walls (0.58): LONDON CLAY- 750 mm, Brick slips- 25 mm, Cast concrete- 100 mm, Flooring screed- 50 mm.

NCM external wall (1.60): Brick- outer leaf- 340mm, Plasterboard- 13mm.

NCM pitched roof (2.5): Tiles Concrete- 10 mm, Cavity- mm, Plasterboard (ceiling)- 9.5mm.

NCM flat roof (2.1): Stone Chippings- 25 mm, Asphalt Mastic Roofing- 19 mm, Aerated-Concrete Slab- 150 mm, Cavity- mm, Plasterboard (ceiling)- 13 mm.

NCM External Window (5.7): Outer Pane- 4 mm.

NCM Skylight (5.7): Outer Pane- 4 mm.

NCM Door (3.0): Plywood- 30 mm.

# 4-RESULTS

A number of different simulations have been undertaken to demonstrate the environmental impacts of the proposed works.

## SIMULATION 1 – EXISTING

This initial simulation formed the basis of the report to establish a baseline for the building to calculate the impact of the proposed works.

This simulation utilised the above thermal elements derived from the NCM database plus the existing surveyed Mechanical & Electrical services. Generally the existing services are as follows:

- 102 Basement – Un-serviced.
- 104 Basement – Low pressure hot water heating via high level coil, individual supply & extract ventilation (no heat recovery).
- 102 Ground Floor – Existing split air conditioning units.
- 104 Ground Floor – Low pressure hot water heating via radiators, part mechanical heat recovery ventilation, part mechanical extract ventilation, part natural ventilation.
- 102 First Floor - Assumed low pressure hot water heating via radiators and natural ventilation.
- 104 First Floor - Low pressure hot water heating via radiators and part mechanical heat recovery ventilation and part natural ventilation.
- 102 Second Floor - Assumed low pressure hot water heating via radiators and natural ventilation.
- 104 Second Floor - Low pressure hot water heating via radiators and part mechanical extract ventilation and part natural ventilation.
- 102 Third Floor – Un-serviced.
- 104 Third Floor – Assumed LPHW background heating and natural ventilation.

Utilising the above information, these details were inputted into the software to generate the base building energy consumptions. The below figures are based on a square meter basis.

| | | |
|---|---|---|
| Calculated Heating energy consumption | 150.66 | [kWh/m²] |
| Calculated Cooling energy consumption | 0.37 | [kWh/m²] |
| Calculated Auxiliary energy consumption | 10.85 | [kWh/m²] |
| Calculated Lighting energy consumption | 64.51 | [kWh/m²] |
| Calculated Hot Water energy consumption | 42.33 | [kWh/m²] |
| Calculated Equipment energy consumption* | 44.04 | [kWh/m²] |
| **Calculated TOTAL energy consumption** | **268.72** | **[kWh/m²]** |

*Energy used for equipment does not count towards the total consumption or emissions.

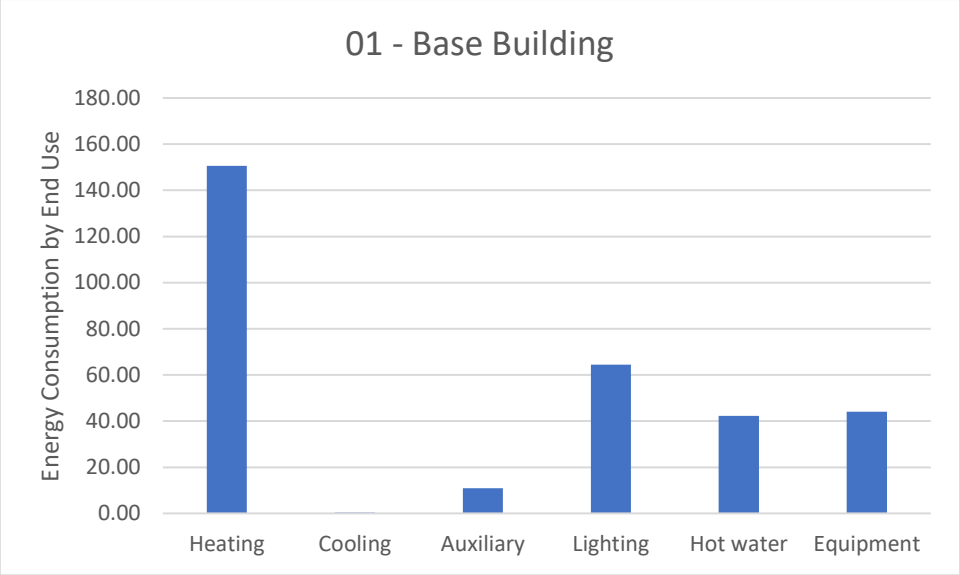



Table of Base Building Energy Consumption by End Use

| | | |
|---|---|---|
| Building CO2 Emission Rate (BER) | 83.50 | [Kg.$CO_2$/$m^{2]}$ |
| Energy Performance Certificate (EPC) | D87 | |

## SIMULATION 2 – PROPOSED NEW MECHANICAL SERVICES

This simulation utilised the details from the first however incorporated the proposed new mechanical services as follows:

- 102 Basement – New LPHW underfloor heating, New MHR ventilation.
- 102 Ground Floor – New high COP heat recovery VRF external condenser.
- 102 First Floor – No changes.
- 102 Second Floor – No changes.
- 102 Third Floor – New plasma electric panel heaters.
- 104 Building – Minor alterations to existing services.

Results of the second simulation as follows:

| | | |
|---|---|---|
| Calculated Heating energy consumption | 148.21 | [kWh/m²] |
| Calculated Cooling energy consumption | 0.11 | [kWh/m²] |
| Calculated Auxiliary energy consumption | 11.67 | [kWh/m²] |
| Calculated Lighting energy consumption | 64.51 | [kWh/m²] |
| Calculated Hot Water energy consumption | 42.33 | [kWh/m²] |
| Calculated Equipment energy consumption* | 44.04 | [kWh/m²] |
| **Calculated TOTAL energy consumption** | **266.83** | **[kWh/m²]** |

*Energy used for equipment does not count towards the total consumption or emissions.

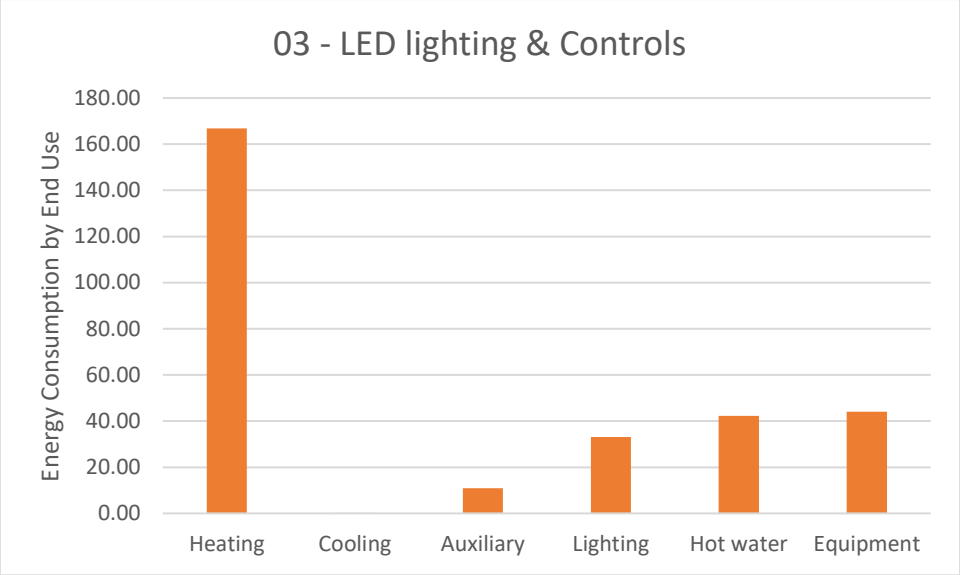



Table of Base Building Energy Consumption by End Use

| | | |
|---|---|---|
| Building CO2 Emission Rate (BER) | 83.10 | [Kg.$CO_2$/$m^{2]}$ |
| Energy Performance Certificate (EPC) | D82 | |

Due to a number of areas proposed to have new mechanical services are currently un-serviced, there are minimal improvements to the individual end use.

| | Simulation 1 | Simulation 2 | Improvement |
|---|---|---|---|
| Heating energy consumption | 150.66 | 148.21 | 2.45 |
| Cooling energy consumption | 0.37 | 0.11 | 0.26 |
| Auxiliary energy consumption | 10.85 | 11.67 | -0.82 |
| Lighting energy consumption | 64.51 | 64.51 | 0.00 |
| Hot Water energy consumption | 42.33 | 42.33 | 0.00 |
| Equipment energy consumption* | 44.04 | 44.04 | 0.00 |
| **TOTAL energy consumption** | **268.72** | **266.83** | **1.89** |
| Building CO2 Emission Rate (BER) | 83.50 | 83.10 | 0.40 |
| Energy Performance Certificate (EPC) | D87 | D82 | 4 |

## Simulation 3 – Proposed New LED Lighting and Controls

This simulation utilised the details from the first however incorporated the proposed new LED lighting and controls, however minus the proposed mechanical services.

Results of the third simulation as follows:

| | | |
|---|---|---|
| Calculated Heating energy consumption | 166.80 | [kWh/m²] |
| Calculated Cooling energy consumption | 0.29 | [kWh/m²] |
| Calculated Auxiliary energy consumption | 10.85 | [kWh/m²] |
| Calculated Lighting energy consumption | 33.14 | [kWh/m²] |
| Calculated Hot Water energy consumption | 42.33 | [kWh/m²] |
| Calculated Equipment energy consumption* | 44.04 | [kWh/m²] |
| **Calculated TOTAL energy consumption** | **253.41** | **[kWh/m²]** |

*Energy used for equipment does not count towards the total consumption or emissions.

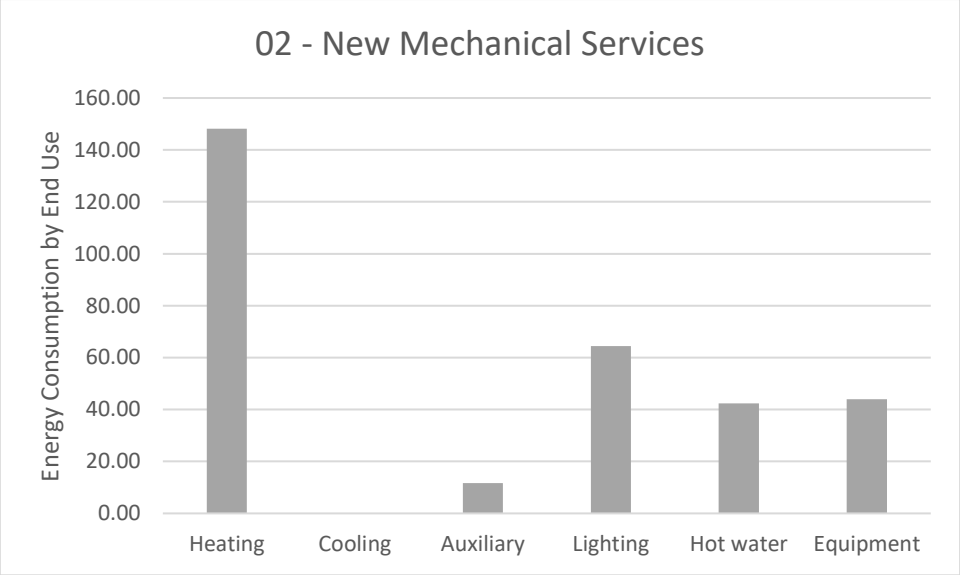



Table of Base Building Energy Consumption by End Use

| | | |
|---|---|---|
| Building CO2 Emission Rate (BER) | 83.10 | [Kg.$CO_2$/$m^{2]}$ |
| Energy Performance Certificate (EPC) | C74 | |

| | Simulation 1 | Simulation 3 | Improvement |
|---|---|---|---|
| Heating energy consumption | 150.66 | 166.80 | -16.14 |
| Cooling energy consumption | 0.37 | 0.29 | 0.08 |
| Auxiliary energy consumption | 10.85 | 10.85 | 0.00 |
| Lighting energy consumption | 64.51 | 33.14 | 31.37 |
| Hot Water energy consumption | 42.33 | 42.33 | 0.00 |
| Equipment energy consumption* | 44.04 | 44.04 | 0.00 |
| **TOTAL energy consumption** | **268.72** | **253.41** | **15.31** |
| Building CO2 Emission Rate (BER) | 83.50 | 70.80 | 12.70 |
| Energy Performance Certificate (EPC) | D87 | C74 | 13 |

Utilising new LED lighting and controls there is a significant impact with the reduction in energy consumption relating to lighting. However there is a knock on effect to the heating energy consumption for heating, this has increased slightly as the new efficient lighting will give off less heat, therefore the mechanical services will require to be operated longer to compensate.

## SIMULATION 4 – PROPOSED NEW M&E INSTALLATIONS

This simulation utilised the details from the first however incorporated the proposed new mechanical and electrical service installations, plus insulation to the attic of Building 102 to achieve a U-Value of 0.18.

Results of the fourth simulation as follows:

| | | |
|---|---|---|
| Calculated Heating energy consumption | 162.79 | [kWh/m²] |
| Calculated Cooling energy consumption | 0.08 | [kWh/m²] |
| Calculated Auxiliary energy consumption | 11.67 | [kWh/m²] |
| Calculated Lighting energy consumption | 33.14 | [kWh/m²] |
| Calculated Hot Water energy consumption | 42.33 | [kWh/m²] |
| Calculated Equipment energy consumption* | 44.04 | [kWh/m²] |
| **Calculated TOTAL energy consumption** | **250.01** | **[kWh/m²]** |

*Energy used for equipment does not count towards the total consumption or emissions.

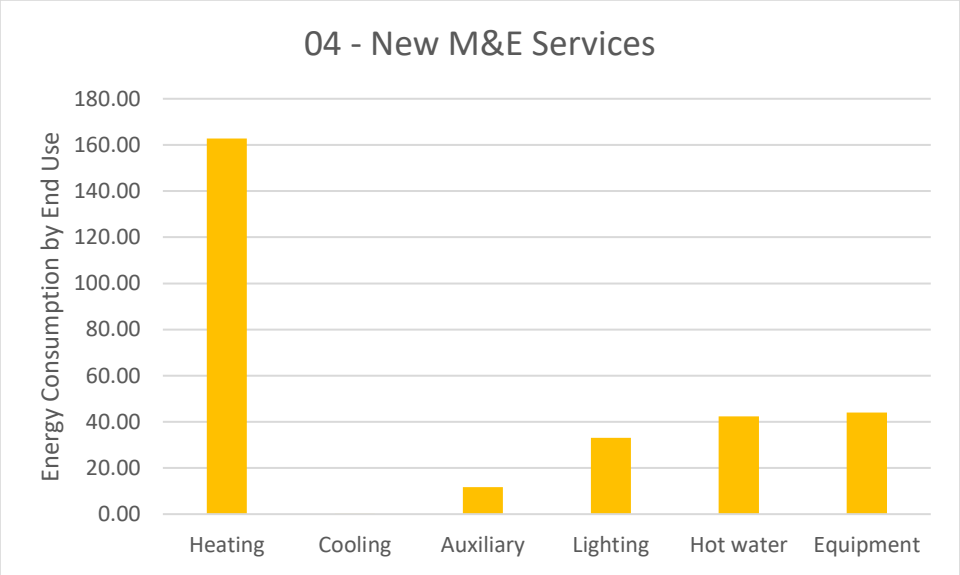



Table of Base Building Energy Consumption by End Use

| | | |
|---|---|---|
| Building CO2 Emission Rate (BER) | 83.10 | [Kg.$CO_2$/$m^2$] |
| Energy Performance Certificate (EPC) | C68 | |

| | Simulation 1 | Simulation 4 | Improvement |
|---|---|---|---|
| Heating energy consumption | 150.66 | 162.79 | -12.13 |
| Cooling energy consumption | 0.37 | 0.08 | 0.29 |
| Auxiliary energy consumption | 10.85 | 11.67 | -0.82 |
| Lighting energy consumption | 64.51 | 33.14 | 31.37 |
| Hot Water energy consumption | 42.33 | 42.33 | 0.00 |
| Equipment energy consumption* | 44.04 | 44.04 | 0.00 |
| **TOTAL energy consumption** | **268.72** | **250.01** | 18.71 |
| Building CO2 Emission Rate (BER) | 83.50 | **69.40** | 14.10 |
| Energy Performance Certificate (EPC) | D87 | C68 | 19 |

The proposed energy efficient lighting has a negative effect to the existing heating system, this is because the new lighting will not produce the same heat output to compliment the existing systems. On the other hand, the new insulation to Building 102 attic room reduces the heating consumption.

New proposed air conditioning systems are more efficient had have a positive impact to reducing overall energy consumption and reducing $CO_2$ emissions.

Auxiliary energy will increase slightly due to the incorporation of additional new mechanical heat recovery ventilation.

Lighting is significantly reduced due to the inclusion of LED lighting and controls.

Hot water has remained the same as there is no significant alterations.

Energy consumption from equipment is a notional figure assumed by the calculation software and remains the same in all simulations.

## 5-CONCLSUION

On review of the simulations it is clear that the proposed new mechanical and electrical installation and new insulation to Building 102 attic rooms will have a significant impact on the energy consumption and CO2 emissions. The following graph demonstrates the overall reductions through each simulation.

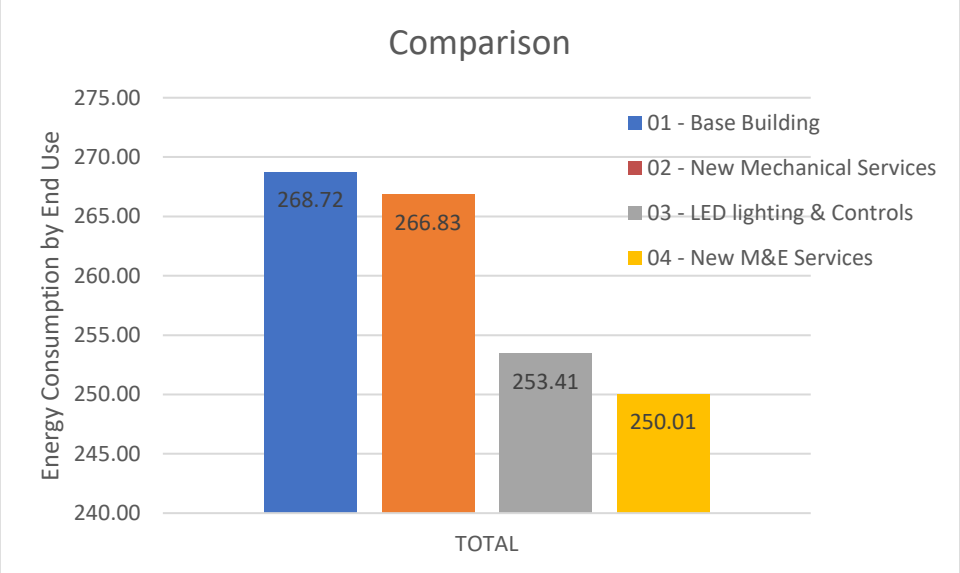



Table of Base Building Energy Consumption by End Use

## APPENDICES

## A – BUILDING REGULATIONS UK PART L DOCUMENT

## B – SBEM MAIN CALCULATION OUTPUT DOCUMENT

## C – ENERGY PERFORMANCE CERTIFICATE