ENERGY STRATEGY

PROJECT:

MEADOWS HALL, RICHMOND

PROJECT NUMBER:

P2197

DOCUMENT REF:

P2197-ENE-03

Revision	Date	Details	Authored	Checked
R1	17.11.2021	Issued for comment	C. Armstrong	S. Richardson
R2	05.07.2022	Reissued for design revision	C. Armstrong	S. Richardson
R3	08.08.2022	Updated to Latest Architectural info	A. Jones	S. Richardson

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1.0 EXECUTIVE SUMMARY

QuinnRoss Energy was commissioned to develop an energy assessment for the proposed *Meadows Hall* development that would demonstrate how it will provide heating and power and meet the energy and carbon emission targets set by national, regional, and local policy.

The site is located on Church Road, in the London Borough of Richmond. The development will involve the erection of a new 4 storey block of 1 no. Support Accom, 7 no. apartments and a series of 5 no. duplex town houses at the rear.

This development will be subject to the following requirements:

Requirement	Description / Summary
Building Regulations Part L1A 2013	Each individual dwelling must have better building fabric and energy performance when compared to a Target Emission Rate (TER)
London Plan 2021	All new development, residential and commercial, must have zero CO_2 emissions. A CO_2 reduction of at least 35% is expected and the remaining CO_2 to zero must be off-set with a cash in lieu contribution.
Richmond Local Plan 2018	Policy LP 22, Sustainable Design & Construction, requires all new development to comply with the latest London Plan standards (as outlined above).
Richmond Residential Development Standards	Section 5.0, Sustainable Design, although does not outline any specific targets it does expect all new dwellings to exceed CO_2 reduction requirements under current Build Regs.

Table 1: Summary of energy and sustainability targets

To achieve the above targets, the following energy reduction methods will be required, using the London Plan's Energy Hierarchy:

Method	Description / Summary
Be Lean	
Building form	The building form will be optimised to help limit any unnecessary energy use.
High performing building thermal envelope	The construction U-values will perform above the current building regulations.
Low infiltration	Air tightness will be no higher than 4.0 m^3/m^2h.
Daylight strategy	Daylight penetration in rooms will be maximised to reduce lighting demand significantly.
Highly efficient lighting with controls	LED lighting will be installed throughout with daylight and PIR sensors where possible.

Highly efficient HVAC systems	Highly efficient heat pumps for heating are specified, and mech vent units with low SFP's and heat recovery.
Highly efficient hot water generation	The hot water demand will be provided by a heat pump generator
Insulated pipe work	All Internal heating pipework will be insulated to a standard beyond building regulation requirements.
Unregulated Energy Use	Efforts will be made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods in apartments.
Be Clean	
District Heating (DH)	All existing and proposed heat networks are many km from the site and associated pipework and excavation would be too excessive to justify a connection for this development. DH is therefore not considered.
Combined Heat and Power (CHP)	Although CHP is feasible, it would not offer better savings over the proposed heat pumps. It must also be noted that future Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.
Be Green	
Air source heat pumps	Highly efficient heat pump system for space heating will be installed, along with a separate heat pump system for hot water generation.
Solar Panels	64 m² of photovoltaic solar panels will be installed on available roof space on the duplexes.

Table 2: Summary of energy hierarchy Lean, Clean & Green methods

Thermal and Energy Modelling Results

The whole development has been analysed for its energy use using current 2013 Building Regulations, Part L2A 2013 and SAP 2012, in approved energy modelling software. The predicted and saved tonnes of CO_2 are shown below:

Current Building Regs using Part L2A 2013 and Sap 2012						
	New build commercial (includes major refurbishments assessed under Part L2A)		New build residential (includes major refurbishments assessed under Part L1A)		Overall area weighted reductions	
	Total tCO_2	% Reduction at each stage	Total tCO_2	% Reduction at each stage	Total tCO_2	% Reduction at each stage
Baseline	0	N/A	23	N/A	23	N/A
Be Lean	0	0%	19	17%	19	17%
Be Clean	0	0%	19	0%	19	0%
Be Green	0	0%	10	38%	10	38%
TOTAL	**0**	**0%**	**13**	**55%**	**13**	**55%**
Shortfall	Total tCO_2	£ in Leiu	Total tCO_2	£ in Leiu	Total tCO_2	£ in Leiu
	0	**£0**	**10**	**£18,322**	**10**	**£18,322**

Table 3: Summary carbon reductions calculations using current Build Regs

The whole development has been analysed for its energy use using predicted future Build Regs using SAP 10 carbon factors in approved energy modelling software. The predicted and saved tonnes of CO_2 for residential and commercial areas combined are shown below:

Future Building Regs using Sap 10 CO_2 factors						
	New build commercial (includes major refurbishments assessed under Part L2A)		New build residential (includes major refurbishments assessed under Part L1A)		Overall area weighted reductions	
	Total tCO_2	% Reduction at each stage	Total tCO_2	% Reduction at each stage	Total tCO_2	% Reduction at each stage
Baseline	0	N/A	14	N/A	14	N/A
Be Lean	0	0%	5	61%	5	61%
Be Clean	0	0%	5	0%	5	0%
Be Green	0	0%	3	16%	3	16%
TOTAL	**0**	**0%**	**11**	**77%**	**11**	**77%**
Shortfall	Total tCO_2	£ in Leiu	Total tCO_2	£ in Leiu	Total tCO_2	£ in Leiu
	0	**£0**	**3**	**£5,915**	**3**	**£5,915**

Table 4: Summary carbon reductions calculations using future Build Regs

A comparison of the carbon reductions calculations, between current and future Build Regs, is shown in the figure below:

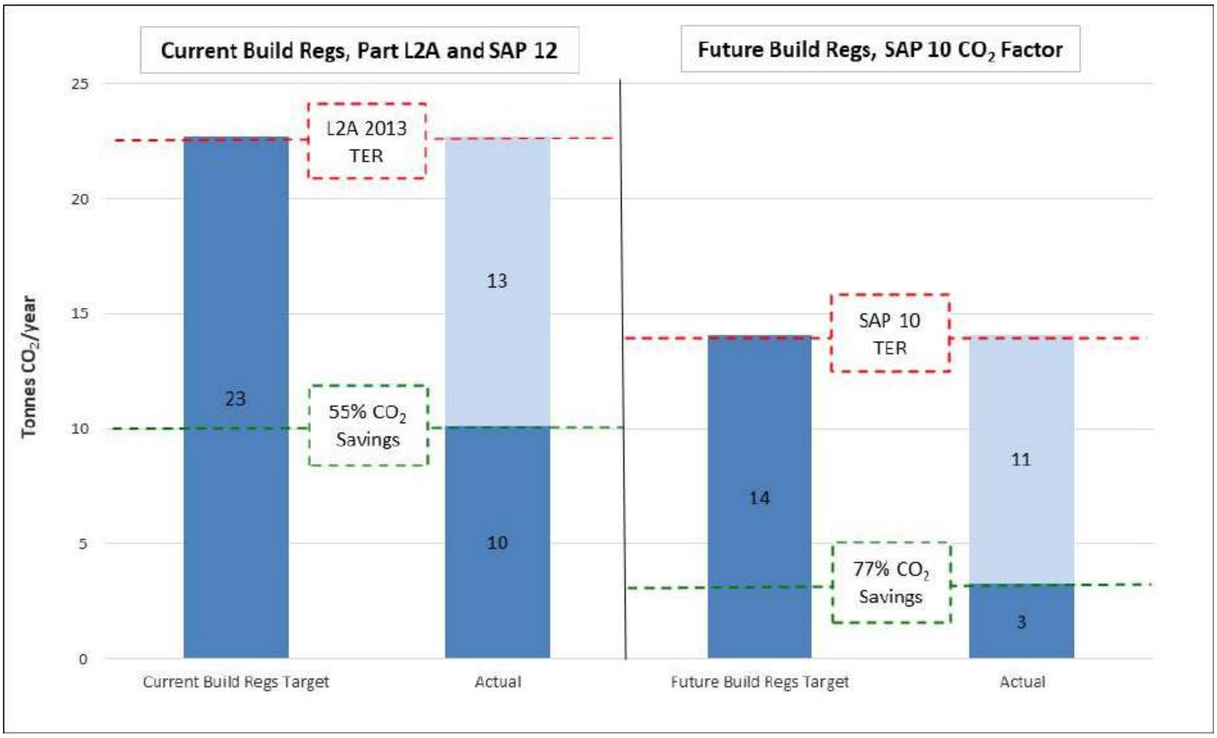


Figure 01: Carbon reductions comparison between current and future Build Regs

All inputs and SAP output documents can be found in the appendices. Please note as Sap 10 is still in its beta phase no official output documents are currently available.

Shortfall to zero carbon: The development has done everything possible to reduce CO_2 emissions as far as possible. Solar panels have already been maximised and any further units cannot realistically fit on site. The chosen heat pump heating system is also the most efficient available, alternative systems would increase the CO_2 production. Any further LZC is not feasible given the site constraints.

2.0 INTRODUCTION

QuinnRoss Energy was commissioned to develop an energy assessment for the proposed *Meadows Hall* development that would demonstrate how it will provide heating and power and meet the energy and carbon emission targets set by national, regional, and local policy.

The site is located on Church Road, in the London Borough of Richmond. The development will involve the erection of a new 4 storey block of 1 no. Support Accom, 7 no. apartments and a series of 5 no. duplex town houses at the rear.

3.0 PLANNING POLICY AND LEGISLATION

This section describes the planning policies and regulations that will affect the proposed development. These are outlined below:

- Building Regulations Part L1A 2013, new dwellings.
- London Plan 2021.
- Richmond Adopted Local Plan 2018.
- Richmond Residential Development Standards 2010.

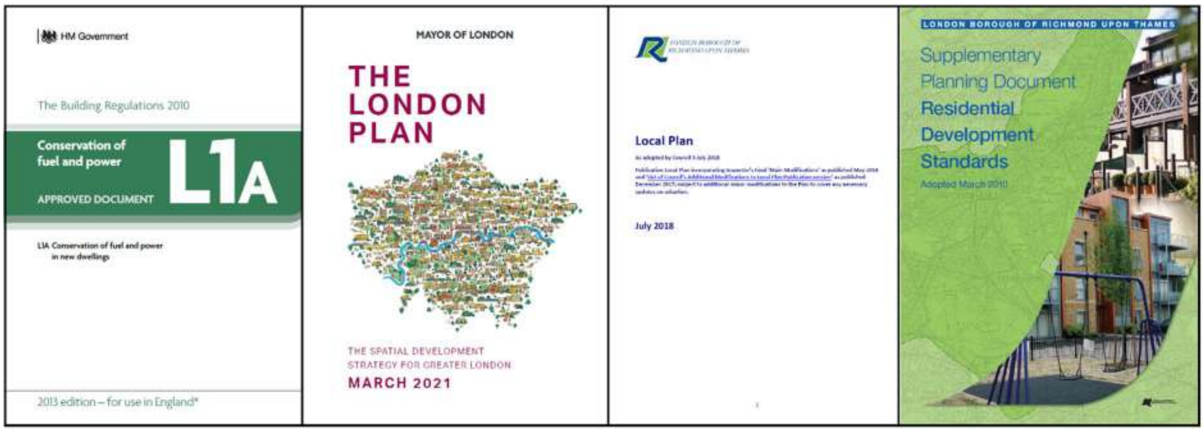


Figure 02: Document front cover images of applicable policies

3.01 Building Regulations Part L1A

The residential areas will be subject to the Building Regulations Conservation of Fuel and Power in new dwellings Part L1A. Each individual dwelling will subject to the Standard Assessment Procedure (SAP) calculation which will determine energy consumption, therefore CO_2 emissions, in kWh/m^2/yr and a Target Fabric Energy Efficiency (TFEE) value. This effectively requires a minimum level of building fabric and energy performance when compared to a Target Emission Rate (TER) which is determined by the approved SAP software (kg/CO_2/m^2/yr).

The Target Emissions Rate is a limit of kg CO_2 per m^2 based on regulated loads of the building. Regulated loads refer to heating, cooling, auxiliary, lighting and DHW energy consumption, end uses related to the quality of the building construction and design. Unregulated loads are energy consuming end uses related to occupant's behaviour, such as computers, lifts, or escalators.

3.02 London Plan 2021

The London Plan 2021 outlines a number of policies to underpin London's response to climate change. These policies cover adaptation, waste, aggregates, contaminated land, hazardous substances and most applicable to this development climate change mitigation. The key policies within the London Plan relating to energy consumption and CO_2 emissions include the following policies:

- SI2 Minimising greenhouse gas emissions
- SI3 Energy infrastructure
- SI4 Managing heat risk

3.02.01 Policy SI2 Minimising Greenhouse Gas Emissions

Policy SI2 above will have the most significant impact on this development as it outlines specific carbon emissions targets:

- All major development must have zero CO_2 emissions.
- CO_2 emissions must be at a minimum 40% lower than the Building Regulations Part L2A 2010 TER (which is 35% better than the current 2013 Building Regulations) then further short fall off-set through a cash in lieu payment.

3.02.02 Energy Assessment Guidance, Chapter 4.3

All energy assessments must use CO_2 emissions factors outlined under current Building Regulations 2013 **and** in the proposed SAP 10 draft Building Regulations.

3.03 Richmond Adopted Local Plan 2018

The Richmond Local Plan 2018, Policy LP 22 Sustainable Design and Construction, outlines several energy and CO_2 related targets for new development to achieve:

- Reducing Carbon Dioxide Emissions: All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan 2021 policy (as outlined above).
- Decentralised Energy Networks: All new development must assess the feasibility to connect to local district heating networks and install a connection where possible.

Please note a new draft Local Plan for the Borough of Richmond is currently in development however it was not available for issue at the time of writing this strategy.

3.04 Richmond Residential Development Standards 2010.

The Richmond Residential Development Standards 2010, Section 5.0, does not outline any specific energy or CO2 targets however it does expect all new development to exceed the Building Regulations standards for sustainable buildings.

4.0 ENERGY HIERACHY

As part of our aims to provide a sustainable development we will be following the energy hierarchy outlined in the London Plan policy. The hierarchy shown below guides our approach to minimising the energy use within the building and to create a comfortable internal environment. This consists of three best practice criteria: Be Lean, Be Clean and Be Green to achieve Low energy and carbon design.

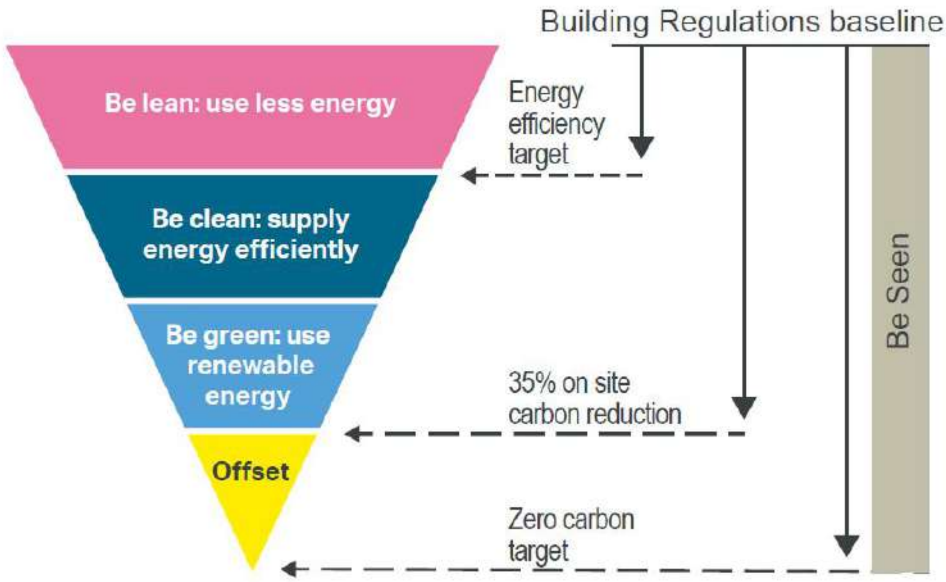


Figure 04: London Plan's energy hierarchy

The design team has taken the above criteria and applied the most feasible measures to the building.

4.01 Be Lean

4.01.01 Building Form

The first thing to consider under passive design measures is how the building form can be best optimised and influenced to help limit any unnecessary energy use. The building form design includes the following to reduce energy use:

- Generous floor to ceiling heights to help optimise daylight penetration into spaces.
- The majority of bedrooms have been positioned on a North facing façade to reduce solar gain.

4.01.02 Building Envelope Thermal Performance

The most effective way of keeping heating energy consumption to a minimum is to ensure the building uses high performing fabric properties. It is proposed the building is well insulated and uses high performing constructions above the current minimum requirement of the building regulations. As a result, the following construction U-values (W/m².K) are proposed:

Envelope Element	U-Value W/m².K	
	Residential Build Regs Req	Proposed Residential
Wall	0.30	0.16
Roof	0.20	0.12
Floor	0.25	0.10
Glazing	2.00	1.20

Table 05: Proposed U-values

4.01.03 Air Infiltration

Uncontrolled air infiltration in a building can contribute to a sizeable proportion of heat losses particularly in well insulated modern buildings. An air permeability of no greater than 4.0 m^3/m^2h is proposed.

4.01.04 Daylight strategy

The provision of artificial lighting accounts for a considerable proportion of most building's primary energy consumption. The maximisation of daylight within a building can reduce this demand significantly. The below items will be considered during the design development period throughout the contract:

- Generous floor to ceiling heights
- Dual aspect glazing in areas where possible
- Daylight dimmable sensors where possible

4.01.05 Energy efficient services

A number of energy efficient HVAC and lighting strategies are proposed for the development:

- Lighting – LED lighting will be installed throughout and be chosen to minimise over-illumination.
- Energy meters – energy meters will be installed for all major energy uses including water.
- Central controls – a building management systems (BMS) will be installed in the commercial spaces and enable the heating, cooling and DHW systems to respond to the demand dynamically and run more efficiently.
- User controls – Efficient and user-friendly controls will be specified throughout all buildings.
- Heating – The development will be highly insulated for low space heating requirements. Residential heating will be provided by high efficiency heat pump systems with a 300% heating generator seasonal efficiency.
- Hot water – All hot water will be provided by high efficiency heat pumps.
- Mechanical ventilation – All mechanical / fresh air ventilation units will use highly efficient heat recovery systems and low specific fan powers (SFP's).
- Cooling – Efficient mechanical equipment (lighting, fans etc) will be specified to minimise internal gains. Solar control glazing with a 0.55 g-value will also be installed to reduce solar gains.
- Air conditioning – There is no mechanical cooling on site, eliminating emissions from such systems.

4.01.06 Insulated pipework

All Internal heating pipework, particularly those located in internal corridors, will be insulated to a standard beyond building regulation requirements. This will minimise issues of internal heat gain and avoid the need for any additional ventilation or cooling.

4.01.07 Unregulated energy use

In addition, efforts are being made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods in each room to encourage energy consumption reduction.

Please note the benefits of high efficiency appliances cannot be included in any results shown in this report. These measures interact to some degree (e.g., more low energy lighting reduces the ancillary heat gains from lighting, so increases the space heating demand) so comparisons of individual results can produce apparent anomalies and are not provided as a result.

4.02 Be Clean

4.02.01 District Heating (DH) Networks

The next stage of the London Plan hierarchy is to look at the availability of decentralised heat networks within the vicinity of the development. Consideration should be given to connecting to these networks should there be one close to the development, or if a network is proposed for the local area. The image below shows the location of the site on the current London Heat Map (https://maps.london.gov.uk/webmaps/heatmap/):

Figure 05: London heat map image showing site

As the image above shows the nearest existing and proposed DH networks are over 11km and 6km from the site, respectively. The resulting pipework and excavation involved would be extreme to secure a connection, therefore it is an unfeasible therefore this is not considered an option.

4.02.02 Combined Heat and Power (CHP)

Although it is feasible to install a CHP engine for this development it must be noted that CHP would not offer significantly better savings over the proposed heat pumps.

It must also be noted that future Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.

4.03 Be Green

The final part of the hierarchy is to minimise carbon dioxide emissions using renewable / Low or Zero Carbon (LZC) technologies. An initial LZC tech feasibility study has been conducted, shown in appendix A, and the most appropriate product available is heat pumps.

4.03.01 Air source heat pumps

Several energy studies were performed to establish the most CO_2 neutral system available and using a highly efficient heat pump system for space heating uses the least amount of energy. The heating and hot water generator seasonal efficiency will be around 300%.

4.03.02 Solar Panels

Initial calculations and space planning shows that 60m² of solar photovoltaic (PV) panels can be located at roof level. A highly efficient product is specified with an 19.6% module efficiency. See appendices for roof layout and panel tech details.

4.04 Be Seen

Extensive monitoring and metering for all major plant and equipment will be installed. Individual equipment and services will be capable of being monitored individually and their energy consumption tabulated for review. All metering will also have pulsed outputs and be capable of warning of “out of range” values.

5.0 THERMAL & ENERGY MODELLING, & BREEAM RESULTS

5.01 Part L1A Software Used

All residential dwellings will be calculated using the Standard Assessment Procedure (SAP). The software used will be *Elmhurst Energy*'s (formerly NHER) *Design SAP 2012* which is widely used for building energy calculations throughout the On-Construction industry. All versions of *Elmhurst's Design SAP* software are fully BRE tested, and Government approved; they calculate the necessary building regulations/standards for England (Part L), Wales (Part L), Northern Ireland (Part F) and Scotland (Section 6).

http://www.elmhurstenergy.co.uk/

The calculations were also conducted by an approved *Elmhurst Energy* On-Construction Domestic Energy Assessor (OCDEA).

5.02 Carbon Factors

The current London Plan (2016) requires energy simulations be run using two sets of carbon factors, one for the current Building Regulations and one for the proposed future Building Regulations that use the carbon factors as outlined in proposed SAP 10. A summary is below:

Fuel (kg CO_2/KWh)	Current Build Regs 2013	SAP 10
Mains gas	0.216	0.210
Electricity	0.519	0.233

Table 06: Carbon factors for current and proposed Build Regs

The most noteworthy from the above is that under SAP 10 gas and electricity have more or less the same CO_2 factor. This will in effect render CHP engines obsolete as they will produce as much CO_2 as they save.

5.03 Results Using Current Building Regulations 2013

The Part L1A results under current Building Regulations 2013 (current) are shown below:

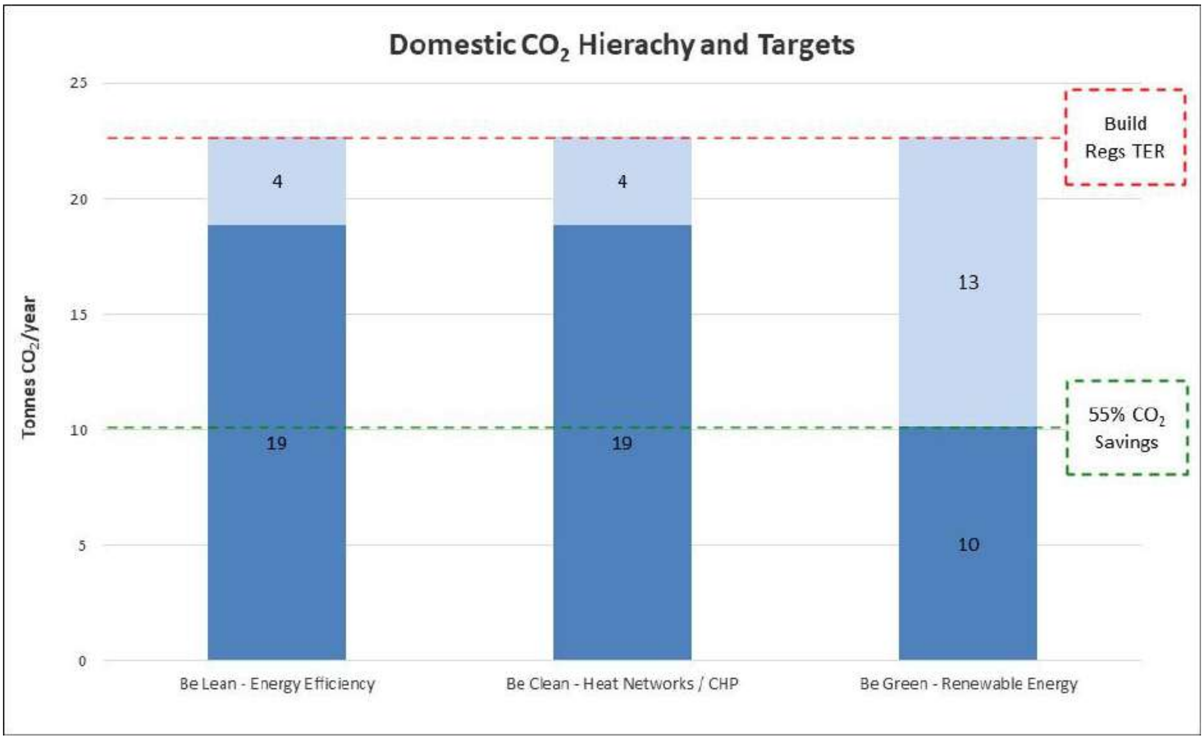


Figure 06: Part L1A results

Using the input data outlined in this report the proposed building will exceed Part L1A 2013 compliance by 55%.

A selection of sample SAP output documents for the Lean and Green scenarios as proof of the above calculations can be found in the appendices.

5.04 Results Using Proposed Future Building Regulations (SAP 10)

The residential energy simulation results under the predicted future Building Regulations (SAP 10) are shown below:

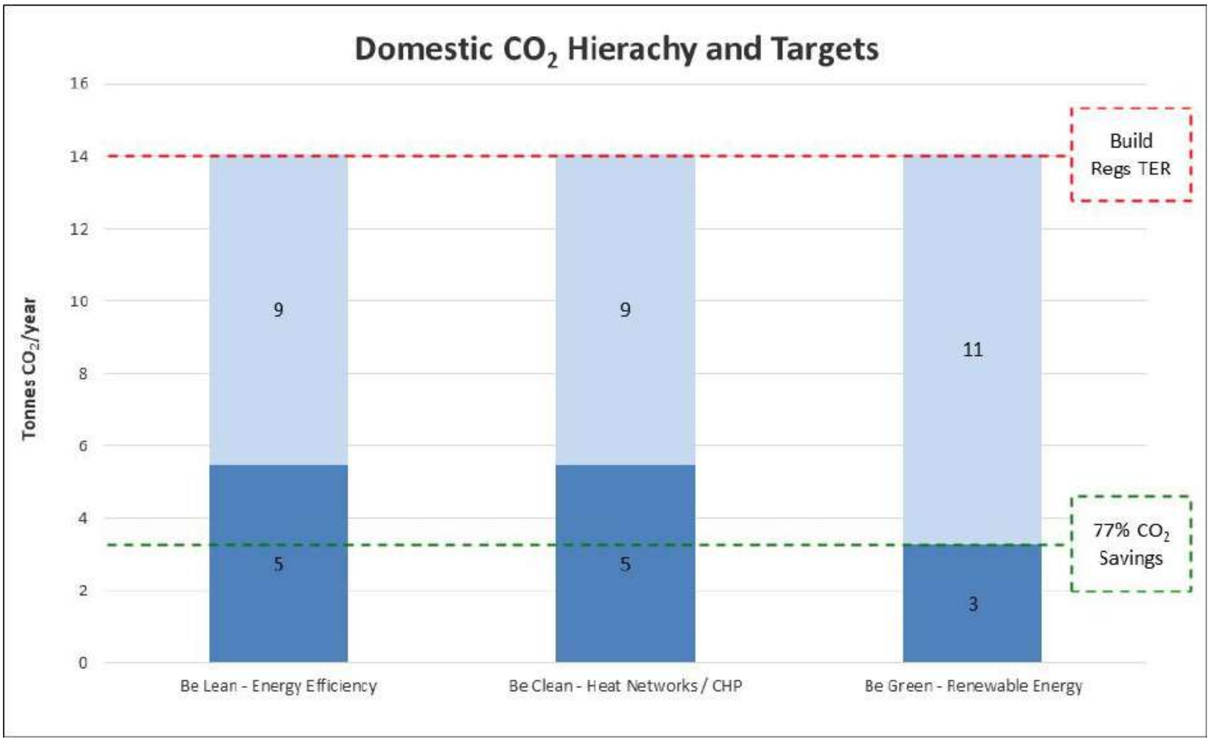


Figure 07: Predicted Future Build Regs results using SAP 10 CO_2 factors

Using the input data outlined in this report the proposed building will exceed predicted future Building Regulations compliance by 77%.

Please note SAP documents cannot be provided for the above calculations as the calculation software is a beta version, i.e., not legally approved for obvious reasons.

6.0 SUMMARY & CONCLUSION

The proposed development will have to achieve the following energy & sustainability targets:

Requirement	Description / Summary
Building Regulations Part L1A 2013	Each individual dwelling must have better building fabric and energy performance when compared to a Target Emission Rate (TER)
London Plan 2021	All new development, residential and commercial, must have zero CO_2 emissions. A CO_2 reduction of at least 35% is expected and the remaining CO_2 to zero must be off-set with a cash in lieu contribution.
Richmond Local Plan 2018	Policy LP 22, Sustainable Design & Construction, requires all new development to comply with the latest London Plan standards (as outlined above).
Richmond Residential Development Standards	Section 5.0, Sustainable Design, although does not outline any specific targets it does expect all new dwellings to exceed CO_2 reduction requirements under current Build Regs.

Table 07: Summary of energy and sustainability targets

To achieve the above targets, the following energy reduction methods will be required, using the London Plan's Energy Hierarchy:

Be Lean

- **Building Form** – The building form must be optimised to help limit any unnecessary energy use. This includes limiting solar gains on south facing facades and large floor to ceiling heights to help optimise daylight penetration.

- **High performing building thermal envelope** – Construction U-values performing above the current building regulations. The following construction U-values will be used

Envelope Element	U-Value W/m².K	
	Residential Build Regs Req	Proposed Residential
Wall	0.30	0.16
Roof	0.20	0.12
Floor	0.25	0.10
Glazing	2.00	1.20

Table 08: Proposed U-values

- **Low Infiltration –** Air tightness no higher than 4.0 m³/m²h.

- **Daylight Strategy** – The maximisation of daylight within a building can reduce lighting demand significantly by using generous floor to ceiling heights, dual aspect glazing and daylight dimmable sensors where possible.

- **Highly efficient lighting with controls** – LED lighting installed throughout with daylight and PIR sensors where possible.

- **Highly efficient HVAC systems** – Only specifying a high efficiency heat pump system and mech vent units with low SFP's and heat recovery.

- **Highly efficient hot water generator -** The hot water demand will be provided by a heat pump generator.

- **Insulated pipe work -** All Internal heating pipework will be insulated to a standard beyond building regulation requirements.

- **Unregulated Energy Use -** In addition, efforts are being made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods in apartments.

Be Clean

- **District Heating (DH)** – All existing and proposed heat networks are many km from the site and associated pipework and excavation would be too excessive to justify a connection for this development. DH is therefore not considered.

- **Combined Heat and Power (CHP)** – Although CHP is feasible, it would not offer better savings over the proposed heat pumps. It must also be noted that future Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.

Be Green

- **Air Source Heat Pumps** – Highly efficient heat pump heating will be installed, along with a separate heat pump system for hot water generation.

- **Solar Panels -** Initial calculations and space planning shows that 60m² of solar photovoltaic (PV) panels can be located at roof level. A highly efficient product is specified with an 19.6% module efficiency.

Energy Modelling Results – Current (2013) Building Regulations

The whole development has been analysed for its energy use using approved energy modelling software. The predicted tonnes of CO_2 are shown below:

Domestic	
Scenario	**Regulated t/CO_2 year**
Baseline: Part L 2013 of the Building Regulations Compliant Development	22.7
After Energy Demand Reduction	18.9
After Heat Network / CHP	18.9
After Renewable Energy	10.2

Scenario	Regulated Domestic Carbon Dioxide Savings	
	Regulated t/CO_2 year	**%**
Savings From Energy Demand Reduction	3.8	17%
Savings From Heat Network / CHP	0	0%
Savings From Renewable Energy	8.7	38%
Cumulative On-Site Savings	12.5	55%
Carbon Shortfall	10.2	-

Table 9: Summary of CO_2 emissions and savings

As the results above show, when including all available Lean, Clean and Green technologies and methods, the building will achieve a 55% improvement over current Building Regulations.

Energy Modelling Results – Predicted Future Building Regulations (SAP 10)

The whole development has been analysed for its energy use using predicted future Building Regulations, namely the proposed CO_2 factors as outlined in SAP 10. The predicted and saved tonnes of CO_2 are shown below:

Domestic	
Scenario	**Regulated t/CO_2 year**
Baseline: Part L 2013 of the Building Regulations Compliant Development	14.1
After Energy Demand Reduction	5.5
After Heat Network / CHP	5.5
After Renewable Energy	3.3

Scenario	Regulated Domestic Carbon Dioxide Savings	
	Regulated t/CO_2 year	**%**
Savings From Energy Demand Reduction	8.6	61%
Savings From Heat Network / CHP	0	0%
Savings From Renewable Energy	2.2	16%
Cumulative On-Site Savings	10.8	77%
Carbon Shortfall	3.3	-

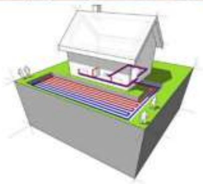
Table 10: Summary of CO_2 emissions and savings

As the results above show, when including all available Lean, Clean and Green technologies and methods, the building will achieve an 77% improvement over predicted future Building Regulations using the SAP 10 CO_2 factors.

Shortfall to zero carbon: The development has done everything possible to reduce CO_2 emissions as far as possible. Solar panels have already been maximised and any further units cannot realistically fit on site. The chosen heat pump heating system is also the most efficient available, alternative systems would increase the CO_2 production. Any further LZC is not feasible given the site constraints.

7.0 APPENDICES

7.01 Appendix A – LZC Technology Feasibility Analysis

Technology		Feasibility	
Photovoltaic (PV) Panels		PV's use semiconductor technology to convert incident solar radiation into electrical power. The building is well suited for solar collection with a large flat roofs located several storeys above ground level. Any electricity that is generated and used on site is preferable as every kWh used is one that the development doesn't have to purchase. Any surplus electricity generated can be exported to the national grid, receiving a further export tariff in addition to the generation tariff.	**Medium**
Solar Thermal Panels		Solar thermal panels are a method of harvesting the sun's energy, commonly to provide a source of preheated water. As mentioned above, the building has a large area of roof providing an ideal location for solar thermal collection. The optimum size of a solar thermal array is to provide approximately a third of the daily stored demand, which would benefit the residential areas however it would be at the cost of PV panel area. Electricity demand reduction, from PV's, has a greater impact on CO_2 savings than the gas demand used for hot water heating, especially when including CHP making this tech feasible but less effective than other options.	**Medium**
Ground Source Heat Pump (GSHP)		A GSHP takes low-grade heat from the ground and uses electricity to convert it to useful heat (at approximately 40°C) that can be used to heat a building. The ground can also be used as a heat sink to provide cooling. The bore holes and length of pipework into the ground required for this tech make this option difficult to justify considering the developments suburban location.	**Low**
Air Source Heat Pump (ASHP)		Similar to the GSHP, ASHP utilises the external environment as a heat source. A heat pump uses electricity or gas to run a refrigerant cycle, extracting heat from external air to convert it to useful heat for space heating. ASHPs offer high efficiencies and are suited to institutional and commercial properties. Although these systems are typically noisy, must be located externally and require an area of flat roof, their high efficiencies are too beneficial to rule out.	**High**
Wind Turbines		Wind energy can be converted to electricity by using wind turbines. This renewable technology is suited to exposed areas free from obstructions where the average wind speeds are high. On the site there are plenty of obstructions which would lead to the wind having a turbulent nature resulting in poor output for turbines, plus they have significant visual and noise impacts on neighbouring areas. Hence they are unsuitable for this development.	**Low**
Biomass		Biomass fuel is usually wood chips or wood pellets, and as it comes from plants it is considered a low-carbon source of high-grade heat that can be used for space heating, domestic hot water and, with absorption chillers, cooling (this last option is very rarely implemented due to high capital cost). A biomass boiler needs to operate under a reasonably constant load being a solid fuel boiler; it is unable to respond to load fluctuations as quickly as a gas or oil boiler. This limits the boilers to being suitable to operate for the provision of the base load. This could still be suitable for this development for its likely large base load however biomass also has the potential to have a significantly detrimental effect on air quality in the local vicinity, frequent fuel deliveries are required which could be disruptive to residents and there are significant maintenance costs. Unless a free source of wood can be found, such as waste from a factory or forestry management operation, the biomass fuel is often the same price or more expensive than gas. This means that the additional capital outlay on top of the increased fuel, maintenance costs, air quality, running costs and maintenance issues make biomass less viable than other tech available.	**Low**
Combined Heat and Power		CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process, the heat being distributed in surrounding buildings instead of being wasted. CHP is best suited to buildings with large heating and DHW demands making it feasible for this development. Although CHP is feasible, it would not offer significantly better savings over the proposed heat pumps. It must also be noted that future Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.	**Medium**
District Heating		DH tends to be large CHP units run by commercial energy firms supplying energy to local buildings through underground pipework. Though they offer the same benefits as an on site CHP, without maintenance costs (provided by the supplier), the limitations are the proposed site needs to be within reasonable distance of a network. All existing and proposed heat networks are many km from the site and associated pipework and excavation would be too excessive to justify a connection for this development. DH is therefore not considered.	**Low**

7.02 Appendix B – Residential input data used for LEAN calculations

Survey

Survey Details	
Calculation type	New Build (As Designed)
Property tenure	Unknown
Transaction type	New dwelling
Terrain type	Suburban

Construction

Construction U-values W/m².K	
Ground floor	0.10
External wall	0.16
Roof	0.12
Front door	2.00

Glazing Parameters	
Overall U-value, including frame	1.20
g-value	0.55

Internal / Party Constructions	
Party wall	Filled cavity with edge ceiling
Internal partitions	Plasterboard on timber frame
Party ceiling	Concrete plank floor - screed laid on insulation
Party floor	Concrete plank floor - screed laid on insulation
Internal ceiling	Plasterboard ceiling, carpeted chipboard floor
Internal floor	Plasterboard ceiling, carpeted chipboard floor

Thermal Mass Parameter (TMP)	
TMP	250.00

Thermal Bridging	
Calculating source type	Calculated
Window lintels	K1 Approved
Window Sills	K1 Approved
Window Jambs	K1 Approved
All other bridges	Default

Air Permeability

Pressure Test	
Pressure Test AP50	4.0

Ventilation

Mechanical Ventilation	
Type	Balanced mechanical ventilation with heat recovery
Duct type	Rigid
SFP W/l/s	0.52
Heat recovery efficiency	92%

Cooling

Fixed cooling system	
Cooling type	-
Energy class	-
Control	-

Lighting

Lighting	
% of Low Energy Lighting (L.E.L.) fittings	100%
Tariff	Standard

Heating System

Heat Source - Mansion Block	
Heat source	Air source heat pump
Heating use	Heating and hot water
Efficiency	170.0%
Code	CCK Flat rate charging, programmer and at least two room thermostats

Heat Source - Duplex's	
Heat source	PET Electricity heat pump air-to-water
Heating use	Heating and hot water
Efficiency	170.0%
Heat emitter	Underfloor
Heating method	Pipes in thin screed
Flow temp	<35°C
Code	Time and temp control

Domestic Hot Water

Water Heating	
Water heating	From main heating system
Heater type	-
Fuel type	-
Type	-

Hot Water Cylinder - Duplex's only	
Cylinder in heated space	Yes
Loss kwh/day	1.80
Cylinder volume (litres)	200
Pipework	Fully insulated

Renewables

None	
-	-

7.03 Appendix C – Residential input data used for GREEN calculations

Survey

Survey Details	
Calculation type	New Build (As Designed)
Property tenure	Unknown
Transaction type	New dwelling
Terrain type	Urban

Construction

Construction U-values W/m².K	
Ground floor	0.10
External wall	0.16
Roof	0.12
Front door	2.00

Glazing Parameters	
Overall U-value, including frame	1.20
g-value	0.55

Internal / Party Constructions	
Party wall	Filled cavity with edge ceiling
Internal partitions	Plasterboard on timber frame
Party ceiling	Concrete plank floor - screed laid on insulation
Party floor	Concrete plank floor - screed laid on insulation
Internal ceiling	Plasterboard ceiling, carpeted chipboard floor
Internal floor	Plasterboard ceiling, carpeted chipboard floor

Thermal Mass Parameter (TMP)	
TMP	250.00

Thermal Bridging	
Calculating source type	Calculated
Window lintels	K1 Approved
Window Sills	K1 Approved
Window Jambs	K1 Approved
All other bridges	Default

Air Permeability

Pressure Test	
Pressure Test AP50	4.0

Ventilation

Mechanical Ventilation	
Type	Balanced mechanical ventilation with heat recovery
Duct type	Rigid
SFP W/l/s	0.52
Heat recovery efficiency	92%

Cooling

Fixed cooling system	
Cooling type	-
Energy class	-
Control	-

Lighting

Lighting	
% of Low Energy Lighting (L.E.L.) fittings	100%
Tariff	Standard

Heating System

Heat Source - Mansion Block	
Heat source	Air source heat pump
Heating use	Heating and hot water
Efficiency	**300.0%**
Code	CCK Flat rate charging, programmer and at least two room thermostats

Heat Source - Duplex's	
Heat source	PET Electricity heat pump air-to-water
Heating use	Heating and hot water
Efficiency	**381.1%**
Heat emitter	Underfloor
Heating method	Pipes in thin screed
Flow temp	<35°C
Code	Time and temp control

Domestic Hot Water

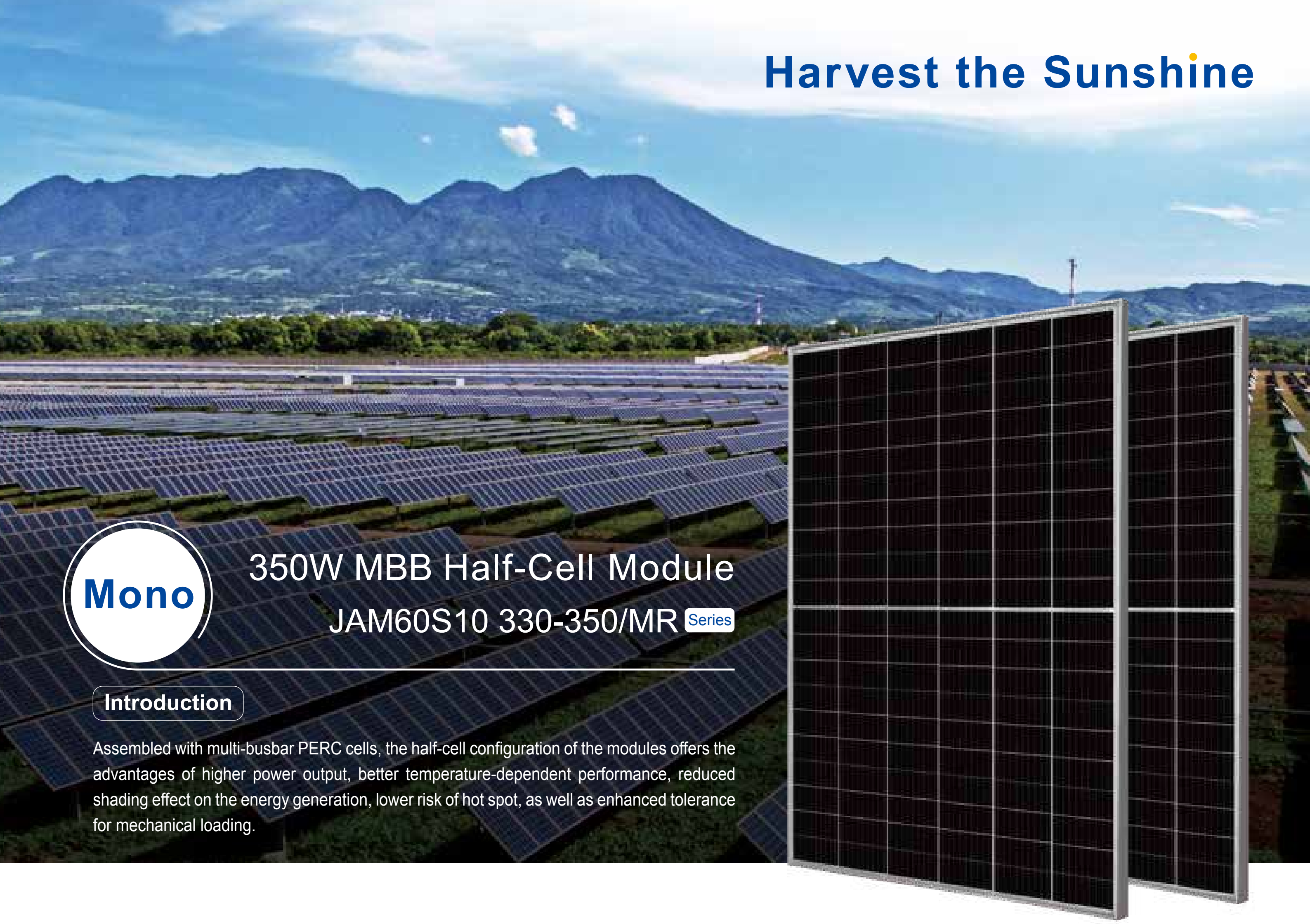
Water Heating	
Water heating	From main heating system
Heater type	-
Fuel type	-
Type	-

Hot Water Cylinder - Duplex's only	
Cylinder in heated space	Yes
Loss kwh/day	1.80
Cylinder volume (litres)	200
Pipework	Fully insulated

Renewables

Photovoltaics - Duplex's only	
Peak cells kWp (avg per apartment)	2.0
Overshadowing	Modest
Connected to the building's electrcity meter	No

7.04 Appendix D – Solar panel tech details



Harvest the Sunshine

Mono

350W MBB Half-Cell Module

JAM60S10 330-350/MR Series

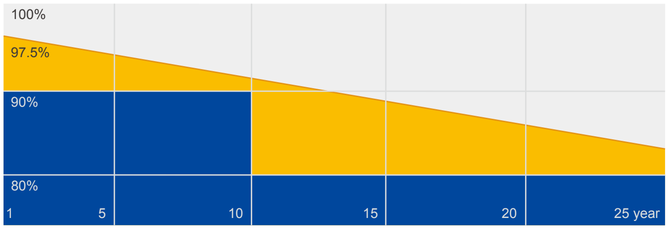
Introduction

Assembled with multi-busbar PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.

- Higher output power
- Lower LCOE
- Less shading and lower resistive loss
- Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty



■ JA Linear Power Warranty ■ Industry Warranty

Comprehensive Certificates

- IEC 61215, IEC 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- OHSAS 18001: 2007 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval

TÜV SÜD CE

JA SOLAR

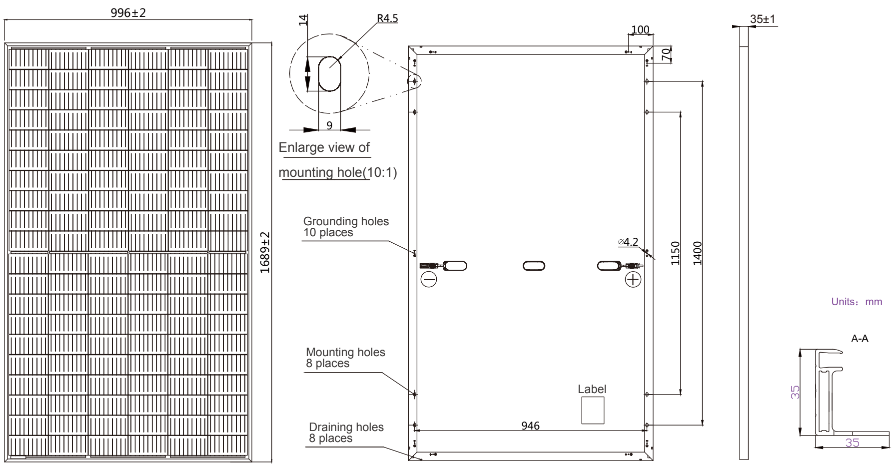
www.jasolar.com

Specifications subject to technical changes and tests.
JA Solar reserves the right of final interpretation.

JA SOLAR

JAM60S10 330-350/MR Series

MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	18.7kg±3%
Dimensions	1689±2mm×996±2mm×35±1mm
Cable Cross Section Size	4mm²
No. of cells	120(6×20)
Junction Box	IP68, 3 diodes
Connector	MC4 Original QC 4.10(1000V) QC 4.10-35(1500V)
Cable Length (Including Connector)	Portrait:300mm(+)/400mm(-); Landscape:1000mm(+)/1000mm(-)
Packaging Configuration	31 Per Pallet

ELECTRICAL PARAMETERS AT STC

TYPE	JAM60S10 -330/MR	JAM60S10 -335/MR	JAM60S10 -340/MR	JAM60S10 -345/MR	JAM60S10 -350/MR
Rated Maximum Power(Pmax) [W]	330	335	340	345	350
Open Circuit Voltage(Voc) [V]	41.08	41.32	41.55	41.76	42.02
Maximum Power Voltage(Vmp) [V]	34.24	34.48	34.73	34.99	35.25
Short Circuit Current(Isc) [A]	10.30	10.38	10.46	10.54	10.62
Maximum Power Current(Imp) [A]	9.64	9.72	9.79	9.86	9.93
Module Efficiency [%]	19.6	19.9	20.2	20.5	20.8
Power Tolerance	0~+5W				
Temperature Coefficient of Isc(α_Isc)	+0.044%/℃				
Temperature Coefficient of Voc(β_Voc)	-0.272%/℃				
Temperature Coefficient of Pmax(γ_Pmp)	-0.350%/℃				
STC	Irradiance 1000W/m², cell temperature 25℃, AM1.5G				

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

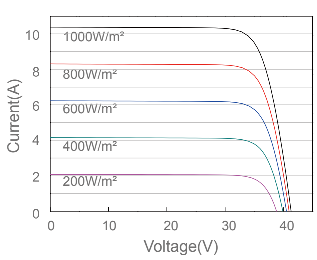
TYPE	JAM60S10 -330/MR	JAM60S10 -335/MR	JAM60S10 -340/MR	JAM60S10 -345/MR	JAM60S10 -350/MR
Rated Max Power(Pmax) [W]	249	253	257	261	265
Open Circuit Voltage(Voc) [V]	38.46	38.68	38.90	39.09	39.31
Max Power Voltage(Vmp) [V]	32.02	32.21	32.40	32.61	32.84
Short Circuit Current(Isc) [A]	8.21	8.28	8.35	8.42	8.49
Max Power Current(Imp) [A]	7.78	7.85	7.93	8.00	8.07
NOCT	Irradiance 800W/m², ambient temperature 20℃, wind speed 1m/s, AM1.5G				

OPERATING CONDITIONS

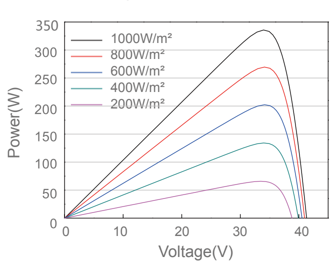
Maximum System Voltage	1000V/1500V DC(IEC)
Operating Temperature	-40℃~+85℃
Maximum Series Fuse	20A
Maximum Static Load,Front	5400Pa
Maximum Static Load,Back	2400Pa
NOCT	45±2℃
Safety Class	Glass Ⅱ

CHARACTERISTICS

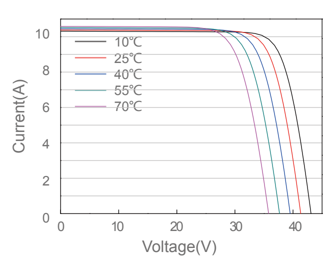
Current-Voltage Curve JAM60S10-335/MR



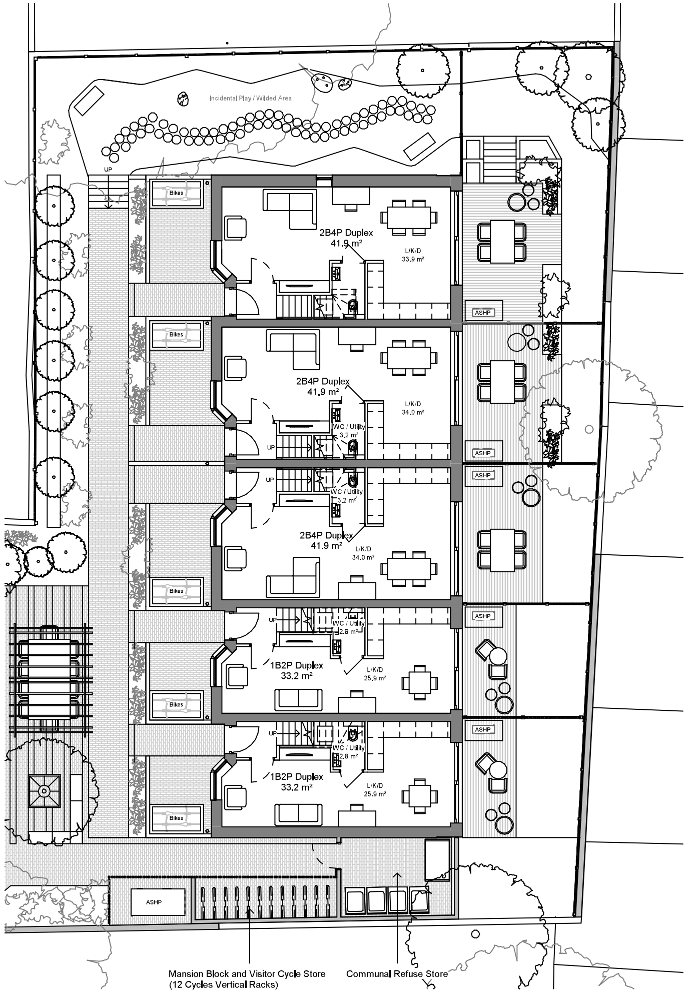
Power-Voltage Curve JAM60S10-335/MR



Current-Voltage Curve JAM60S10-335/MR



7.05 Appendix E – Solar panel layout at roof level



1 **Ground Floor Plan - Mews**
1 : 100

2 **First Floor Plan - Mews**
1 : 100

0 1m 2m 5m

Revision	Date	Description
P0	21/07/2022	Planning Issue

project
Meadows Hall

drawing title
Proposed Plans - Mews Block

drawing number
WP-0733-A-0112

revision
P0

scale @ A1
1 : 100

First Issue
21/07/2022

drawing purpose
PLANNING

WIMSHURST PELLERITI

The Mews,
6 Putney Common, SW15 1HL

0208 780 2206

info@wp.uk.com
wimshurst-pelleriti.com

7.06 Appendix F – LEAN SAP outputs

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

QuinnRoss CONSULTANTS LTD

Property Reference	P2197 - LEAN	**Issued on Date**	17/11/2021
Assessment Reference	03 - Mansion 1st	**Prop Type Ref**	
Property	Meadows Hall, Church Road, Richmonnd, TW10 6LN		

SAP Rating	82 B	**DER**	25.26	**TER**	29.14
Environmental	84 B	**% DER<TER**	13.31		
CO_2 Emissions (t/year)	1.04	**DFEE**	49.17	**TFEE**	50.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	2.88		

Assessor Details	Mr. Christopher Armstrong, Christopher Armstrong, Tel: 01795 841035, carmstrong@quinnross.com	**Assessor ID**	P763-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Flat, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.75 m	50.50 m²	3.00 m

7.0 Living Area	23.60	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	236.28	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.16	150.00	63.00	44.45

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	3.73

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	90.50

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete plank floor (screed laid on insulation), carpeted	30.00	50.50

11.1 Party Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete plank floor (screed laid on insulation), carpeted	40.00	50.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							2.00
Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Glaz E	Window	[1] External Wall 1	East	None	0.00					7.05	
Glaz W	Window	[1] External Wall 1	West	None	0.00					6.50	
Glaz SW	Window	[1] External Wall 1	South West	None	0.00					2.50	
Glaz NW	Window	[1] External Wall 1	North West	None	0.00					2.50	

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	6.10	0.300	Yes
Table K1 - Approved	E3 Sill	6.10	0.040	Yes
Table K1 - Approved	E4 Jamb	26.00	0.050	Yes
Table K1 - Default	E7 Party floor between dwellings (in blocks of flats)	28.75	0.140	Yes
Table K1 - Default	E16 Corner (normal)	16.00	0.180	No
Table K1 - Default	E17 Corner (inverted – internal area greater than external area)	6.00	0.000	No
Table K1 - Default	E18 Party wall between dwellings	3.00	0.120	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.46	0.000	No

Y-value 0.169 W/m²K

18.0 Pressure Testing Yes

Designed AP_{50} 4.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP_{50} m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	No
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167

Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	92.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	20
Total number of L.E.L. fittings	20
Percentage of L.E.L. fittings	100.00 %

External

External lights fitted	No

23.0 Electricity Tariff — Standard

24.0 Main Heating 1 — None

26.0 Community Heating

Community Heating	Space and Water Combined
Space Community Heating	
PCDF Index	n/a
Distribution Loss	Piping system >= 1991, pre-insulated, medium temp, variable flow
Controls	CCJ Charging system linked to use of community heating, TRVs
SAP Code	2310
PCDF Index	n/a

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical
Heat Source 1	Heat pump	Electricity	Space and Water	170.00	100.00%			

28.0 Water Heating — HWP From main heating 1

Water Heating	Community Heating
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No

SAP Code	901
29.0 Hot Water Cylinder	None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Property Reference	P2197 - LEAN	Issued on Date	17/11/2021
Assessment Reference	09 - Duplex 01 End	Prop Type Ref	
Property	Meadows Hall, Church Road, Richmonnd, TW10 6LN		

SAP Rating	80 C	DER	25.60	TER	32.32
Environmental	82 B	% DER<TER	20.79		
CO_2 Emissions (t/year)	1.24	DFEE	61.48	TFEE	66.09
General Requirements Compliance	Pass	% DFEE<TFEE	6.97		

Assessor Details	Mr. Christopher Armstrong, Christopher Armstrong, Tel: 01795 841035, carmstrong@quinnross.com	Assessor ID	P763-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	16.90 m	32.10 m²	3.00 m
1st Storey:	16.90 m	30.80 m²	2.50 m

7.0 Living Area 30.70 m²

8.0 Thermal Mass Parameter Precise calculation

Thermal Mass 388.89 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.16	150.00	92.95	76.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	41.80

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	92.50

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.12	9.00	30.80	30.80

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	32.10

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Slab on ground, screed over insulation	0.10	110.00	55.60

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	30.80

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							2.00
Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Glaz E	Window	[1] External Wall 1	East	None	0.00					9.00	
Glaz W	Window	[1] External Wall 1	West	None	0.00					2.25	
Glaz NW	Window	[1] External Wall 1	North West	None	0.00					5.00	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	5.90	0.300	Yes
Table K1 - Approved	E3 Sill	5.90	0.040	Yes
Table K1 - Approved	E4 Jamb	21.00	0.050	Yes
Table K1 - Default	E5 Ground floor (normal)	16.90	0.320	Yes
Table K1 - Default	E6 Intermediate floor within a dwelling	16.90	0.140	Yes
Table K1 - Default	E14 Flat roof	16.90	0.080	Yes
Table K1 - Default	E16 Corner (normal)	11.00	0.180	Yes
Table K1 - Default	E18 Party wall between dwellings	11.00	0.120	Yes
Table K1 - Default	E25 Staggered party wall between dwellings	5.50	0.120	No
Table K1 - Default	P1 Party wall - Ground floor	7.60	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.60	0.000	No

Y-value	0.097	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	No

Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	92.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard

24.0 Main Heating 1	SAP table	
Percentage of Heat	100	%
Main Heating	PET	
SAP Code	224	
Efficiency (SAP Table)	170.0	%
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2	None

Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Supplementary Immersion	No	
Immersion Only Heating Hot Water	No	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.80	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

7.07 Appendix G – GREEN SAP outputs

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

QuinnRoss CONSULTANTS LTD

Property Reference	P2197 - GREEN	**Issued on Date**	17/11/2021
Assessment Reference	03 - Mansion 1st	**Prop Type Ref**	
Property	Meadows Hall, Church Road, Richmonnd, TW10 6LN		

SAP Rating	81 B	**DER**	17.18	**TER**	29.14
Environmental	89 B	**% DER<TER**	41.04		
CO_2 Emissions (t/year)	0.72	**DFEE**	49.17	**TFEE**	50.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	2.88		

Assessor Details	Mr. Christopher Armstrong, Christopher Armstrong, Tel: 01795 841035, carmstrong@quinnross.com	**Assessor ID**	P763-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Flat, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.75 m	50.50 m²	3.00 m

7.0 Living Area	23.60	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	236.28	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.16	150.00	63.00	44.45

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	3.73

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	90.50

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete plank floor (screed laid on insulation), carpeted	30.00	50.50

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete plank floor (screed laid on insulation), carpeted	40.00	50.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							2.00
Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Glaz E	Window	[1] External Wall 1	East	None	0.00					7.05	
Glaz W	Window	[1] External Wall 1	West	None	0.00					6.50	
Glaz SW	Window	[1] External Wall 1	South West	None	0.00					2.50	
Glaz NW	Window	[1] External Wall 1	North West	None	0.00					2.50	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	6.10	0.300	Yes
Table K1 - Approved	E3 Sill	6.10	0.040	Yes
Table K1 - Approved	E4 Jamb	26.00	0.050	Yes
Table K1 - Default	E7 Party floor between dwellings (in blocks of flats)	28.75	0.140	Yes
Table K1 - Default	E16 Corner (normal)	16.00	0.180	No
Table K1 - Default	E17 Corner (inverted – internal area greater than external area)	6.00	0.000	No
Table K1 - Default	E18 Party wall between dwellings	3.00	0.120	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.46	0.000	No

Y-value	0.169	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	No
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167

Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	92.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System: No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff: Standard

24.0 Main Heating 1: None

26.0 Community Heating

Community Heating	Space and Water Combined

Space Community Heating

PCDF Index	n/a
Distribution Loss	Piping system <= 1990, not pre-ins, medium/high temp, full flow
Controls	CCJ Charging system linked to use of community heating, TRVs
SAP Code	2310
PCDF Index	n/a

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical
Heat Source 1	Heat pump	Electricity	Space and Water	300.00	100.00%			

28.0 Water Heating: HWP From main heating 1

Water Heating	Community Heating
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No

SAP Code	901
29.0 Hot Water Cylinder	None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Property Reference	P2197 - GREEN	Issued on Date	17/11/2021
Assessment Reference	09 - Duplex 01 End	Prop Type Ref	
Property	Meadows Hall, Church Road, Richmonnd, TW10 6LN		

SAP Rating	87 B	DER	12.01	TER	32.32
Environmental	92 A	% DER<TER	62.84		
CO_2 Emissions (t/year)	0.53	DFEE	61.48	TFEE	66.09
General Requirements Compliance	Pass	% DFEE<TFEE	6.97		

Assessor Details	Mr. Christopher Armstrong, Christopher Armstrong, Tel: 01795 841035, carmstrong@quinnross.com	Assessor ID	P763-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	16.90 m	32.10 m²	3.00 m
1st Storey:	16.90 m	30.80 m²	2.50 m

7.0 Living Area 30.70 m²

8.0 Thermal Mass Parameter Precise calculation

Thermal Mass 388.89 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.16	150.00	92.95	76.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	41.80

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	92.50

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.12	9.00	30.80	30.80

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	32.10

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Slab on ground, screed over insulation	0.10	110.00	55.60

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	30.80

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							2.00
Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Glaz E	Window	[1] External Wall 1	East	None	0.00					9.00	
Glaz W	Window	[1] External Wall 1	West	None	0.00					2.25	
Glaz NW	Window	[1] External Wall 1	North West	None	0.00					5.00	

14.0 Conservatory
None

15.0 Draught Proofing
100 %

16.0 Draught Lobby
No

17.0 Thermal Bridging
Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	5.90	0.300	Yes
Table K1 - Approved	E3 Sill	5.90	0.040	Yes
Table K1 - Approved	E4 Jamb	21.00	0.050	Yes
Table K1 - Default	E5 Ground floor (normal)	16.90	0.320	Yes
Table K1 - Default	E6 Intermediate floor within a dwelling	16.90	0.140	Yes
Table K1 - Default	E14 Flat roof	16.90	0.080	Yes
Table K1 - Default	E16 Corner (normal)	11.00	0.180	Yes
Table K1 - Default	E18 Party wall between dwellings	11.00	0.120	Yes
Table K1 - Default	E25 Staggered party wall between dwellings	5.50	0.120	No
Table K1 - Default	P1 Party wall - Ground floor	7.60	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.60	0.000	No

Y-value: 0.097 W/m²K

18.0 Pressure Testing
Yes

Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	No

Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500167
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	92.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	104570	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	308.7	
In Summer	288.4	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2	None

Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	No	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.80	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.91	Horizontal	Horizontal	Modest	No

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None