MEADOWS + ROSS
BUILDING PERFORMANCE CONSULTANTS

46 Platts Lane, London

Space Conditioning Analysis

Contents

Declaration of Competency

Meadows and Ross Limited comprises highly experienced building performance consultants who have delivered energy and sustainability services on thousands of buildings.

Collectively, our team hold accreditations as Level 5 Non-Domestic Energy Assessors, On Construction Domestic Energy Assessors, Certified Passive House Consultants and Chartered Engineers.

We are CIBSE Low Carbon Consultants and are qualified to produce Level 3, 4 and 5 Energy Performance Certificates throughout the UK.

Report Details

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Revision	Date of Issue	Reason(s) for Issue
1st	29/04/2024	Initial issue

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The assessment detailed in this report has been carried out by Meadows and Ross Limited based on the design information provided by the Client and project team. Some assumptions are made as part of this process which may not occur in practice, the details of which are included in the report. Whilst Meadows and Ross Limited take great care in carrying out these assessments, certain variables are difficult to predict (i.e. weather and occupancy patterns), therefore higher or lower values than those calculated are likely to occur. It therefore remains the responsibility of others to design and construct the building appropriately to ensure a comfortable internal environment for occupants is guaranteed throughout the year. Meadows and Ross Limited accept no liability should occupants be dissatisfied with internal temperatures or energy consumption during in use performance.

Executive Summary

This report was prepared by Meadows and Ross to present the results of an assessment into the impact of installing air conditioning (AC) at 46 Platts Lane in London. Air conditioning has been proposed as a last resort following the consideration of passive design measures required to overcome the risk of overheating that was established when the property was assessed under the CIBSE TM59 modelling approach. The results of the initial CIBSE TM59 assessment concluded that:

– The existing building design does not comply with the requirements of CIBSE TM59 and most occupied spaces were found to overheat.

– Whilst passive means of cooling such as theoretical improvements to the fabric insulation, reducing solar gain through glazing, using internal blinds, using louvres, installing MVHR, and ensuring adequate levels of ventilation occur, all lead to reduced internal temperatures, this did not result in compliance with CIBSE TM59 and many rooms were found to overheat still.

– Air conditioning was found to be the only practical solution which reduced internal temperatures to acceptable levels and ensured compliance with CIBSE TM59 was achieved.

The 46 Platts Lane property was created in the IES Virtual Environment software using the relevant design information such as the building geometry, fabric performance and mechanical ventilation.

3D model representation of the buildings within the IES VE assessment software.

The assessment includes the following three scenarios that were simulated:

1. **Baseline**
   Representing the current performance of the property using a gas-fired boiler and radiators.

2. **Baseline + Air Conditioning**
   To calculate the impact of air conditioning without any passive improvement measures.

3. **Baseline + Air Conditioning + Passive Improvement Measures**
   To calculate the impact of air conditioning with passive improvement measures.

Passive improvement measures include solar film and internal blinds to reduce solar heat gains, the main contributing factor towards the risk of overheating.

Two assessments were performed:

1. Assessing the impact of the passive improvement measures
2. An operational energy and CO_2 analysis

Assessment 1: Impact of Passive Improvement Measures

The results predict that the passive improvement measures will reduce the annual cooling demand by 20.0%. Reducing the provision of solar heat gains can increase the heating demand. The is set to increase by only 2.6%.

	Without Passive Improvement Measures		With Passive Improvement Measures	
	Cooling Demand (MWh)	Heating Demand (MWh)	Cooling Demand (MWh)	Heating Demand (MWh)
Annual	6.18	22.14	4.94	22.73

Considering the environmental impact of the passive improvement measures, the net impact is set to be a reduction in operational CO_2 emissions by 63 kg.CO_2 per annum.

Assessment 2: Operational Energy and Carbon Analysis

The results of the simulations for the proposed solution (air conditioning and passive improvement measures) were compared against the results for the existing property simulations (gas boiler only) to establish the environmental impact.

The results of the analysis predict that the air conditioning system alone is capable to meet the room heating demands. The central heating system, however, will still be needed to serve rooms without AC.

Considering the environmental impact of installing air conditioning to provide cooling and reduce the reliance of fossil fuels for space heating, the following table presents the results of the analysis for the entire property:

Results		Existing (gas boiler serving radiators only)	Proposed (gas boiler, AC and passive improvement measures)
Space Heating Energy Consumption (MWh)	Boilers	29.95	6.84
	AC	0	3.96
Space Cooling Energy Consumption (MWh)		0	0.88
Operational carbon emissions associated with space conditioning (kg.CO_2 per annum)		6,290	2,148

The results of the operational CO_2 analysis suggests that the installation of the air conditioning system will result in a 65% reduction in carbon emissions associated with the space conditioning of 46 Platts Lane. This is due to both the efficiency of heat pumps and the cleanliness of grid-supplied electricity compared to natural gas, which will only improve as the national grid continues to decarbonise.

1. Introduction

This report was prepared by Meadows and Ross to present the results of an assessment into the impact of installing air conditioning (AC) at 46 Platts Lane in London. Air conditioning has been proposed as a last resort following the consideration of passive design measures required to overcome the risk of overheating that was established when the property was assessed under the CIBSE TM59 modelling approach. The results of the initial CIBSE TM59 assessment concluded that:

– The existing building design does not comply with the requirements of CIBSE TM59 and most occupied spaces were found to overheat.

– Whilst passive means of cooling such as theoretical improvements to the fabric insulation, reducing solar gain through glazing, using internal blinds, using louvres, installing MVHR, and ensuring adequate levels of ventilation occur, all lead to reduced internal temperatures, this did not result in compliance with CIBSE TM59 and many rooms were found to overheat still.

– Air conditioning was found to be the only practical solution which reduced internal temperatures to acceptable levels and ensured compliance with CIBSE TM59 was achieved.

To reduce the required output of the air conditioning system (and the energy consumption and carbon emissions associated with it), passive design measures are being implemented. This report quantifies the impact of these passive measures.

The proposed air conditioning is also capable of providing space heating as well as space cooling. As the AC system utilises refrigerant air source heat pumps fuelled by grid-supplied electricity, the space heating carbon emissions will also be reduced as the property currently employs a gas-fired boiler only. This report therefore quantifies the environmental impact of the AC system with the heat pump being the primary source of heat and gas-fired boiler meeting only used when additional heat is required.

2. Project Description

2.1. Project Location

46 Platts Lane is an existing residential property located in Camden, London, NW3 7NT.

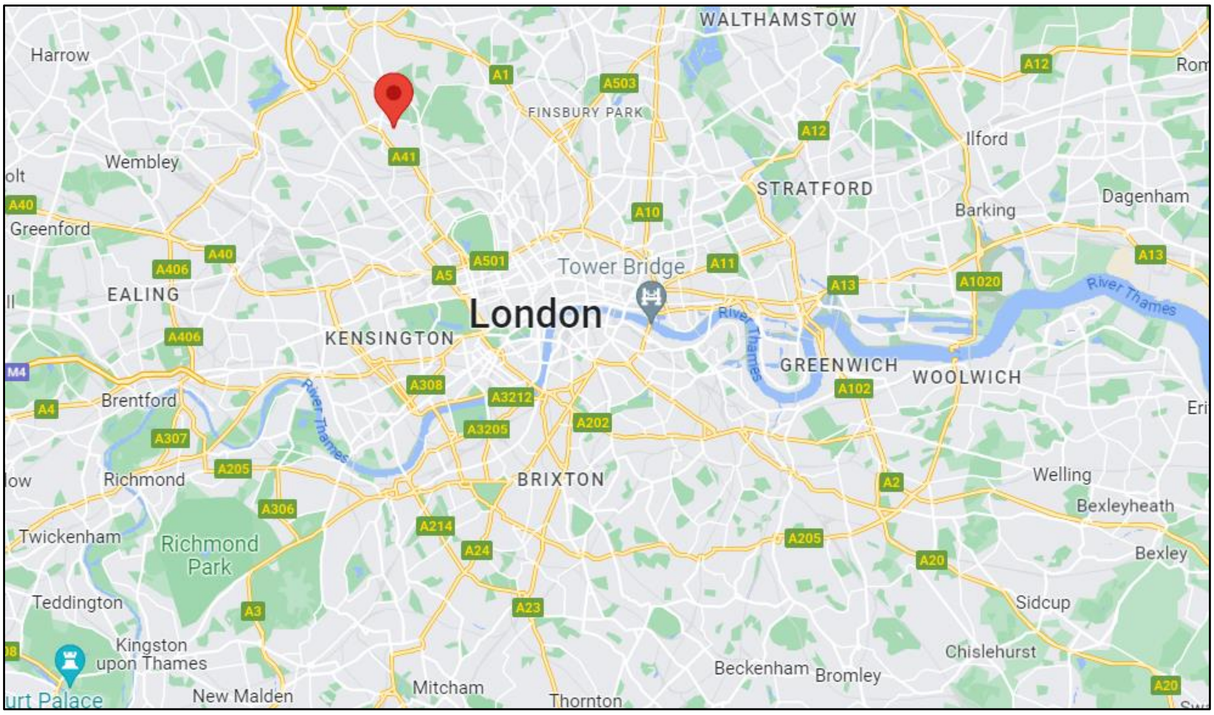


Figure 1. Location of 46 Platts Lane as shown on Google maps. The location is marked with the red pin.

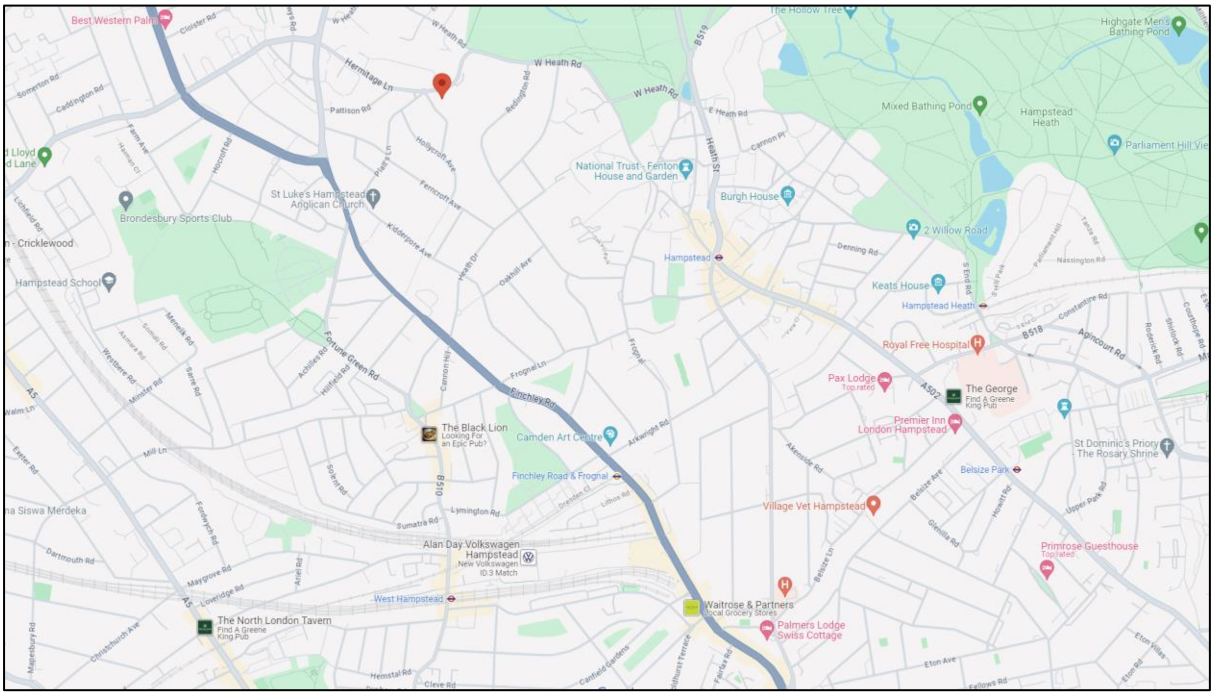


Figure 2. Location of 46 Platts Lane as shown on Google maps. The location is marked with the red pin

2.2. Street View

Figure 3. External street view of 46 Platts Lane as shown via Google Street View (shown centrally).

Figure 4. Google Earth view from above. 46 Platts Lane indicated by red marker with neighbouring properties either side.

2.3. Floor Plans and Elevations

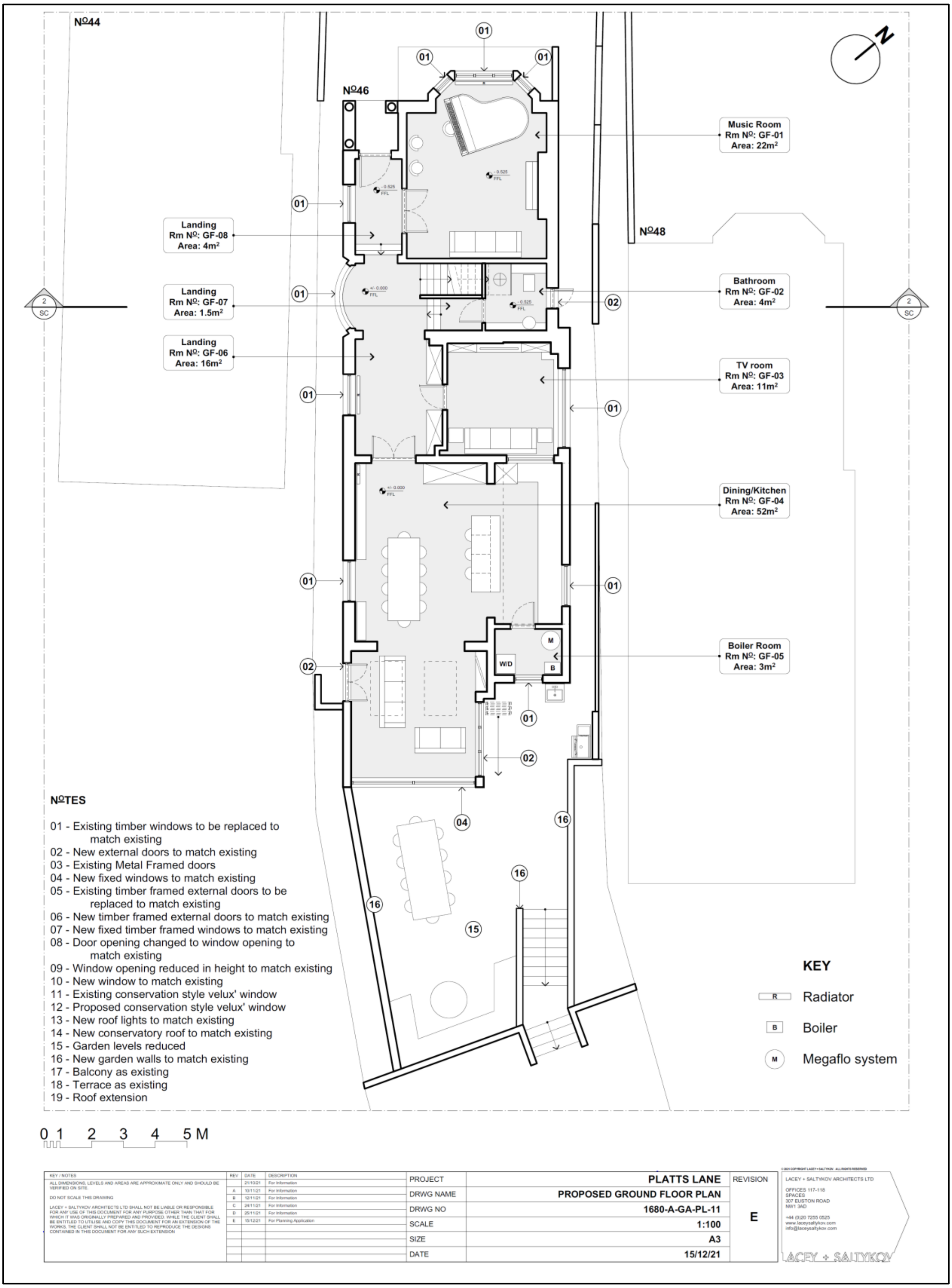


Figure 5. Ground floor plan.

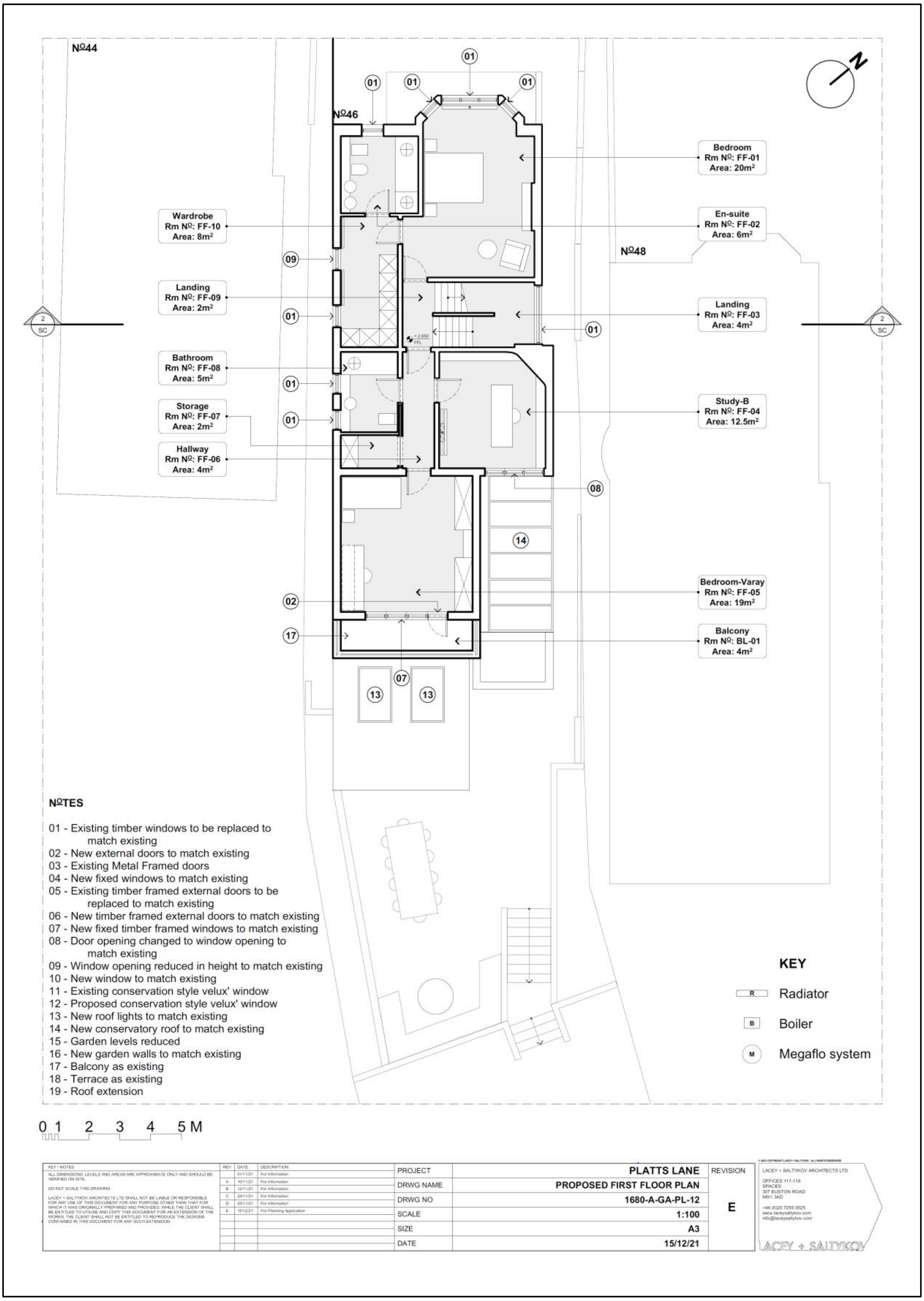


Figure 6. First floor plan.

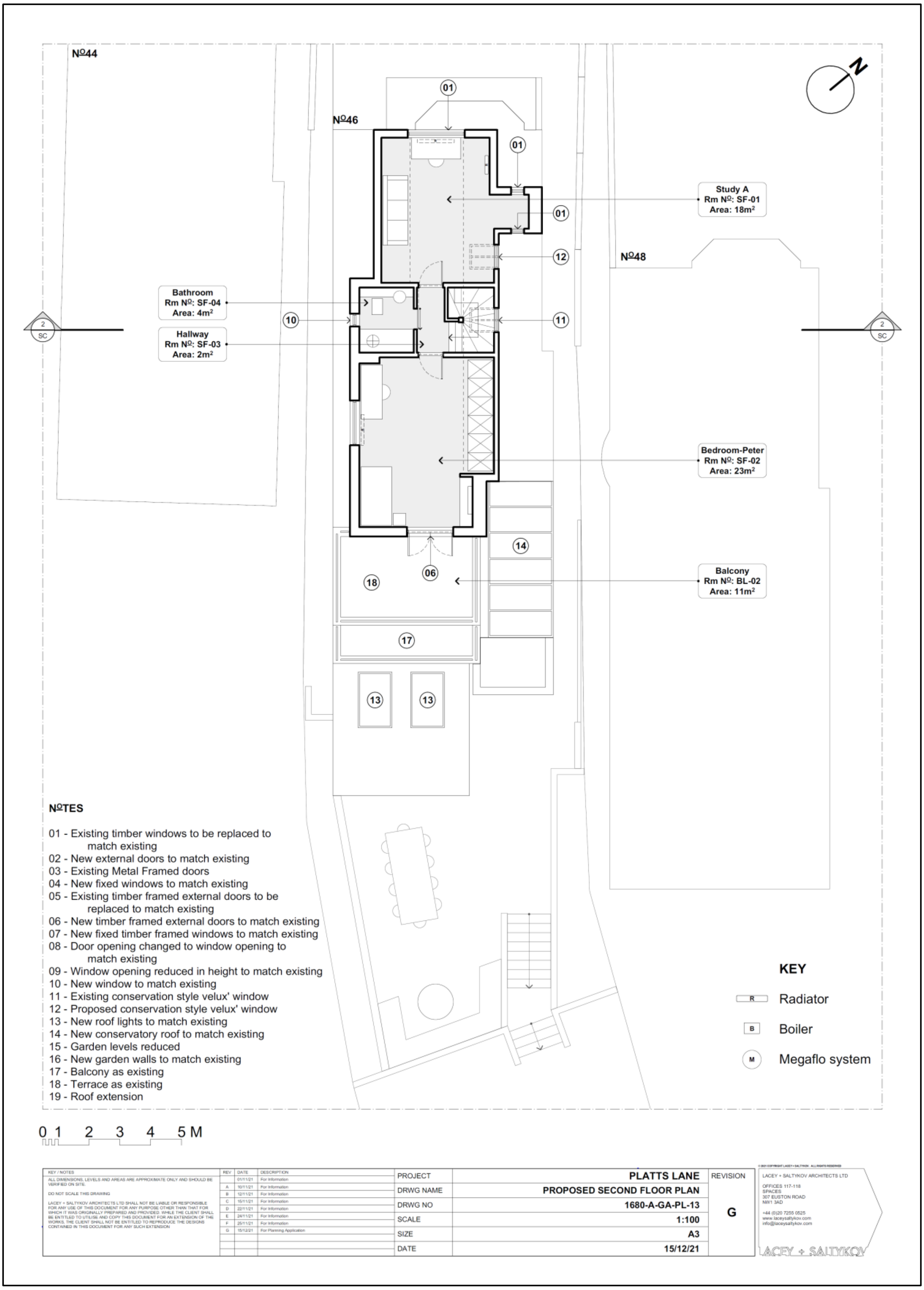


Figure 7. Second floor plan.

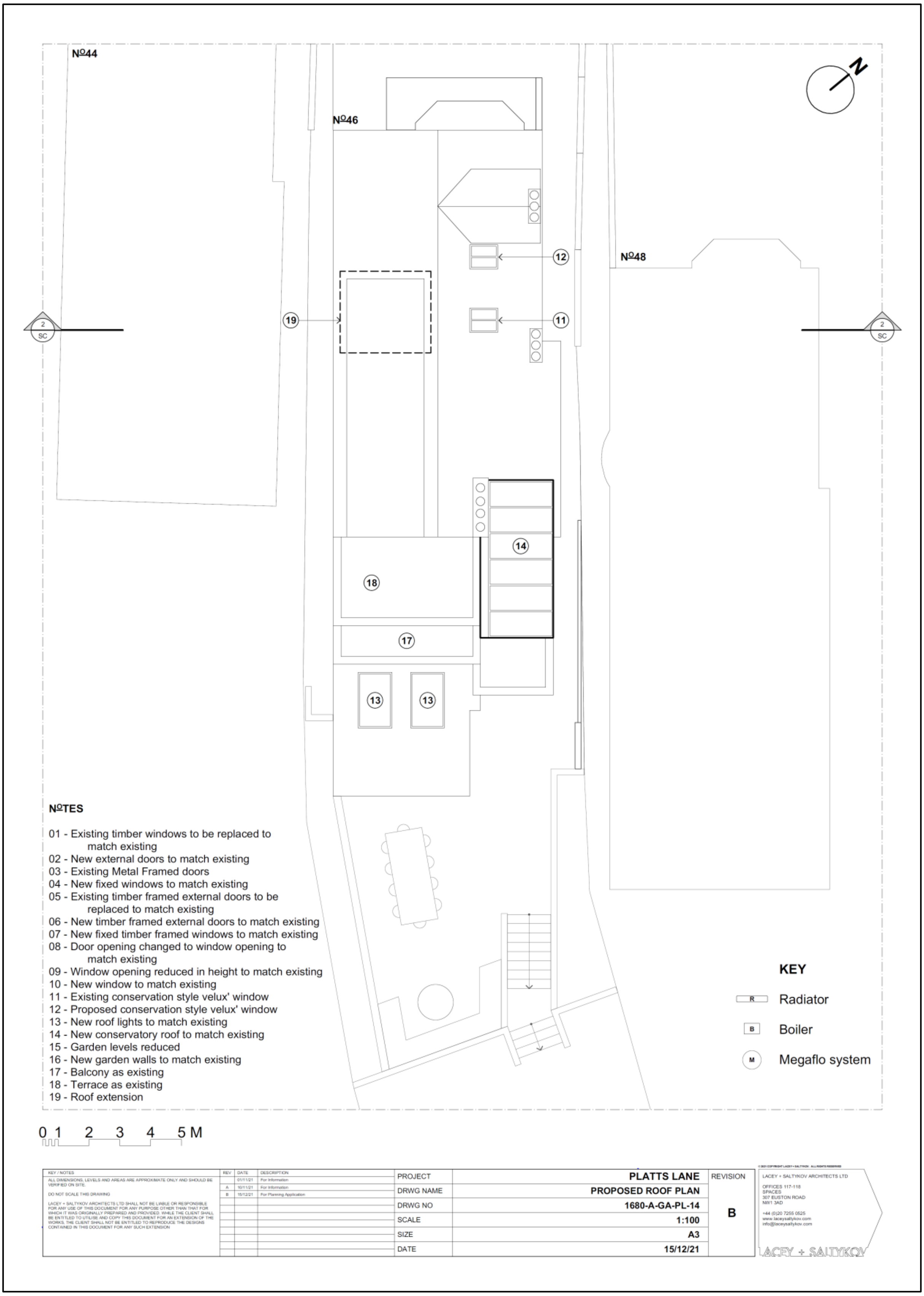


Figure 8. Roof plan.

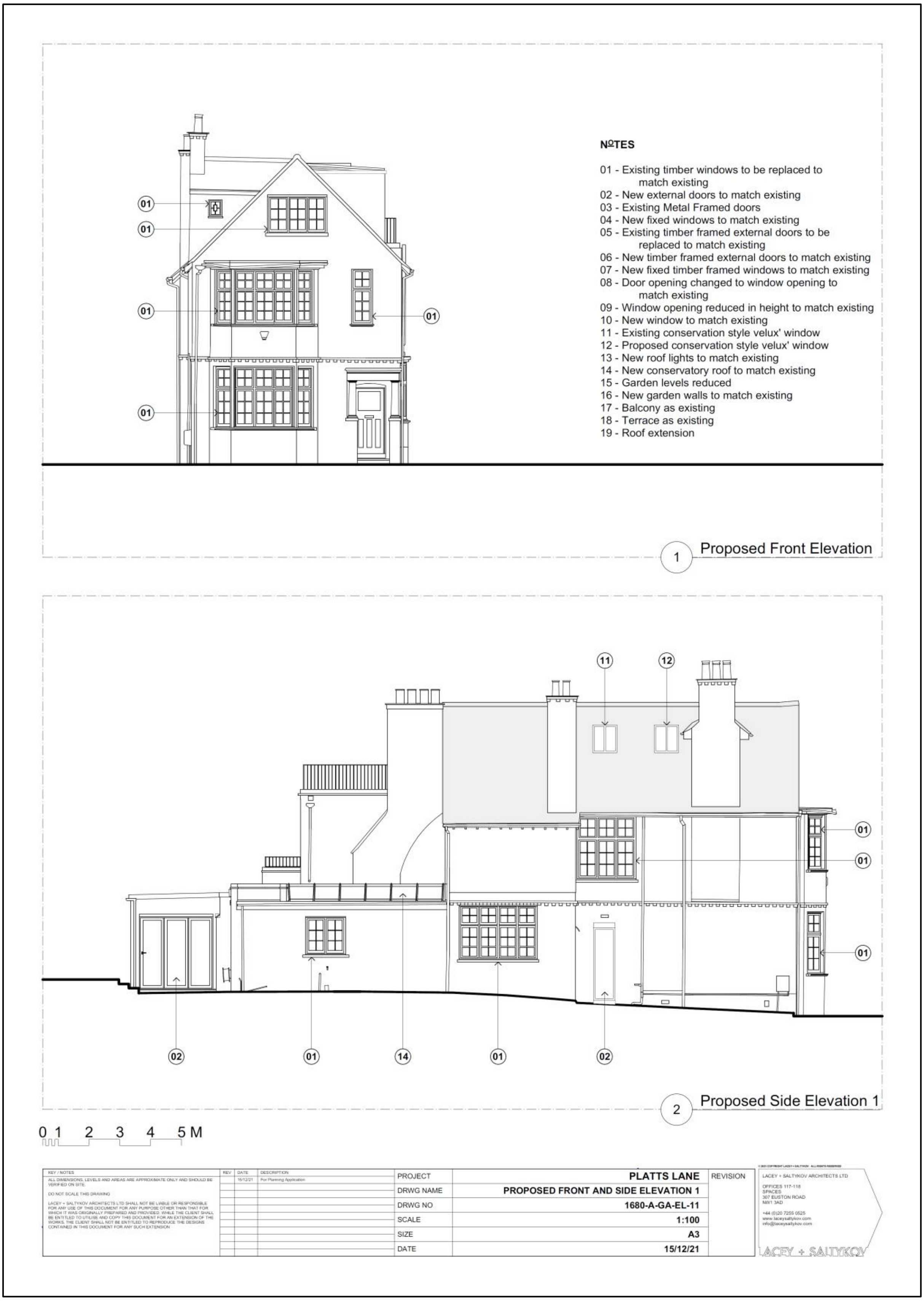


Figure 9. Front and side elevation.

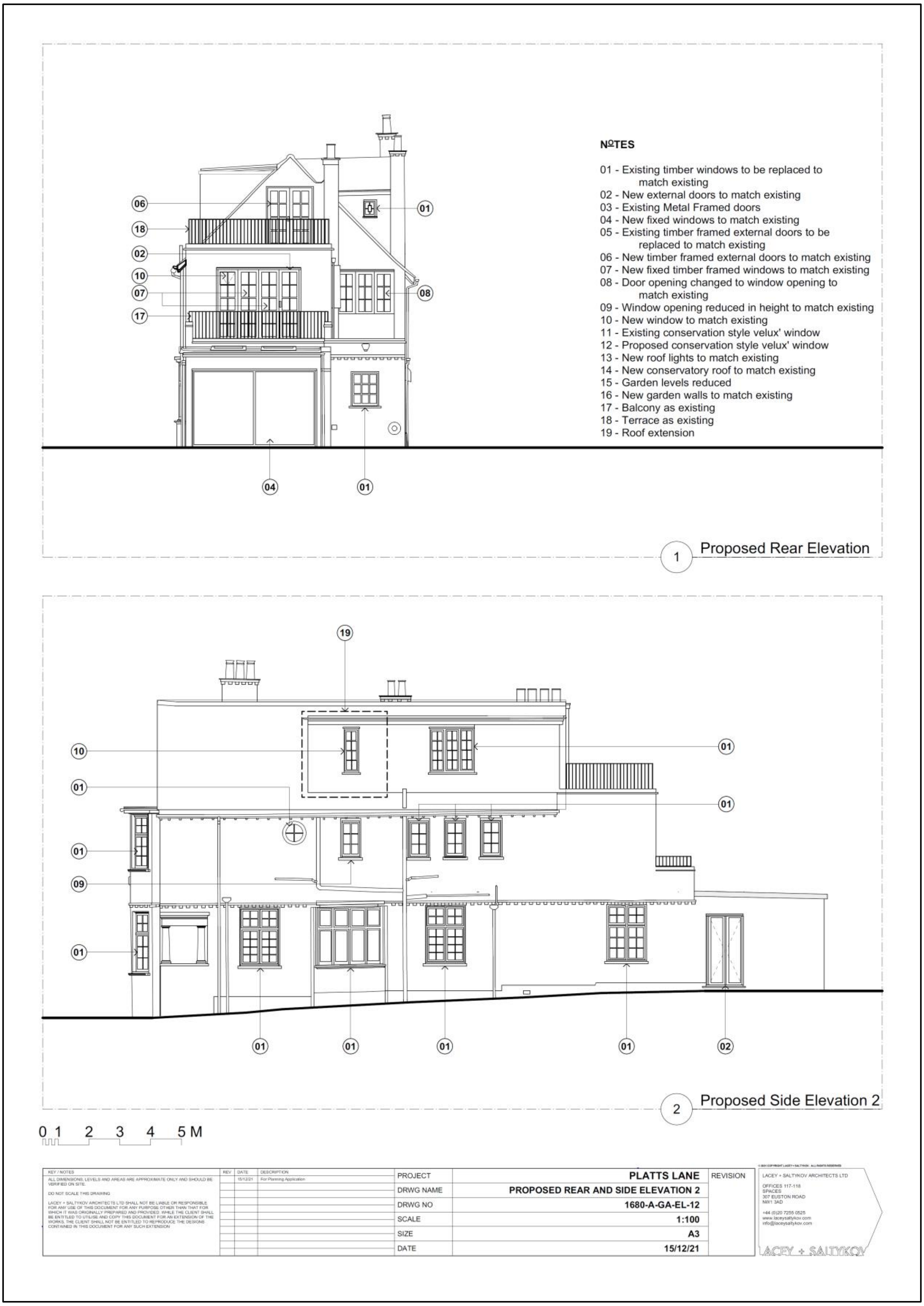


Figure 10. Rear and side elevation.

3. Assessment Methodology

The assessment has been performed using the IES Virtual Environment (IES VE) dynamic thermal modelling software to ensure the highest level of decision-making confidence. IES VE is a 3D modelling software package that allows many aspects of building performance to be assessed for example, energy efficiency, thermal performance, and daylighting.

The 46 Platts Lane property was created in the IES Virtual Environment software using the relevant design information such as the building geometry, fabric performance and mechanical ventilation.

The modelling approach follows the CIBSE TM59 calculation methodology with additional inputs to accurately account for winter usage. The CIBSE TM59 'Design methodology for the assessment of overheating risk in homes (2017)', requires the use of appropriate modelling software. Whilst CIBSE TM59 focuses on thermal comfort, the IES VE software also enables the energy consumption and CO_2 emissions associated with improvement measures to be quantified.

Figure 11. 3D model representation of the buildings within the IES VE assessment software.

The assessment includes the following three scenarios that were simulated:

4. **Baseline**
   Representing the current performance of the property using a gas-fired boiler and radiators.

5. **Baseline + Air Conditioning**
   To calculate the impact of air conditioning without any passive improvement measures.

6. **Baseline + Air Conditioning + Passive Improvement Measures**
   To calculate the impact of air conditioning with passive improvement measures.

4. Baseline Model

The following tables describe some of the key inputs into the baseline thermal model. Allowances for occupancy and internal heat gains follow the CIBSE TM59 methodology.

4.1. Ventilation Strategy

Table 1. Ventilation strategy

Element	Specification
Air Permeability Rate	15.0 $m^3/h/m^2$ @ 50Pa - *RdSAP Inference*
Mechanical Ventilation System	Intermittent extract fans only
Window Openings	Modelled as closed.

4.2. Fabric Specification

The table below details the fabric specification used within the models. These values are taken from the RdSAP inference figures based on the year of construction and original building.

Table 2. Fabric specification

Element	U-value (W/m^2K)
External walls	1.50
Ground floor	0.50
Roofs	2.70
Windows & Glazed Doors	1.60 (g = 0.63)
Rooflights	2.30 (g = 0.65)

4.3. Climate Data

Calculations were performed using the DSY 1 2020s High Emissions 50 Percentile scenario weather file.

5. Air Conditioning Specification

Table 3 details the proposed air conditioning system:

Table 3. proposed air conditioning strategy.

<table>
<tr><td rowspan="10">External Condenser (VRF)</td><th colspan="2">Element</th><th colspan="2">Specification</th></tr>
<tr><td colspan="2">Manufacturer/Model</td><td colspan="2">Panasonic Mini ECOi LE Series 2 x U-4L2E5</td></tr>
<tr><td rowspan="4">Cooling</td><td>Capacity</td><td colspan="2">12.1 kW</td></tr>
<tr><td>EER</td><td colspan="2">4.5 kW/kW</td></tr>
<tr><td>SEER</td><td colspan="2">7.9</td></tr>
<tr><td>Set-point</td><td colspan="2">24.0 °C</td></tr>
<tr><td rowspan="4">Heating</td><td>Capacity</td><td colspan="2">12.5 kW</td></tr>
<tr><td>COP</td><td colspan="2">5.2 kW/kW</td></tr>
<tr><td>SCOP</td><td colspan="2">4.9</td></tr>
<tr><td>Set-point</td><td colspan="2">20.0 °C</td></tr>
<tr><td rowspan="5">Internal Units</td><th>Model Ref</th><th>Room(s)</th><th>Cooling Capacity</th><th>Heating Capacity</th></tr>
<tr><td>S-15MM1E5B</td><td>TV room, FF study</td><td>1.5 kW</td><td>1.7 kW</td></tr>
<tr><td>S-22MM1E5B</td><td>SF study</td><td>2.2 kW</td><td>2.5 kW</td></tr>
<tr><td>S-28MM1E5B</td><td>FF Bedroom, SF bedroom</td><td>2.8 kW</td><td>3.2 kW</td></tr>
<tr><td>S-36MM1E5B</td><td>Music room, Master bedroom, Dining/kitchen</td><td>3.6 kW</td><td>4.2 kW</td></tr>
</table>

6. Passive Improvement Measures

The following tables describe the specification of the passive design measures that are being proposed to reduce the cooling energy demand for the property.

6.1. Solar Film

Solar film can be retrospectively added to glazed elements to reduce solar heat gains, the main contributor towards overheating and thermal discomfort in summer months. Different solar film products are available, offering varying levels of solar transmission and consideration must be given to the reduction in the provision of natural daylight that may occur when installed.

Consideration should also be given to the reduction in solar heat gain contribution during the winter months as the sun provides an element of free heating.

In London, the risk of overheating and thermal discomfort can be a serious health risk. Whilst installing solar film may marginally increase the winter heating costs, the summertime benefit significantly outweighs any drawbacks.

Solar film that reduces the g-value from 0.63 down to 0.45 is proposed and is based on the Window Films Direct Solar Silver 50 product, or equal and approved (with due consideration given to the visible light transmittance reduction).

6.2. Internal Blinds

Similar to solar film, internal blinds can be employed to reduce solar heat gains into a space, but can sometimes be less effective as the heat is already within the space. They do, however, offer user control and additional benefits such as glare, daylight and privacy control.

Venetian blinds have been modelled with a shading coefficient of 0.61 and a short wave radiant fraction of 0.30. It has been assumed that blinds will be closed when the incident irradiance exceeds 200W/m^2.

7. Model Images

The following model images are provided for illustration. These are taken from the IES VE building physics assessment software. Adjacent building aren't always shown for clarity of illustration. Modelling implications are made where appropriate to do so.

Figure 112. Axonometric view from rear.

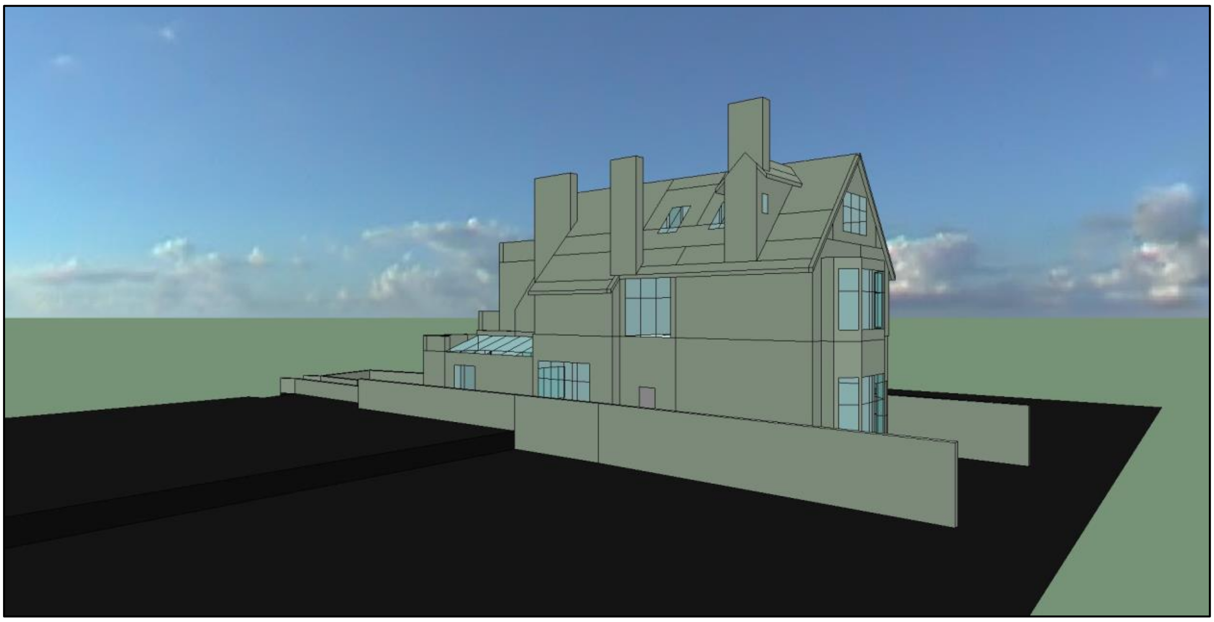


Figure 123. View from North.

Figure 134. View from South.

Figure 145. View from East.

Figure 156. View from West.

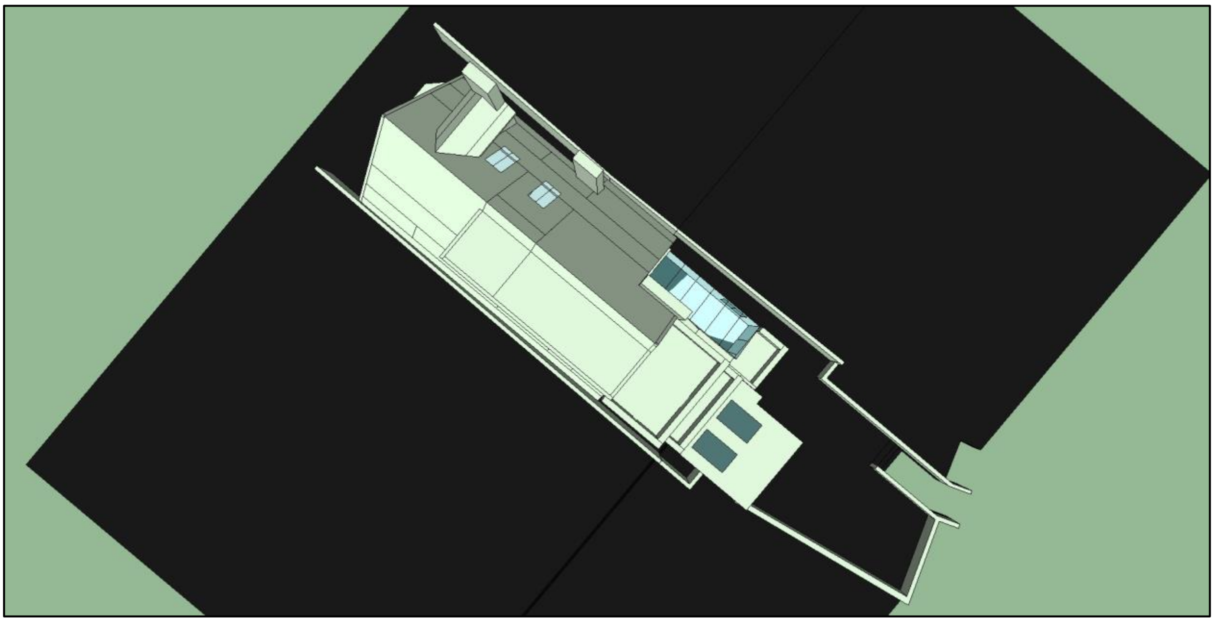


Figure 167. View from overhead.

8. Results

As detailed in Section 3, three simulations were performed:

1. **Baseline**
   Representing the current performance of the property using a gas-fired boiler and radiators.

2. **Baseline + Air Conditioning**
   To calculate the impact of air conditioning without any passive improvement measures.

3. **Baseline + Air Conditioning + Passive Improvement Measures**
   To calculate the impact of air conditioning with passive improvement measures.

The following CO_2 emission factors have been used for environmental assessments.

Fuel	CO2 emission factor for fuels (kg.CO_2/kWh)											
	J	F	M	A	M	J	J	A	S	O	N	D
Electricity	0.163	0.160	0.153	0.143	0.132	0.120	0.111	0.112	0.122	0.136	0.151	0.163
Natural Gas	0.210											

8.1. Impact of Passive Improvement Measures

In a bid to reduce the cooling energy demand of the building, solar film and internal blinds have been proposed. The following tables and figures compare the air conditioning solution with and without the passive improvement measures.

	Without Passive Improvement Measures		With Passive Improvement Measures	
	Cooling Demand (MWh)	Heating Demand (MWh)	Cooling Demand (MWh)	Heating Demand (MWh)
Jan	0.00	3.92	0.00	3.97
Feb	0.00	3.26	0.00	3.34
Mar	0.02	2.72	0.01	2.81
Apr	0.03	2.60	0.01	2.71
May	1.02	0.41	0.76	0.44
Jun	1.32	0.38	1.08	0.41
Jul	2.04	0.03	1.74	0.03
Aug	1.32	0.09	1.06	0.09
Sep	0.41	0.30	0.29	0.32
Oct	0.02	1.23	0.00	1.28
Nov	0.00	3.35	0.00	3.43
Dec	0.00	3.86	0.00	3.89
Total	**6.18**	**22.14**	**4.94**	**22.73**

The results predict that the passive improvement measures will reduce the annual cooling demand by 20.0%. Reducing the provision of solar heat gains can increase the heating demand. The is set to increase by only 2.6%.

Considering the environmental impact of the passive improvement measures, the net impact is set to be a reduction in operational CO_2 emissions by 63 kg.CO_2 per annum.

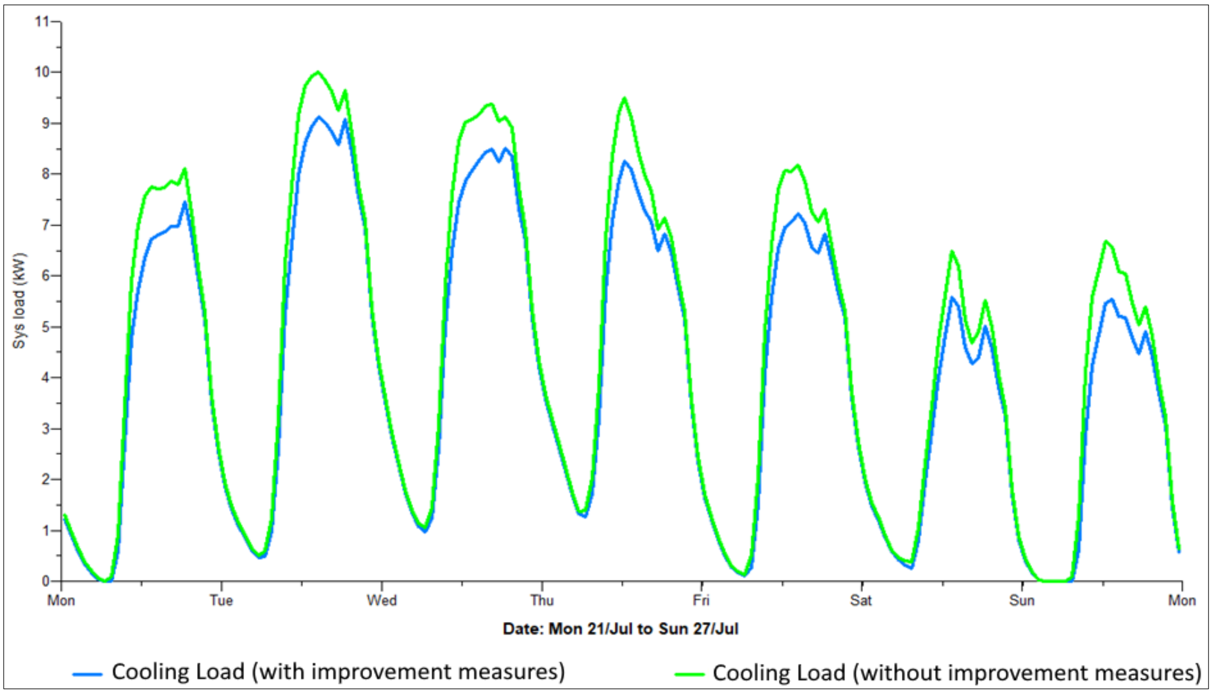


Figure 178. Space Cooling Demand with and without improvement measures for a week in July

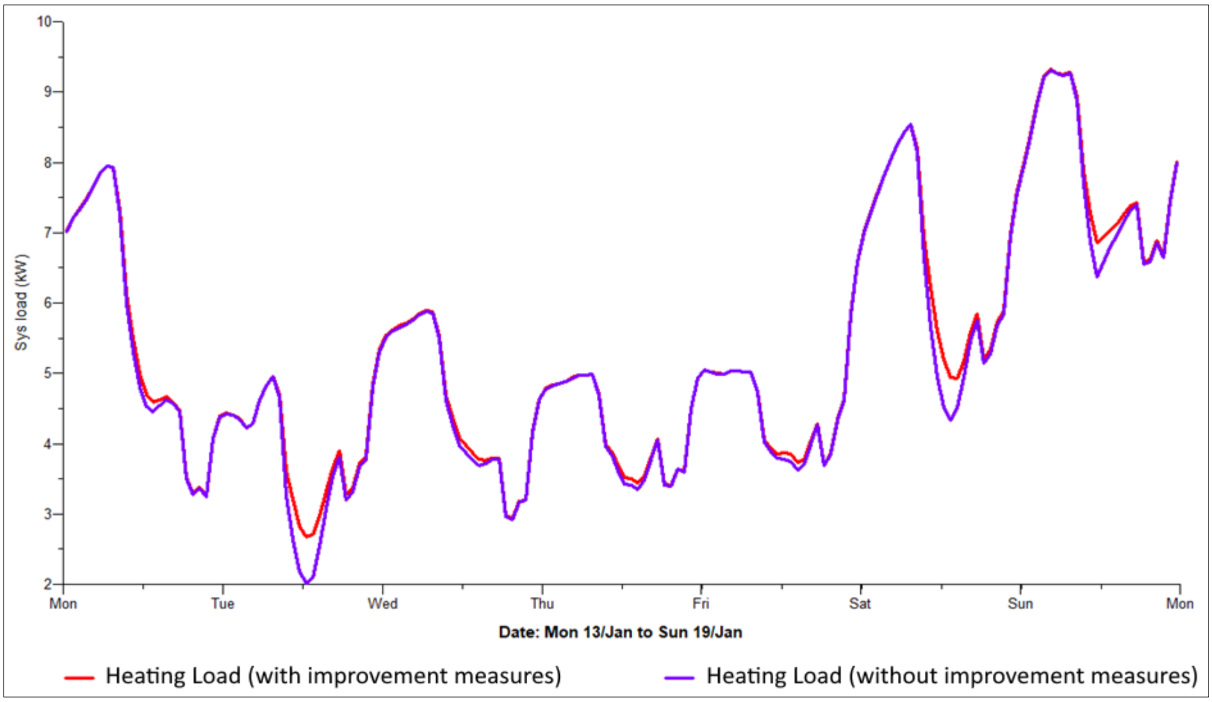


Figure 189. Space Heating Demand with and without improvement measures for a week in January

8.2. Operational Energy and CO_2 Analysis

The results of the simulations for the proposed solution (air conditioning and passive improvement measures) have been compared against the results for the existing property simulations (gas boiler only) to establish the environmental impact.

As the proposed air conditioning system is capable of providing space heating as well as space cooling the air conditioning system will reduce the demand for natural gas, given that the air conditioning will be utilised to meet the space heating demand before turning the central heating system on.

Floor	Rooms	Heating Capacity of Indoor AC Unit (kW)	Room Peak Heat Demand (kW)	Residual - gas boiler contribution (kW)
Ground	TV room	1.7	0.60	0
	Music room	4.2	1.28	0
	Dining	4.2	2.22	0
	Kitchen	4.2	1.71	0
First	Bedroom	3.2	1.07	0
	Study	1.7	0.61	0
	Master bedroom	4.2	0.86	0
Second	Bedroom	3.2	1.38	0
	Study	2.5	1.22	0

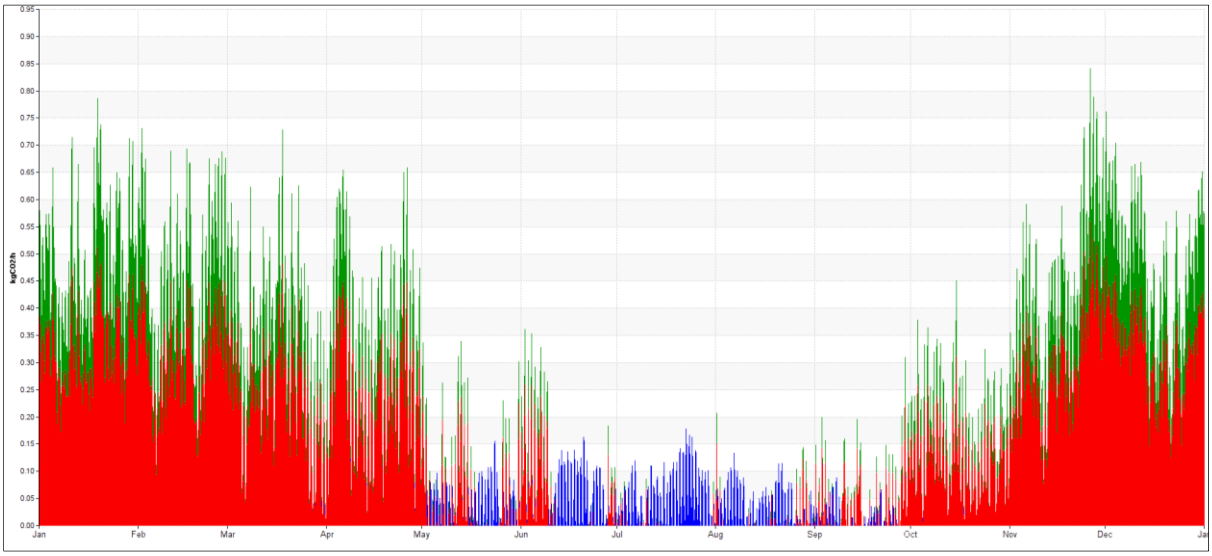
The results of the analysis predict that the air conditioning system alone is capable of meeting the room heating demands. The central heating system, however, will still be needed to serve rooms without air conditioning. It's worth noting that the indoor AC units may appear to be larger than necessary, these will have been selected based on the cooling demand of individual rooms, and not the heating demands.

Considering the environmental impact of installing air conditioning to provide cooling and reduce the reliance of fossil fuels for space heating, the following table presents the results of the analysis for the entire property:

Results		Existing (gas boiler serving radiators only)	Proposed (gas boiler, AC and passive improvement measures)
Space Heating Energy Consumption (MWh)	Boilers	29.95	6.84
	AC	0	3.96
Space Cooling Energy Consumption (MWh)		0	0.88
Operational carbon emissions associated with space conditioning (kg.CO_2 per annum)		6,290	2,148

The results of the operational CO_2 analysis suggests that the installation of the air conditioning system will result in a 65% reduction in carbon emissions associated with the space conditioning of 46 Platts Lane. This is due to both the efficiency of heat pumps and the cleanliness of grid-supplied electricity compared to natural gas, which will only improve as the national grid continues to decarbonise. Whilst these figures don't include emissions associated with hot water and lighting, the calculated impact is considered to be significant.

To provide further insights, the following graph has been provided which illustrates CO_2 emissions across the year for the heating and cooling systems.



Gas Boiler CO_2 emissions AC – Heating emissions AC – Cooling emissions

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End of report.