



iQ Echo Street, Manchester

Energy Statement & Overheating Report
7054-WBS-ZZ-XX-RP-MEP-10001

27th April 2023

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Client Name: IQ Student Accommodation
Document Reference: 7054-WBS-ZZ-XX-RP-MEP-10001
Project Number: BSD14517

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

Issue	Date	Prepared by	Checked by	Approved by
P01	27.04.2023	C Nisbett	P Evans	C Nisbett
				

Comments

A	17.04.2023	First Issue
P01	27.04.2023	Updated results for PV

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1. Executive Summary

1.1 Introduction and Site Description

This energy statement relates to the proposed development at Echo Street, Granby Row, Manchester M1 3QJ, and is intended to support a detailed planning application for the proposed development. The development consists of purpose-built student accommodation (PBSA) comprising of three interlinked tower blocks linking block buildings, associated amenity space and external landscaping.

This energy statement forms part of the full planning application and covers the philosophy for meeting the requirements of Building Control for Approved Document Part L volume 2.

The proposed building is shown to achieve an improvement against the Target Emissions Rating for Approved Document L2 2021, excluding unregulated loads. This has been achieved using a high efficiency thermal envelope, high efficiency building services system, air source heat pumps providing hot water, and a roof top solar PV array. The proposed development has an onsite renewable energy of 27% provided by air source heat pump and 6% provided by PV which is a total of 33% of the site overall energy demand. The latest design guidance and energy benchmarking has been used to develop this design.

1.2 Proposed Energy Strategy

The energy strategy for the new development at iQ Echo St Manchester is as follows:

- 1) High performance thermal fabric and efficient building services design.
- 2) The use of heat pump technology to provide hot water.
- 3) Highly efficient controls
- 4) Roof top Solar PV Array.

1.3 Carbon Emissions and Savings

The table below shows a summary of the regulated and unregulated emissions. Unregulated emissions are taken from the BRUKL output document.

Table 1: Carbon Emissions

Carbon dioxide emissions (tonnes (CO ₂)/annum)			
	Regulated	Unregulated	Total
Part L 2021 TER	120,364	117,809	238,173
Part L 2021 BER	122,593	117,809	240,402

The table above shows that the proposed development achieves a carbon saving considering regulated loads compared to a notional building assessed under Part L 2021. The building therefore complies with Approved Document L Volume 2 2021.

2. Introduction

This Energy Report has been prepared to demonstrate how the Echo Street development meets the requirements of Local and National Planning Policy requirements in relation to energy and carbon emissions.

Supporting the full planning application, this report provides a technical appraisal of the regulations and guidance that apply, the energy options considered for the project and the energy conservation measures that have been incorporated into the Echo St development.

The focus of the design approach has been to limit building CO₂ emissions through optimising the performance of the building envelope, together with energy efficiency measures.

2.1 Description of the Development

The development is located at Echo Street, Granby Row, Manchester M1 3QJ, reference should be made to Figure 1 for a map of the site and surrounding area.

The proposals comprise the construction of purpose-built student accommodation comprising three interlinked tower blocks with intermediary linking block buildings, and associated amenity spaces. The development provides the follow across the development:

Block A: adjacent to Vimto Gardens - 16 storeys, 150 studios, 75 cluster bedrooms.

Link Block A-B – 80 bed spaces.

Block B: middle block - 22 storeys, 115 studios, 255 cluster bedrooms.

Link Block B-C – 112 bed spaces.

Block C: adjacent to Echo St – 28 storeys, 162 studios, 275 cluster bedrooms.

The modelling geometry has been based on Architectural drawings provided by Sheppard Robson Architects, as scheduled later in the report.

Figure 1: Site Location



Source: Sheppard Robson

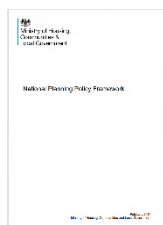
3. Relevant Planning Policies and Design Guidance

3.1 National Planning Policy Requirements



The Climate Change Act (2008) has set a legally binding target to reduce UK carbon emissions by 80% by 2050, against a 1990 baseline. It establishes a Committee on Climate Change which advises the Government on the setting of binding 5-year carbon budgets on a pathway to achieving the 2050 target of carbon neutrality. The Act is the driver behind a framework of national strategy and policy documents and is the basis for the development of local Planning Policy and updates to the Building Regulations.

National Planning Policy Framework.



The National Planning Framework was published in July 2021, of which the most relevant policies are set out below:

- 153. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

- 154. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

3.2 Building Energy Labelling



The Energy Performance of Buildings (Certificates and Inspections) Regulations 2007 were introduced to raise awareness of energy use in buildings, but also to enable an energy comparison between buildings.

This energy label has become a quality mark which will help prospective purchasers make informed decisions on building procurement and will also include recommendations on how a building's energy performance can be improved.

An EPC is classed as an asset rating, which is required for all buildings when they are constructed, sold or rented out. An EPC will provide a rating of the efficiency of the building fabric and fixed building services, which will be an assessment based on the calculated performance for a defined pattern of use.

A DEC will also be displayed in the entrance area to the building showing the actual energy consumed by the building.

A draft EPC for the iQ Echo street Manchester has been generated with an EPC 'A' rating.

3.3 Energy Targets

The primary energy objectives for this project are:

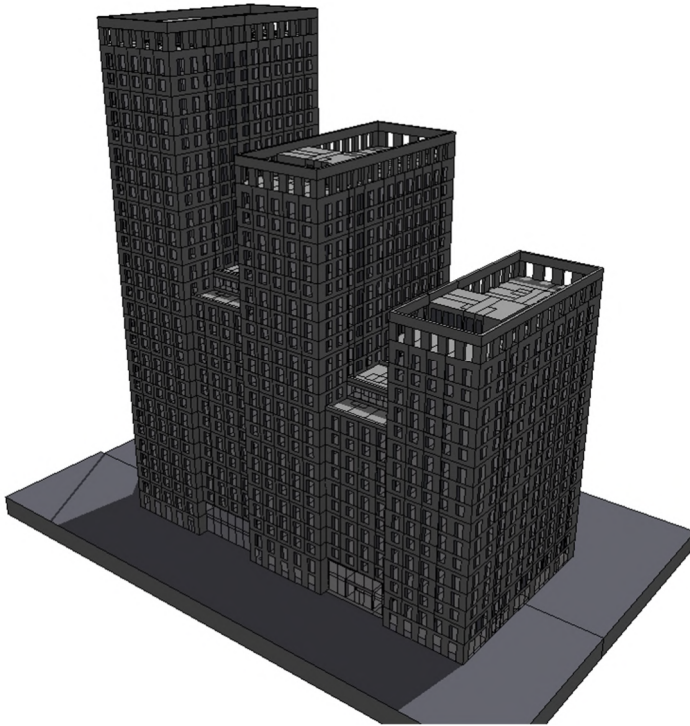
- 1) Ensure that the engineering systems and the building design is to a sufficiently high standard to exceed the requirements of Part L volume 2 2021.
- 2) Using grid supplied electricity sourced from renewable energy sources.

4. Modelling Data

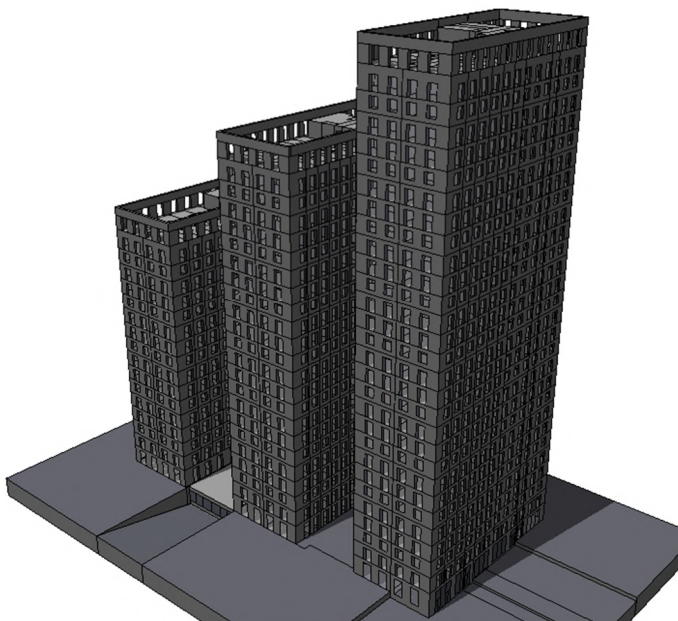
4.1 Design Information

The modelling has been based architectural model provided by Sheppard Robson Architects.

Figure 2: Graphical Representation of the Thermal Model



Source: Waterman Building Services



Source: Waterman Building Services

4.1.1 Building Fabric Data

The focus of the design team's approach has been to limit building energy consumption and carbon emissions through careful consideration of the performance of the building envelope. This approach has also aimed to reduce solar gains and heat losses to levels commensurate with good practice benchmarks as opposed to reliance on energy efficient measures adopted solely to offset the limitations of a poor performing building fabric. Part L volume 2 2021 regulations require solar gain to be controlled in all zones to the equivalent of an East facing building element with 1m high continuous glazing strip (0.1 frame factor) and glazing with a G-value equal to 0.4.

Where possible the development is targeting the U values listed within LETI guidance.

The following U-values have been incorporated into the building fabric design:

Table 2: Proposed U-Value Summary

Construction Element	Approved Document Part L2 (W/m ² K)	iQ Echo St Development (W/m ² K)
Exposed Wall	0.26	0.18
Exposed Floor	0.18	0.13
Exposed Roof	0.18	0.13
Windows & Rooflights	1.6	1.2, g value 0.4
External Doors	1.6	1.5
High Usage Doors	3	3
Air Permeability	10	3

Source: Waterman Building Services

In terms of ensuring the project meets the requirements for summertime over heating, Approved Document Part L2A requires that Criterion 3 – limiting solar gains shall be met by all internal spaces. Our study confirms that all spaces within the development meet the requirements of Approved Document Part L2 – Criterion 3.

A high level of air tightness of the thermal fabric of the building will reduce heat losses in winter and heat gains in summer and will increase the efficiency of the mechanical ventilation systems. The target design air permeability for the proposed development is 3 m³/h/m² at 50Pa. This represents an improvement of 70% over the baseline requirements set out in Part L 2021 (i.e. maximum allowable design air permeability is 8 m³/h/m² at 50Pa).

4.1.2 Heating

The core load for the site is based on using electric panel heaters for space heating within the accommodation areas, and high efficiency Air Source Heat pump unit for domestic hot water. The circulation areas will also be served by high efficiency ASHP via a LTHW heating circuit, this strategy minimise the distribution losses.

Table 3: Heating System Parameters

System and Type	Generator	Actual
Main System	Fuel	Electricity
Electric panel heaters	Seasonal Efficiency	1.0000
	Delivery Efficiency	1.0000
	SCoP kW/kW	1.0000
DHW System		
DHW served by ASHP	Fuel	Electric
	Seasonal Efficiency	4.3000
	Delivery Efficiency	0.9929
	SCoP kW/kW	4.2693
	Combined Loop Length (m)	6400

Source: Waterman Building Services

4.1.3 Cooling

Cooling is to be provided to the amenity area.

Table 4: Cooling System Parameters

System and Type	Generator	Actual
Main System	Fuel	Electricity
ASHP	Seasonal Efficiency	6.0000
	Delivery Efficiency	0.9318
	SCoP kW/kW	5.5908

Source: Waterman Building Services

4.1.4 Air Supply

Table 5: System Air Supply

Air Supply	
Outside air supply condition	External Air

The model assumes that all air used to ventilate the internal spaces is taken from external air. That is to say, the energy used to condition the air is taken from the temperature within the weather file.

4.1.5 Auxiliary Energy

The energy used by fans and pumps is known as the 'auxiliary energy' within the SBEM and DSM software. The Auxiliary Energy Values (AEV) and Specific Fan Powers (SFP) are shown in the table below. The values used for these are based on manufacturer's details and in accordance with the Approved Document L Volume 2.

All cluster bedrooms, studios and kitchens are to be provided with mechanical ventilation based on 30-60 l/s in order to meet Part O requirement and air quality issues.

Table 6: Auxiliary Energy Summary

MVHR System	Specific Fan Power W(l/s)	Heat Recovery (%)
Studios/Bedrooms/Kitchens	0.42	91

Source: Vent-Axia

The amenity area shall be provided with local MVHR ventilation with an SFP of 1.6 and heat recovery efficiency of 75%.

4.1.6 Efficient Lamps with Automatic Controls

The more functions a lighting control system has, the more expensive the system becomes. However, the payback periods on lighting controls systems are very good so the investment is beneficial.

In terms of our design goals for this development we are looking to achieve the following benchmarks: -

Significant energy performance targets within the electrical design:

All areas: 125 luminaire lumens per circuit Watt and Light Output Ratio of 1.00

It is proposed to provide highly low energy fittings to the student accommodation in the form of LED light fittings. This will significantly reduce lighting electricity usage and as a result the overall emissions.

Automatic lighting controls within bedrooms are not generally utilised because they are adequately controlled manually by the occupiers and therefore the cost of the controls is not justified. However, it is proposed to incorporate automatic lighting controls in general areas where it will be beneficial. Day lighting sensors will control perimeter areas which benefit from natural daylight, such as the open plan amenity spaces, whilst presence detection will be incorporated into the lift lobbies and corridors at each level and cleaners' stores. Further design development will be required post planning with the aspiration to increase lighting efficiency further.

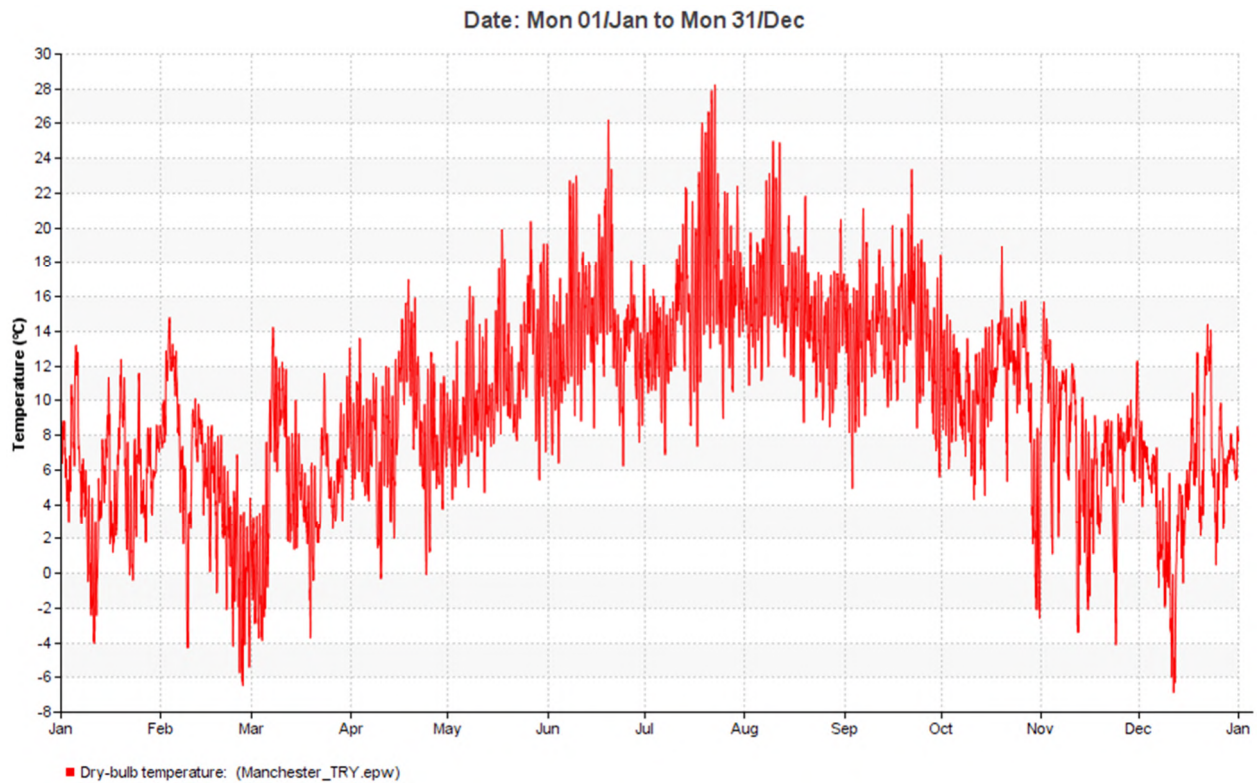
4.1.7 Weather Data

All environmental simulation software uses standardised weather data sets. The weather files available consist of CIBSE Test Reference years, CIBSE Design Summer Years, ASHRAE weather files as well as annualised weather files which average 10 years of weather data. The weather file used for our analysis is the CIBSE Test Reference Year for Manchester, in accordance with the National Calculation Method, being the most representative geographical data set available.

The weather file consists of various parameters such as dry bulb, wet bulb temperatures, cloud cover, wind speed and directions and solar data for an entire year, based on 10-minute intervals. Therefore, for each parameter within the weather file there are approximately 525,000 values forming the weather file. It is this data that are used to analyse the building, in order to determine how the building performs when subjected to actual weather conditions.

There is a huge amount of data available within the weather file, however, some parameter details are shown below providing information on the maximum, minimum and average external dry bulb temperatures for the Manchester Weather File.

Figure 3: Dry Bulb Temperature from the Manchester TRY Weather File



Source: IES Weather Data

4.2 Thermal Comfort - Overheating

The building construction is a highly efficient envelope and utilises solar control glazing with a low G value of 0.40 to maximise daylight while minimising solar gain. The glazed areas have been optimised to give the desired balance between good daylighting and minimising solar gains. Highly efficient lighting is used to further minimise internal heat gains.

The TM59 assessment has been carried out based on Category II (new build)

4.2.1 Part L 2021 Criterion 3

The iQ Echo St development has been reviewed using the Criterion 3 – limiting solar gains calculations that form part of the compliance calculations. Glazing areas and properties have been reviewed to ensure that the limiting criteria of Part L volume 2 and L volume 1 are not exceeded.

The results of our modelling show that the current building orientation and glazing proportions are maintaining solar gain within the required limits.

4.2.2 TM59

This assessment looks at the internal air temperatures over a simulated period, factoring in thermal sources from occupants, lighting and small power, as well as from external sources, with solar gain and external air temperatures. This method of assessment is referred to as the Dynamic Simulation Method (DSM).

The guidance for determining overheating has been taken from the CIBSE Technical Memorandum 59 (TM59), *Design methodology for the assessment of overheating risk in homes*. This document describes two criteria to determine the severity and extent of overheating in buildings.

Each of these criteria defined in TM 59 as follows: -

- (a) *For living rooms, kitchens and bedrooms:* the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: *Hours of exceedance*).
- (b) *For bedrooms only:* to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (*Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail*).

To meet the requirements of TM59 all criteria shown above must be passed for all relevant rooms.

All criteria are assessed against the varying operative temperature, which is calculated as a function of air temperature and mean radiant temperature (room surface temperatures), as calculated by the dynamic simulation. The parameters therefore fluctuate with external temperatures, and therefore seasonal changes. Further details are given within the Technical Memorandum.

The model has been simulated through accredited software, using IES Virtual Environment. The room geometry is created, and thermal properties are assigned throughout the model to define the building. Time profiles and internal gains are then assigned within the model, including ventilation rates and natural ventilation opening areas. It is then simulated against external weather data; in this case the CIBSE Design Summer Year (DSY) for Manchester.

An airtight envelope is another important factor in reducing outside air infiltration which add to the design loads indicated above, reducing the ability to maintain indoor air conditions.

Manchester 2020 50th (DSY1) medium weather data for the above design summer years has been used.

These weather files provide the opportunity to evaluate the impact of varying climate change scenarios building performance throughout its life cycle.

The below strategies of the proposed design have been reviewed under the climate change scenarios and to see if the building will maintain tenable internal conditions under the climate change:

- All rooms are assumed to have windows closed due to air quality issues – these spaces are provided with 30-60l/s of mechanical ventilation. All rooms above have minimum Part F ventilation rates.
- Solar treated glazing - g value of 0.40 and low emissivity.

4.3 Adaptability – Projected Climate Change Scenarios

With the increasing demand for more sustainable and energy efficient buildings and services to combat climate change and maintain design comfort criteria, weather data has now become an essential component of virtually every new building design and major refurbishment.

A range of alternative probabilistic weather files produced in accordance with the UK climate impacts programme (UKCIP) 2009, projections have been produced to be compatible with simulation software packages. These weather files provide the opportunity to evaluate the impact of varying climate change scenarios building design performance throughout its life cycle.

The following design weather file has been used:

- DSY2 – a year with a very intense single warm spell
- DSY3 – a year with a prolonged period of sustained warmth

These weather files provide the opportunity to evaluate the impact of varying climate change scenarios building performance throughout its life cycle.

Table 7: TM59 Assessment results – DSY1, DSY2 & DSY3

Pass rate	DSY1	100%	DSY2	100%	DSY3	42%
Mandatory			Advisory			
Room	DSY1	Result s	DSY2	Result s	DSY3	Result
00-B01 Bedroom	0.2	✓	0.3	✓	1.2	✓
00-B1 Kitchen	3.0	✓	2.8	✓	7.7	✗
00-C1 Kitchen	3.0	✓	2.4	✓	7.5	✗
00-B02 Bedroom	0.3	✓	0.3	✓	1.3	✓
00-B03 Bedroom	0.3	✓	0.3	✓	1.4	✓
00-B04 Bedroom	0.2	✓	0.3	✓	1.3	✓
00-B05 Bedroom	0.4	✓	0.3	✓	2	✓
00-C01 Bedroom	0.1	✓	0.2	✓	1.1	✓
00-C02 Bedroom	0.2	✓	0.3	✓	1.1	✓
00-C03 Bedroom	0.2	✓	0.3	✓	1.1	✓
00-C04 Bedroom	0.2	✓	0.3	✓	1.3	✓
00-C05 Bedroom	0.4	✓	0.3	✓	1.7	✓
01-A01 Bedroom	0.3	✓	0.3	✓	1.3	✓
01-A01 Studio	2.5	✓	1.8	✓	4.7	✗
01-A1 Kitchen	2.0	✓	1.3	✓	5.4	✗
01-A02 Bedroom	0.3	✓	0.3	✓	1.6	✓
01-A02 Studio	1.8	✓	1.1	✓	4	✗
01-A03 Bedroom	0.3	✓	0.3	✓	1.7	✓
01-A03 Studio	1.7	✓	1.1	✓	3.9	✗
01-A04 Bedroom	0.4	✓	0.4	✓	1.9	✓
01-A04 Studio	1.6	✓	1	✓	3.6	✗
01-A05 Bedroom	0.5	✓	0.5	✓	2.2	✓
01-A05 Studio	3.0	✓	2.6	✓	5.4	✗
01-A06 Studio	1.9	✓	1.5	✓	3.9	✗
01-A07 Studio	1.9	✓	1.5	✓	3.8	✗
01-A08 Studio	1.9	✓	1.5	✓	3.8	✗
01-A09 Studio	2.0	✓	1.5	✓	4	✗
01-A10 Studio	2.6	✓	1.8	✓	4.9	✗
01-A11 Studio	1.3	✓	0.8	✓	3.2	✗
01-A12 Studio	1.6	✓	1.1	✓	3.8	✗
01-A13 Studio	1.6	✓	1	✓	3.8	✗
01-A14 Studio	1.3	✓	0.9	✓	3.3	✗
01-B01 Acc. Bedroom	0.0	✓	0.2	✓	0.6	✓
01-B01 Studio	0.9	✓	0.6	✓	2.7	✓
01-B1 Kitchen	0.9	✓	0.6	✓	3.5	✗
01-B02 Bedroom	0.3	✓	0.3	✓	1.4	✓
01-B02 Studio	1.6	✓	1.1	✓	3.8	✗
01-B2 Kitchen	2.0	✓	1.3	✓	5.4	✗

01-B03 Bedroom	0.3	✓	0.3	✓	1.5	✓
01-B03 Studio	1.6	✓	1	✓	3.8	✗
01-B04 Bedroom	0.4	✓	0.3	✓	1.7	✓
01-B04 Studio	1.2	✓	0.7	✓	3.1	✗
01-B05 Acc. Bedroom	0.2	✓	0.3	✓	1.2	✓
01-B06 Bedroom	0.3	✓	0.3	✓	1.4	✓
01-B07 Bedroom	0.4	✓	0.3	✓	1.7	✓
01-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
01-B09 Bedroom	0.4	✓	0.3	✓	1.8	✓
01-B10 Bedroom	0.4	✓	0.3	✓	1.8	✓
01-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
01-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
01-C01 Studio	1.0	✓	0.6	✓	2.6	✓
01-C1 Kitchen	2.4	✓	1.6	✓	5.6	✗
01-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
01-C02 Studio	1.7	✓	1.1	✓	3.9	✗
01-C2 Kitchen	2.3	✓	1.6	✓	5.9	✗
01-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
01-C03 Studio	1.8	✓	1.1	✓	4.1	✗
01-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
01-C04 Studio	1.8	✓	1.1	✓	4.1	✗
01-C05 Bedroom	0.5	✓	0.3	✓	1.9	✓
01-C05 Studio	1.9	✓	1.3	✓	4.5	✗
01-C06 Bedroom	0.6	✓	0.5	✓	2.8	✓
01-C06 Studio	1.7	✓	1.2	✓	4.5	✗
01-C07 Bedroom	0.6	✓	0.5	✓	2.8	✓
01-C08 Bedroom	0.5	✓	0.5	✓	2.6	✓
01-C09 Bedroom	0.7	✓	0.6	✓	3	✓
01-C10 Bedroom	0.7	✓	0.6	✓	3.1	✗
02-A01 Bedroom	0.3	✓	0.3	✓	1.3	✓
02-A01 Studio	2.0	✓	1.5	✓	4.7	✗
02-A1 Kitchen	1.5	✓	0.9	✓	4.8	✗
02-A02 Bedroom	0.3	✓	0.3	✓	1.6	✓
02-A02 Studio	2.0	✓	1.2	✓	4.4	✗
02-A03 Bedroom	0.4	✓	0.3	✓	1.7	✓
02-A03 Studio	1.9	✓	1.1	✓	4.3	✗
02-A04 Bedroom	0.4	✓	0.3	✓	1.8	✓
02-A04 Studio	1.8	✓	1.1	✓	4.1	✗
02-A05 Bedroom	0.5	✓	0.4	✓	2	✓
02-A05 Studio	2.2	✓	1.7	✓	4.5	✗
02-A06 Studio	1.6	✓	1.1	✓	3.5	✗
02-A07 Studio	1.7	✓	1.1	✓	3.6	✗
02-A08 Studio	1.7	✓	1.1	✓	3.6	✗
02-A09 Studio	1.7	✓	1.2	✓	3.7	✗
02-A10 Studio	2.2	✓	1.5	✓	4.7	✗

02-A11 Studio	1.5	✓	0.9	✓	3.7	✗
02-A12 Studio	1.9	✓	1.2	✓	4.4	✗
02-A13 Studio	1.9	✓	1.2	✓	4.3	✗
02-A14 Studio	1.6	✓	1	✓	3.8	✗
02-A15 Studio	1.8	✓	1.1	✓	4.1	✗
02-A16 Studio	1.7	✓	1.2	✓	4.1	✗
02-A17 Studio	1.8	✓	1.2	✓	4.1	✗
02-A18 Studio	1.8	✓	1.2	✓	4.1	✗
02-B01 Acc. Bedroom	0.0	✓	0.2	✓	0.7	✓
02-B01 Studio	1.1	✓	0.7	✓	3.2	✗
02-B1 Kitchen	0.7	✓	0.4	✓	3	✓
02-B02 Bedroom	0.4	✓	0.3	✓	1.6	✓
02-B02 Studio	1.9	✓	1.2	✓	4.3	✗
02-B2 Kitchen	1.3	✓	0.8	✓	4	✗
02-B03 Bedroom	0.4	✓	0.3	✓	1.6	✓
02-B03 Studio	1.9	✓	1.2	✓	4.3	✗
02-B04 Bedroom	0.4	✓	0.3	✓	1.6	✓
02-B04 Studio	1.4	✓	0.8	✓	3.7	✗
02-B05 Acc. Bedroom	0.2	✓	0.3	✓	1.3	✓
02-B05 Studio	1.0	✓	0.7	✓	2.7	✓
02-B06 Bedroom	0.3	✓	0.3	✓	1.4	✓
02-B06 Studio	1.7	✓	1.1	✓	4	✗
02-B07 Bedroom	0.4	✓	0.3	✓	1.6	✓
02-B07 Studio	1.8	✓	1.2	✓	4.1	✗
02-B08 Bedroom	0.4	✓	0.3	✓	1.7	✓
02-B08 Studio	1.7	✓	1.1	✓	3.8	✗
02-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
02-B09 Studio	1.7	✓	1.1	✓	3.9	✗
02-B10 Bedroom	0.3	✓	0.3	✓	1.7	✓
02-B10 Studio	1.8	✓	1.1	✓	4.1	✗
02-B11 Bedroom	0.4	✓	0.4	✓	1.9	✓
02-B11 Studio	1.7	✓	1.2	✓	4.1	✗
02-B12 Studio	1.8	✓	1.2	✓	4.1	✗
02-B13 Studio	1.7	✓	1.2	✓	4	✗
02-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
02-C01 Studio	1.0	✓	0.6	✓	2.7	✓
02-C1 Kitchen	1.5	✓	0.9	✓	4.5	✗
02-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
02-C02 Studio	1.9	✓	1.1	✓	4.2	✗
02-C2 Kitchen	1.6	✓	1	✓	5.2	✗
02-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
02-C03 Studio	2.0	✓	1.2	✓	4.5	✗
02-C04 Bedroom	0.3	✓	0.3	✓	1.6	✓
02-C04 Studio	1.9	✓	1.1	✓	4.4	✗
02-C05 Bedroom	0.4	✓	0.3	✓	1.7	✓

02-C05 Studio	1.6	✓	1.2	✓	4.1	✗
02-C06 Bedroom	0.6	✓	0.5	✓	2.6	✓
02-C06 Studio	1.5	✓	1.1	✓	4.3	✗
02-C07 Bedroom	0.5	✓	0.5	✓	2.5	✓
02-C08 Bedroom	0.5	✓	0.5	✓	2.5	✓
02-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
02-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
03-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
03-A01 Studio	2.9	✓	2	✓	5.4	✗
03-A1 Kitchen	2.1	✓	1.4	✓	5.8	✗
03-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
03-A02 Studio	2.2	✓	1.3	✓	4.8	✗
03-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
03-A03 Studio	2.2	✓	1.2	✓	4.7	✗
03-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
03-A04 Studio	2.0	✓	1.2	✓	4.6	✗
03-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
03-A05 Studio	2.7	✓	2.1	✓	5.1	✗
03-A06 Studio	1.8	✓	1.4	✓	3.9	✗
03-A07 Studio	1.9	✓	1.5	✓	4	✗
03-A08 Studio	1.9	✓	1.5	✓	4	✗
03-A09 Studio	2.0	✓	1.6	✓	4.1	✗
03-A10 Studio	2.9	✓	2.1	✓	5.5	✗
03-A11 Studio	1.6	✓	1	✓	3.9	✗
03-A12 Studio	2.0	✓	1.3	✓	4.6	✗
03-A13 Studio	2.0	✓	1.3	✓	4.5	✗
03-A14 Studio	1.6	✓	1	✓	3.9	✗
03-A15 Studio	2.2	✓	1.4	✓	4.7	✗
03-A16 Studio	2.2	✓	1.4	✓	4.8	✗
03-A17 Studio	2.3	✓	1.4	✓	4.8	✗
03-A18 Studio	2.2	✓	1.4	✓	4.7	✗
03-B01 Acc. Bedroom	0.0	✓	0.2	✓	0.8	✓
03-B01 Studio	1.3	✓	0.7	✓	3.5	✗
03-B1 Kitchen	1.1	✓	0.6	✓	3.8	✗
03-B02 Bedroom	0.4	✓	0.3	✓	1.8	✓
03-B02 Studio	2.0	✓	1.3	✓	4.6	✗
03-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
03-B03 Bedroom	0.5	✓	0.3	✓	1.9	✓
03-B03 Studio	2.0	✓	1.3	✓	4.5	✗
03-B04 Bedroom	0.5	✓	0.4	✓	1.9	✓
03-B04 Studio	1.5	✓	0.9	✓	3.8	✗
03-B05 Acc. Bedroom	0.3	✓	0.3	✓	1.5	✓
03-B05 Studio	1.2	✓	0.8	✓	3	✓
03-B06 Bedroom	0.3	✓	0.3	✓	1.6	✓
03-B06 Studio	2.2	✓	1.4	✓	4.7	✗

03-B07 Bedroom	0.4	✓	0.3	✓	1.9	✓
03-B07 Studio	2.4	✓	1.5	✓	4.9	✗
03-B08 Bedroom	0.5	✓	0.3	✓	1.9	✓
03-B08 Studio	2.1	✓	1.3	✓	4.7	✗
03-B09 Bedroom	0.5	✓	0.4	✓	2	✓
03-B09 Studio	2.1	✓	1.3	✓	4.7	✗
03-B10 Bedroom	0.4	✓	0.3	✓	1.9	✓
03-B10 Studio	2.2	✓	1.4	✓	4.8	✗
03-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
03-B11 Studio	2.2	✓	1.4	✓	4.8	✗
03-B12 Studio	2.3	✓	1.4	✓	4.8	✗
03-B13 Studio	2.2	✓	1.4	✓	4.7	✗
03-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
03-C01 Studio	1.1	✓	0.7	✓	2.8	✓
03-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
03-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
03-C02 Studio	2.1	✓	1.2	✓	4.6	✗
03-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
03-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
03-C03 Studio	2.3	✓	1.3	✓	4.8	✗
03-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
03-C04 Studio	2.1	✓	1.3	✓	4.8	✗
03-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
03-C05 Studio	2.1	✓	1.4	✓	4.8	✗
03-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
03-C06 Studio	2.0	✓	1.4	✓	5	✗
03-C07 Bedroom	0.7	✓	0.6	✓	3	✓
03-C08 Bedroom	0.7	✓	0.6	✓	3	✓
03-C09 Bedroom	0.7	✓	0.6	✓	3	✓
03-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗
04-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
04-A01 Studio	2.8	✓	2	✓	5.4	✗
04-A1 Kitchen	2.1	✓	1.4	✓	5.8	✗
04-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
04-A02 Studio	2.3	✓	1.3	✓	4.8	✗
04-A03 Bedroom	0.4	✓	0.3	✓	1.9	✓
04-A03 Studio	2.2	✓	1.2	✓	4.7	✗
04-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
04-A04 Studio	2.1	✓	1.2	✓	4.6	✗
04-A05 Bedroom	0.5	✓	0.5	✓	2.3	✓
04-A05 Studio	2.7	✓	2	✓	5.1	✗
04-A06 Studio	1.8	✓	1.4	✓	3.9	✗
04-A07 Studio	1.9	✓	1.5	✓	4	✗
04-A08 Studio	1.9	✓	1.5	✓	4	✗
04-A09 Studio	2.0	✓	1.6	✓	4.1	✗

04-A10 Studio	2.9	✓	2	✓	5.4	✗
04-A11 Studio	1.5	✓	0.9	✓	3.8	✗
04-A12 Studio	2.0	✓	1.2	✓	4.5	✗
04-A13 Studio	2.0	✓	1.2	✓	4.4	✗
04-A14 Studio	1.6	✓	0.9	✓	3.8	✗
04-A15 Studio	2.3	✓	1.4	✓	4.8	✗
04-A16 Studio	2.4	✓	1.4	✓	4.9	✗
04-A17 Studio	2.4	✓	1.5	✓	4.9	✗
04-A18 Studio	2.3	✓	1.5	✓	4.8	✗
04-B01 Studio	1.3	✓	0.7	✓	3.4	✗
04-B02 Studio	2.0	✓	1.2	✓	4.5	✗
04-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
04-B03 Studio	2.0	✓	1.2	✓	4.4	✗
04-B04 Studio	1.5	✓	0.9	✓	3.7	✗
04-B05 Studio	1.2	✓	0.8	✓	3	✓
04-B06 Studio	2.3	✓	1.4	✓	4.8	✗
04-B07 Studio	2.4	✓	1.5	✓	5	✗
04-B08 Studio	2.2	✓	1.4	✓	4.7	✗
04-B09 Studio	2.2	✓	1.3	✓	4.7	✗
04-B10 Studio	2.3	✓	1.4	✓	4.9	✗
04-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
04-B11 Studio	2.4	✓	1.4	✓	4.9	✗
04-B12 Studio	2.4	✓	1.5	✓	4.9	✗
04-B13 Studio	2.2	✓	1.4	✓	4.8	✗
04-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
04-C01 Studio	1.1	✓	0.7	✓	2.9	✓
04-C1 Kitchen	2.1	✓	1.3	✓	5.2	✗
04-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
04-C02 Studio	2.1	✓	1.2	✓	4.6	✗
04-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
04-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
04-C03 Studio	2.3	✓	1.3	✓	4.8	✗
04-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
04-C04 Studio	2.1	✓	1.3	✓	4.8	✗
04-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
04-C05 Studio	2.0	✓	1.4	✓	4.8	✗
04-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
04-C06 Studio	2.0	✓	1.4	✓	5	✗
04-C07 Bedroom	0.7	✓	0.6	✓	3	✓
04-C08 Bedroom	0.7	✓	0.6	✓	3	✓
04-C09 Bedroom	0.7	✓	0.6	✓	3	✓
04-C10 Bedroom	0.8	✓	0.6	✓	3	✓
04-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
04-B02 Bedroom	0.5	✓	0.3	✓	1.8	✓
04-B03 Bedroom	0.5	✓	0.3	✓	1.9	✓

04-B04 Bedroom	0.5	✓	0.3	✓	1.9	✓
04-B05 Bedroom	0.5	✓	0.3	✓	1.9	✓
04-B06 Bedroom	0.5	✓	0.3	✓	2	✓
04-B1 Kitchen	1.8	✓	1.1	✓	4.8	✗
04-B07 Bedroom	0.3	✓	0.3	✓	1.4	✓
04-B08 Bedroom	0.4	✓	0.3	✓	1.9	✓
04-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
04-B10 Bedroom	0.5	✓	0.4	✓	2	✓
04-B11 Bedroom	0.5	✓	0.4	✓	2	✓
05-A01 Bedroom	0.2	✓	0.3	✓	1.4	✓
05-A01 Studio	2.1	✓	1.5	✓	4.8	✗
05-A1 Kitchen	1.5	✓	0.9	✓	4.8	✗
05-A02 Bedroom	0.3	✓	0.3	✓	1.6	✓
05-A02 Studio	2.0	✓	1.2	✓	4.6	✗
05-A03 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-A03 Studio	2.0	✓	1.2	✓	4.4	✗
05-A04 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-A04 Studio	1.9	✓	1.1	✓	4.3	✗
05-A05 Bedroom	0.5	✓	0.4	✓	2	✓
05-A05 Studio	2.1	✓	1.6	✓	4.5	✗
05-A06 Studio	1.6	✓	1.1	✓	3.6	✗
05-A07 Studio	1.7	✓	1.1	✓	3.6	✗
05-A08 Studio	1.7	✓	1.1	✓	3.6	✗
05-A09 Studio	1.7	✓	1.2	✓	3.7	✗
05-A10 Studio	2.2	✓	1.6	✓	4.8	✗
05-A11 Studio	1.6	✓	1	✓	3.9	✗
05-A12 Studio	2.1	✓	1.3	✓	4.6	✗
05-A13 Studio	2.1	✓	1.3	✓	4.5	✗
05-A14 Studio	1.6	✓	1	✓	3.9	✗
05-A15 Studio	2.2	✓	1.4	✓	4.6	✗
05-A16 Studio	2.2	✓	1.3	✓	4.6	✗
05-A17 Studio	2.2	✓	1.3	✓	4.7	✗
05-A18 Studio	2.2	✓	1.3	✓	4.6	✗
05-B01 Studio	1.3	✓	0.7	✓	3.5	✗
05-B02 Studio	2.1	✓	1.3	✓	4.6	✗
05-B2 Kitchen	1.3	✓	0.8	✓	4	✗
05-B03 Studio	2.1	✓	1.3	✓	4.5	✗
05-B04 Studio	1.5	✓	0.9	✓	3.8	✗
05-B05 Studio	1.1	✓	0.7	✓	2.8	✓
05-B06 Studio	2.1	✓	1.3	✓	4.6	✗
05-B07 Studio	2.3	✓	1.4	✓	4.7	✗
05-B08 Studio	2.0	✓	1.2	✓	4.5	✗
05-B09 Studio	2.1	✓	1.2	✓	4.6	✗
05-B10 Studio	2.2	✓	1.4	✓	4.6	✗
05-B11 Bedroom	0.4	✓	0.4	✓	1.9	✓

05-B11 Studio	2.2	✓	1.3	✓	4.6	✗
05-B12 Studio	2.2	✓	1.3	✓	4.6	✗
05-B13 Studio	2.1	✓	1.3	✓	4.5	✗
05-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
05-C01 Studio	1.0	✓	0.6	✓	2.8	✓
05-C1 Kitchen	1.4	✓	0.9	✓	4.4	✗
05-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
05-C02 Studio	1.9	✓	1.1	✓	4.3	✗
05-C2 Kitchen	1.6	✓	1	✓	5.2	✗
05-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
05-C03 Studio	2.1	✓	1.2	✓	4.6	✗
05-C04 Bedroom	0.3	✓	0.3	✓	1.6	✓
05-C04 Studio	2.0	✓	1.2	✓	4.5	✗
05-C05 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-C05 Studio	1.7	✓	1.2	✓	4.2	✗
05-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
05-C06 Studio	1.6	✓	1.1	✓	4.4	✗
05-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
05-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
05-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
05-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
05-B01 Bedroom	0.2	✓	0.3	✓	1.3	✓
05-B02 Bedroom	0.4	✓	0.3	✓	1.6	✓
05-B03 Bedroom	0.4	✓	0.3	✓	1.6	✓
05-B04 Bedroom	0.4	✓	0.3	✓	1.6	✓
05-B05 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-B06 Bedroom	0.5	✓	0.3	✓	1.8	✓
05-B1 Kitchen	1.3	✓	0.9	✓	3.9	✗
05-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
05-B08 Bedroom	0.4	✓	0.3	✓	1.6	✓
05-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-B10 Bedroom	0.4	✓	0.3	✓	1.7	✓
05-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
06-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
06-A01 Studio	2.9	✓	2	✓	5.4	✗
06-A1 Kitchen	2.1	✓	1.4	✓	5.8	✗
06-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
06-A02 Studio	2.3	✓	1.3	✓	4.8	✗
06-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
06-A03 Studio	2.2	✓	1.2	✓	4.7	✗
06-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
06-A04 Studio	2.1	✓	1.2	✓	4.6	✗
06-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
06-A05 Studio	2.7	✓	2	✓	5.1	✗
06-A06 Studio	1.8	✓	1.4	✓	3.9	✗

06-A07 Studio	1.9	✓	1.5	✓	4	✗
06-A08 Studio	1.9	✓	1.5	✓	4	✗
06-A09 Studio	2.0	✓	1.6	✓	4.1	✗
06-A10 Studio	2.9	✓	2.1	✓	5.5	✗
06-A11 Studio	1.6	✓	0.9	✓	3.8	✗
06-A12 Studio	2.0	✓	1.2	✓	4.5	✗
06-A13 Studio	2.0	✓	1.2	✓	4.4	✗
06-A14 Studio	1.6	✓	0.9	✓	3.8	✗
06-A15 Studio	2.3	✓	1.4	✓	4.8	✗
06-A16 Studio	2.3	✓	1.4	✓	4.8	✗
06-A17 Studio	2.4	✓	1.4	✓	4.8	✗
06-A18 Studio	2.3	✓	1.4	✓	4.8	✗
06-B01 Studio	1.3	✓	0.7	✓	3.4	✗
06-B02 Studio	2.0	✓	1.2	✓	4.5	✗
06-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
06-B03 Studio	2.0	✓	1.2	✓	4.4	✗
06-B04 Studio	1.5	✓	0.9	✓	3.7	✗
06-B05 Studio	1.2	✓	0.8	✓	3	✓
06-B06 Studio	2.3	✓	1.4	✓	4.8	✗
06-B07 Studio	2.4	✓	1.5	✓	5	✗
06-B08 Studio	2.2	✓	1.4	✓	4.7	✗
06-B09 Studio	2.3	✓	1.3	✓	4.7	✗
06-B10 Studio	2.3	✓	1.4	✓	4.9	✗
06-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
06-B11 Studio	2.3	✓	1.4	✓	4.8	✗
06-B12 Studio	2.4	✓	1.4	✓	4.8	✗
06-B13 Studio	2.2	✓	1.4	✓	4.7	✗
06-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
06-C01 Studio	1.1	✓	0.7	✓	2.9	✓
06-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
06-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
06-C02 Studio	2.1	✓	1.2	✓	4.6	✗
06-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
06-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
06-C03 Studio	2.3	✓	1.3	✓	4.8	✗
06-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
06-C04 Studio	2.1	✓	1.3	✓	4.8	✗
06-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
06-C05 Studio	2.1	✓	1.4	✓	4.8	✗
06-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
06-C06 Studio	2.1	✓	1.4	✓	5.1	✗
06-C07 Bedroom	0.7	✓	0.6	✓	3	✓
06-C08 Bedroom	0.7	✓	0.6	✓	3	✓
06-C09 Bedroom	0.7	✓	0.6	✓	3	✓
06-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗

06-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
06-B02 Bedroom	0.4	✓	0.3	✓	1.8	✓
06-B03 Bedroom	0.4	✓	0.3	✓	1.8	✓
06-B04 Bedroom	0.5	✓	0.3	✓	1.8	✓
06-B05 Bedroom	0.5	✓	0.4	✓	1.9	✓
06-B06 Bedroom	0.5	✓	0.4	✓	2	✓
06-B1 Kitchen	1.8	✓	1.2	✓	4.8	✗
06-B07 Bedroom	0.2	✓	0.3	✓	1.4	✓
06-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
06-B09 Bedroom	0.4	✓	0.3	✓	1.9	✓
06-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
06-B11 Bedroom	0.5	✓	0.4	✓	2	✓
07-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
07-A1 Kitchen	2.1	✓	1.4	✓	5.8	✗
07-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
07-A02 Studio	2.3	✓	1.3	✓	4.8	✗
07-A03 Bedroom	0.4	✓	0.3	✓	1.9	✓
07-A03 Studio	2.2	✓	1.2	✓	4.7	✗
07-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
07-A04 Studio	2.1	✓	1.2	✓	4.6	✗
07-A05 Bedroom	0.5	✓	0.5	✓	2.3	✓
07-A05 Studio	2.6	✓	2	✓	5.1	✗
07-A06 Studio	1.8	✓	1.4	✓	3.9	✗
07-A07 Studio	1.9	✓	1.5	✓	4	✗
07-A08 Studio	1.9	✓	1.5	✓	4	✗
07-A09 Studio	2.0	✓	1.6	✓	4.1	✗
07-A10 Studio	2.9	✓	2	✓	5.4	✗
07-A11 Studio	1.7	✓	1	✓	3.9	✗
07-A12 Studio	2.1	✓	1.3	✓	4.7	✗
07-A13 Studio	2.1	✓	1.3	✓	4.5	✗
07-A14 Studio	1.6	✓	1	✓	3.9	✗
07-A15 Studio	2.2	✓	1.4	✓	4.6	✗
07-A16 Studio	2.2	✓	1.3	✓	4.6	✗
07-A17 Studio	2.2	✓	1.3	✓	4.7	✗
07-A18 Studio	2.2	✓	1.3	✓	4.6	✗
07-B01 Studio	1.3	✓	0.7	✓	3.5	✗
07-B02 Studio	2.1	✓	1.3	✓	4.6	✗
07-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
07-B03 Studio	2.1	✓	1.3	✓	4.5	✗
07-B04 Studio	1.5	✓	0.9	✓	3.8	✗
07-B05 Studio	1.2	✓	0.8	✓	3	✓
07-B06 Studio	2.3	✓	1.4	✓	4.8	✗
07-B07 Studio	2.4	✓	1.5	✓	5	✗
07-B08 Studio	2.2	✓	1.4	✓	4.7	✗
07-B09 Studio	2.3	✓	1.3	✓	4.7	✗

07-B10 Studio	2.2	✓	1.4	✓	4.7	✗
07-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
07-B11 Studio	2.2	✓	1.3	✓	4.7	✗
07-B12 Studio	2.2	✓	1.3	✓	4.6	✗
07-B13 Studio	2.1	✓	1.3	✓	4.5	✗
07-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
07-C01 Studio	1.1	✓	0.7	✓	2.9	✓
07-C1 Kitchen	2.1	✓	1.3	✓	5.2	✗
07-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
07-C02 Studio	2.1	✓	1.2	✓	4.6	✗
07-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
07-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
07-C03 Studio	2.3	✓	1.3	✓	4.8	✗
07-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
07-C04 Studio	2.1	✓	1.3	✓	4.8	✗
07-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
07-C05 Studio	2.0	✓	1.4	✓	4.8	✗
07-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
07-C06 Studio	2.0	✓	1.4	✓	5	✗
07-C07 Bedroom	0.7	✓	0.6	✓	3	✓
07-C08 Bedroom	0.7	✓	0.6	✓	3	✓
07-C09 Bedroom	0.7	✓	0.6	✓	3	✓
07-C10 Bedroom	0.8	✓	0.6	✓	3	✓
07-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
07-B02 Bedroom	0.4	✓	0.3	✓	1.8	✓
07-B03 Bedroom	0.4	✓	0.3	✓	1.8	✓
07-B04 Bedroom	0.5	✓	0.3	✓	1.8	✓
07-B05 Bedroom	0.5	✓	0.4	✓	1.9	✓
07-B06 Bedroom	0.5	✓	0.4	✓	2	✓
07-B1 Kitchen	1.8	✓	1.2	✓	4.8	✗
07-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
07-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
07-B09 Bedroom	0.4	✓	0.3	✓	1.9	✓
07-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
07-B11 Bedroom	0.5	✓	0.4	✓	2	✓
07-A01 Studio	2.7	✓	1.9	✓	5.3	✗
08-A01 Bedroom	0.2	✓	0.3	✓	1.4	✓
08-A1 Kitchen	1.5	✓	0.9	✓	4.8	✗
08-A02 Bedroom	0.3	✓	0.3	✓	1.6	✓
08-A02 Studio	2.1	✓	1.2	✓	4.6	✗
08-A03 Bedroom	0.4	✓	0.3	✓	1.7	✓
08-A03 Studio	2.0	✓	1.2	✓	4.4	✗
08-A04 Bedroom	0.4	✓	0.3	✓	1.8	✓
08-A04 Studio	1.9	✓	1.1	✓	4.3	✗
08-A05 Bedroom	0.5	✓	0.4	✓	2	✓

08-A05 Studio	2.1	✓	1.6	✓	4.5	✗
08-A06 Studio	1.6	✓	1.1	✓	3.6	✗
08-A07 Studio	1.7	✓	1.1	✓	3.6	✗
08-A08 Studio	1.7	✓	1.1	✓	3.6	✗
08-A09 Studio	1.7	✓	1.2	✓	3.7	✗
08-A10 Studio	2.2	✓	1.6	✓	4.8	✗
08-A11 Studio	1.6	✓	0.9	✓	3.8	✗
08-A12 Studio	2.0	✓	1.2	✓	4.5	✗
08-A13 Studio	2.0	✓	1.2	✓	4.4	✗
08-A14 Studio	1.6	✓	1	✓	3.9	✗
08-A15 Studio	2.3	✓	1.4	✓	4.8	✗
08-A16 Studio	2.3	✓	1.4	✓	4.8	✗
08-A17 Studio	2.4	✓	1.4	✓	4.9	✗
08-A18 Studio	2.3	✓	1.4	✓	4.8	✗
08-B01 Studio	1.3	✓	0.7	✓	3.4	✗
08-B02 Studio	2.0	✓	1.2	✓	4.5	✗
08-B2 Kitchen	1.3	✓	0.8	✓	4	✗
08-B03 Studio	2.0	✓	1.2	✓	4.4	✗
08-B04 Studio	1.5	✓	0.9	✓	3.7	✗
08-B05 Studio	1.1	✓	0.7	✓	2.8	✓
08-B06 Studio	2.1	✓	1.3	✓	4.6	✗
08-B07 Studio	2.3	✓	1.4	✓	4.7	✗
08-B08 Studio	2.0	✓	1.2	✓	4.5	✗
08-B09 Studio	2.1	✓	1.2	✓	4.6	✗
08-B10 Studio	2.3	✓	1.4	✓	4.9	✗
08-B11 Bedroom	0.4	✓	0.4	✓	1.9	✓
08-B11 Studio	2.3	✓	1.4	✓	4.8	✗
08-B12 Studio	2.4	✓	1.4	✓	4.8	✗
08-B13 Studio	2.2	✓	1.4	✓	4.7	✗
08-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
08-C01 Studio	1.0	✓	0.6	✓	2.8	✓
08-C1 Kitchen	1.4	✓	0.9	✓	4.4	✗
08-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
08-C02 Studio	1.9	✓	1.1	✓	4.3	✗
08-C2 Kitchen	1.6	✓	1	✓	5.2	✗
08-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
08-C03 Studio	2.1	✓	1.2	✓	4.6	✗
08-C04 Bedroom	0.3	✓	0.3	✓	1.6	✓
08-C04 Studio	2.0	✓	1.2	✓	4.5	✗
08-C05 Bedroom	0.4	✓	0.3	✓	1.8	✓
08-C05 Studio	1.7	✓	1.2	✓	4.2	✗
08-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
08-C06 Studio	1.6	✓	1.1	✓	4.4	✗
08-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
08-C08 Bedroom	0.6	✓	0.5	✓	2.6	✓

08-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
08-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
08-B01 Bedroom	0.2	✓	0.3	✓	1.3	✓
08-B02 Bedroom	0.4	✓	0.3	✓	1.6	✓
08-B03 Bedroom	0.4	✓	0.3	✓	1.6	✓
08-B04 Bedroom	0.4	✓	0.3	✓	1.6	✓
08-B05 Bedroom	0.5	✓	0.3	✓	1.7	✓
08-B06 Bedroom	0.5	✓	0.3	✓	1.8	✓
08-B1 Kitchen	1.3	✓	0.9	✓	4	✗
08-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
08-B08 Bedroom	0.4	✓	0.3	✓	1.6	✓
08-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
08-B10 Bedroom	0.4	✓	0.3	✓	1.7	✓
08-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
08-A01 Studio	2.1	✓	1.5	✓	4.8	✗
09-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
09-A1 Kitchen	2.2	✓	1.5	✓	5.8	✗
09-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
09-A02 Studio	2.3	✓	1.3	✓	4.8	✗
09-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
09-A03 Studio	2.2	✓	1.2	✓	4.7	✗
09-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
09-A04 Studio	2.1	✓	1.2	✓	4.6	✗
09-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
09-A05 Studio	2.7	✓	2	✓	5.1	✗
09-A06 Studio	1.8	✓	1.4	✓	3.9	✗
09-A07 Studio	1.9	✓	1.5	✓	4	✗
09-A08 Studio	1.9	✓	1.5	✓	4	✗
09-A09 Studio	2.0	✓	1.6	✓	4.1	✗
09-A10 Studio	2.9	✓	2.1	✓	5.5	✗
09-A11 Studio	1.7	✓	1	✓	4	✗
09-A12 Studio	2.1	✓	1.3	✓	4.7	✗
09-A13 Studio	2.1	✓	1.3	✓	4.6	✗
09-A14 Studio	1.7	✓	1	✓	4.1	✗
09-A15 Studio	2.2	✓	1.4	✓	4.6	✗
09-A16 Studio	2.2	✓	1.3	✓	4.6	✗
09-A17 Studio	2.2	✓	1.3	✓	4.6	✗
09-A18 Studio	2.2	✓	1.3	✓	4.6	✗
09-B01 Studio	1.3	✓	0.7	✓	3.5	✗
09-B02 Studio	2.1	✓	1.3	✓	4.6	✗
09-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
09-B03 Studio	2.1	✓	1.3	✓	4.5	✗
09-B04 Studio	1.5	✓	0.9	✓	3.8	✗
09-B05 Studio	1.2	✓	0.8	✓	3	✓
09-B06 Studio	2.3	✓	1.4	✓	4.8	✗

09-B07 Studio	2.4	✓	1.5	✓	5	✗
09-B08 Studio	2.2	✓	1.4	✓	4.7	✗
09-B09 Studio	2.3	✓	1.3	✓	4.7	✗
09-B10 Studio	2.2	✓	1.4	✓	4.6	✗
09-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
09-B11 Studio	2.2	✓	1.3	✓	4.6	✗
09-B12 Studio	2.2	✓	1.3	✓	4.6	✗
09-B13 Studio	2.1	✓	1.3	✓	4.5	✗
09-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
09-C01 Studio	1.1	✓	0.7	✓	2.9	✓
09-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
09-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
09-C02 Studio	2.1	✓	1.2	✓	4.6	✗
09-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
09-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
09-C03 Studio	2.3	✓	1.3	✓	4.8	✗
09-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
09-C04 Studio	2.1	✓	1.3	✓	4.8	✗
09-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
09-C05 Studio	2.1	✓	1.4	✓	4.8	✗
09-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
09-C06 Studio	2.1	✓	1.4	✓	5.1	✗
09-C07 Bedroom	0.7	✓	0.6	✓	3	✓
09-C08 Bedroom	0.7	✓	0.6	✓	3	✓
09-C09 Bedroom	0.7	✓	0.6	✓	3	✓
09-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗
09-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
09-B02 Bedroom	0.4	✓	0.3	✓	1.8	✓
09-B03 Bedroom	0.5	✓	0.3	✓	1.8	✓
09-B04 Bedroom	0.5	✓	0.3	✓	1.9	✓
09-B05 Bedroom	0.5	✓	0.4	✓	1.9	✓
09-B06 Bedroom	0.5	✓	0.4	✓	2	✓
09-B1 Kitchen	1.8	✓	1.2	✓	4.8	✗
09-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
09-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
09-B09 Bedroom	0.4	✓	0.3	✓	1.9	✓
09-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
09-B11 Bedroom	0.5	✓	0.4	✓	2	✓
09-A01 Studio	2.8	✓	1.9	✓	5.4	✗
10-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
10-A1 Kitchen	2.1	✓	1.4	✓	5.8	✗
10-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
10-A02 Studio	2.3	✓	1.3	✓	4.8	✗
10-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
10-A03 Studio	2.2	✓	1.2	✓	4.7	✗

10-A04 Bedroom	0.5	✓	0.3	✓	1.9	✓
10-A04 Studio	2.1	✓	1.2	✓	4.7	✗
10-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
10-A05 Studio	2.6	✓	2	✓	5.1	✗
10-A06 Studio	1.8	✓	1.4	✓	3.9	✗
10-A07 Studio	1.9	✓	1.5	✓	4	✗
10-A08 Studio	1.9	✓	1.5	✓	4	✗
10-A09 Studio	2.0	✓	1.6	✓	4.1	✗
10-A10 Studio	2.9	✓	2	✓	5.4	✗
10-A11 Studio	1.6	✓	1	✓	3.9	✗
10-A12 Studio	2.0	✓	1.3	✓	4.5	✗
10-A13 Studio	2.0	✓	1.2	✓	4.5	✗
10-A14 Studio	1.7	✓	1	✓	4	✗
10-A15 Studio	2.2	✓	1.4	✓	4.7	✗
10-A16 Studio	2.2	✓	1.3	✓	4.6	✗
10-A17 Studio	2.2	✓	1.3	✓	4.6	✗
10-A18 Studio	2.2	✓	1.4	✓	4.7	✗
10-B01 Studio	1.3	✓	0.7	✓	3.4	✗
10-B02 Studio	2.0	✓	1.2	✓	4.5	✗
10-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
10-B03 Studio	2.0	✓	1.2	✓	4.4	✗
10-B04 Studio	1.5	✓	0.9	✓	3.7	✗
10-B05 Studio	1.2	✓	0.8	✓	3	✓
10-B06 Studio	2.3	✓	1.4	✓	4.8	✗
10-B07 Studio	2.4	✓	1.5	✓	5	✗
10-B08 Studio	2.2	✓	1.4	✓	4.7	✗
10-B09 Studio	2.3	✓	1.3	✓	4.7	✗
10-B10 Studio	2.3	✓	1.4	✓	4.9	✗
10-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
10-B11 Studio	2.3	✓	1.4	✓	4.8	✗
10-B12 Studio	2.4	✓	1.4	✓	4.8	✗
10-B13 Studio	2.2	✓	1.4	✓	4.7	✗
10-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
10-C01 Studio	1.1	✓	0.7	✓	2.9	✓
10-C1 Kitchen	2.1	✓	1.3	✓	5.2	✗
10-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
10-C02 Studio	2.1	✓	1.2	✓	4.6	✗
10-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
10-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
10-C03 Studio	2.3	✓	1.3	✓	4.8	✗
10-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
10-C04 Studio	2.1	✓	1.3	✓	4.8	✗
10-C05 Bedroom	0.5	✓	0.4	✓	1.9	✓
10-C05 Studio	2.0	✓	1.4	✓	4.8	✗
10-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗

10-C06 Studio	2.0	✓	1.4	✓	5	✗
10-C07 Bedroom	0.7	✓	0.6	✓	3	✓
10-C08 Bedroom	0.7	✓	0.6	✓	3	✓
10-C09 Bedroom	0.7	✓	0.6	✓	3	✓
10-C10 Bedroom	0.8	✓	0.6	✓	3	✓
10-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
10-B02 Bedroom	0.5	✓	0.3	✓	1.8	✓
10-B03 Bedroom	0.5	✓	0.3	✓	1.9	✓
10-B04 Bedroom	0.5	✓	0.3	✓	1.9	✓
10-B05 Bedroom	0.5	✓	0.4	✓	2	✓
10-B06 Bedroom	0.5	✓	0.4	✓	2	✓
10-B1 Kitchen	1.8	✓	1.2	✓	4.8	✗
10-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
10-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
10-B09 Bedroom	0.4	✓	0.3	✓	1.9	✓
10-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
10-B11 Bedroom	0.5	✓	0.4	✓	2	✓
10-A01 Studio	2.8	✓	1.9	✓	5.4	✗
11-A01 Bedroom	0.2	✓	0.3	✓	1.4	✓
11-A1 Kitchen	1.5	✓	0.9	✓	4.8	✗
11-A02 Bedroom	0.4	✓	0.3	✓	1.6	✓
11-A02 Studio	2.1	✓	1.2	✓	4.6	✗
11-A03 Bedroom	0.4	✓	0.3	✓	1.7	✓
11-A03 Studio	2.0	✓	1.2	✓	4.5	✗
11-A04 Bedroom	0.4	✓	0.3	✓	1.8	✓
11-A05 Bedroom	0.5	✓	0.4	✓	2	✓
11-A05 Studio	2.1	✓	1.6	✓	4.5	✗
11-A06 Studio	1.6	✓	1.1	✓	3.6	✗
11-A07 Studio	1.7	✓	1.1	✓	3.6	✗
11-A08 Studio	1.7	✓	1.1	✓	3.6	✗
11-A09 Studio	1.7	✓	1.2	✓	3.7	✗
11-A10 Studio	2.2	✓	1.6	✓	4.8	✗
11-A11 Studio	1.7	✓	1	✓	4.1	✗
11-A12 Studio	2.0	✓	1.3	✓	4.6	✗
11-A13 Studio	2.0	✓	1.3	✓	4.5	✗
11-A14 Studio	1.8	✓	1.1	✓	4.2	✗
11-B01 Studio	1.3	✓	0.7	✓	3.5	✗
11-B02 Studio	2.1	✓	1.3	✓	4.6	✗
11-B2 Kitchen	1.3	✓	0.8	✓	4	✗
11-B03 Studio	2.1	✓	1.3	✓	4.6	✗
11-B04 Studio	1.5	✓	0.9	✓	3.8	✗
11-B06 Studio	2.2	✓	1.3	✓	4.6	✗
11-B07 Studio	2.3	✓	1.4	✓	4.8	✗
11-B08 Studio	2.0	✓	1.2	✓	4.5	✗
11-B09 Studio	2.1	✓	1.2	✓	4.6	✗

11-B10 Studio	2.2	✓	1.4	✓	4.6	✗
11-B11 Bedroom	0.4	✓	0.4	✓	1.9	✓
11-B11 Studio	2.2	✓	1.3	✓	4.7	✗
11-B12 Studio	2.2	✓	1.3	✓	4.7	✗
11-B13 Studio	2.1	✓	1.3	✓	4.5	✗
11-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
11-C01 Studio	1.0	✓	0.6	✓	2.8	✓
11-C1 Kitchen	1.4	✓	0.9	✓	4.4	✗
11-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
11-C02 Studio	1.9	✓	1.1	✓	4.3	✗
11-C2 Kitchen	1.6	✓	1	✓	5.2	✗
11-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
11-C03 Studio	2.1	✓	1.2	✓	4.6	✗
11-C04 Bedroom	0.3	✓	0.3	✓	1.6	✓
11-C04 Studio	2.0	✓	1.2	✓	4.5	✗
11-C05 Bedroom	0.4	✓	0.3	✓	1.8	✓
11-C05 Studio	1.7	✓	1.2	✓	4.2	✗
11-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
11-C06 Studio	1.6	✓	1.1	✓	4.4	✗
11-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
11-C08 Bedroom	0.6	✓	0.5	✓	2.6	✓
11-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
11-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
11-B01 Bedroom	0.3	✓	0.3	✓	1.4	✓
11-B02 Bedroom	0.4	✓	0.3	✓	1.8	✓
11-B03 Bedroom	0.4	✓	0.4	✓	1.8	✓
11-B04 Bedroom	0.4	✓	0.3	✓	1.8	✓
11-B05 Bedroom	0.5	✓	0.3	✓	1.8	✓
11-B06 Bedroom	0.5	✓	0.4	✓	1.8	✓
11-B1 Kitchen	1.3	✓	0.9	✓	4	✗
11-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
11-B08 Bedroom	0.4	✓	0.3	✓	1.6	✓
11-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
11-B10 Bedroom	0.4	✓	0.3	✓	1.7	✓
11-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
11-A01 Studio	2.1	✓	1.5	✓	4.9	✗
11-A04 Studio	2.1	✓	1.3	✓	4.7	✗
11-B05 Studio	1.4	✓	1.1	✓	3.5	✗
12-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
12-A1 Kitchen	2.2	✓	1.5	✓	5.8	✗
12-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
12-A02 Studio	2.3	✓	1.3	✓	4.8	✗
12-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
12-A03 Studio	2.3	✓	1.3	✓	4.8	✗
12-A04 Bedroom	0.5	✓	0.3	✓	2	✓

12-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
12-A05 Studio	2.7	✓	2	✓	5.1	✗
12-A06 Studio	1.8	✓	1.4	✓	3.9	✗
12-A07 Studio	1.9	✓	1.5	✓	4	✗
12-A08 Studio	1.9	✓	1.5	✓	4	✗
12-A09 Studio	2.0	✓	1.6	✓	4.1	✗
12-A10 Studio	2.9	✓	2.1	✓	5.5	✗
12-B01 Studio	1.3	✓	0.7	✓	3.4	✗
12-B02 Studio	2.0	✓	1.2	✓	4.5	✗
12-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
12-B03 Studio	2.0	✓	1.2	✓	4.4	✗
12-B04 Studio	1.5	✓	0.9	✓	3.7	✗
12-B06 Studio	2.4	✓	1.5	✓	4.9	✗
12-B07 Studio	2.4	✓	1.5	✓	5	✗
12-B08 Studio	2.2	✓	1.4	✓	4.7	✗
12-B09 Studio	2.3	✓	1.3	✓	4.7	✗
12-B10 Studio	2.3	✓	1.4	✓	4.9	✗
12-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
12-B11 Studio	2.4	✓	1.4	✓	4.8	✗
12-B12 Studio	2.4	✓	1.4	✓	4.8	✗
12-B13 Studio	2.2	✓	1.4	✓	4.7	✗
12-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
12-C01 Studio	1.1	✓	0.7	✓	2.9	✓
12-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
12-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
12-C02 Studio	2.1	✓	1.2	✓	4.6	✗
12-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
12-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
12-C03 Studio	2.3	✓	1.3	✓	4.8	✗
12-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
12-C04 Studio	2.1	✓	1.3	✓	4.8	✗
12-C05 Bedroom	0.5	✓	0.4	✓	2	✓
12-C05 Studio	2.1	✓	1.4	✓	4.8	✗
12-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
12-C06 Studio	2.1	✓	1.4	✓	5.1	✗
12-C07 Bedroom	0.7	✓	0.6	✓	3	✓
12-C08 Bedroom	0.7	✓	0.6	✓	3	✓
12-C09 Bedroom	0.7	✓	0.6	✓	3	✓
12-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗
12-B01 Bedroom	0.4	✓	0.3	✓	1.9	✓
12-B02 Bedroom	0.5	✓	0.5	✓	2.1	✓
12-B03 Bedroom	0.6	✓	0.5	✓	2.1	✓
12-B04 Bedroom	0.6	✓	0.5	✓	2.1	✓
12-B05 Bedroom	0.6	✓	0.5	✓	2.1	✓
12-B06 Bedroom	0.5	✓	0.5	✓	2.1	✓

12-B1 Kitchen	1.9	✓	1.2	✓	4.9	✗
12-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
12-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
12-B09 Bedroom	0.4	✓	0.3	✓	1.9	✓
12-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
12-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
12-A01 Studio	2.8	✓	1.9	✓	5.4	✗
12-A04 Studio	2.4	✓	1.5	✓	5.1	✗
12-B05 Studio	2.0	✓	1.5	✓	4.2	✗
13-A01 Bedroom	0.3	✓	0.3	✓	1.5	✓
13-A1 Kitchen	2.2	✓	1.4	✓	5.8	✗
13-A02 Bedroom	0.4	✓	0.3	✓	1.8	✓
13-A02 Studio	2.3	✓	1.3	✓	4.8	✗
13-A03 Bedroom	0.5	✓	0.3	✓	1.9	✓
13-A03 Studio	2.3	✓	1.3	✓	4.8	✗
13-A04 Bedroom	0.5	✓	0.3	✓	2	✓
13-A05 Bedroom	0.6	✓	0.5	✓	2.3	✓
13-A05 Studio	2.6	✓	2	✓	5	✗
13-A06 Studio	1.8	✓	1.4	✓	3.9	✗
13-A07 Studio	1.9	✓	1.5	✓	4	✗
13-A08 Studio	1.9	✓	1.5	✓	4	✗
13-A09 Studio	2.0	✓	1.6	✓	4.1	✗
13-A10 Studio	2.9	✓	2	✓	5.4	✗
13-B01 Studio	1.3	✓	0.7	✓	3.5	✗
13-B02 Studio	2.1	✓	1.3	✓	4.7	✗
13-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
13-B03 Studio	2.1	✓	1.3	✓	4.6	✗
13-B04 Studio	1.6	✓	0.9	✓	3.9	✗
13-B06 Studio	2.4	✓	1.5	✓	5	✗
13-B07 Studio	2.4	✓	1.5	✓	5	✗
13-B08 Studio	2.2	✓	1.4	✓	4.7	✗
13-B09 Studio	2.3	✓	1.3	✓	4.7	✗
13-B10 Studio	2.2	✓	1.4	✓	4.7	✗
13-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
13-B11 Studio	2.2	✓	1.3	✓	4.6	✗
13-B12 Studio	2.2	✓	1.3	✓	4.6	✗
13-B13 Studio	2.1	✓	1.3	✓	4.6	✗
13-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
13-C01 Studio	1.1	✓	0.7	✓	2.9	✓
13-C1 Kitchen	2.1	✓	1.3	✓	5.2	✗
13-C02 Bedroom	0.3	✓	0.3	✓	1.5	✓
13-C02 Studio	2.1	✓	1.2	✓	4.6	✗
13-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
13-C03 Bedroom	0.4	✓	0.3	✓	1.6	✓
13-C03 Studio	2.3	✓	1.3	✓	4.8	✗

13-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
13-C04 Studio	2.1	✓	1.3	✓	4.8	✗
13-C05 Bedroom	0.5	✓	0.4	✓	2	✓
13-C05 Studio	2.0	✓	1.4	✓	4.8	✗
13-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
13-C06 Studio	2.0	✓	1.4	✓	5	✗
13-C07 Bedroom	0.7	✓	0.6	✓	3	✓
13-C08 Bedroom	0.7	✓	0.6	✓	3	✓
13-C09 Bedroom	0.7	✓	0.6	✓	3	✓
13-C10 Bedroom	0.8	✓	0.6	✓	3	✓
13-B01 Bedroom	0.5	✓	0.5	✓	2.1	✓
13-B02 Bedroom	0.6	✓	0.5	✓	2.2	✓
13-B03 Bedroom	0.7	✓	0.5	✓	2.3	✓
13-B04 Bedroom	0.7	✓	0.5	✓	2.3	✓
13-B05 Bedroom	0.6	✓	0.5	✓	2.3	✓
13-B06 Bedroom	0.6	✓	0.5	✓	2.3	✓
13-B1 Kitchen	1.9	✓	1.3	✓	5	✗
13-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
13-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
13-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
13-B10 Bedroom	0.5	✓	0.3	✓	1.9	✓
13-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
13-A01 Studio	2.8	✓	1.9	✓	5.4	✗
13-A04 Studio	2.4	✓	1.6	✓	5.2	✗
13-B05 Studio	2.3	✓	1.7	✓	4.4	✗
13-B14 Studio	1.2	✓	0.8	✓	3	✓
14-A01 Bedroom	0.2	✓	0.3	✓	1.4	✓
14-A1 Kitchen	1.5	✓	0.9	✓	4.8	✗
14-A02 Bedroom	0.4	✓	0.3	✓	1.6	✓
14-A02 Studio	2.0	✓	1.2	✓	4.5	✗
14-A03 Bedroom	0.4	✓	0.3	✓	1.7	✓
14-A03 Studio	2.0	✓	1.2	✓	4.5	✗
14-A04 Bedroom	0.4	✓	0.3	✓	1.8	✓
14-A05 Bedroom	0.5	✓	0.4	✓	2	✓
14-A05 Studio	2.1	✓	1.6	✓	4.4	✗
14-A06 Studio	1.6	✓	1.1	✓	3.5	✗
14-A07 Studio	1.7	✓	1.1	✓	3.6	✗
14-A08 Studio	1.7	✓	1.1	✓	3.6	✗
14-A09 Studio	1.7	✓	1.2	✓	3.7	✗
14-A10 Studio	2.2	✓	1.5	✓	4.8	✗
14-B01 Studio	1.3	✓	0.7	✓	3.5	✗
14-B02 Studio	2.0	✓	1.2	✓	4.5	✗
14-B2 Kitchen	1.3	✓	0.8	✓	4	✗
14-B03 Studio	2.0	✓	1.2	✓	4.5	✗
14-B04 Studio	1.5	✓	0.9	✓	3.8	✗

14-B06 Studio	2.3	✓	1.4	✓	4.7	✗
14-B07 Studio	2.3	✓	1.4	✓	4.8	✗
14-B08 Studio	2.1	✓	1.2	✓	4.6	✗
14-B09 Studio	2.1	✓	1.2	✓	4.6	✗
14-B10 Studio	2.2	✓	1.4	✓	4.7	✗
14-B11 Bedroom	0.4	✓	0.4	✓	2	✓
14-B11 Studio	2.2	✓	1.3	✓	4.6	✗
14-B12 Studio	2.2	✓	1.3	✓	4.6	✗
14-B13 Studio	2.1	✓	1.3	✓	4.6	✗
14-C01 Bedroom	0.2	✓	0.3	✓	1.3	✓
14-C01 Studio	1.1	✓	0.7	✓	2.9	✓
14-C1 Kitchen	1.5	✓	0.9	✓	4.5	✗
14-C02 Bedroom	0.3	✓	0.3	✓	1.4	✓
14-C02 Studio	1.9	✓	1.1	✓	4.4	✗
14-C2 Kitchen	1.6	✓	1	✓	5.2	✗
14-C03 Bedroom	0.3	✓	0.3	✓	1.5	✓
14-C03 Studio	2.1	✓	1.2	✓	4.6	✗
14-C04 Bedroom	0.4	✓	0.3	✓	1.6	✓
14-C04 Studio	2.0	✓	1.2	✓	4.5	✗
14-C05 Bedroom	0.5	✓	0.3	✓	1.8	✓
14-C05 Studio	1.7	✓	1.2	✓	4.2	✗
14-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
14-C06 Studio	1.6	✓	1.1	✓	4.3	✗
14-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
14-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
14-C09 Bedroom	0.6	✓	0.5	✓	2.5	✓
14-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
14-B01 Bedroom	0.6	✓	0.5	✓	2.1	✓
14-B02 Bedroom	0.7	✓	0.6	✓	2.4	✓
14-B03 Bedroom	0.7	✓	0.6	✓	2.4	✓
14-B04 Bedroom	0.7	✓	0.6	✓	2.3	✓
14-B05 Bedroom	0.7	✓	0.5	✓	2.3	✓
14-B06 Bedroom	0.6	✓	0.5	✓	2.3	✓
14-B1 Kitchen	1.4	✓	1	✓	4.2	✗
14-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
14-B08 Bedroom	0.4	✓	0.3	✓	1.6	✓
14-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
14-B10 Bedroom	0.4	✓	0.3	✓	1.8	✓
14-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
14-A01 Studio	2.1	✓	1.5	✓	4.7	✗
14-A04 Studio	2.1	✓	1.3	✓	4.8	✗
14-B05 Studio	1.9	✓	1.5	✓	4.2	✗
14-B14 Studio	1.2	✓	0.8	✓	3.1	✗
15-A01 Bedroom	0.2	✓	0.3	✓	1.4	✓
15-A1 Kitchen	1.7	✓	1	✓	5.3	✗

15-A02 Bedroom	0.4	✓	0.3	✓	1.7	✓
15-A02 Studio	2.1	✓	1.2	✓	4.5	✗
15-A03 Bedroom	0.4	✓	0.3	✓	1.8	✓
15-A03 Studio	2.0	✓	1.2	✓	4.5	✗
15-A04 Bedroom	0.4	✓	0.3	✓	1.8	✓
15-A05 Bedroom	0.5	✓	0.4	✓	2.1	✓
15-A05 Studio	2.4	✓	1.8	✓	4.7	✗
15-A06 Studio	1.7	✓	1.2	✓	3.7	✗
15-A07 Studio	1.8	✓	1.3	✓	3.8	✗
15-A08 Studio	1.8	✓	1.3	✓	3.8	✗
15-A09 Studio	1.8	✓	1.4	✓	3.9	✗
15-A10 Studio	2.5	✓	1.7	✓	5.1	✗
15-B02 Studio	2.0	✓	1.3	✓	4.5	✗
15-B2 Kitchen	1.8	✓	1.2	✓	5.2	✗
15-B03 Studio	2.0	✓	1.2	✓	4.5	✗
15-B04 Studio	1.7	✓	1	✓	4	✗
15-B06 Studio	2.5	✓	1.5	✓	5	✗
15-B07 Studio	2.5	✓	1.5	✓	5.1	✗
15-B08 Studio	2.3	✓	1.4	✓	4.8	✗
15-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
15-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
15-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
15-C02 Bedroom	0.3	✓	0.3	✓	1.6	✓
15-C02 Studio	2.2	✓	1.3	✓	4.7	✗
15-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
15-C03 Bedroom	0.4	✓	0.3	✓	1.7	✓
15-C03 Studio	2.3	✓	1.3	✓	4.8	✗
15-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
15-C04 Studio	2.1	✓	1.3	✓	4.8	✗
15-C05 Bedroom	0.5	✓	0.4	✓	2	✓
15-C05 Studio	2.0	✓	1.4	✓	4.8	✗
15-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
15-C06 Studio	2.0	✓	1.4	✓	5.1	✗
15-C07 Bedroom	0.7	✓	0.6	✓	3	✓
15-C08 Bedroom	0.7	✓	0.6	✓	3	✓
15-C09 Bedroom	0.7	✓	0.6	✓	3	✓
15-C10 Bedroom	0.8	✓	0.6	✓	3	✓
15-B01 Bedroom	0.9	✓	0.7	✓	2.7	✓
15-B02 Bedroom	1.1	✓	0.8	✓	2.9	✓
15-B03 Bedroom	1.1	✓	0.8	✓	2.9	✓
15-B04 Bedroom	1.1	✓	0.8	✓	3	✓
15-B05 Bedroom	1.1	✓	0.8	✓	2.9	✓
15-B06 Bedroom	1.0	✓	0.8	✓	2.9	✓
15-B1 Kitchen	2.2	✓	1.6	✓	5.4	✗
15-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓

15-B08 Bedroom	0.4	✓	0.3	✓	1.8	✓
15-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
15-B10 Bedroom	0.5	✓	0.3	✓	2	✓
15-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
15-A01 Studio	2.4	✓	1.7	✓	5.1	✗
15-A04 Studio	2.2	✓	1.3	✓	4.8	✗
15-B05 Studio	2.7	✓	2	✓	5	✗
15-B14 Studio	1.7	✓	1.4	✓	3.8	✗
15-B09 Studio	2.3	✓	1.5	✓	5	✗
15-B01 Studio	1.4	✓	0.8	✓	3.6	✗
15-C01 Studio	1.4	✓	1	✓	3.4	✗
16-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
16-B06 Studio	2.5	✓	1.6	✓	5.1	✗
16-B07 Studio	2.5	✓	1.6	✓	5.1	✗
16-B08 Studio	2.3	✓	1.4	✓	4.8	✗
16-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
16-C01 Bedroom	0.3	✓	0.3	✓	1.4	✓
16-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
16-C02 Bedroom	0.4	✓	0.3	✓	1.6	✓
16-C02 Studio	2.2	✓	1.3	✓	4.7	✗
16-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
16-C03 Bedroom	0.4	✓	0.3	✓	1.7	✓
16-C03 Studio	2.3	✓	1.3	✓	4.8	✗
16-C04 Bedroom	0.5	✓	0.3	✓	1.7	✓
16-C04 Studio	2.1	✓	1.3	✓	4.8	✗
16-C05 Bedroom	0.5	✓	0.4	✓	2	✓
16-C05 Studio	2.0	✓	1.4	✓	4.8	✗
16-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
16-C06 Studio	2.0	✓	1.4	✓	5	✗
16-C07 Bedroom	0.7	✓	0.6	✓	3	✓
16-C08 Bedroom	0.7	✓	0.6	✓	3	✓
16-C09 Bedroom	0.7	✓	0.6	✓	3	✓
16-C10 Bedroom	0.8	✓	0.6	✓	3	✓
16-B01 Bedroom	1.3	✓	1	✓	3.2	✗
16-B02 Bedroom	1.4	✓	1.1	✓	3.3	✗
16-B03 Bedroom	1.4	✓	1.1	✓	3.3	✗
16-B04 Bedroom	1.4	✓	1.1	✓	3.3	✗
16-B05 Bedroom	1.3	✓	1.1	✓	3.3	✗
16-B06 Bedroom	1.3	✓	1	✓	3.3	✗
16-B1 Kitchen	2.3	✓	1.7	✓	5.6	✗
16-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
16-B08 Bedroom	0.4	✓	0.3	✓	1.9	✓
16-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
16-B10 Bedroom	0.5	✓	0.3	✓	2	✓
16-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓

16-B05 Studio	2.8	✓	2.1	✓	5.2	✗
16-B14 Studio	2.2	✓	1.6	✓	4.3	✗
16-C01 Studio	1.6	✓	1.2	✓	3.8	✗
16-B09 Studio	2.5	✓	1.6	✓	5.2	✗
17-B2 Kitchen	1.3	✓	0.8	✓	4	✗
17-B06 Studio	2.4	✓	1.5	✓	4.9	✗
17-B07 Studio	2.4	✓	1.5	✓	4.9	✗
17-B08 Studio	2.1	✓	1.2	✓	4.6	✗
17-B11 Bedroom	0.5	✓	0.4	✓	2	✓
17-C01 Bedroom	0.2	✓	0.3	✓	1.4	✓
17-C1 Kitchen	1.5	✓	0.9	✓	4.5	✗
17-C02 Bedroom	0.3	✓	0.3	✓	1.6	✓
17-C02 Studio	2.0	✓	1.2	✓	4.5	✗
17-C2 Kitchen	1.6	✓	1	✓	5.2	✗
17-C03 Bedroom	0.3	✓	0.3	✓	1.6	✓
17-C03 Studio	2.1	✓	1.2	✓	4.7	✗
17-C04 Bedroom	0.4	✓	0.3	✓	1.7	✓
17-C04 Studio	2.0	✓	1.2	✓	4.5	✗
17-C05 Bedroom	0.5	✓	0.3	✓	1.8	✓
17-C05 Studio	1.7	✓	1.2	✓	4.2	✗
17-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
17-C06 Studio	1.6	✓	1.1	✓	4.3	✗
17-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
17-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
17-C09 Bedroom	0.6	✓	0.5	✓	2.5	✓
17-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
17-B01 Bedroom	1.1	✓	0.8	✓	3	✓
17-B02 Bedroom	1.3	✓	0.9	✓	3.1	✗
17-B03 Bedroom	1.3	✓	0.9	✓	3.1	✗
17-B04 Bedroom	1.3	✓	0.9	✓	3.1	✗
17-B05 Bedroom	1.2	✓	0.8	✓	3.1	✗
17-B06 Bedroom	1.2	✓	0.8	✓	3	✓
17-B1 Kitchen	1.7	✓	1.2	✓	4.7	✗
17-B07 Bedroom	0.2	✓	0.3	✓	1.2	✓
17-B08 Bedroom	0.4	✓	0.3	✓	1.6	✓
17-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
17-B10 Bedroom	0.4	✓	0.3	✓	1.8	✓
17-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
17-B05 Studio	2.3	✓	1.7	✓	4.7	✗
17-B14 Studio	1.9	✓	1.5	✓	4.1	✗
17-C01 Studio	1.5	✓	1	✓	3.5	✗
17-B09 Studio	2.2	✓	1.4	✓	4.9	✗
18-B2 Kitchen	1.9	✓	1.2	✓	5.2	✗
18-B06 Studio	2.5	✓	1.6	✓	5.2	✗
18-B07 Studio	2.5	✓	1.6	✓	5.1	✗

18-B08 Studio	2.3	✓	1.4	✓	4.8	✗
18-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
18-C01 Bedroom	0.3	✓	0.3	✓	1.6	✓
18-C1 Kitchen	2.2	✓	1.5	✓	5.4	✗
18-C02 Bedroom	0.4	✓	0.4	✓	1.9	✓
18-C02 Studio	2.2	✓	1.3	✓	4.8	✗
18-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
18-C03 Bedroom	0.5	✓	0.4	✓	2	✓
18-C03 Studio	2.3	✓	1.3	✓	4.9	✗
18-C04 Bedroom	0.5	✓	0.4	✓	2	✓
18-C04 Studio	2.1	✓	1.3	✓	4.8	✗
18-C05 Bedroom	0.5	✓	0.5	✓	2.1	✓
18-C05 Studio	2.0	✓	1.4	✓	4.8	✗
18-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
18-C06 Studio	2.0	✓	1.4	✓	5.1	✗
18-C07 Bedroom	0.7	✓	0.6	✓	3	✓
18-C08 Bedroom	0.7	✓	0.6	✓	3	✓
18-C09 Bedroom	0.7	✓	0.6	✓	3	✓
18-C10 Bedroom	0.8	✓	0.6	✓	3	✓
18-B01 Bedroom	1.5	✓	1.1	✓	3.5	✗
18-B02 Bedroom	1.6	✓	1.2	✓	3.6	✗
18-B03 Bedroom	1.6	✓	1.2	✓	3.6	✗
18-B04 Bedroom	1.6	✓	1.2	✓	3.6	✗
18-B05 Bedroom	1.6	✓	1.2	✓	3.6	✗
18-B06 Bedroom	1.6	✓	1.1	✓	3.5	✗
18-B1 Kitchen	2.5	✓	1.8	✓	5.8	✗
18-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
18-B08 Bedroom	0.4	✓	0.3	✓	1.9	✓
18-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
18-B10 Bedroom	0.5	✓	0.3	✓	2	✓
18-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
18-B05 Studio	2.9	✓	2.2	✓	5.3	✗
18-B14 Studio	2.4	✓	1.8	✓	4.7	✗
18-C01 Studio	1.9	✓	1.4	✓	4.1	✗
18-B09 Studio	2.5	✓	1.6	✓	5.2	✗
19-B2 Kitchen	1.8	✓	1.2	✓	5.1	✗
19-B06 Studio	2.5	✓	1.6	✓	5.2	✗
19-B07 Studio	2.5	✓	1.6	✓	5.1	✗
19-B08 Studio	2.3	✓	1.4	✓	4.8	✗
19-B11 Bedroom	0.5	✓	0.4	✓	2.2	✓
19-C01 Bedroom	0.4	✓	0.4	✓	1.8	✓
19-C1 Kitchen	2.2	✓	1.6	✓	5.5	✗
19-C02 Bedroom	0.5	✓	0.4	✓	2	✓
19-C02 Studio	2.3	✓	1.3	✓	4.8	✗
19-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗

19-C03 Bedroom	0.5	✓	0.5	✓	2.1	✓
19-C03 Studio	2.3	✓	1.3	✓	4.9	✗
19-C04 Bedroom	0.6	✓	0.5	✓	2.2	✓
19-C04 Studio	2.1	✓	1.3	✓	4.8	✗
19-C05 Bedroom	0.6	✓	0.5	✓	2.3	✓
19-C05 Studio	2.0	✓	1.4	✓	4.8	✗
19-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
19-C06 Studio	2.0	✓	1.4	✓	5	✗
19-C07 Bedroom	0.7	✓	0.6	✓	3	✓
19-C08 Bedroom	0.7	✓	0.6	✓	3	✓
19-C09 Bedroom	0.7	✓	0.6	✓	3	✓
19-C10 Bedroom	0.8	✓	0.6	✓	3	✓
19-B01 Bedroom	1.5	✓	1.1	✓	3.5	✗
19-B02 Bedroom	1.6	✓	1.2	✓	3.6	✗
19-B03 Bedroom	1.6	✓	1.2	✓	3.6	✗
19-B04 Bedroom	1.6	✓	1.2	✓	3.6	✗
19-B05 Bedroom	1.6	✓	1.2	✓	3.6	✗
19-B06 Bedroom	1.5	✓	1.1	✓	3.5	✗
19-B1 Kitchen	2.4	✓	1.8	✓	5.8	✗
19-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
19-B08 Bedroom	0.4	✓	0.3	✓	1.9	✓
19-B09 Bedroom	0.5	✓	0.3	✓	1.9	✓
19-B10 Bedroom	0.5	✓	0.3	✓	2	✓
19-B11 Bedroom	0.5	✓	0.4	✓	2.1	✓
19-B05 Studio	2.9	✓	2.2	✓	5.2	✗
19-B14 Studio	2.4	✓	1.8	✓	4.7	✗
19-C01 Studio	2.1	✓	1.6	✓	4.3	✗
19-B09 Studio	2.5	✓	1.6	✓	5.2	✗
20-B2 Kitchen	1.3	✓	0.8	✓	4	✗
20-B06 Studio	2.4	✓	1.5	✓	4.8	✗
20-B07 Studio	2.4	✓	1.4	✓	4.9	✗
20-B08 Studio	2.1	✓	1.2	✓	4.6	✗
20-B11 Bedroom	0.5	✓	0.4	✓	2	✓
20-C01 Bedroom	0.5	✓	0.4	✓	2	✓
20-C1 Kitchen	1.6	✓	1	✓	4.8	✗
20-C02 Bedroom	0.6	✓	0.5	✓	2.2	✓
20-C02 Studio	2.1	✓	1.2	✓	4.6	✗
20-C2 Kitchen	1.6	✓	1	✓	5.2	✗
20-C03 Bedroom	0.6	✓	0.5	✓	2.2	✓
20-C03 Studio	2.2	✓	1.2	✓	4.7	✗
20-C04 Bedroom	0.6	✓	0.5	✓	2.2	✓
20-C04 Studio	2.0	✓	1.2	✓	4.5	✗
20-C05 Bedroom	0.7	✓	0.5	✓	2.3	✓
20-C05 Studio	1.7	✓	1.2	✓	4.2	✗
20-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓

20-C06 Studio	1.6	✓	1.1	✓	4.3	✗
20-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
20-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
20-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
20-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
20-B01 Bedroom	1.1	✓	0.8	✓	3	✓
20-B02 Bedroom	1.3	✓	0.9	✓	3.1	✗
20-B03 Bedroom	1.3	✓	0.9	✓	3.1	✗
20-B04 Bedroom	1.3	✓	0.9	✓	3.1	✗
20-B05 Bedroom	1.2	✓	0.8	✓	3.1	✗
20-B06 Bedroom	1.1	✓	0.8	✓	3	✓
20-B1 Kitchen	1.7	✓	1.2	✓	4.7	✗
20-B07 Bedroom	0.2	✓	0.3	✓	1.2	✓
20-B08 Bedroom	0.4	✓	0.3	✓	1.7	✓
20-B09 Bedroom	0.4	✓	0.3	✓	1.7	✓
20-B10 Bedroom	0.4	✓	0.3	✓	1.8	✓
20-B11 Bedroom	0.4	✓	0.3	✓	1.9	✓
20-B05 Studio	2.3	✓	1.7	✓	4.7	✗
20-B14 Studio	1.9	✓	1.4	✓	4	✗
20-C01 Studio	1.9	✓	1.5	✓	4.1	✗
20-B09 Studio	2.2	✓	1.4	✓	4.8	✗
21-B2 Kitchen	1.4	✓	1	✓	4.7	✗
21-B06 Studio	2.4	✓	1.4	✓	4.9	✗
21-B07 Studio	2.4	✓	1.4	✓	4.9	✗
21-B08 Studio	2.0	✓	1.3	✓	4.5	✗
21-B11 Bedroom	0.5	✓	0.4	✓	2	✓
21-C01 Bedroom	0.8	✓	0.6	✓	2.5	✓
21-C1 Kitchen	2.6	✓	1.9	✓	6	✗
21-C02 Bedroom	0.9	✓	0.7	✓	2.7	✓
21-C02 Studio	2.4	✓	1.4	✓	4.9	✗
21-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
21-C03 Bedroom	1.1	✓	0.7	✓	2.8	✓
21-C03 Studio	2.4	✓	1.4	✓	4.9	✗
21-C04 Bedroom	1.1	✓	0.7	✓	2.8	✓
21-C04 Studio	2.2	✓	1.3	✓	4.8	✗
21-C05 Bedroom	1.1	✓	0.8	✓	2.9	✓
21-C05 Studio	2.0	✓	1.4	✓	4.8	✗
21-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
21-C06 Studio	2.0	✓	1.4	✓	5.1	✗
21-C07 Bedroom	0.7	✓	0.6	✓	3	✓
21-C08 Bedroom	0.7	✓	0.6	✓	3	✓
21-C09 Bedroom	0.7	✓	0.6	✓	3	✓
21-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗
21-B01 Bedroom	1.3	✓	0.9	✓	3.2	✗
21-B02 Bedroom	1.5	✓	1.1	✓	3.4	✗

21-B03 Bedroom	1.5	✓	1.1	✓	3.4	✗
21-B04 Bedroom	1.5	✓	1.1	✓	3.4	✗
21-B05 Bedroom	1.4	✓	1	✓	3.3	✗
21-B06 Bedroom	1.3	✓	1	✓	3.3	✗
21-B1 Kitchen	2.0	✓	1.5	✓	5.3	✗
21-B07 Bedroom	0.2	✓	0.3	✓	1.3	✓
21-B08 Bedroom	0.4	✓	0.3	✓	1.7	✓
21-B09 Bedroom	0.4	✓	0.3	✓	1.8	✓
21-B10 Bedroom	0.4	✓	0.3	✓	1.8	✓
21-B11 Bedroom	0.4	✓	0.4	✓	1.9	✓
21-B05 Studio	2.6	✓	1.9	✓	5	✗
21-B14 Studio	2.1	✓	1.6	✓	4.2	✗
21-C01 Studio	2.6	✓	1.9	✓	4.8	✗
21-B09 Studio	2.2	✓	1.4	✓	4.9	✗
22-C01 Bedroom	1.0	✓	0.7	✓	2.8	✓
22-C1 Kitchen	2.9	✓	2	✓	6.3	✗
22-C02 Bedroom	1.2	✓	0.9	✓	3.1	✗
22-C02 Studio	2.4	✓	1.4	✓	4.9	✗
22-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
22-C03 Bedroom	1.2	✓	0.9	✓	3.1	✗
22-C03 Studio	2.4	✓	1.4	✓	4.9	✗
22-C04 Bedroom	1.2	✓	0.9	✓	3.1	✗
22-C04 Studio	2.2	✓	1.3	✓	4.8	✗
22-C05 Bedroom	1.3	✓	1	✓	3.3	✗
22-C05 Studio	2.0	✓	1.4	✓	4.8	✗
22-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
22-C06 Studio	2.0	✓	1.4	✓	5	✗
22-C07 Bedroom	0.7	✓	0.6	✓	3	✓
22-C08 Bedroom	0.7	✓	0.6	✓	3	✓
22-C09 Bedroom	0.7	✓	0.6	✓	3	✓
22-C10 Bedroom	0.8	✓	0.6	✓	3	✓
22-C01 Studio	2.8	✓	2	✓	5.1	✗
23-C01 Bedroom	0.9	✓	0.6	✓	2.6	✓
23-C1 Kitchen	2.1	✓	1.4	✓	5.3	✗
23-C02 Bedroom	1.1	✓	0.7	✓	2.9	✓
23-C02 Studio	2.2	✓	1.3	✓	4.7	✗
23-C2 Kitchen	1.7	✓	1	✓	5.2	✗
23-C03 Bedroom	1.1	✓	0.7	✓	2.9	✓
23-C03 Studio	2.2	✓	1.2	✓	4.8	✗
23-C04 Bedroom	1.1	✓	0.7	✓	2.9	✓
23-C04 Studio	2.0	✓	1.2	✓	4.5	✗
23-C05 Bedroom	1.1	✓	0.8	✓	2.9	✓
23-C05 Studio	1.7	✓	1.2	✓	4.2	✗
23-C06 Bedroom	0.6	✓	0.5	✓	2.7	✓
23-C06 Studio	1.6	✓	1.1	✓	4.4	✗

23-C07 Bedroom	0.6	✓	0.5	✓	2.6	✓
23-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
23-C09 Bedroom	0.6	✓	0.5	✓	2.6	✓
23-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
23-C01 Studio	2.2	✓	1.7	✓	4.6	✗
24-C01 Bedroom	1.2	✓	0.8	✓	3.1	✗
24-C1 Kitchen	3.0	✓	2.1	✓	6.5	✗
24-C02 Bedroom	1.4	✓	1	✓	3.4	✗
24-C02 Studio	2.4	✓	1.4	✓	4.9	✗
24-C2 Kitchen	2.4	✓	1.7	✓	6.2	✗
24-C03 Bedroom	1.4	✓	1	✓	3.4	✗
24-C03 Studio	2.4	✓	1.4	✓	4.9	✗
24-C04 Bedroom	1.4	✓	1	✓	3.4	✗
24-C04 Studio	2.2	✓	1.3	✓	4.8	✗
24-C05 Bedroom	1.5	✓	1.1	✓	3.5	✗
24-C05 Studio	2.0	✓	1.4	✓	4.8	✗
24-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
24-C06 Studio	2.0	✓	1.4	✓	5.1	✗
24-C07 Bedroom	0.7	✓	0.6	✓	3	✓
24-C08 Bedroom	0.7	✓	0.6	✓	3	✓
24-C09 Bedroom	0.7	✓	0.6	✓	3	✓
24-C10 Bedroom	0.8	✓	0.6	✓	3.1	✗
24-C01 Studio	2.8	✓	2.1	✓	5.1	✗
25-C01 Bedroom	1.2	✓	0.8	✓	3.1	✗
25-C1 Kitchen	3.0	✓	2.1	✓	6.4	✗
25-C02 Bedroom	1.4	✓	1	✓	3.4	✗
25-C02 Studio	2.4	✓	1.4	✓	4.9	✗
25-C2 Kitchen	2.4	✓	1.7	✓	6.1	✗
25-C03 Bedroom	1.4	✓	1	✓	3.4	✗
25-C03 Studio	2.4	✓	1.4	✓	4.9	✗
25-C04 Bedroom	1.4	✓	1	✓	3.4	✗
25-C04 Studio	2.1	✓	1.3	✓	4.8	✗
25-C05 Bedroom	1.5	✓	1.1	✓	3.5	✗
25-C05 Studio	2.0	✓	1.3	✓	4.8	✗
25-C06 Bedroom	0.8	✓	0.6	✓	3.1	✗
25-C06 Studio	2.0	✓	1.4	✓	5	✗
25-C07 Bedroom	0.7	✓	0.6	✓	3	✓
25-C08 Bedroom	0.7	✓	0.6	✓	3	✓
25-C09 Bedroom	0.7	✓	0.6	✓	3	✓
25-C10 Bedroom	0.8	✓	0.6	✓	3	✓
25-C01 Studio	2.8	✓	2.1	✓	5.1	✗
26-C01 Bedroom	0.9	✓	0.6	✓	2.6	✓
26-C1 Kitchen	2.1	✓	1.4	✓	5.2	✗
26-C02 Bedroom	1.1	✓	0.7	✓	2.9	✓
26-C02 Studio	2.2	✓	1.2	✓	4.7	✗

26-C2 Kitchen	1.6	✓	1	✓	5.1	✗
26-C03 Bedroom	1.1	✓	0.7	✓	2.9	✓
26-C03 Studio	2.2	✓	1.2	✓	4.7	✗
26-C04 Bedroom	1.1	✓	0.8	✓	2.9	✓
26-C04 Studio	1.9	✓	1.2	✓	4.5	✗
26-C05 Bedroom	1.1	✓	0.8	✓	3	✓
26-C05 Studio	1.7	✓	1.1	✓	4.1	✗
26-C06 Bedroom	0.6	✓	0.5	✓	2.6	✓
26-C06 Studio	1.5	✓	1.1	✓	4.3	✗
26-C07 Bedroom	0.6	✓	0.5	✓	2.5	✓
26-C08 Bedroom	0.6	✓	0.5	✓	2.5	✓
26-C09 Bedroom	0.6	✓	0.5	✓	2.5	✓
26-C10 Bedroom	0.6	✓	0.5	✓	2.6	✓
26-C01 Studio	2.1	✓	1.7	✓	4.5	✗
27-C01 Bedroom	1.1	✓	0.7	✓	2.9	✓
27-C1 Kitchen	2.4	✓	1.7	✓	5.7	✗
27-C02 Bedroom	1.3	✓	0.9	✓	3.2	✗
27-C02 Studio	2.2	✓	1.3	✓	4.7	✗
27-C2 Kitchen	1.9	✓	1.3	✓	5.6	✗
27-C03 Bedroom	1.3	✓	0.9	✓	3.2	✗
27-C03 Studio	2.2	✓	1.3	✓	4.7	✗
27-C04 Bedroom	1.3	✓	0.9	✓	3.2	✗
27-C04 Studio	2.0	✓	1.2	✓	4.5	✗
27-C05 Bedroom	1.3	✓	0.9	✓	3.3	✗
27-C05 Studio	1.8	✓	1.2	✓	4.4	✗
27-C06 Bedroom	0.6	✓	0.6	✓	2.8	✓
27-C06 Studio	1.6	✓	1.2	✓	4.6	✗
27-C07 Bedroom	0.6	✓	0.5	✓	2.8	✓
27-C08 Bedroom	0.6	✓	0.5	✓	2.8	✓
27-C09 Bedroom	0.6	✓	0.5	✓	2.8	✓
27-C10 Bedroom	0.6	✓	0.6	✓	2.8	✓
27-C01 Studio	2.4	✓	1.8	✓	4.9	✗

The tables above shows that the proposed occupied spaces pass TM59 under DSY1 and DSY2, with 42% passing under the advisory future weather file for a long less intense warm spell DSY3 weather file.

5. Renewable Energy

This section of the report reviews the technologies currently available to the Client and draws conclusions on suitable and effective renewable sources of energy for the iQ Echo St development.

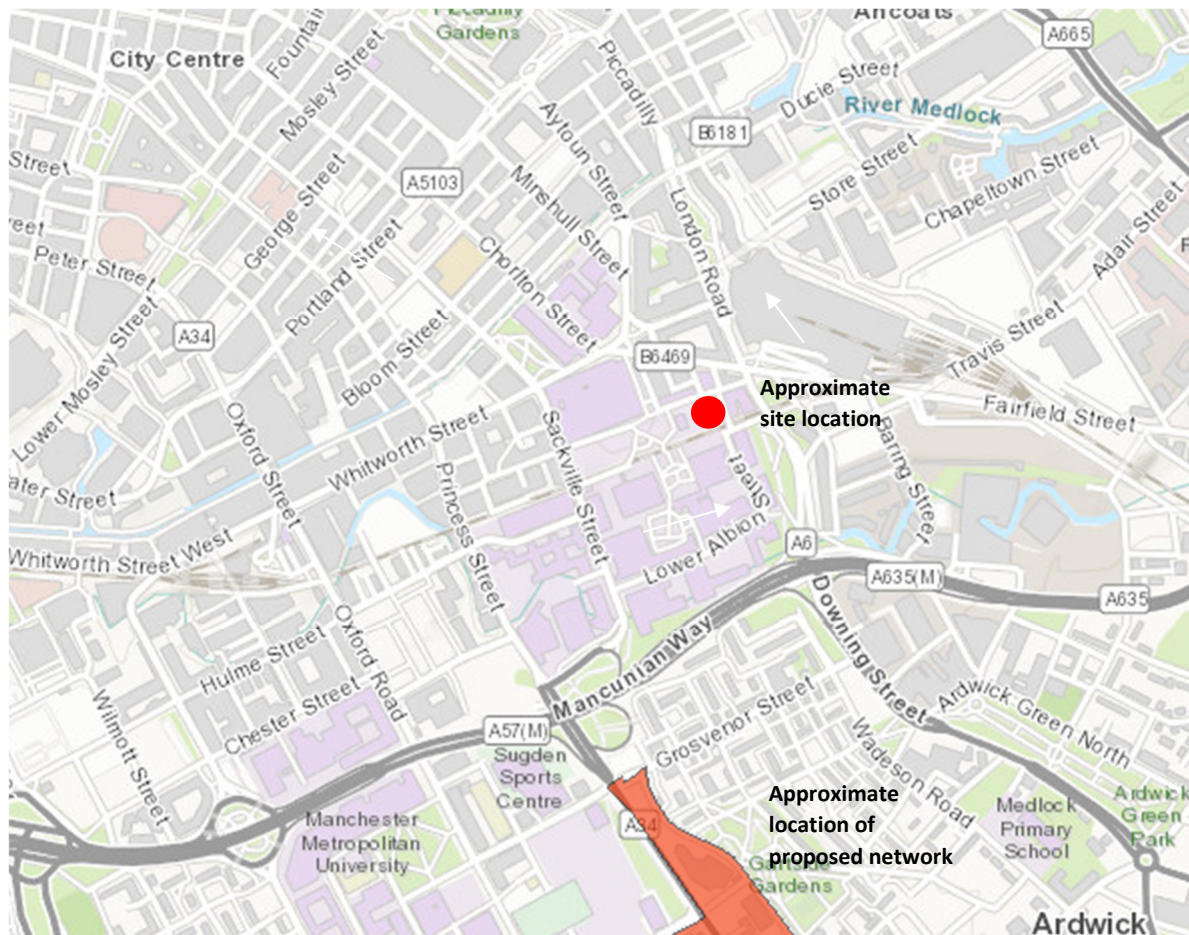
The design team have initially looked to reduce energy consumption through the use of high-performance building fabric and careful orientation of the building on the site.

5.1 District Heating Network Connection

We have researched the area surrounding the site to establish the availability of district heating networks. There is currently no existing district heating network near the site that should allow a feasible connection, and no proposed local heating network shown on the Manchester City Council website.

The image next page is taken from the UK CHP Development Map, showing the extent of the existing district heating mains network, and proposed heat networks.

Figure 4: Manchester District Heating Network Map



Source: Newcastle City Council

5.2 Wind Power

Wind power is conversion of wind energy into more useful forms. Common contemporary wind power is generated in the form of electricity by converting the rotation of turbine blades into electrical current by means of an electrical generator. Wind energy is renewable, widely distributed, clean, and reduces toxic atmospheric and greenhouse gas emissions if used to replace fossil-fuel-derived electricity. Horizontal or vertical axis wind turbines could be used to assist in the power requirements for a building. Not as a single solution, but part of renewable energy strategy, a turbine could be integrated into a building profile.

Figure 5: Wind Turbine



It is essential that turbines should be sited away from obstructions, with a clear exposure or fetch for the prevailing wind. The only feasible location for wind turbines on the proposed building would be at roof level. However, it is appreciated that this may lead to noise and/or vibration issues for occupants, especially at night, since most applicable wind turbines emit 60 to 65 dBA of noise. This could restrict the potential use of the turbines and thus reduce their effective energy generation significantly.

Reviewing the data provided by the RenSmart wind resource data base we see below that there is insufficient wind resource to achieve the minimum recommended average wind speed of 6.2m/s. **It is therefore concluded that wind turbines will not be considered further for this project.**

Figure 6: Average Wind Speed for the Site

Location

- Latitude: 54.97229253464205
- Longitude: -1.6035933495354813
- Height above sea level: 151 m

Wind Speeds

estimates from NOABL data

- At 10m above ground level 4.7 m/s
- At 25m above ground level 5.6 m/s
- At 45m above ground level 6.2 m/s

Solar

falling on a optimally oriented panel

- Annual Energy per m² 1081 kWh
- Daily Energy per m² 2962 Wh

Source: RenSmart

5.3 Ground Source Heating Pump (GSHP)

In the UK, soil temperatures stay at a constant temperature of around 11-12°C throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and water heating. The process is similar to that used in refrigerators. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide heating and heat new hot water.

A vertical closed loop field is composed of pipes that run vertically in the ground. A hole is bored in the ground, typically, 50 to 150m deep. Pipe pairs are installed in the hole and are joined with a U-shaped cross connector at the bottom of the hole. The borehole is commonly filled with a bentonite grout surrounding the pipe to provide a good thermal connection to the surrounding soil or rock. Vertical loop fields are typically used when there is a limited square footage of land available. Bore holes are spaced 5–6 m apart and are generally 15m deep per kWth of capacity. Typically, high capital costs are associated with vertical ground source heating systems due to the complications associated with the drilling of deep boreholes.

Figure 7: Ground Source Heating



As we are only using the loops for hot water, and not heating. It is therefore proposed to not pursue the open water loop system further.

Therefore, this technology is not recommended for the iQ Echo St development.

5.4 Water Source Heat Pumps

Water source Heat Pump systems make use of the relatively stable temperature of below ground aquifers. The cold water in aquifers can be used to provide space cooling within buildings or as a source for heat for preheating ventilation air. Water from aquifers can be pumped directly or indirectly to cooling systems and be used as a heat source or sink for heat pumps.

Based on the site location it is anticipated this technology would face practical and technical difficulties in respect to drilling bore holes to reach aquifers due to the possible presence of existing underground train tunnels, sewage and telecom networks, water and gas pipes etc.

Therefore, this technology is not recommended for the iQ Echo St development.

5.5 Biomass

Today, wood is still our largest biomass energy resource. But many other sources of biomass can now be used, including plants, residues from agriculture or forestry, and the organic component of municipal and industrial wastes. Even the fumes from landfills can be used as a biomass energy source.

The use of biomass energy has the potential to greatly reduce our greenhouse gas emissions. Biomass generates about the same amount of carbon dioxide as fossil fuels, but every time a new plant grows, carbon dioxide is removed from the atmosphere. The net emission of carbon dioxide will be zero as long as plants continue to be replenished for biomass energy purposes.

Biomass is CO₂ neutral since the CO₂ released during the combustion of the wood is only that taken during the growth of the tree i.e. the CO₂ is simply recycled. However, energy used in the harvesting and transportation of wood fuel can result in CO₂ emissions. Wood also has a low sulphur and nitrogen content.

Figure 8: Biomass Wood Pellets



Wood fuel is primarily available for use in London in the form of “wood pellets”.

5.5.1 Wood Pellet Facts:

- Wood pellets cost 3.9p/kWh (min)
- Wood pellets are generally denser, with larger energy content than other wood fuels
- Wood pellets are easy to transport due to shape and form.
- Wood pellets have low moisture content (8% EU standard) which means no special modifications are required to storage containers.
- Screws feeding pellets to the boiler are low-cost and reliable as pellets flow easily and do not stick together.
- Wood pellets burn very efficiently and residues remain in the burn chamber therefore cyclone extraction is not required.
- Flues must be cleaned once a year.
- Pellets produce less than 1% by volume of ash.

- Pellets have an almost total combustion; the ash produced is fine dust and is a good source of free fertilizer.

A significant constraint is with regards to the delivery of the fuel supply.

5.5.2 Delivery

Wood pellet fuel is often delivered using tankers which blow the pellets through a 100mm diameter hose to the storage silo up to 30 metres away. This uses a specially adapted delivery lorry which is complete with a blower and can deliver the wood pellets direct into a storage hopper. However, it should be noted that the tipper is still required to be partially elevated in order for the pellets to enter the blower system. This option is only suitable with wood pellets because of their shape and form.

5.5.3 Availability of Wood Fuel

There are multiple companies which are providing wood fuel pellets. The nominated maintenance contractor will be required to ensure that a suitable delivery strategy is in place with a fuel supplier to ensure sufficient storage is maintained throughout the year. The maintenance contractor will also be required to ensure that the wood fuel storage is kept as dry as possible as the drier the fuel the better the combustion. There are various methods of purchasing the wood fuel from payments per delivery/tonnage to energy services contracts (ESCO's).

5.5.4 Flue and Planning Issues

Biomass boilers require a separate flue from that of the gas fired boilers. This is due to the differences in the flue gas velocities and particulate matter found within Biomass combustion products.

The type of wood fuel used may also dictate the regulations for which the flue design will be required to meet.

The overall flue design would be regulated under the Local Air Pollution Prevention and Control (LAPPC) as detailed within PG1/12.

It should be noted that on occasion with wood fuel biomass boilers there may be an instance where white smoke is visible. This is allowable under the Clean-Air Act Legislation. This smoke can occur during the start-up period and is caused by the moisture content within the wood fuel. Typically, wood pellets have lower moisture content than many other wood fuels.

As it is currently believed that the scheme can achieve the energy savings without the use of biomass, and primarily because of the issues of local air quality and the logistics of delivery to the site it is not proposed to take this option forward. **Therefore, biomass boilers are not proposed for the iQ Echo St development.**

5.6 Air Source Heat Pump (ASHP) – Serving Hot Water

This system extracts thermal energy from the air and transfers it to the working medium (in this case water) Air source heat pumps use the vapour compression cycle and can achieve high efficiencies in excess of 300%. As such they are classed as a Low or Zero Carbon (LZC) technology.

An air source heat pump system could be used to provide space heating in addition to hot water however electric panel heaters with intelligent control typically provide the best energy efficiency in this kind of building, therefore we are looking at hot water generation only.

Air source heat pumps typically generate low grade heat, but new products such as the Mitsubishi Q-Ton produces high grade heat due to the use of CO₂ as a refrigerant we are able to produce much higher water temperatures, which is proposed for this development. They are bespoke products designed specifically to produce domestic hot water. The controls strategies designed to optimise running conditions. They are located at roof level and remain serviceable and easy to maintain or replace at end of life.

By using an ASHP there are no NOx emissions and no local pollution emissions associated with the generation of hot water.

We are proposing to use this technology to meet the onsite renewables requirement.

5.7 Photovoltaics

Solar energy a renewable resource that is inexhaustible and is locally available. It is a clean energy source that allows for local energy independence. The sun's power flow reaching the earth is typically about 1,000 W/m², although availability varies with location, cloud cover and time of year. Capturing solar energy typically requires equipment with a relatively high initial capital cost. However, over the lifetime of the solar equipment, these systems can prove to be cost-competitive, as compared to conventional energy technologies. The key to successful solar energy installation is to use quality components that have long lifetimes and require minimal maintenance.

Electricity can be produced from sunlight through the use of photovoltaics (PV), which can be applied, in either a centralized or decentralized fashion. "Photo" refers to light and "voltaic" to voltage. The term describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun. Solar cells are made of semi-conducting material, most commonly silicon, coated with special additives. A typical silicon PV cell is composed of a thin wafer consisting of an ultra-thin layer of phosphorus-doped (N-type) silicon on top of a thicker layer of boron-doped (P-type) silicon. An electrical field is created near the top surface of the cell where these two materials are in contact, called the P-N junction. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of current when the solar cell is connected to an electrical load.

Figure 9: PV Panels/ Photovoltaic Array



Photovoltaics is recommended and included in this project, the proposal is to maximise the roof area maintaining access for maintenance.

6. Modelling Results

This section of the report demonstrates that the proposed building complies with Approved Document L 2021.

The VE compliance module of IES Virtual Environment version 7.0.19 was used to generate the results.

This calculation method compares the total energy consumption of iQ Echo St and its services, expressed as CO₂ emissions of the building being assessed ("Building Emissions Rate" or BER) with a target value ("Target Emissions Rate" or TER) derived from similar calculations for a "Notional Building".

The table below shows CO₂ for the baseline building, after energy saving measures, after carbon off-setting. Regulated emissions have been calculated using the IES model, unregulated emissions from electrical use have been taken from the BRUKL output document appended to this report.

Table 8: Carbon Emissions

Carbon dioxide emissions (tonnes (CO ₂)/annum)			
	Regulated	Unregulated	Total
Part L 2021 TER	120,364	117,809	238,173
Part L 2021 BER	122,593	117,809	240,402

Source: Waterman Building Services

The table above shows that the proposed development achieves a carbon saving considering regulated loads compared to a notional building assessed under Part L 2021. The building therefore complies with Approved Document L Volume 2 2021. The proposed development has an onsite renewable energy of 27% provided by air source heat pump and 6% provided by PV which is a total of 33% of the site overall energy demand.

7. Conclusion and Summary of Proposals

The proposed development at iQ Echo St has been assessed using approved software to demonstrate the potential CO₂ emissions against Approved Document L2 of Building Regulations.

From the results presented within this document it can be seen that the proposed development with the inclusion of renewable technologies as well as the other measures proposed, has the potential to better the ADL2 2021 maximum requirements for CO₂ emissions. This potential reduction is achieved by the inclusion of improved fabric design, energy efficient lighting system, heat recovery ventilation, and air source heat pump providing hot water.

APPENDICES

A. Appendix A – BRUKL Output Document.

BRUKL Output Document

Compliance with England Building Regulations Part L 2021



Project name

iQ Echo Street

As designed

Date: Wed Apr 26 16:26:26 2023

Administrative information

Building Details

Address: Echo Street, Manchester, M1 7DP

Certifier details

Name: Nicolas Walker

Telephone number: 07980130861

Address: Walker Energy Analysis, Redlands Business Centre, 3-5 Tipton House Road, Sheffield, S10 5BY

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.20

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.20

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 766.9

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	3.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	3.24
Target primary energy rate (TPER), kWh _{ep} /m ² annum	35.09
Building primary energy rate (BPER), kWh _{ep} /m ² annum	33.98
Do the building's emission and primary energy rates exceed the targets?	BER <= TER BPER <= TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	00000015:Surf[2]
Floors	0.18	0.13	0.13	00000047:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.13	0.13	00000076:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	00000015:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.09	1.2	00000015:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_a-Calc = Limiting area-weighted average U-values [W/(m²K)]
U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/(m²K).
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

B. Appendix B – Draft EPC Certificate.

Energy Performance Certificate		HM Government	
Non-Domestic Building			
Echo Street Manchester M1 7DP		Certificate Reference Number: 9153-6467-8868-2371-9087	
This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document <i>Energy Performance Certificates for the construction, sale and let of non-dwellings</i> available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.			
Energy Performance Asset Rating			
More energy efficient			
			
A 0-25		9 This is how energy efficient the building is.	
B 26-50			
C 51-75			
D 76-100			
E 101-125			
F 126-150			
G Over 150			
Less energy efficient			
Technical information		Benchmarks	
Main heating fuel: Grid Supplied Electricity		Buildings similar to this one could have ratings as follows:	
Building environment: Heating and Mechanical Ventilation		9 If newly built	
Total useful floor area (m ²): 37149.367		37 If typical of the existing stock	
Building complexity: Level 5			
Building emission rate (kgCO ₂ /m ² per year): 3.24			
Primary energy use (kWh _e /m ² per year): 33.98			

UK and Ireland Office Locations

