KNOLL HOUSE HOTEL REDEVELOPMENT

Energy Statement

for

Kingfisher Resorts Studland Limited

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EXECUTIVE SUMMARY

The proposed re-development at Knoll House Hotel has been designed to achieve the highest levels of energy efficiency and low carbon emissions in accordance with all relevant local and national policy.

A combination of very good building fabric, high efficiency Air Source Heat Pumps and the use of solar PV to the full extent possible will deliver a building that will improve on the Target Emission baseline all in accordance with a Lean, Clean, Green design approach, in compliance with local council and national regulations

Lean

Energy and carbon emissions would be minimised by a Fabric First approach utilising efficient building fabric with materials providing a higher level of thermal performance than Conservation of fuel and power: Approved Document L 2021

Clean

A review of local energy sources to the site has been evaluated to focus on mains electrical power in preference to cheaper fossil fuel alternatives where ongoing decarbonisation of the electrical power grid will be a benefit for the future and match the needs of the regulations.

Green

A review of green options available and a proposal for a hybrid low temperature site energy grid using heat pump technology will be used to ensure efficient heating and cooling requirements throughout the site using:

- Site wide thermal conservation and re-use of energy using a Site Community Energy Network running at ambient temperatures
- Off peak demand load reduction using buffered storage and air source heat pumps as well as variable speed drives and optimised with a BMS
- Modular local water source heat pump systems to each block to minimise demand and provide viable energy options.

The Energy Statement defines how the proposed design of the development would implement energy efficiencies and strategies to minimise energy consumption and reduce the potential carbon footprint for the site.

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1 INTRODUCTION

1.1 GENERAL

This Energy Statement has been written to accompany the detailed planning application on behalf of our client Kingfisher Resorts Studland Ltd for the redevelopment of the site located off Ferry Road, Studland, near Swanage, Dorset.

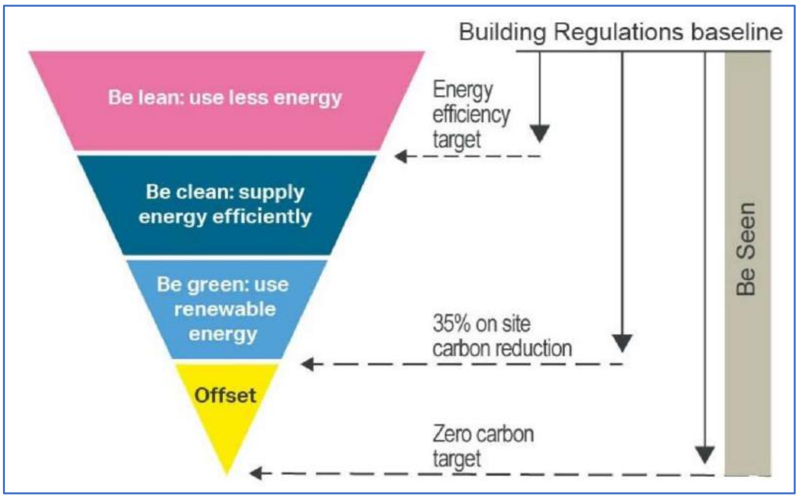
The site is accessed from Ferry Road and currently contains approximately 30 buildings including the original manor house. The accommodation comprises of 106 guest bedrooms along with 57 staff bedrooms and ancillary facilities with associated car parking and landscaping. The topography is approximately 29m AOD at its highest point and varies significantly across the site. The site levels drop towards the north, south and significantly to the east leading to Ferry Road. The site has been redeveloped in a piecemeal fashion over the years and lacks a coherent form with informal parking across the site and a number of low quality ancillary buildings.

The proposal seeks to optimise the potential of the site by developing a new masterplan removing poor quality ancillary buildings and linking green spaces, providing a high quality hotel, holiday villas and leisure facilities in this key location within Studland. Collectively, the new elements will comprise a single resort, operated by Kingfisher and delivering a luxury destination. It seeks to contribute positively to its setting by creating a contemporary and balanced building that connects with the surrounding area and skyline through the introduction of a well-proportioned facade design and the creation of vibrant ground floor and garden spaces.

1.2 METHODOLOGY

This Energy Statement has been prepared following the methodology outlined in the Conservation of fuel and power: Approved Document L 2021, and in particular considers the project against the principles of the "Energy Hierarchy", reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following hierarchy:

- **Be lean**: use less energy and manage demand during construction and operation.
- **Be clean**: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.
- **Be green**: generate, store and use renewable energy on-site.
- **Be Seen**: monitor, verify and report



Dorset County Council requirements for the Energy Strategy for building works refers to HM Government – Manual to the Building Regulations which in turn refers to Part L of the Building Regulations in terms of energy usage and efficiency within buildings and hence is the basis used for evaluation and compliance.

Evaluations will be carried out on the basis of compliance with Part L of the Building Regulations using IESVE simulation software to determine the following:

Base Case target emissions

Improvements to the Base Case – Be Lean

Improvements to incorporate alternatives to fossil fuels – Be Clean

Improvements to incorporate alternative heating, cooling and control strategies – Be Green

2 BASELINE CO2

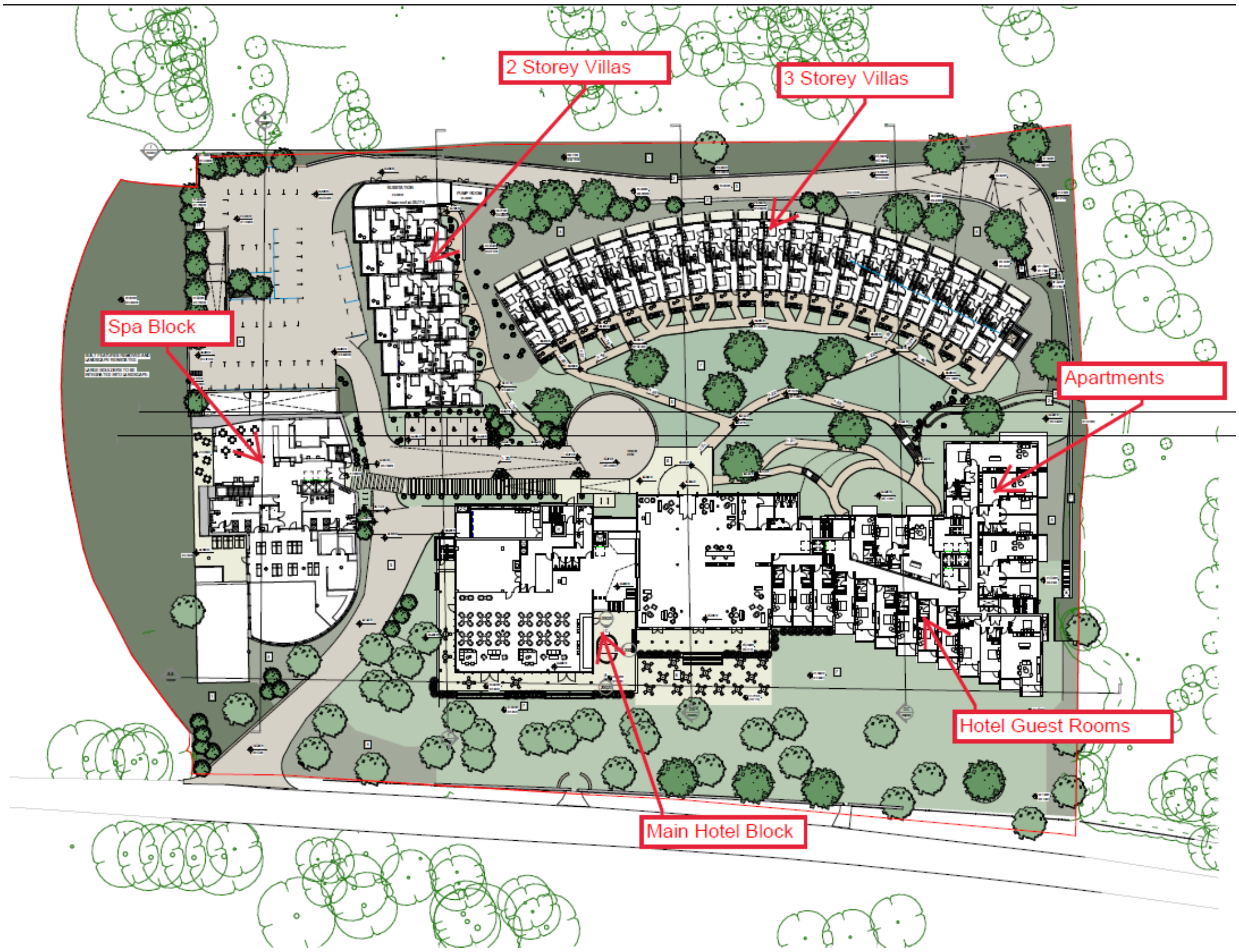
The first step is to establish baseline carbon emissions for the proposed development, represented by Conservation of Fuel and Power: Approved Document L 2021

A representative sample of each type of building of each type will be analysed using energy simulation software will be carried out and applied to the following buildings:

1. Main Hotel Block and Guest Rooms
2. Apartments
3. Villas – 2 and 3 Storey
4. Spa Block

Target emissions will be determined for each block for compliance.

Plan of the Proposed Development (Refer to Architects Drawings for details)



3 DEMAND REDUCTION MEASURES ("BE LEAN")

3.1 INTRODUCTION

Energy efficiency measures are always the most cost-effective and long-lasting means of reducing energy demand, and hence carbon emissions, from buildings and the early design stage is the most cost-effective time to incorporate design and technological measures to this end. Once built-in, energy-efficiency measures will continue to provide savings for the lifetime of the building. The design team has therefore prioritised this area, in accordance with the Energy Hierarchy as detailed below.

Initial designs focus on the buildings exceeding Building Regulations (Part L 2021) requirements – ie. the baseline - through demand reduction measures alone, for domestic and non-domestic uses. Measures typically include both architectural and building fabric measures (passive design) and energy efficient services (active design).

Part L requires at least a reduction of 35% against the baseline for new build sites.

3.2 HOTEL SPACE

The energy requirements for space heating, water heating and ventilation within the new build retail space have been calculated using the National Calculation Method (NCM) in line with AD L2A of the Building Regulations 2021 and the Non-Domestic Heating Compliance Guide.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM) and the programme to be used will be the IESVE programme which enables accurate SBEM models to be created and enhanced to assist in optimizing the solutions.

For calculation purposes the notional reference building and characteristics are defined within NCM along with the minimum fabric values and fixed services efficiencies set down by AD L2A 2021 and the Non-domestic Compliance Guide

- The Baseline solution has been assumed as: LTHW heating system, via gas fired boilers
- Natural ventilation.
- Domestic Hot Water (DHW) will be supplied from the same boilers via appropriately sized calorifiers and a secondary circulation loop.

This creates the Target Emission Rate (TER) and should be considered as stage ‘zero’ of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development against which, SBEM assesses the “actual” design, fabric values, heating lighting and ventilation systems and creates the Building Emissions Rate (BER).

Since the site is large and all part of the same complex, the villa and apartment blocks will all be evaluated using the same methodology as opposed to residential accommodation type.

Table 4.1 Limiting U-values for new or replacement elements in new and existing buildings and air permeability in new buildings

Element type	Maximum U-value[1] $W/(m^2 \cdot K)$ or air permeability
Roof (flat roof)[2]	0.18
Roof (pitched roof)[2]	0.16
Wall[2][3]	0.26
Floor[4][5]	0.18
Swimming pool basin[6]	0.25
Windows in buildings similar to dwellings[7][8]	1.6 or Window Energy Rating[9] Band B
All other windows,[8][10][11] roof windows, curtain walling	1.6
Rooflights[12][13]	2.2
Pedestrian doors (including glazed doors)[14]	1.6
Vehicle access and similar large doors	1.3
High-usage entrance doors	3.0
Roof ventilators (including smoke vents)	3.0
Air permeability (for new buildings)	$8.0m^3/(h \cdot m^2)$ @ 50Pa

NOTES:

1. Area-weighted average values, except for new windows, rooflights and doors in existing buildings.
2. For dormer windows, 'roof' includes the roof parts of the windows and 'wall' includes the wall parts (cheeks).
3. If meeting such a standard in an existing building would reduce by more than 5% the internal floor area of the room bounded by the wall, a lesser provision may be appropriate.
4. The U-value of the floor of an extension may be calculated using the exposed perimeter and floor area of either the whole enlarged building or the extension alone.
5. If meeting such a standard in an existing building, would create significant problems in relation to adjoining floor levels, a lesser provision may be appropriate.
6. The U-value of a swimming pool basin (walls and floor) calculated according to **BS EN ISO 13370**.
7. For example, student accommodation, care homes and similar uses where the occupancy levels and internal heat gains are essentially domestic in character.
8. If other performance (e.g. wind load, safety, security or acoustic attenuation) requires thicker glass to be used, an equivalent window unit with standard thickness glazing should be shown to meet the required standard.
9. The methods for calculating Window Energy Rating are set out in the Glass and Glazing Federation's Glazing Manual Data Sheet 2.3, Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors.
10. No maximum U-value is set for display windows and similar glazing. There are no limits on the design of display windows and similar glazing, but for new buildings their impact must be taken into account in the calculation of primary energy and CO_2 emissions.
11. In buildings with high internal heat gains, the average U-value for windows can be relaxed from the values given above if this can be shown to be an appropriate way of reducing overall CO_2 emissions and primary energy. However, values should be no higher than $2.7W/(m^2 \cdot K)$.
12. U-values for rooflights or rooflight-and-kerb assemblies should be based on the developed surface area of the rooflight (U_d values), which is often greater than the area of the roof opening. Further guidance on U_d-values is given in the Building Research Establishment's BR 443 and the National Association of Rooflight Manufacturers' Technical Document NTD02.
13. The limiting value for rooflights also applies to kerbs that are supplied as part of a single rooflight-and-kerb assembly sourced from the same supplier and for which the supplier can provide a combined U_d-value for the assembly. An upstand built on site should have a maximum U-value of $0.35W/m^2 \cdot K$.
14. For external fire doorsets, as defined in Appendix A of Approved Document B, Volume 2, in new and existing non-domestic buildings, a maximum U-value of $1.8W/(m^2 \cdot K)$ is permissible.

3.3 SUSTAINABLE DESIGN PRINCIPLES

3.3.1 Passive Design

Dorset Council have declared a Climate Emergency on 16 May 2019 and as a council to be carbon neutral by 2040 and has pledged to support the wider county to be carbon neutral by 2050.

In addition the need for Energy Security needs to be incorporated into the scheme by minimising the need for heating and cooling to the site.

The National Planning Policy Framework emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today.

Increased climatic temperatures directly drive the potential for overheating in buildings and design of building fabric to limit overheating will be assessed using the Fabric First hierarchy in the scheme design i.e. minimise heat exchange to and from the Environment.

The purpose of the TM52 calculations is limit the period overheating in summer to a maximum by using passive means so that cooling requirements can be minimised where possible to each space.

The TM52 overheating compliance criteria is as follows;

Criterion 1: Hours of Exceedance – 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% of the occupied hours.

Criterion 2: Daily Weighted Exceedance – To allow for the severity of overheating the weighted exceedance shall be less than or equal to 6 in any one day.

Criterion 3: Upper Limit Temperature – To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

Provided that compliance can be achieved, the TM52 calculations will provide guidance on:

a. Confirmation of glazed areas to limit heat gain to spaces.
b. Insulation and thermal massing properties
c. Incorporation of solar shading

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures to minimise the use of energy for cooling to the internal spaces.

The Knoll House project will be designed to ensure that the buildings are less vulnerable to overheating, including the following considerations

Minimise internal heat generation through energy efficient design

The project will be designed to best practice thermal insulation levels or better, full details of which are noted under 3.2.2 below. Good insulation assists both in reducing heat losses in the winter, and in reducing fabric heat gains in summer.

Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall

The predominately east-west orientation of the development naturally avoids excessive exposure to the southern sun –the hotel rooms and villas receive the majority of their natural daylight from these west or east aspects. This large easterly and westerly glazing offers good levels of natural daylight, whilst utilising balcony and roof overhangs to offer protective shading with additional brise soleil in some locations.

Glazing specification has been considered as part of the overheating risk and the specified new glazing will achieve an adequate g-values in order to assist in reducing overheating risk from solar sources.

Manage the heating and cooling within the building through lightweight construction.

The new build structure will be lightweight construction with high levels of insulation and low U values to assist in room thermal control and low energy consumption. Thermal response to heating and cooling demands will be assisted using the lightweight fabric solution and reduce in maximum demand periods.

The proposed cladding is predominately timber, zinc and curtain walling with stone at some ground floor areas.

Heating for each villas would be underfloor heating from low temperature heat pump sources.

View of central green space with solar shading to hotel guestrooms and villas

Shading to the Restaurant Areas – South East and North East Facades and Trees Foliage.

3.3.2 Thermal Specification

Kingfisher Resorts Studland Ltd have sought to design their re-development to contribute meaningfully towards local, regional and national carbon reduction targets. Their approach follows the energy hierarchy, which places good thermal performance second only to good passive design. Having maximised the opportunities for good design principles as outlined above, the intention being to deliver a build specification which exceeds the 'Be Lean' targets norms. This is shown in the Tables below.

Domestic Accommodation

Building Element	Typical 'Good Practice' specification/ Part L 2021	Proposed 'Be Lean' specification (new buildings)
Roof	0.11 W/m^2.K	0.11 W/m^2.K - Provisional
External walls	0.18 W/m^2.K	0.15 W/m^2.K - Provisional
Floors	0.13 W/m^2.K	0.13 W/m^2.K - Provisional
Glazing	1.2 W/m^2.K	1.2 W/m^2.K - Provisional
	g- value: 0.5 maximum	g-value: 0.4 - Provisional
Air Permeability (m^3/h/m^2 at 50 Pa)	3.0 -5.0	3.5 - Provisional

Commercial Accommodation

Building Element	Typical 'Good Practice' specification/ Part L 2021	Proposed 'Be Lean' specification (new buildings)
Roof	-	-
External walls	0.18 W/m².K	0.15 W/m².K - Provisional
Floors	0.13 W/m².K	0.13 W/m².K - Provisional
Glazing	1.6 W/m².K	1.4 W/m².K - Provisional
	g- value: 0.6 maximum	g-value: 0.5 - Provisional
Air Permeability ($m^3/h/m^2$ at 50 Pa)	3.0 -5.0	3.5 - Provisional

3.3.3 Heating, Cooling, domestic hot water

As outlined in detail in the 'Be Green' section below, the proposed scheme design is for a space heating and domestic hot water generation system based upon:

a. Site Wide 'Community' Energy Network to serve each block – instead of modular block solution
b. A central high efficiency Air-Source Heat Pumps (ASHP) instead of the benchmark gas boiler option.
c. Mutual use of the site heating network for block located High Efficiency Water to Water Heat Pumps (WWHP)
d. Domestic Hot Water using WWHP units connected to the Site Community Heating network.

The main driver for this is to reduce the carbon footprint from Gas Fired Heating to Electrically Driven Heat Pumps and this would be enhanced with the ongoing de-carbonisation of the Electrical Power Grid going forward

Mechanical cooling would be provided by WWHP's to those spaces where required and inject heat back into the Site Heating Network for other uses, such as Domestic Hot Water Heating.

3.3.4 Ventilation

Most areas will be provided with high-efficiency Mechanical Ventilation Heat Recovery (MVHR) units with summer bypass mode.

Villa Bedrooms/Occupied Spaces:

Natural Ventilation will be provided to bedroom areas by means of openable glazing/doors to allow for ventilation should guests require and linked to fan coil unit cooling operation via microswitches to prevent energy wastage.

Apartment and Hotel Guest Bedrooms/Occupied Spaces:

Natural Ventilation will be provided to bedroom areas by means of openable glazing/doors to allow for ventilation should guests require and linked to fan coil unit cooling operation via microswitches to prevent energy wastage.

Hotel Common Areas:

These areas will be provided with ventilation via MVHR units or inherent heat reclaim in air handling units to larger spaces to suit the application.

Basement and Service Area:

Enclosed Basement car park areas and the like would be provided with 100% fresh air where for compliance purposes and driven via exhaust fans and/or jet fans to expel smoke in the event of a fire or run at low speed based upon CO2 monitoring of the areas.

Multi-Storey Basement Parking would be naturally ventilated via cross flow of air on either side of the car park floor area. In addition the entry/exit ramp adds to the fire safety aspect of the basement area to void products of combustion and limit CO2 levels. Under soffit ‘shunt’ fans would circulate air towards the perimeter openings

Lower Ground and Basement service areas would be ventilated using air handling units with inherent heat reclaim heat exchangers.

Spa Block:

This block will be provided with ventilation inherent heat reclaim in air handling units to larger spaces to suit the application.

3.3.5 Lighting

All internal light fittings throughout the development will be dedicated low-energy/compact fluorescent fittings, and predominantly LED lighting with efficacy of 75 lm/cw.

PIR/presence controls will be used in all common areas and stairwells to ensure lights do no operate when not required.

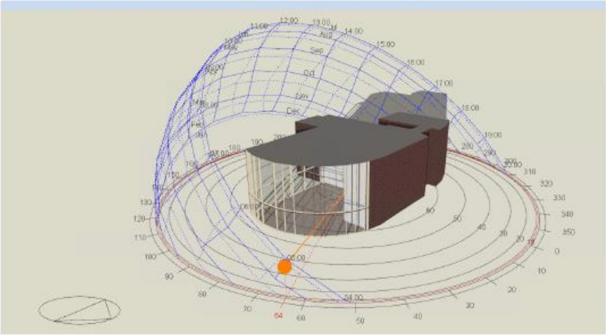
Villas, Apartments and Hotel Guest Rooms would be equipped with key card activated controls to operate the lighting and room heating/cooling functions. Ventilation to guest accommodation would be ramped up during occupancy.

3.3.6 Overheating analysis

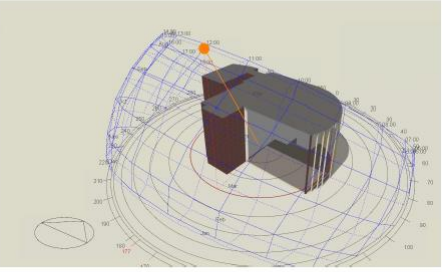
To minimise the amount of active cooling for occupant comfort, analyses will be done to design-out or reduce the cooling requirement to particularly sensitive spaces using comfort evaluations to determine potential areas that need cooling and shading.

Example: Spa Pool Area - Façade Designs
Addition of solar control to the facades – Scoping Study
The basic design has substantial south facing glazing and a study was done to evaluate the necessity for shading:

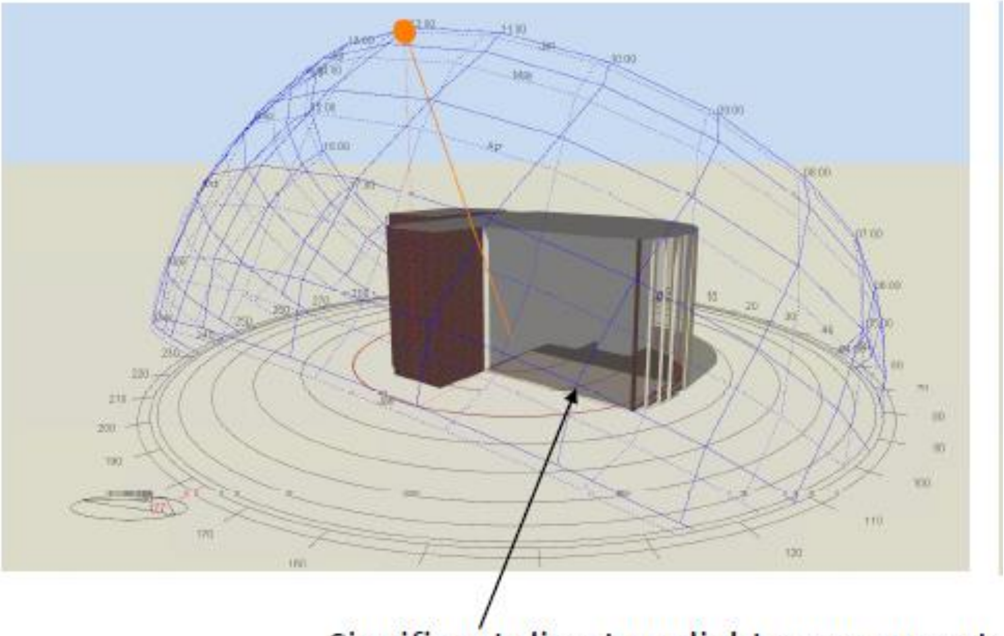
- Significant heat gain early morning (05:00) in summer
- Recommendation – Ventilation from 4:30 in the morning



- Direct sunlight on Swimming pool lounging area (11:00) in summer
- Recommendation – Direct solar transmission should be reduced to as close to 10% as possible as direct solar can increase the Operative temperature with 6°C for 40% transmission

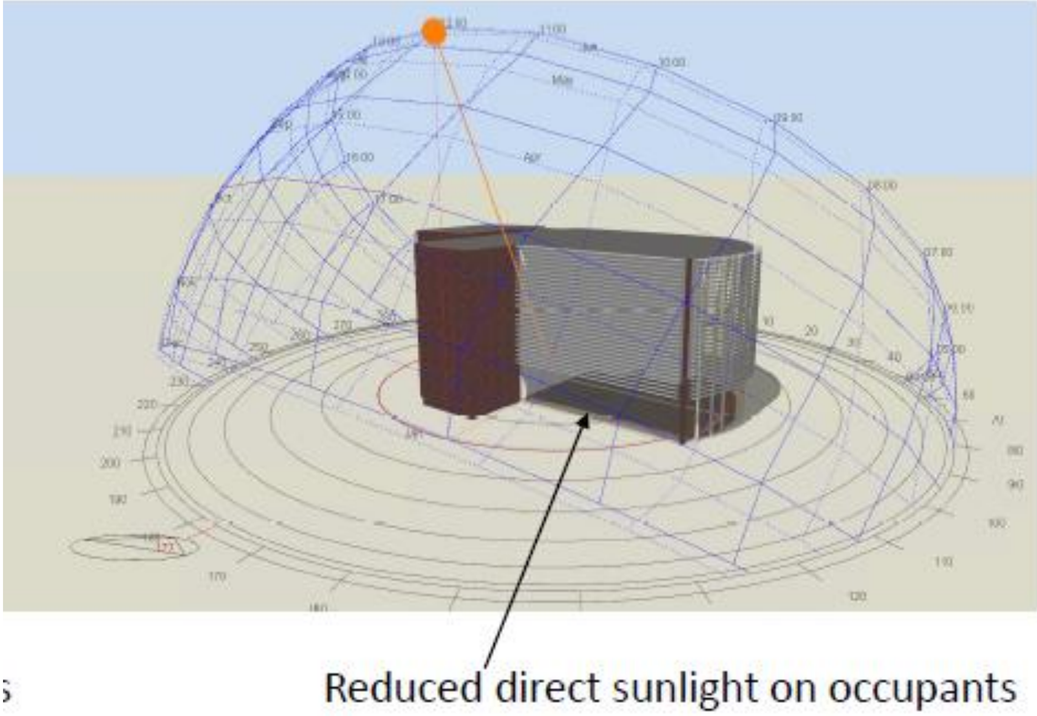


Proposed Application of Shading: Brise Soleil or similar (down to 2.5m AFFL) – South Elevation
Retained and new planting – East Elevation.
Elevation without Shading



Significant direct sunlight on occupants

Elevation with Shading (down to 2.5m)



Recommendations:

- The following is recommended
  - Performance glazing SHGC<0.2 or shading with the same effect
  - >=10ACH ventilation
  - Direct Transmission as close to 10% as possible because direct solar will increase the operative temperature significantly

4 SUPPLY ENERGY EFFICIENTLY ("BE CLEAN")

4.1 GENERAL

Once demand for energy has been minimised, applicants are required to demonstrate how their energy supply system will be designed to supply energy efficiently and reduce CO2 emissions, generally in accordance with the following hierarchy.

a) Connect to local existing or planned heat networks

b) Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)

c) Use low-emission Combined Heat and Power (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)

d) Use ultra-low NOx gas boilers

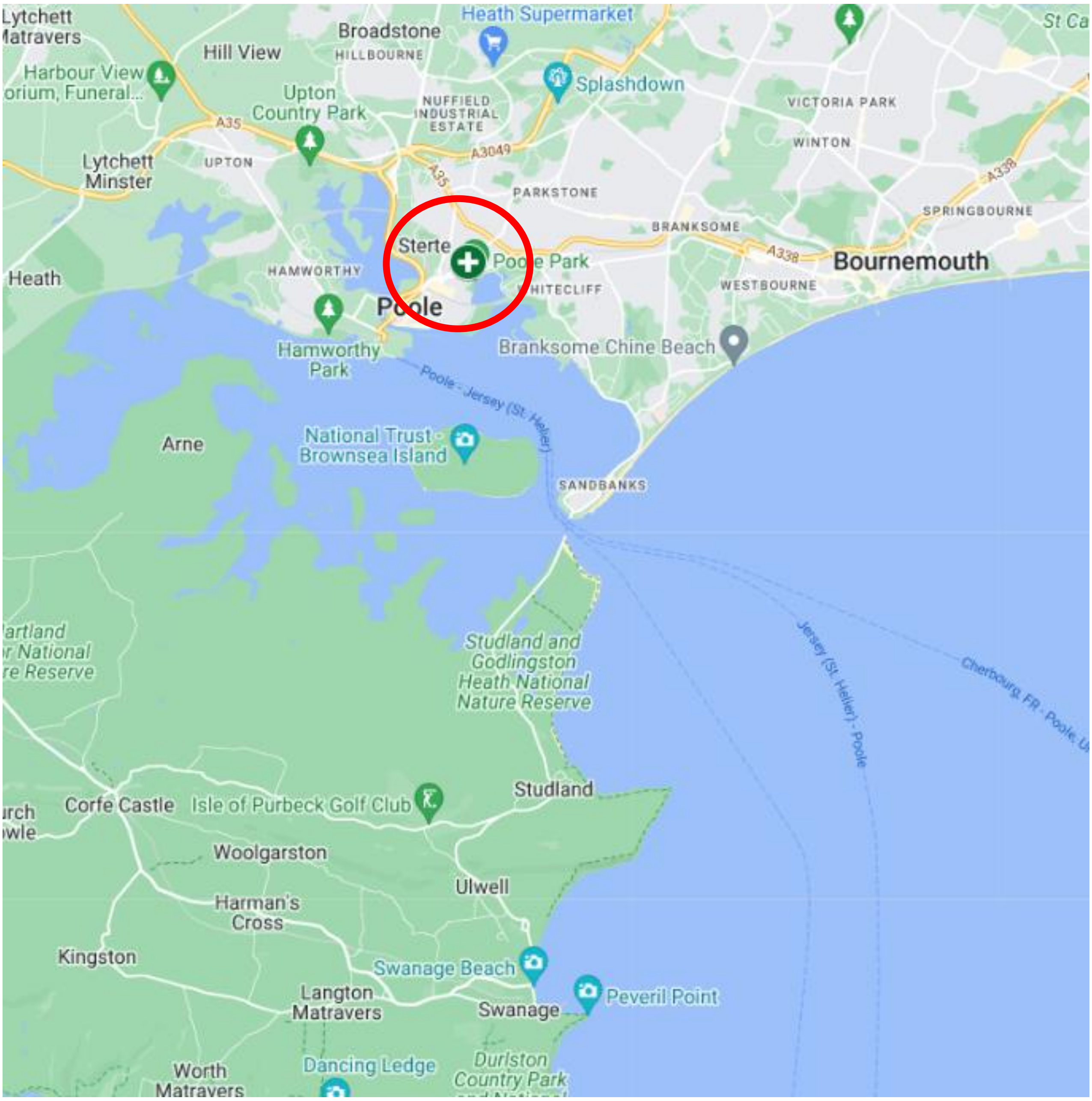
(CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements for improving air quality where appliable)

In accordance with this hierarchy, the following is an assessment of the feasibility of these energy supply options for this development.

4.2 CONNECT TO A LOCAL EXISTING OR PLANNED HEAT NETWORK

Examination of the Local Heat Map for the area around the site, there are not any district heating networks in the area that could provide a service to the site. The closest large scale network is Poole Hospital some miles away across Poole Harbour.

Ref to  on the map)



Due to the distance and difficulty in access to the local area heat networks this option is not considered a viable proposition.

4.3 USE ZERO-EMISSION OR LOCAL SECONDARY HEAT SOURCES

Section 5.3 below which identifies a system of highly efficient heat pumps to supply the site's thermal energy demands identifies in an efficient manner.

For operational and technical reasons there are not any local district networks that may become available in the current planning, however there is potential to create a low carbon or secondary heat network on the site, as proposed in section 5.2 below.

In the future, should a secondary heat source become available, the current scheme can be designed to accommodate a connection with interleading heat exchanger to facilitate connect at a later date, however, heating and cooling will be required for the purpose.

4.4 COMBINED HEAT AND POWER

Combined Heat and Power (CHP) can provide an effective and efficient means of generating heat and electricity on site, however, not all developments are suitable, and if the building is not suited to CHP then the energy and carbon emissions reduction benefits may be much lower in practice than anticipated, burdening the operator with an uneconomic and ineffective system for many years.

CHP is relatively well-suited to applications with well-matched and relatively constant thermal and electrical loads. This is not the case on this development where there is some synergy between heating and cooling loads from summer to winter but the site off peak season will have very low demands on the power and heating requirements that would make CHP energy efficient or economic.

Furthermore, with the current and expected further decarbonisation of the national electricity grid and the adverse differential opening up between gas and electricity carbon emission factors, gas-based schemes are not considered feasible in meeting carbon reduction targets.

CHP is therefore considered as an alternative energy supply option for this development if the mains power supply from the grid is insufficient or not viable.

Limitations of CHP on this site are:
- Limited site space and location for a CHP will have to be planned.
- Safe operation of a CHP on hotel site will be accommodated
- Site storage and use of oil or LPG are needed to be done safely
- Night time noise in a quiet natural setting would need to be incorporated

4.5 ULTRA-LOW NOX GAS BOILERS

As noted in section 4.4, the current and projected widening of differential between gas and electricity carbon emission factors means that gas-based schemes cannot compete with electricity-based schemes in terms of meeting carbon emission reduction targets, and therefore any form of gas-fired boiler scheme has been rejected.

4.6 CONCLUSION

The proposed site energy supply proposed is an all electric mains power supply from the local utility provider to supply an efficient system to heat pumps and the like with the following benefits:

- Over time the national power network will become more efficient as the grid becomes de-carbonised
- Local ‘low energy networks’ are not available.
- CHP options are becoming less beneficial in terms of energy unless there are compelling reasons to the contrary

5 RENEWABLE ENERGY (“BE GREEN”)

5.1 GENERAL

A range of currently available renewable technologies have been assessed for their potential suitability for incorporation into the Euro House scheme. A number of technologies such as were considered:

- Wind turbines

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The site is surrounded by other properties of similar height in all directions. To overcome these obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and project site itself.

It is inconceivable that any wind turbines of this size would be considered acceptable in this location adjacent to the site for aesthetic and landscape impact reasons.

- Ground Source Heat Pumps

The use of a ground source heating/cooling system will therefore require:

- Vertical borehole or ground loop
- Use of under floor heating
- Space for heat pump unit

There is potential for GSHP and collector loops to be installed before construction and this option will be investigated thoroughly as the design proceeds.

Normally the boreholes would need to be 6 to 8 metres apart, however, the performance can only be verified once on site due to variable sub soil conditions for heat transfer. The borehole should also be formed around 3m away from the perimeter of building limiting the potential for holes to be drilled and most specialists don't recommend using the structural boreholes for heat reclaim purposes.

The site has potential for ground source collectors during construction and needs to be verified.

- Air Source Heat Pumps

The use of air source heat pumps need:

- Large footprint to provide low temperature heat (unlike boilers that are compact)
- Need to be on the exterior of buildings for operation or inside large plant areas
- Need acoustic treatment in close proximity to loads

For the site. Modular use of ASHP's are not viable due to space and acoustic constraints and a centralised arrangement would be required.

Temperatures for efficient operation are limited to a maximum of 60 degC for hot water generation and 6degC for chilled water generation, hence this system would need electric top-up heating for DHWS generation which would be wasteful of energy, unless used as part of a hybrid system.

ASHP's as the **sole** source of heating and cooling are an option that would not be completely efficient in use.

- Water Source Heat Pumps

The use of water source heat pumps need:

- A water source such as borehole water OR an ambient temperature heat network.
- To be located in plantrooms in the interior of buildings, preferably close the load.
- Separate pumped 'secondary' or 'tertiary' piped system to serve the loads

For the site, modular use of WSHP's are viable due to the distributed location of the loads provided that a low temperature heat network is available as an energy source

WSHP's as the sole source of heating and cooling are not an option unless used in coordination with a Site 'Community' Heat Network where ASHP's would be used as a hybrid solution as described below.

- Solar thermal

Solar hot water systems are displacing gas for DHW provision, and due to the low emissions rates of gas as a source of energy, it would require a very large system to compete with the off-setting of electricity use afforded by PV panels.

Since the development incorporates green roofs, the area available for solar thermal panels would/has already be required for the use of PV panels for compliance and CO2 offset and hence is not considered viable for this scheme.

The above systems have been accepted or rejected where they have been found to be technically or economically feasible for this particular development.

The potential carbon reduction benefit of those technologies considered to be suitable for this development (identified below) will be assessed, in accordance with the requirements for compliance with Part L.

5.2 PROPOSED SCHEME OVERVIEW

Introduction

Since the site is a varied occupancy space, the proposed scheme required needs to cover a number of variable scenarios in terms of heat and energy loads, layout and usage of each area as well as the external site energy networks available to supply the site.

The proposed scheme is a Site Community Energy Network and Heat Pump Technology with heat reclaim where appropriate.

Site 'Community Heat Network

The site consists of a range of heating, cooling and ventilation requirements and a preliminary evaluation has confirmed that the summer and winter loads are quite diverse across the site and creates major energy requirements to the site.

The challenge on the development is to:

1. Minimise the site maximum demand to the Electrical power grid
2. Utilise the mutual heat/energy requirements across this site for benefit and minimisation of site loads.
3. Ensure that seasonal variations can be accommodated efficiently during off peak periods

The proposal is to create a hybrid Site Community Heat Network by means of an ambient temperature ring main of piping that incorporates:

1. A Central ASHP plant to regulate the overall temperature of the Heat Energy Network.
2. Range of Remote modular WSHP's to provide heating and cooling to each block on demand.
3. Water circulation in a below-ground piped water energy network with branch tap-offs to each block
4. Daily and seasonal demand would be optimised using variable speed drive equipment (VSD) pumps and motor drives or switching off the modular plant when not in use.

As each block requires heating or cooling or domestic hot water generation then this will be provided by the 'Ambient Temperature' Community Heating Network Circuit.

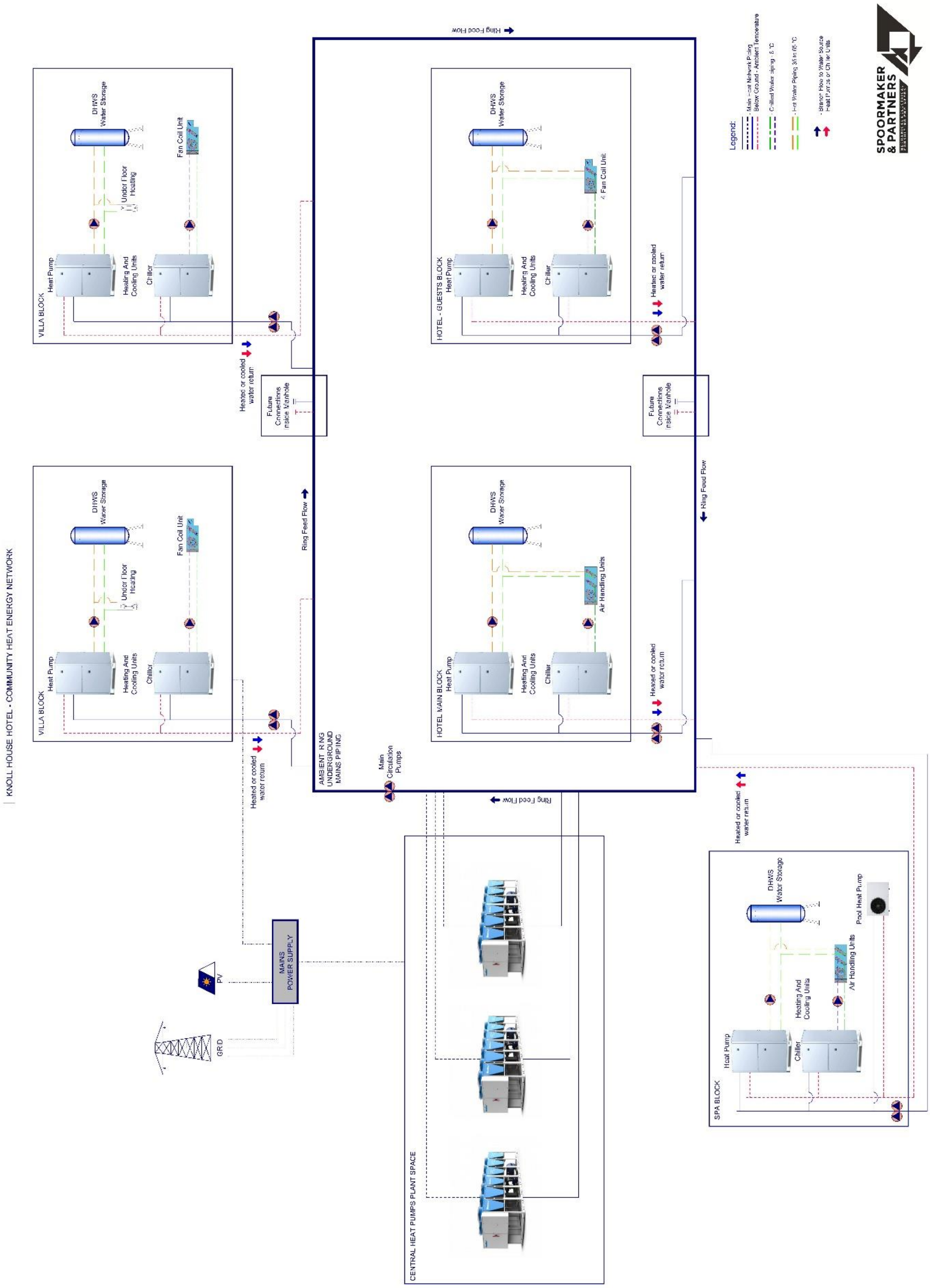
In the eventuality that the Network Circuit over heats or over cools then the Central Air Source Heat Pumps will provide the heating and cooling requirement to make up the deficit and to limit the fluctuations.

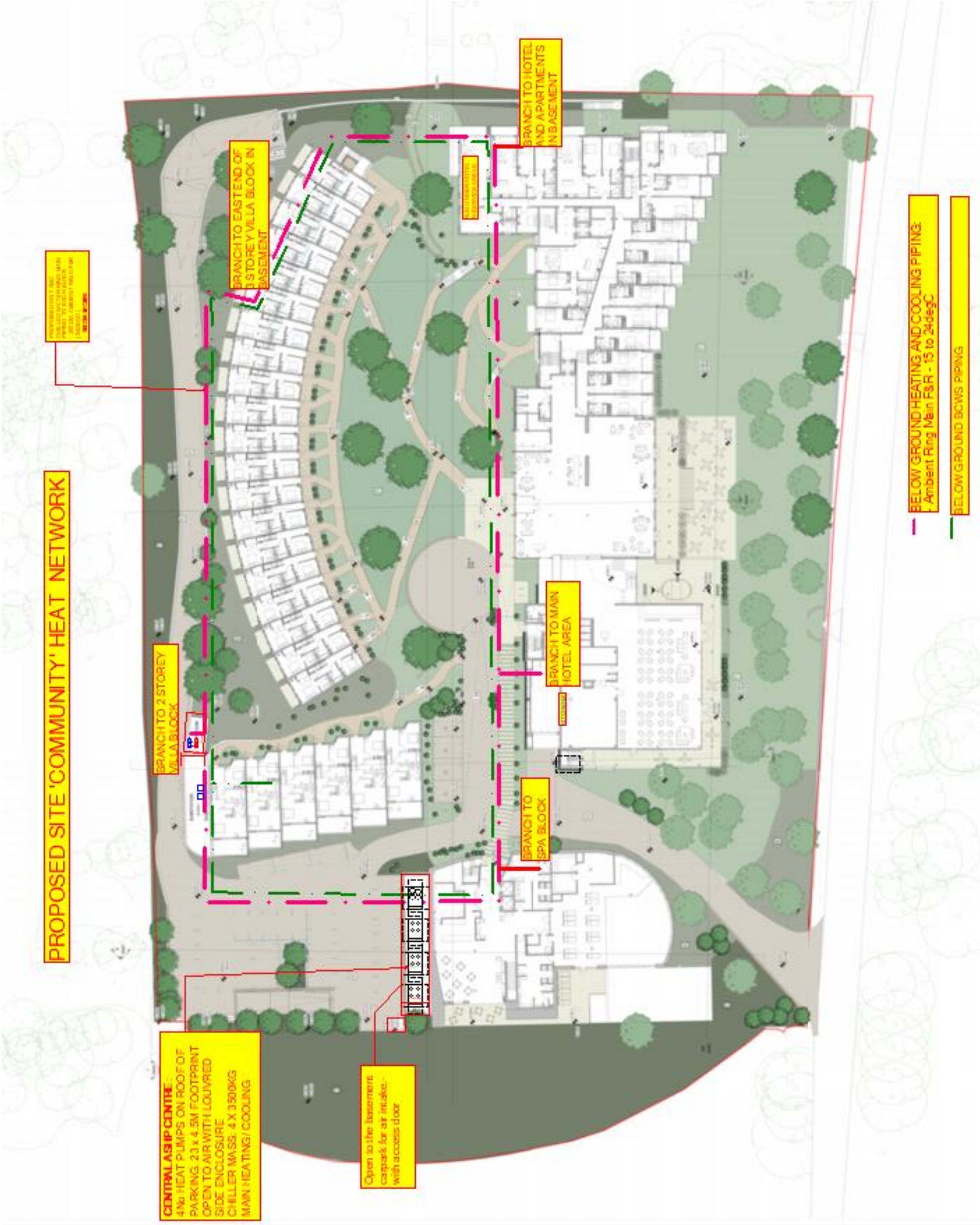
A preliminary energy load schedule has demonstrated the diversity of loads as follows

Conclusions are that:

Preliminary Peak Heating and Cooling Thernmal Energy Loads							
Block	Season	Winter		Mid Season		Summer	
		Heating	Cooling	Heating	Cooling	Heating	Cooling
		kW	kW	kW	kW	kW	kW
Spa		110	20	28	50	28	198
Villas 3 storey		265	29	67	73	67	290
Villas 2 storey		81	7	21	19	21	75
Hotel		189	43	48	107	48	426
Apartments		221	27	56	68	56	272
Deck Car Park							
Below Podium		26		7		7	
Individual peak load		892	126	227	317	227	1260
Combined thermal loads		766		90		1034	
Electrical Energy Loads		Winter		Mid Season		Summer	
SUM TOTAL- Small Power		477		477		477	
Mechanical Loads		436		90		598	
SUM Total Power Load		**913**		567		**1075**	
Potential PV Input Offset Peak		-10		-38		-75	
Preliminary Sum Total Power Load		**903**		529		**1000**	

- Summer Peak: the loads for heating and cooling have potential for heat reclaim
- Winter Peak: the heating load can be spread across the site to minimise the ASHP operation
- Mid season: the heating and cooling thermal loads are similar and the challenge is to optimise the heat reclaim from cooling to heating and vice versa.
- PV inclusion will assist with the summer maximum demand. (ref Annexure B)
- Overall Conclusion: Peak seasons occur for short periods of time and mid-season and off-peak operation occurs for most of the time – hence the proposed scheme would optimise the benefit of a common heat network piping system.


KNOLL HOUSE HOTEL - COMMUNITY HEAT ENERGY NETWORK
VILLA BLOCK
Heat Pump
Heating And Cooling Units
Chiller
DHWS Water Storage
Under Floor Heating
Fan Coil Unit
Heated or cooled water return
Future Connections inside Manhole
Ring Feed Flow
HOTEL - GUESTS BLOCK
HOTEL MAIN BLOCK
Air Handling Units
AMBIENT RING UNDERGROUND MAINS PIPING
Main Circulation Pumps
CENTRAL HEAT PUMPS PLANT SPACE
MAINS POWER SUPPLY
PV
GRID
SPA BLOCK
Pool Heat Pump
Legend:
SPOORMAKER & PARTNERS



The Site Community Heat Network is proposed as a viable option for this site due to:

- Site layout consists of a number of blocks with variable heating and cooling requirements

- Heat or Cooling from the various ‘blocks’ can be shared for efficient use of energy
- Low temperatures can be used with heat pumps for efficient energy generation
- Low loads in off-peak seasons can be accommodated efficiently using variable speed drives

5.3 MECHANICAL VENTILATION HEAT RECLAIM

Each area would be provided with a Mechanical Ventilation Heat Reclaim unit to provide fresh air and exhaust air facility to provide for the following:

1. Compliance with Part F of the Building Regulations.
2. Boost facility for nighttime cooling

Purge ventilation would be provided by openable windows (in the event of cooking smells and the like) to apartments and villas only. This would however need to be linked to window sensors to prevent waste of energy.

Each MVHR unit would consist of:

- Fresh air and exhaust air fans as well as associated air filters using EC motors.
- Enthalpy heat exchanger wheel for heat reclaim with an efficiency of 75%.
- Fresh air bypass for nighttime ventilation
- Range of BMS compatible on-board controls to allow for:
  - Constant airflow control
  - Automatic free cooling
  - Anti-frost system – hot water coil.
  - Open/ Close dampers
  - Alarms/ Time slot management connected to the BMS to site.

Larger spaces with central all-air heating and cooling systems would incorporate MVHR units within the design.

Fresh air would be supplied to the occupied spaces and exhaust air would be extracted from:

- Kitchens
- Bathrooms
- Spa/ Pool/
- Dining and Public Areas
- Guest accommodation.

5.4 AIR SOURCE HEAT PUMPS

Air-Source Heat Pumps (ASHP) provide an energy-efficient, low carbon means of providing space and hot water heating as well as cooling to the Site ‘Community’ Heat Network.

The ASHP’s would consist of a unit that would provide:

- Cooling to the ring main to limit the mains when at a high temperature
- Heating to the ring main to lift the mains when at a low temperature

The heat pump outdoor units will be located in an open air space below ground level, arranged for safe maintenance access and fully in compliance with manufacturer’s requirements for optimal efficiency.

5.5 WATER SOURCE HEAT PUMPS

Each block would be equipped with branch piping and connected to high efficiency water source heat pumps to provide:

- WSHP's to each space/block to provide Heating and Domestic Hot Water generation
- WSHP's to each block to provide cooling to Air Handling units, fan coil units and the like.
- Each WSHP would be located in plantrooms local to the load and connected to the community ring main.

Excess heating or cooling would be piped back to the central heat network to be used in other blocks or heated and cooled by the central heat pumps

The system for space heating and domestic hot water generation solution for the Knoll House Hotel Proposed Scheme would be based on high-efficiency WSHPs deployed as the central source of heating and cooling to the site.

WSHP with hot water cylinder

WSHP – Block cooling or heating unit.

Villas

Individual villa blocks would be equipped with WSHP modules that provide heating and DHWS capability in purpose made Utility Cupboard

Space heating would be provided via low temperature hot water to underfloor heating or radiators for winter heating.

DHWS would be provided from the same Villa heat pump unit up to 64degC

Separate cooling WSHP would be installed for summer cooling where required from a central unit to serve the block

Apartments

Space heating would be provided via low temperature hot water to underfloor heating or radiators for winter heating from a dedicated block WSHP

DHWS would be provided from a dedicated water source heat pump unit supply Water up to 65degC

Separate cooling WSHP would be installed for summer cooling where required from a central unit to serve the block

Main Hotel

Space heating and cooling would be provided from dedicated WSHP units to serve the various equipment on the site.

Terminal units could be fan coil units or underfloor heating systems to suit the various options operating at 35 to 40degC heating supply temperatures.

Site Wide Building Management System

A building-management system will be required across the site to control and optimise the operation the various energy systems.

The purpose would be to:

- Optimise the ambient ring temperature for summer and winter operation.
- Operate pumps and fans to the blocks and variable speed drives to save energy
- Shut down unoccupied spaces and run control systems for frost control and fungal growth minimisation.
- Control and shed load when loads put excessive pressure on the power grid.
- Control and optimise room temperatures

5.6 SOLAR PHOTOVOLTAICS

Solar photovoltaic (PV) systems generate electricity from sunlight, which is used to reduce the amount of electricity bought from the grid. The generated electricity is converted from direct into alternating current and connected to the incoming grid supply. This means that any surplus power generated and not used on site can be exported back to the grid. PV systems are relatively easy to install, and require minimal additional space in risers, for example. They are generally very low-maintenance.

For the Knoll House development, PV are proposed to the top level of the hotel and the roofs of the 3 bed villas. As the site is situated within an area of outstanding natural beauty these roofs are felt to be the most suitable for PV without impacting long range views of the site.

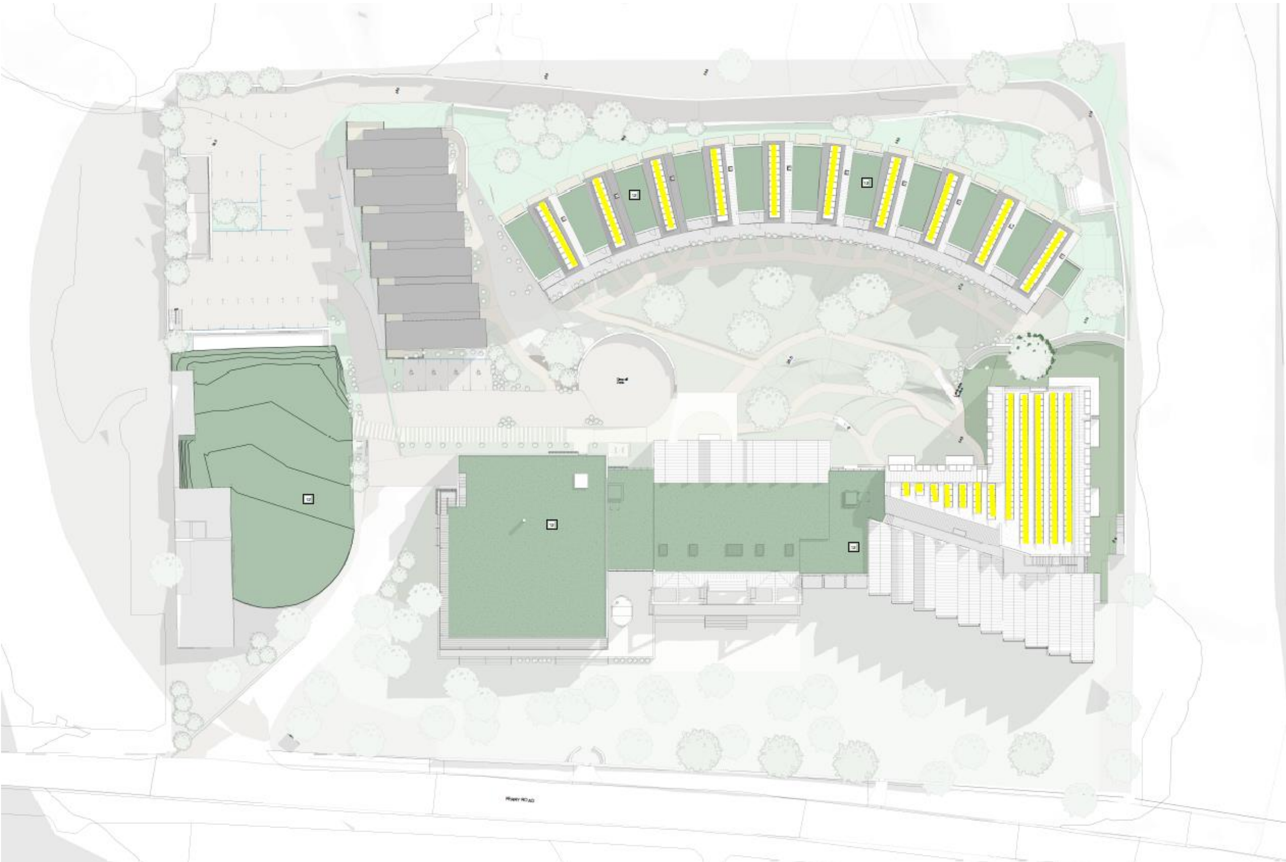
The PV arrays will be mounted at a fixed angle, aligned along the primarily East-West axis of the building, oriented approximately south west. It has been determined, allowing the other uses of the roof as identified from the plans, and allowing for safe and effective maintenance access that a maximum effective PV can be incorporated into the scheme as follows:

Apartment Roof : 385sqm

Pitched Roof: 440sqm

Approximate total PV power: 75kWe at peak summer conditions

Predicted Total Annual Energy Input to ‘Grid’ : 105,671kWh



Although PV arrays (in yellow) have been incorporated into the scheme to the maximum extent that roof space allows, and therefore makes a positive contribution to the generation of renewable energy and a real reduction in carbon emissions, the amount of PV array available is in fact unable offset the maximum load to the site and would only assist in minimising carbon emissions.

5.7 DOMESTIC APPLIANCES

To further reduce energy consumption, the Knoll House Hotel can adopt the Code for Sustainable Homes principles, providing A rated whites goods, ensuring all external lighting systems are high efficacy with appropriate daylight controls and providing local metering to enable FM teams to measure and manage their energy consumption.

6 MONITOR, VERIFY AND REPORT ON ENERGY PERFORMANCE (BE SEEN)

6.1 GENERAL

The proposed development will be equipped with systems and designs to assist in minimizing the use of energy on the site in line with the Be Seen strategy.

6.2 MONITORING

Energy usage and utilities usage will be monitored site wide by the introduction of remote meters at the strategic locations to verify the consumption, located but not limited to:

- Each major area would incorporate smart metering of:
  - Electrical power
  - Energy usage from the main hot water energy network
  - Water consumption.
- Main utilities:
  - Mains power – lighting, small power, external lighting, on site utilities etc.
  - Domestic Water
  - Central ASHP systems serving the common systems to the development.

Each utility would be compiled as an ongoing function of running the site to ensure that basic operation is recorded for the purposes of:

1. Advice Unit occupancy related to their individual energy and utility consumption.
2. Site usage of the various utilities for ongoing analysis and verification.

6.3 VERIFICATION

As part of the initial design the energy statement will need to be consulted to confirm the usage of energy and compliance with the targets set for the site along with the Design Parameters after further detailed designs are compiled.

Once the final design is complete and compliant, the metering results from section 6.2 can be implemented detail so that meters can in installed in the correct strategic locations to give detailed advice on site energy consumption.

Site BMS systems and the like will need to record the data electronically to compile an ongoing energy picture of the site to verify:

1. Usage is less than the targets
2. Deviations can be tracked and investigated expeditiously.
3. Billing can be correctly administered and recorded.

7 CONCLUSIONS

- Using a Lean, Clean, Green and Be Seen methodology an energy strategy has been developed for the proposed Knoll House Hotel development that uses Part L of the Building Regulations as a baseline for a better solution in the final design.

- A good specification for building fabric, driven by achieving and improving upon values of Part L of the Building Regulations would be the basis for the initial drive towards reductions in Energy and Carbon Emissions from the site.

- A hybrid system using a Site Community Network in concert with a central ASHP and WSHP's to the blocks along with PV panels on the roof will minimise the site energy consumption further from the baseline carbon emissions and energy usage.

- A set of energy efficient systems that will minimise energy consumption and provide power through the use of low carbon strategies (Photo Voltaics, MVHR ventilation, ASHP's, LED lighting and the like)

- A philosophy of how the proposed development would be monitored, verified and reported upon going forward once fully commissioned.

This report has detailed the baseline energy measures for the proposed development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO2 reductions using renewable energy technologies.

This is intended to be achieved using innovative design schemes to minimize the energy demand to the Electrical Power Grid with efficient systems and equipment throughout the site for peak and seasonal fluctuations whilst retaining the based efficiency possible and hence provide a site to minimize CO2 Emissions annually and seasonally.

APPENDIX A – PRELIMINARY SITE ELECTRICAL LOAD SCHEDULE

Knoll House				Date:	05/10/2022												
Electrical Schedule				Revision:	4												
						Lighting		Small power 1			Small Power 2			Other	Mechanical Loads		
			Floor Area	Block Area				See Note 2			See Note 3			See Note 1	Total Connected	Winter	Summer
Block No	Name	Level	(m2)	(m2)		W/sqm	W	Included	W/sqm	W	Included	W/sqm	W				
1	Spa	Basement	965			8	7720	no			yes	25	24125				
1	Spa	Ground	915.4			8	7323.2	no			yes	25	22885				
				1880.4													
2	Villas	Basement	427.7			8	3421.6	yes	15	6415.5							
2	Villas	First	1117.1			8	8936.8	yes	15	16756.5							
2	Villas	Second	976.1			8	7808.8	yes	15	14641.5							
2	Villas	Ground	1152.5			8	9220	yes	15	17287.5							
				3673.4													
3	Villas	First	433.4			8	3467.2	yes	15	6501							
3	Villas	Ground	442.6			8	3540.8	yes	15	6639							
				876													
4	Hotel	Basement	566.1			8	4528.8	yes	15	8491.5							
4	Hotel	First	1394.5			8	11156	yes	15	20917.5							
4	Hotel	Ground & Upper Ground	1778.1			8	14224.8	no			yes	25	44452.5	45000			
4	Hotel	Lower Ground	895.3			8	7162.4	yes	15	13429.5							
				4634													
5	Apartments	Basement	205.1			8	1640.8	yes	15	3076.5							
5	Apartments	First	1135.9			8	9087.2	yes	15	17038.5							
5	Apartments	Lower Ground	740.4			8	5923.2	yes	15	11106							
5	Apartments	Second	626.9			8	5015.2	yes	15	9403.5							
5	Apartments	Upper Ground	741			8	5928	yes	15								
				3449.3													
6	Deck Car Park	Basement	1020.1			8	8160.8	yes	15	15301.5							
6	Deck Car Park	Ground	1020.1			8	8160.8	yes	15	15301.5							
				2040.2													
7	Below Podium	Below Podium	685			8	5480	yes	15	10275							
				685													
8	EXTERNAL LIGHTING					8	10000										
	Grand Total			**17238.3**			**147906.4**			**192582**			**91462.5**	**45000**	**1032718**	**521116**	**728366**
														Connected Totals		Winter	Summer
												SUM TOTAL(kw lighting		477		477	477
Notes												Mechanical Connected		1033		522	729
1	HOTEL AND EV CHARGERS ACCOUNTED FROM 400A EXISTING SUPPLY											**SUM Total Connected P**		**1510**		**999**	**1206**
2	Small Power - General usage load																
3	Small Power - High usage load																

APPENDIX B – PHOTO VOLTAIC PANEL – EVALUATION REPORT.

10° tilt Knoll House, 50.64908236492205, -1.9575731169965314

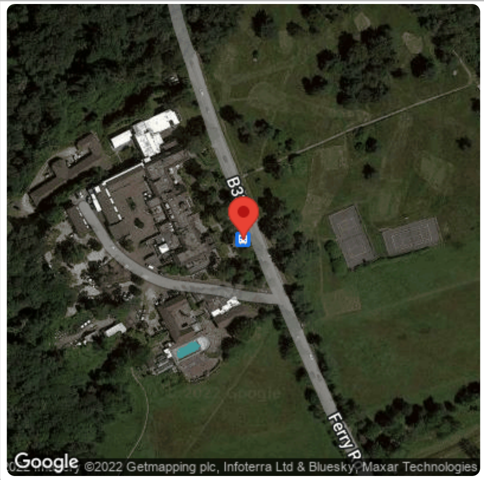
Report

Project Name	Knoll House
Project Address	50.64908236492205, -1.9575731169965314
Prepared By	Josh Landsberg [redacted]

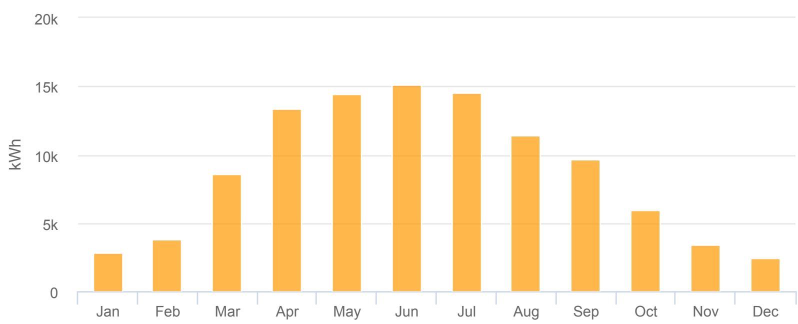
System Metrics

Design	10° tilt
Module DC Nameplate	93.8 kW
Inverter AC Nameplate	75.0 kW Load Ratio: 1.25
Annual Production	105.7 MWh
Performance Ratio	85.5%
kWh/kWp	1,126.4
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	c63c858adc-bad5307cc8-02875c082e-bc60561370

Project Location

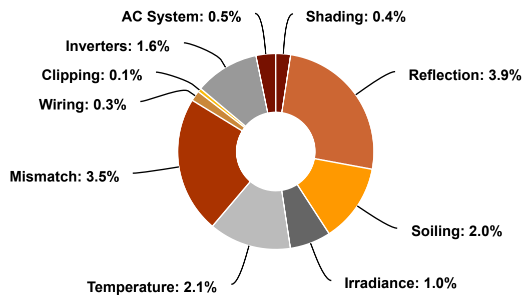


Monthly Production



Month	GHI (kWh/m²)	POA (kWh/m²)	Shaded (kWh/m²)	Nameplate (kWh)	Grid (kWh)
January	25.9	35.2	34.9	3,016.9	2,827.7
February	39.6	46.6	46.4	4,060.1	3,818.4
March	90.6	104.9	104.5	9,216.3	8,611.1
April	148.3	163.7	163.2	14,479.0	13,326.6
May	171.0	179.4	178.8	15,857.3	14,448.1
June	185.6	190.5	190.0	16,857.1	15,169.1
July	177.7	184.2	183.6	16,295.5	14,569.8
August	135.3	144.2	143.7	12,728.4	11,415.7
September	107.2	120.7	120.2	10,610.9	9,619.8
October	62.5	74.0	73.7	6,451.8	5,952.0
November	32.3	43.3	43.0	3,713.6	3,463.3
December	22.2	30.7	30.4	2,617.7	2,449.5

Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,198.1	
	POA Irradiance	1,317.3	9.9%
	Shaded Irradiance	1,312.3	-0.4%
	Irradiance after Reflection	1,260.7	-3.9%
	Irradiance after Soiling	1,235.4	-2.0%
	Total Collector Irradiance	**1,235.4**	**0.0%**
Energy (kWh)	Nameplate	115,904.7	
	Output at Irradiance Levels	114,694.8	-1.0%
	Output at Cell Temperature Derate	112,287.3	-2.1%
	Output After Mismatch	108,369.0	-3.5%
	Optimal DC Output	108,082.2	-0.3%
	Constrained DC Output	107,978.0	-0.1%
	Inverter Output	106,202.1	-1.6%
	Energy to Grid	**105,671.1**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		13.2 °C
	Avg. Operating Cell Temp		21.7 °C
Simulation Metrics			
		Operating Hours	4577
		Solved Hours	4577

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-3.06	-0.0533	1°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Trackers

Maximum Angle	Backtracking
60°	Enabled

Module Characterizations

Module	Uploaded By	Characterization
JKM530M-72HL4-TV (Jinko)	HelioScope	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization

Components

Component	Name	Count
Inverters	SUN2000-33KTL (Huawei)	1 (33.0 kW)
Inverters	SUN2000-42KTL (Huawei)	1 (42.0 kW)
Strings	6 mm2 (Copper)	10 (499.7 m)
Module	Jinko, JKM530M-72HL4-TV (530W)	177 (93.8 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	15-20	Along Racking
Wiring Zone 2	-	12-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Portrait (Vertical)	15°	187.87167°	0.0 m	1x1	10	10	5.30 kW
Field Segment 2	Flush Mount	Portrait (Vertical)	15°	181.03952°	0.0 m	1x1	10	10	5.30 kW
Field Segment 3	Flush Mount	Portrait (Vertical)	15°	175.11479°	0.0 m	1x1	10	10	5.30 kW
Field Segment 4	Flush Mount	Portrait (Vertical)	15°	168.08485°	0.0 m	1x1	10	10	5.30 kW
Field Segment 5	Flush Mount	Portrait (Vertical)	15°	160.93968°	0.0 m	1x1	10	10	5.30 kW
Field Segment 6	Flush Mount	Portrait (Vertical)	15°	154.55826°	0.0 m	1x1	10	10	5.30 kW
Field Segment 7	Flush Mount	Portrait (Vertical)	15°	149.12918°	0.0 m	1x1	10	10	5.30 kW
Field Segment 8	Flush Mount	Portrait (Vertical)	15°	141.70448°	0.0 m	1x1	10	10	5.30 kW
Field Segment 9	Flush Mount	Portrait (Vertical)	15°	134.28284°	0.0 m	1x1	10	10	5.30 kW
Field Segment 10	Flush Mount	Portrait (Vertical)	15°	128.12894°	0.0 m	1x1	10	10	5.30 kW
Field Segment 11	Fixed Tilt	Portrait (Vertical)	10°	154.5097°	2.0 m	1x1	77	77	40.8 kW

Detailed Layout