IN2

Health Service Executive (HSE)
Glen Abbey Ambulance Base

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Stage 2a Environmental Analysis Report

IN2 Project No. A2104
02/11/2022
REV05

Revision History

Date	Revision	Description
07/05/2021	00	Initial Draft issue for design team review
10/05/2021	01	Amended Section 3.2 and Appendix A
20/05/2021	02	Addition of Section 3.0 – Solar Gain, Section 4.0 – Limiting Overheating
03/06/2021	03	Updated to reflect revised U-Values and Proposed PV array
08/07/2021	04	Stage 2a issue
02/11/2022	05	Section 3.0 updated for release of BR 209 3rd Edition

IN2 Engineering Design Partnership operates a formal Integrated Management System, with certification to ISO: 9001 Quality Management System, ISO: 14001 Environmental Management System and OSHAS: 18001 Health and Safety Management System.

Registered Office: Unit E, Mount Pleasant Business Park, Upper Mount Pleasant Avenue, Dublin 6

Company Registration No.: 466565

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1.0 EXECUTIVE SUMMARY

This report compiles the energy analysis undertaken for the proposed refurbishment of The Belgard Ambulance Base, Belgard Road, Tallaght, Dublin 24. The analysis contained within the report is based on drawing information provided for the proposed extension to and refurbishment of the existing building.

Section 2.0 describes the methodology utilised, describing how advanced building and plant simulation software was utilised to determine the environmental performance and predicted energy usage for the development.

Section 3.0 outlines the Daylight Analysis methodology and results for each space across the proposed development. Median Daylight factors were found to be generally in excess of BRE Best Practice Guidelines.

Section 4.0 and 5.0 detail Part L Compliance assessments for Solar Gain and Limiting Overheating (CIBSE TM52), respectively. All spaces have been determined to be compliant under each criterion.

The predicted energy breakdown is analysed in Section 6.0 of the report, assessing both Building Energy Consumption and potential PV energy yield, as well as assessing particular Ambulance energy usage associated with both trickle and EV chargers.

The results of this energy analysis were then converted to CO2 emissions in order to determine whether a "Carbon Neutral" Performance would be viable for the development. The analysis found that this could be possible – however this would be predicated on maximising PV arrays across the site. The analysis also included for ambulance usage (trickle chargers and EV charging), which combined were determined to result in the building being marginally carbon positive – however, this was found to be minimal and other offsets – for example vehicle fuel in lieu of EV charging has not yet been accounted for.

Section 6.0 then includes a Part L Compliance check for the proposed development, which found that the building could be compliant allowing for wholescale omission of PV arrays – but only marginally so, therefore in the event of this omission, no other fabric upgrade or HVAC system upgrade dis-improvements could be viable.

However, the PV arrays were determined to be fundamental in ensuring that, despite the ambulance centre having an intrinsically higher energy usage than most buildings due to its 24/7 operational nature, a viable Carbon Neutral Performance can be achieved for the proposed development.

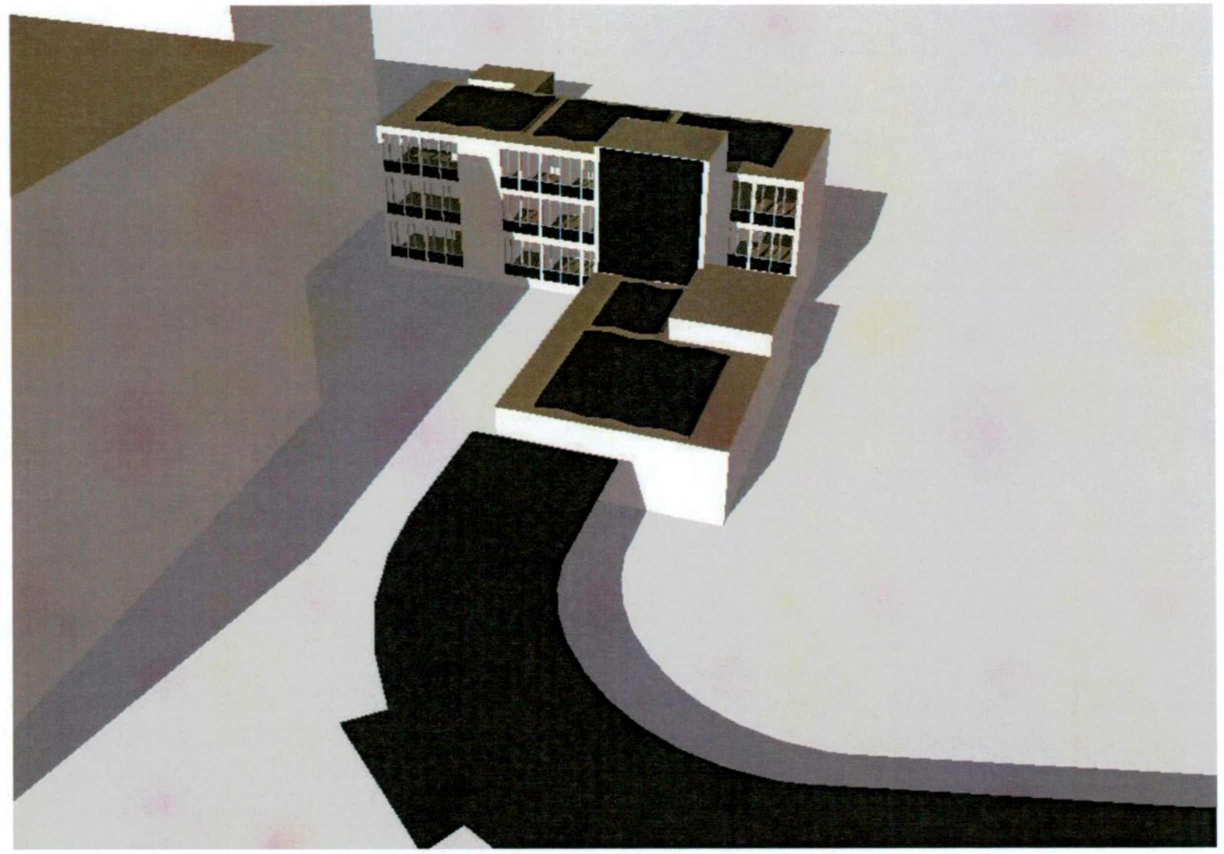


Fig 1.1 – 3D Model of Proposed Belgard Ambulance Base

2.0 METHODOLOGY

A dynamic simulation model of the proposed Belgard Ambulance base was created utilising TAS software.

This involved the creation of a 3D representational model of the existing building and extension, including geometry and site location.

The proposed building constructions and materials were applied, (including fabric upgrades as proposed) including fenestrations and glazing.

The dynamic simulation model was used to demonstrate compliance to TGD 2017 Part L (Solar Gain, Overheating, Cost Optimal Energy benchmarks).

Average Daylight Factors across all spaces were calculated in accordance with BRE Best Practice Guidelines. These values were then used within the simulation model to predict the reduction in lighting energy use by incorporating daylight dimming lighting controls.

The predicted operational usage of the building was applied to the model also, describing envisaged occupancy levels, lighting, equipment, hot water usage, etc. as well as HVAC plant operation.

These parameters were then utilised to determine predicted energy usage for the building as described in Section 6.0 below.

In addition, the simulation model was utilised to predict annual solar insolation to locations of proposed Photovoltaic (PV) installations, with associated PV generated energy determined.

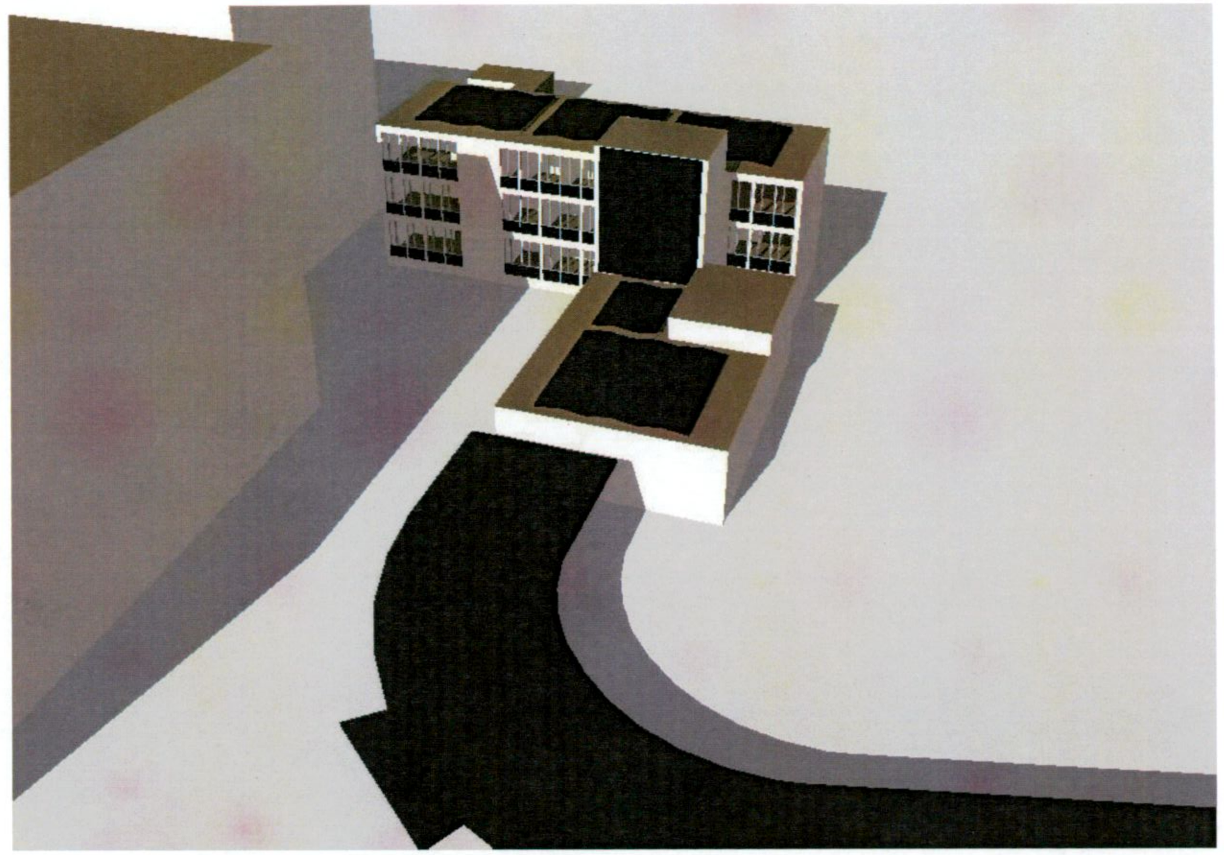


Fig 2.1 – TAS 3D Dynamic Simulation Model of Belgard Ambulance Base

3.0 DAYLIGHT ANALYSIS

3.1 Methodology

Daylighting analysis was undertaken for the proposed extension and refurbishment development using TAS software to determine Median Daylight Factors (MDF's) in accordance with BRE 209 3rd Edition, as referenced in the Sustainable Urban Housing: Design Standards for New Apartments (June 2022).

MDF's were determined for a CIE Overcast Sky equivalent to providing an external, unobstructed ground illumination level of 10,000 Lux. CIE Overcast skies are theoretical sky models, with brightness highest at the zenith and reducing to the horizon, but also unidirectional (as illustrated in Figure 3.1.1); therefore MDF's do not differ for façade orientation, with North facing rooms achieving identical metric performance to South facing, (all else being equal), as results account for diffuse natural light only and exclude any direct sunlight effects.

The daylight analysis accounted for all aspects that can potentially restrict natural light availability including any adjacent / opposing buildings, along with explicitly modelling Building Details (as illustrated in Figure 3.1.2) such as balcony structures, window frames, reveal and cill depth etc. in accordance with the architectural design.

The daylighting models were calculated based on the following assumptions regarding transmittance and reflectance (based on values as identified in BRE 209 3rd edition):

- Glazing Transmission = 68% with maintenance factor of 96%
- Ceilings: 80% reflectance
- Walls: 70% reflectance
- Floors: 40% reflectance

Daylight Factors for each space were then calculated for a working plane height of 0.85m on a 0.25 x 0.25 m grid basis with 0.3m offset, to enable a detailed calculation within each room, the medium value of which was then determined to calculate MDF.

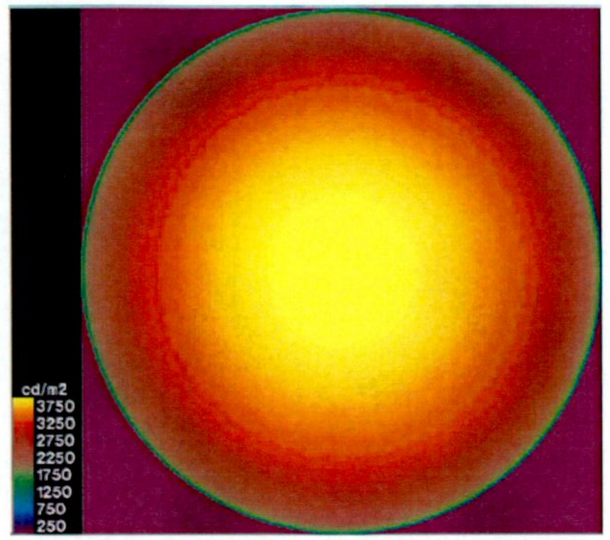


Fig 3.1.1 - CIE Overcast Sky as Viewed from Below

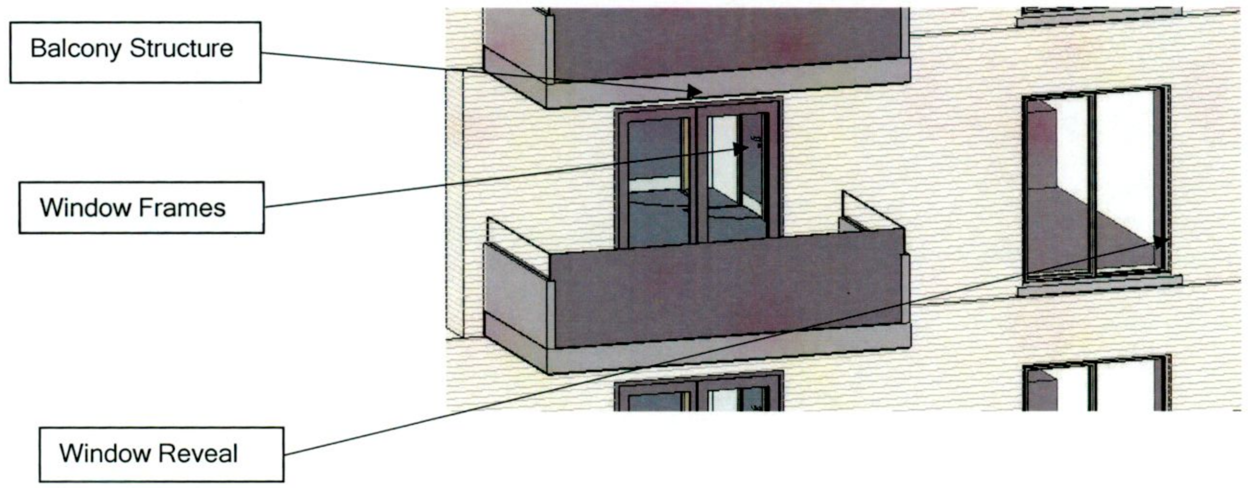


Fig 3.1.2 – Sample Building Details included within Daylight Analysis

Methodology (Cont'd)

For internal daylight assessments of commercial developments, BS EN 17037 gives three levels of recommendation for daylight provision: minimum, medium and high.

Since the daylight calculation uses an overcast sky model, the resulting daylight factors are independent of orientation and location. In order to account for different climatic conditions at different locations, BS EN 17037 gives equivalent daylight factor targets for each capital city in Europe. The values for Dublin are listed below:

Nation	Capital [a]	Geographical latitude φ [°]	Median External Diffuse Illuminance $E_{v,d,med}$	D to exceed 100 lx	D to exceed 300 lx	D to exceed 500 lx	D to exceed 750 lx
Ireland	Dublin	53,43	14 900	0,7 %	2,0 %	3,4 %	5,0 %

The relative level recommendations are met if both target daylight factors are achieved (the median daylight factor over 50% of the reference plane, and the minimum daylight factor over 95% of the reference plane) are achieved.

Level of recommendation	Target daylight factor D for half of assessment grid	Target daylight factor D for 95% of assessment grid
Minimum	2.0%	0.7%
Medium	3.4%	2.2%
High	5.0%	3.4%

We note the BRE guide should be seen as advisory only as the guide was developed for low density urban housing and was developed to inform design rather than to constrain it. Although the guide provides numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design.

3.2 Results - Ground Level

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Median Daylight Factors (MDF's). 2 out of 3 rooms were determined to be compliant at medium level of targeted illuminance.

	Low	Medium	High
> 50%	300 Lux	500 Lux	750 Lux
> 95%	100 Lux	300 Lux	500 Lux

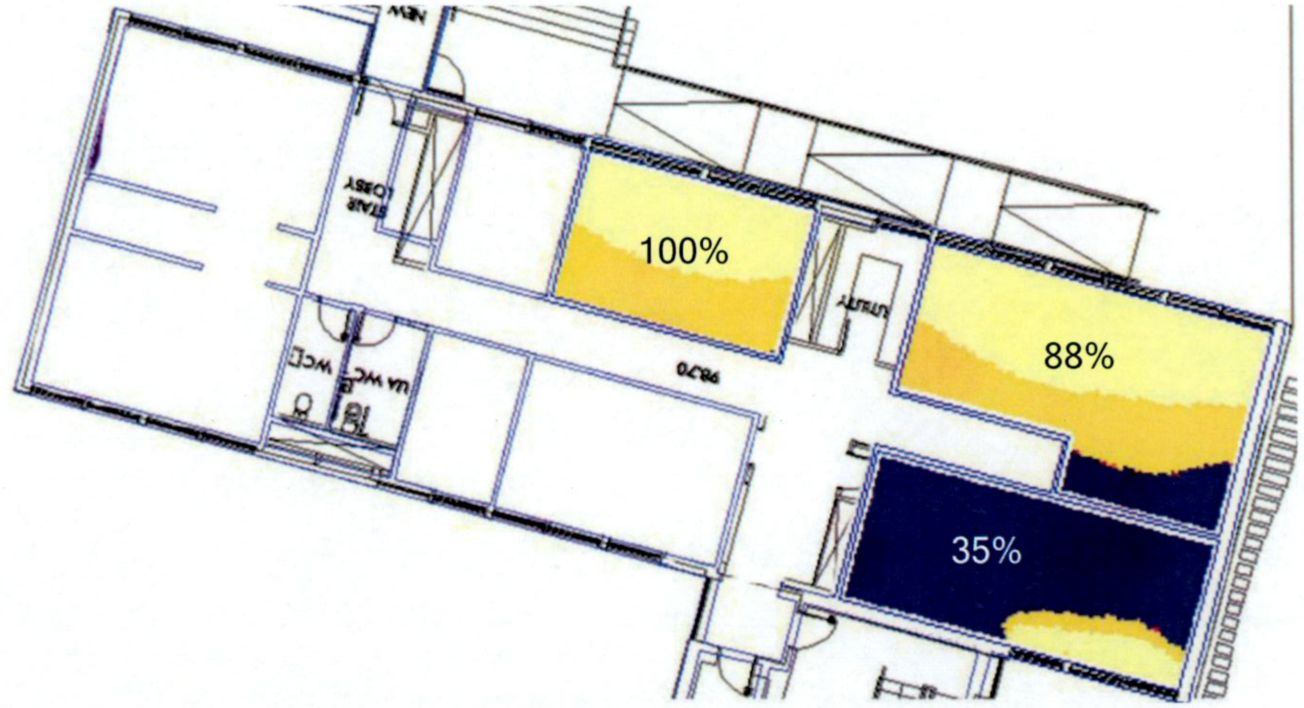


Fig 3.2.1 – Ground Level Daylighting Contours

D.F > 3.4% (Compliant at Medium Level)	
(orange)	> 50%
(blue)	< 50%

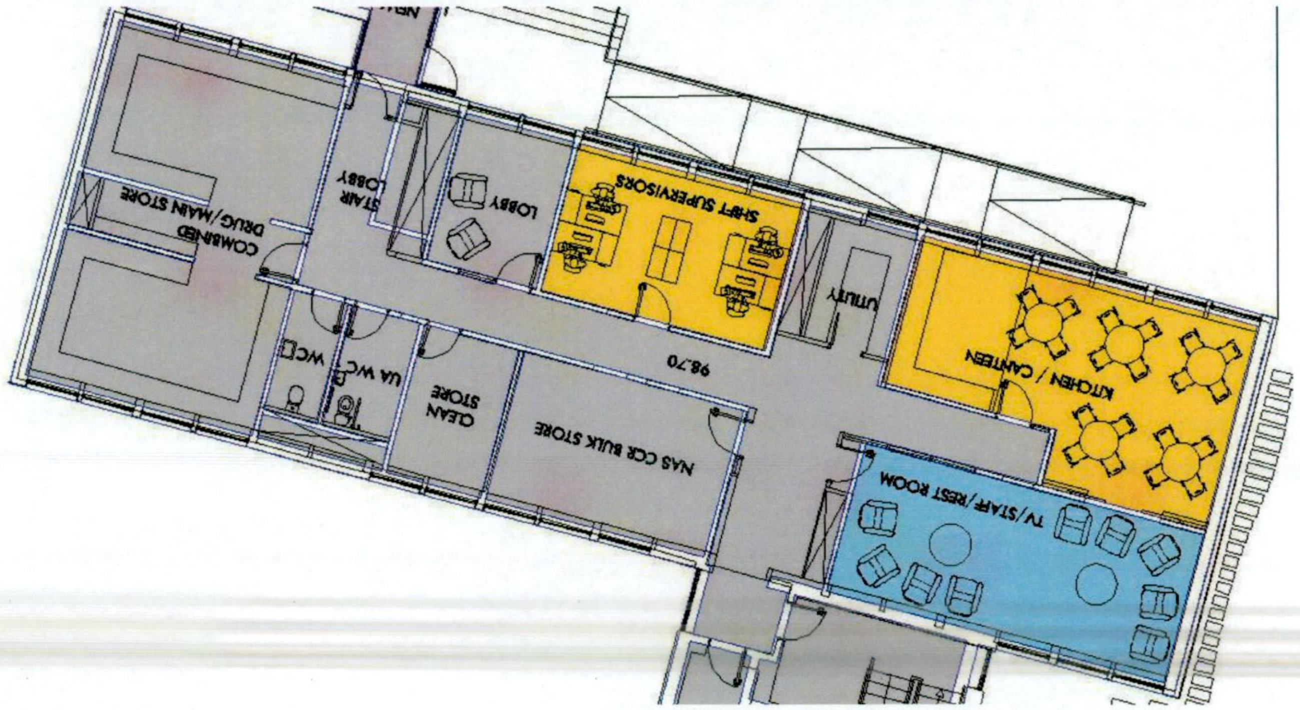


Fig 3.2.2 – Ground Level Daylighting Results

3.3 Results – 1st Floor Level

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Median Daylight Factors (MDF's). 7 out of 8 rooms were determined to be compliant at medium level of targeted illuminance.

	Low	Medium	High
> 50%	300 Lux	500 Lux	750 Lux
> 95%	100 Lux	300 Lux	500 Lux

Fig 3.3.1 – 1st Floor Level Daylighting Contours

D.F > 3.4% (Compliant at Medium Level)	
	> 50%
	< 50%

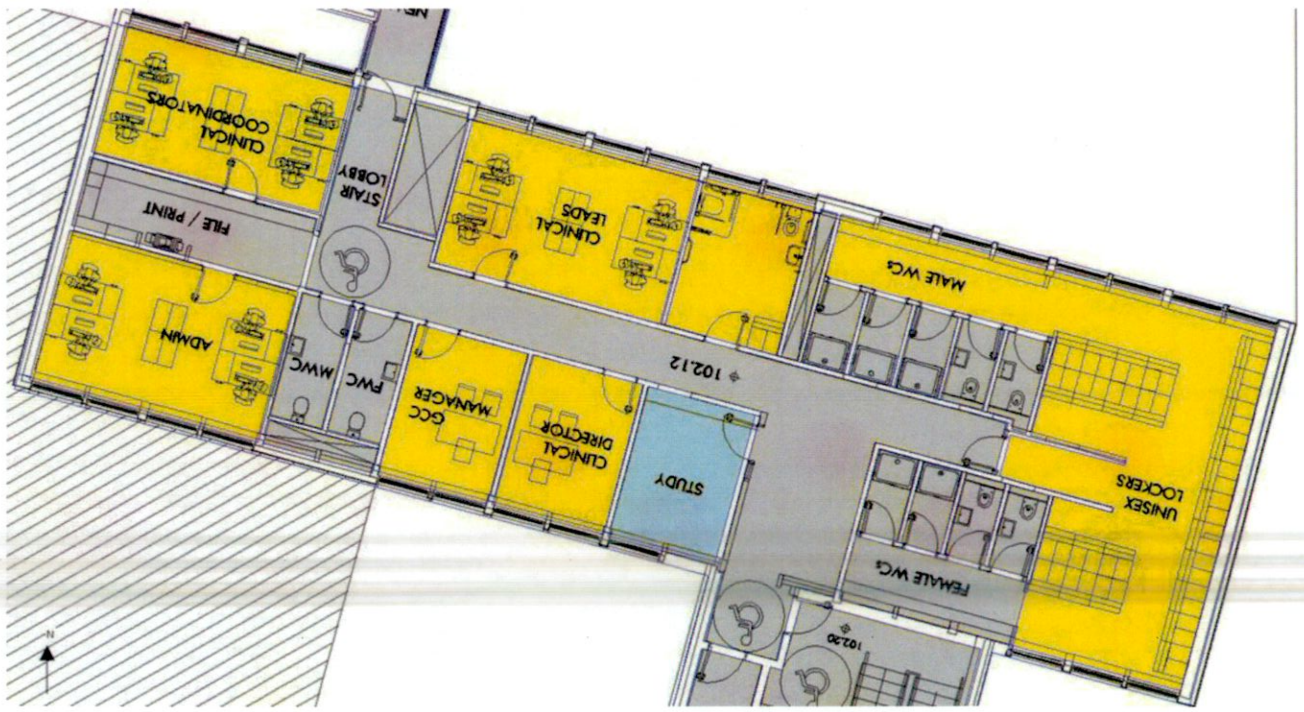


Fig 3.3.2 – First Floor Level Daylighting Results

3.4 Results – 2nd Floor Level

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Median Daylight Factors (MDF's). All rooms were determined to be compliant at medium level of targeted illuminance.

	Low	Medium	High
> 50%	300 Lux	500 Lux	750 Lux
> 95%	100 Lux	300 Lux	500 Lux

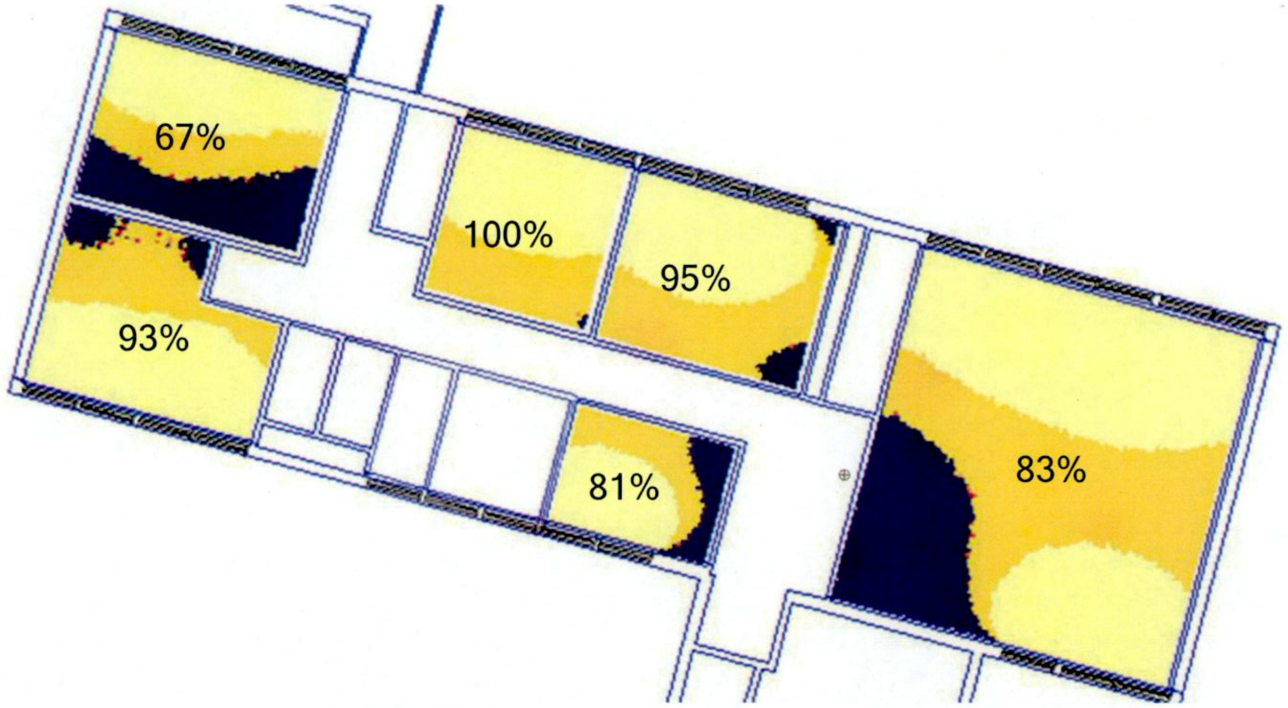


Fig 3.4.1 – 2nd Floor Level Daylighting Contours

D.F > 3.4% (Compliant at Medium Level)	
	> 50%
	< 50%

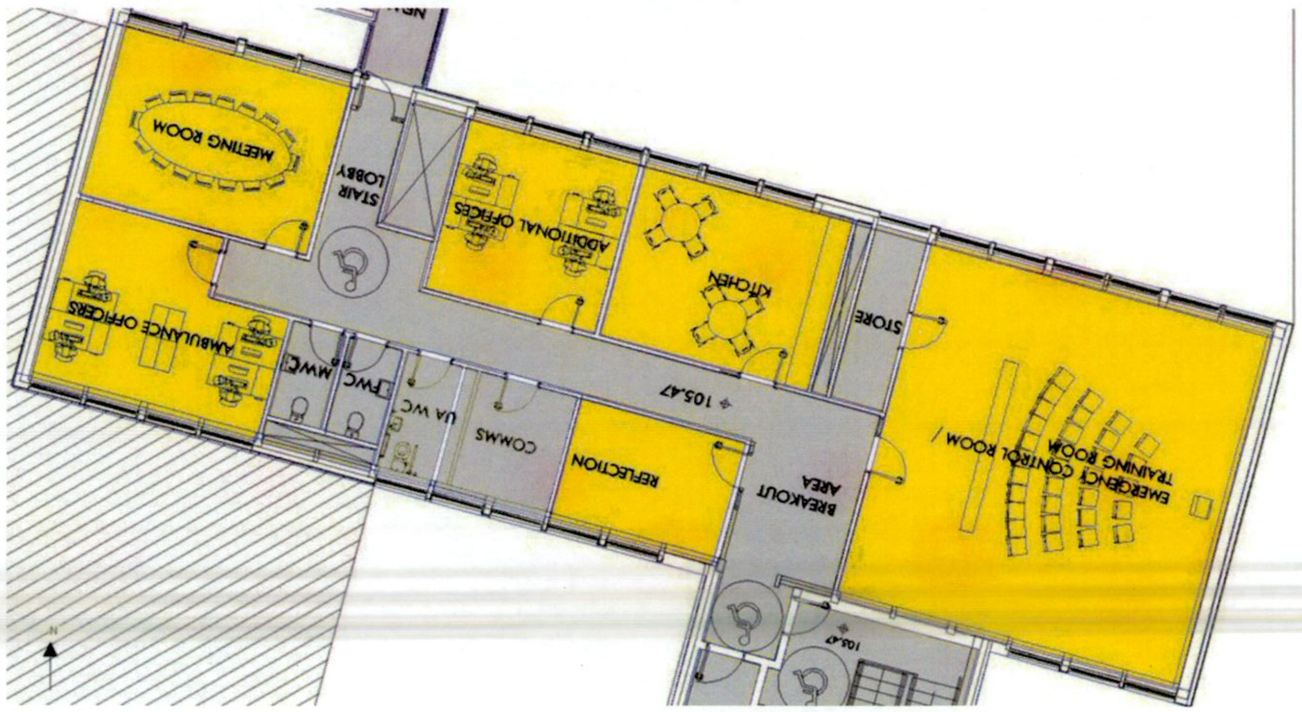


Fig 3.4.2 – 2nd Floor Level Daylighting Results

4.0 SOLAR GAIN

Part L of the Building regulations requires limitation of solar gain through the building fabric to minimise energy required for cooling.

Thermal analysis was undertaken for all occupied perimeter zones of the building using Dynamic Simulation Modelling (TAS software). This involved creating a 3D representational model of the building including its form, materials, and constructions, glazing and shading, both local and from neighbouring buildings.

Using the model, the annual predicted solar gain was calculated for each occupied space within the building and the result compared with the maximum allowable target.

A Solar Transmittance (g-Value) of 0.39 was assumed for all glazing. Based on this, full Part L compliance for solar gain was determined for all rooms.

Appendix A (Table A1) details results for each perimeter space, illustrating how compliance was determined.

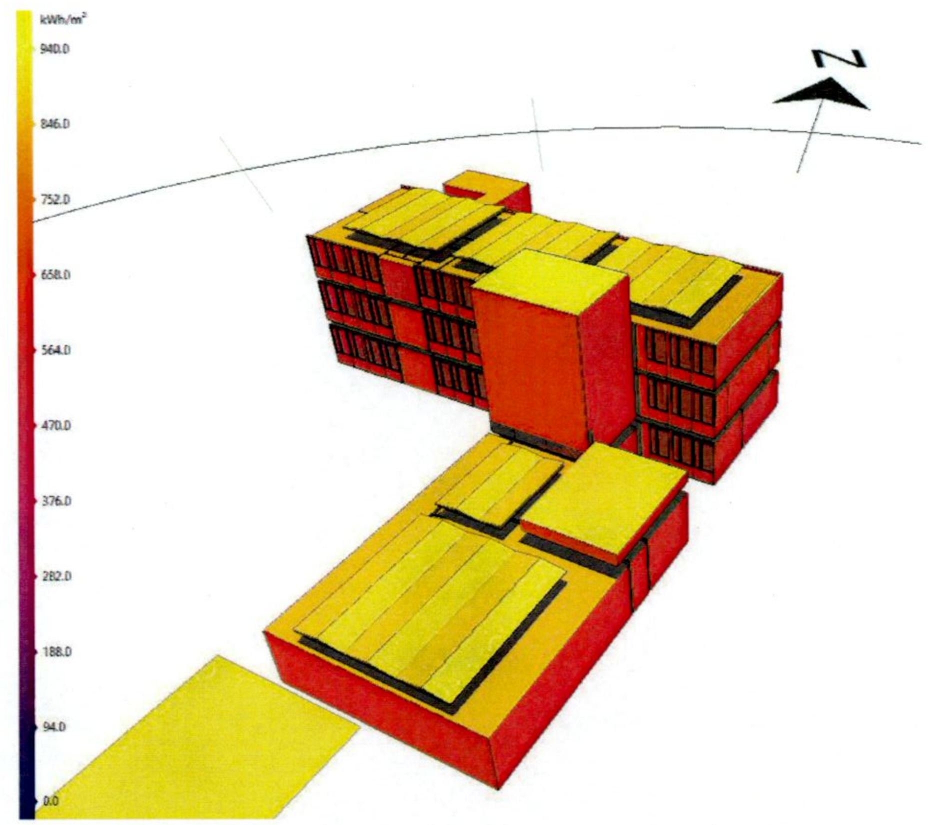


Fig 4.1 – External Surface Solar Gain, viewed from South

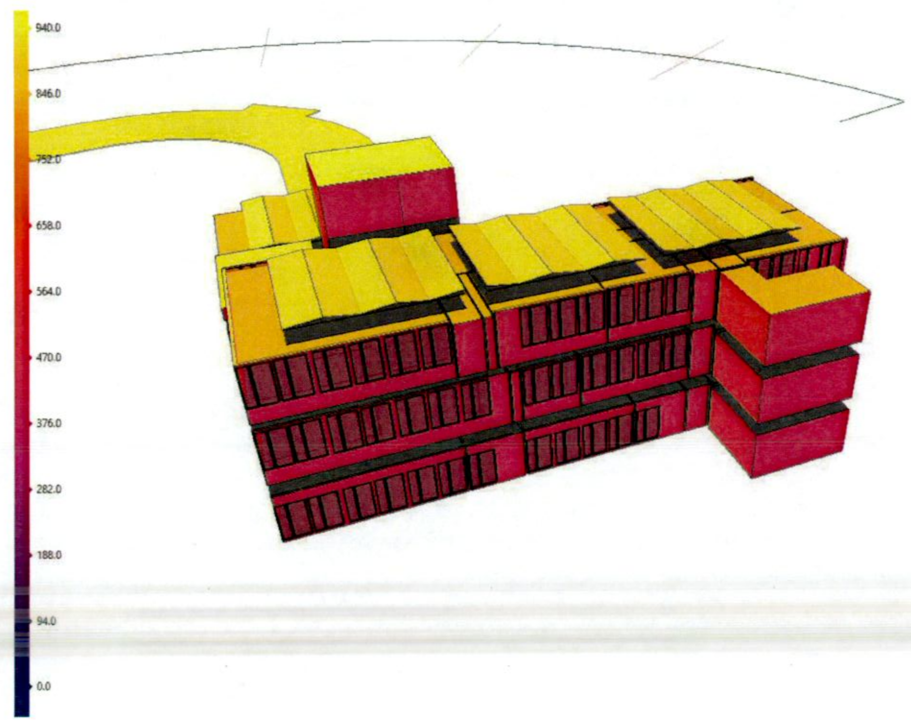


Fig 4.2 – External Surface Solar Gain, viewed from North

5.0 CIBSE TM52 – Limiting Overheating

TGD Part L 2017 of the Building Regulations requires compliance with CIBSE TM52 for Naturally ventilated buildings.

CIBSE TM52 is an adaptive thermal comfort methodology, in that it acknowledges that people will adapt to higher internal temperatures during continuous warm weather periods. Conversely, it accounts for that thermal discomfort will be experienced during cooler external conditions, or if hotter weather suddenly occurs. Whilst Design Summer Year (DSY) data is not available for Dublin (CIBSE DSY data derived for 14 UK locations only), the closest available location of Belfast has been used for this analysis. Figure 5.1 indicates the temperature profiles determined from the Belfast DSY. It can be that instead of having a fixed temperature for compliance, this (Comfort Range Max (T max) in Figure 5.1) varies in accordance with the prevailing external weather conditions. Therefore, higher temperatures in the cooler earlier months (May/ June) and September are penalised more than during July/ August.

CIBSE TM52 includes categorisation of comfort in accordance with people's sensitivity or fragility. Figure 5.2 indicates how differing categories are used depending on this expectation.

Category II in CIBSE TM52 is defined as "Normal expectation (for new buildings and renovations)" and was therefore applied to all occupied spaces within the analysis.

The CIBSE TM52 methodology is a comprehensive thermal comfort assessment, in that three sub-criteria are checked for compliance. At least two of these three sub-criteria must then be demonstrated to be in accordance with the methodology for compliance to be gained, the three sub-criteria are: -

- Summertime Hours: Sets a limit for the number of hours that the operative temperature exceeds the comfort temperature during the summer period (1st May to 30th September). The comfort temperature adjusting for prevailing weather so that higher temperatures are penalised during colder conditions etc.
- Peak Day: An assessment is made of how hot conditions would be throughout an extreme summer day (measured in degree-hours).
- Peak Hour: An absolute upper peak temperature must not be exceeded at any time of the year.

The assessment methodology therefore accounts for matters of thermal comfort not addressed when assessing a fixed temperature for compliance, for example, conditions could be generally warm in a room throughout the year and deemed tolerable, but extreme hot conditions could be experienced on a particular day / hour which may deem natural ventilation unacceptable.

The CIBSE TM52 assessment was undertaken for all naturally ventilated spaces within the building, allowing for Category II assessment of these areas. This analysis determined that two rooms did not meet the Peak Day assessment exceeding the maximum degree-hours. However, each of these spaces achieved overall compliance as they perform within the requirement targets of the other two sub-categories. The results are presented in Appendix B (Table B1). All naturally ventilated spaces are predicted to provide adaptive comfort in full compliance with TM52, provided the Free Area of Opening for windows in each space, as per Appendix B (Table B2), is achieved.

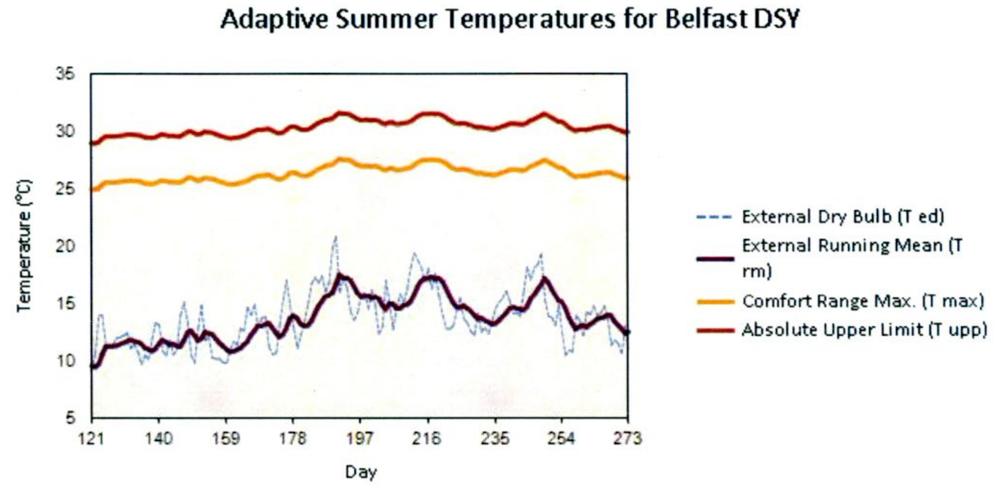


Fig 5.1 – Adaptive Summer Temperatures from May to September

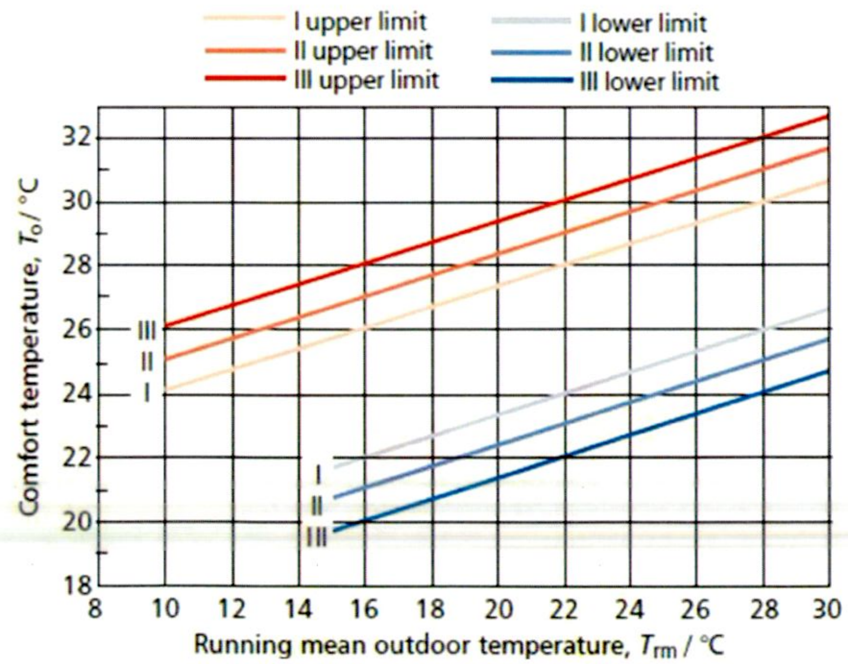


Fig 5.2 – Comfort Range Adjustment (CIBSE TM52 Fig. 6)

6.0 ENERGY BREAKDOWN

6.1 Building Energy

Both Regulated and Unregulated energy usage for the building was analysed, in order to assess the possibility of achieving "True Carbon Neutral" building performance.

Regulated energy usage comprises of heating, (domestic) hot water, auxiliary (fans and pumps), cooling and lighting, and is what is assessed to determine Part L 2017 Building Regulations Compliance and BER analysis. Unregulated energy usage includes all operational requirements; IT, computers, equipment, ambulance trickle / EV chargers, etc.

Heating loads were based on allowing for upgrades to the existing building fabric (insulation and glazing upgrades), as per IN2 Preliminary Energy Upgrade Analysis Report for the proposed development, and summarised in Appendix C.

Both Domestic Hot Water (DHW) and heating were assumed to be served by an Air Source Heat Pump, with an assumed seasonal efficiency of 3.19. The potential heating from water-to-water based heat pump had been previously analysed and found to provide similar performance.

A natural ventilation strategy is proposed for the majority of the refurbishment; therefore Cooling / A/C is minimal, only serving the IT / Comms room.

Heat recovery ventilation is proposed for the locker rooms / shower areas on the 1st floor.

Lighting loads were predicted to be relatively low, due to assumed highly efficient LED lighting with lighting control (photocell and PIR).

Fig 6.1.1 indicates the predicted monthly energy breakdown for these elements, with proposed PV instillation energy offset also indicated. It can be seen that, whilst there was some seasonal variation predicted for both heating and lighting (lower in summer months due to daylight availability), energy was determined to be relatively constant throughout the year – particularly for hot water (showers etc) and equipment, in contrast to PV generated energy. However, as can be seen in Fig 6.1.2, the annual building energy usage is offset by the annual PV generated energy.

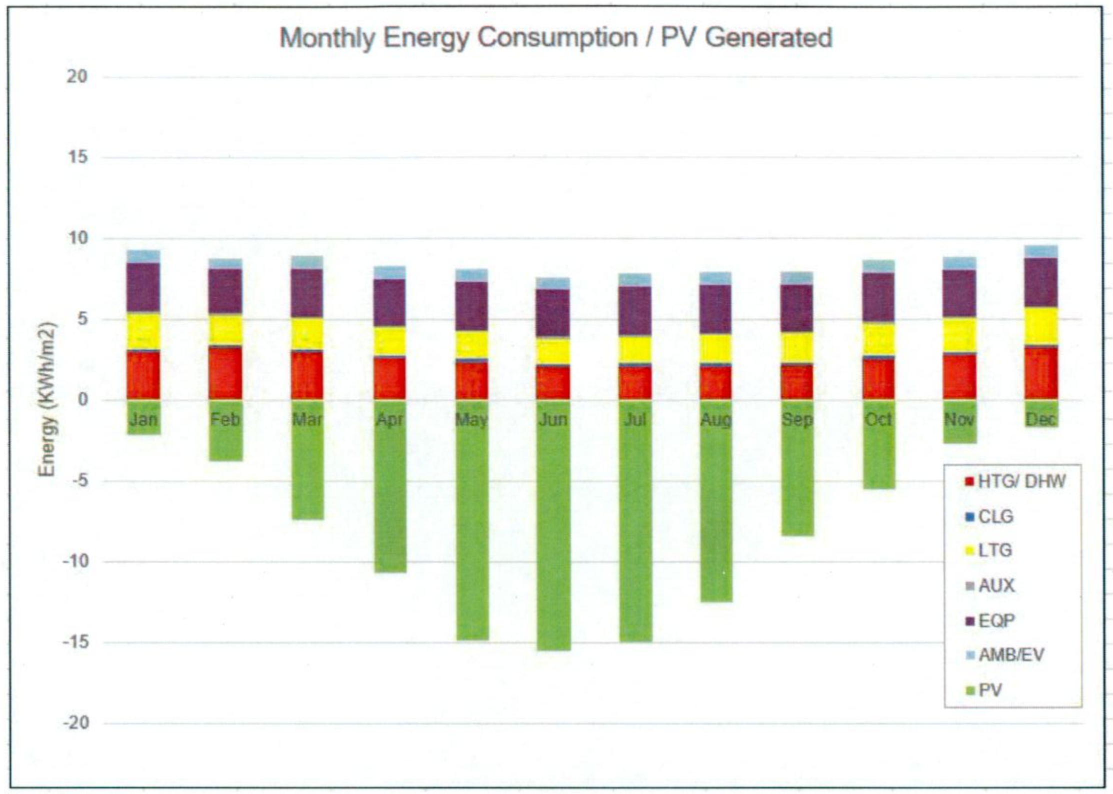


Fig 6.1.1 – Monthly Building Energy Consumption

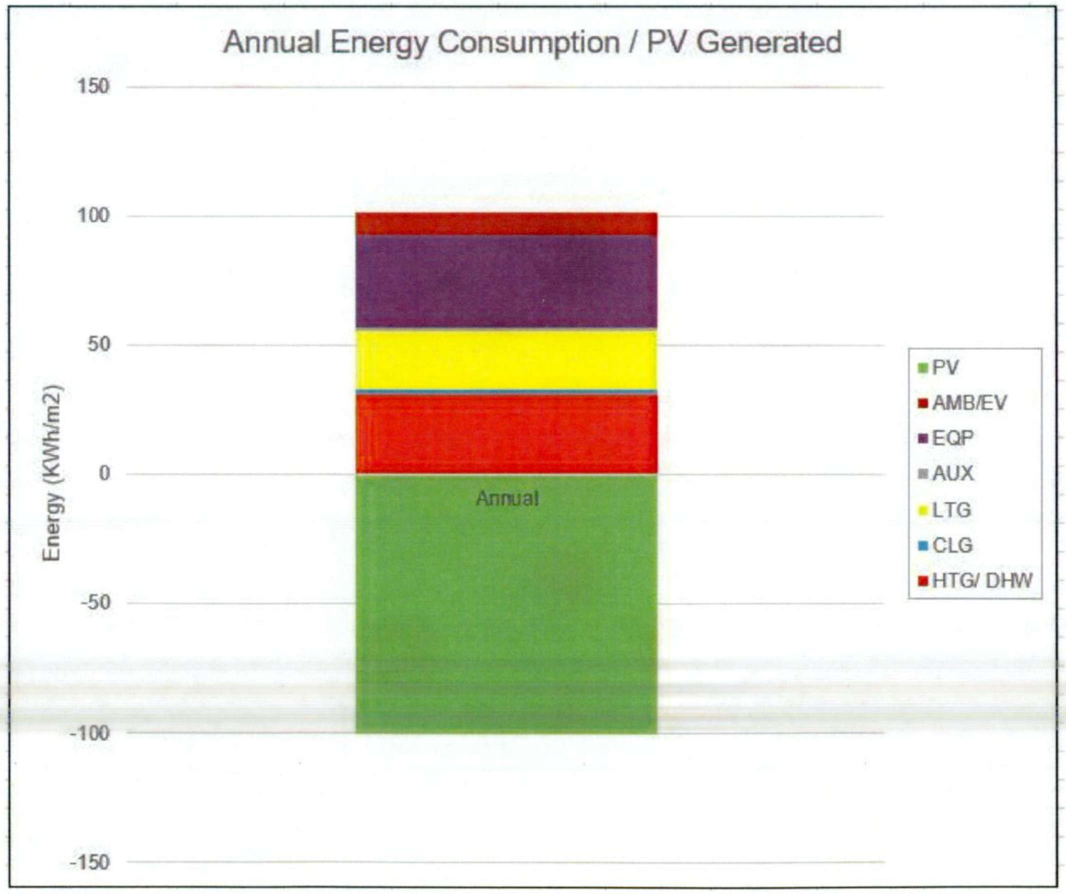


Fig 6.1.2 – Annual Building Energy Consumption

6.2 Photovoltaics

Renewable energy generation via Photovoltaic (PV) panels is proposed to reduce the carbon emissions from the building.

The analysis conducted to determine carbon neutrality viability assessed maximising renewable energy generation from PV arrays; spanning the existing roof, extension roof, south façade, staircore façade, and the parking canopy, as indicated in Fig 6.2.1. The results are based on an assumed overall PV system efficiency of 14.5%.

Predicted PV energy yield was determined, accounting for the proposed apartment block to be adjacent to the site, as illustrated in Fig 6.2.1. The total annual PV Yield per location is outlined in Fig 6.2.2. The proposed adjected apartment block was determined to have only a relatively minor impact on PV performance – with some overshadowing the West end of the existing roof – but practically no impact was determined to the proposed parking canopy which is aspected to the south.

This canopy was predicted to offer the largest solar yield, as illustrated in Figures 6.2.3 and 6.2.4.

The relationship between electricity generation from renewables and its consumption is investigated overleaf.

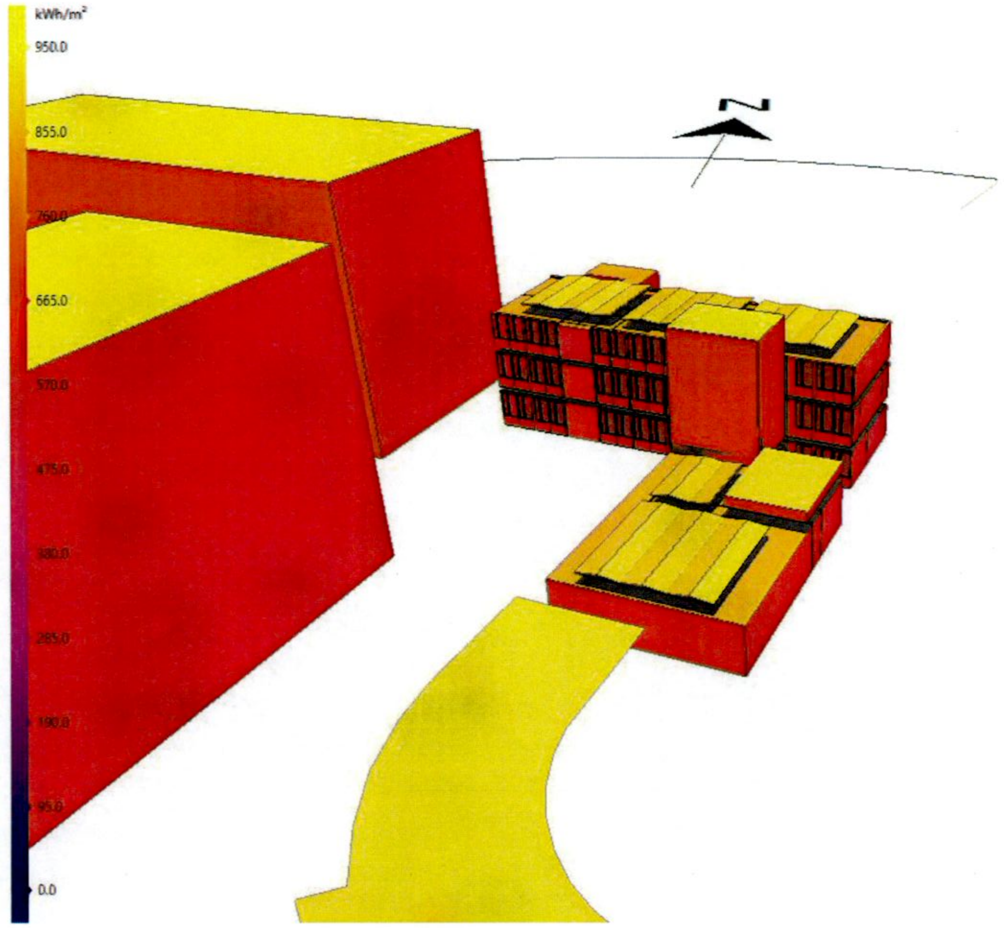


Fig 6.2.1 – Annual Solar Insolation

	Annual Solar Gain (kWh)	Area (m2)	PV Yield @14.5%	PV Yield/m2
Existing Roof	156,561	171	22,701	132.76
Extension Roof	95,389	105	13,831	131.73
South Façade	15,694	24	2,276	94.82
Staircore Façade	42,767	70	6,201	88.59
Canopy	516,026	547	74,824	136.79
Solar PV Glass		12	744	62.00

Total Yield = 120,577 kWh

Fig 6.2.2 – Total Annual PV Yield

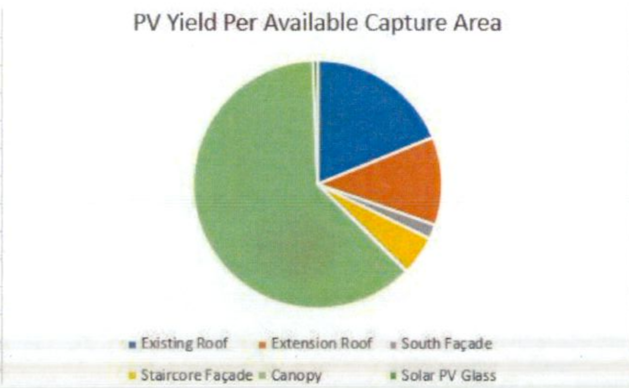


Fig 6.2.3 – PV Yield per Available Capture Area

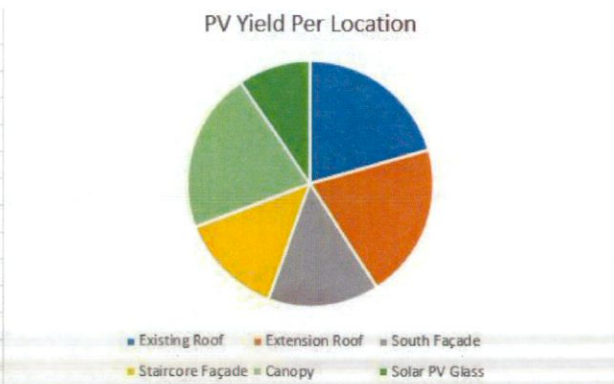


Fig 6.2.4 – PV Yield per Location

6.2 Photovoltaics (Cont'd)

Figure 6.2.4 indicates predicted annual electrical energy for PV and nett Grid imported, illustrated on a daily basis. Summertime electrical energy would essentially be PV generated, but wintertime less so- particularly heating requirements for ASHP during winter mornings when minimal (or no) solar energy would be available. Nevertheless, all of the annual electrical energy was determined to be possible to be practically offset by the PV (roof, canopy and wall arrays).

However, as can be seen in Figure 6.2.5, the PV array (roof/ walls) was predicted to be generally exporting to the grid. 59% of PV generated on-site is predicted to be exported to the grid. Whilst there is no mechanism at present from ESB to be renumerated for this energy exporting, the PV generation alone (irrespective of actual utilisation by the building) is accounted for within Part L and BER methodologies, facilitating also the building towards achieving Carbon Neutrality.

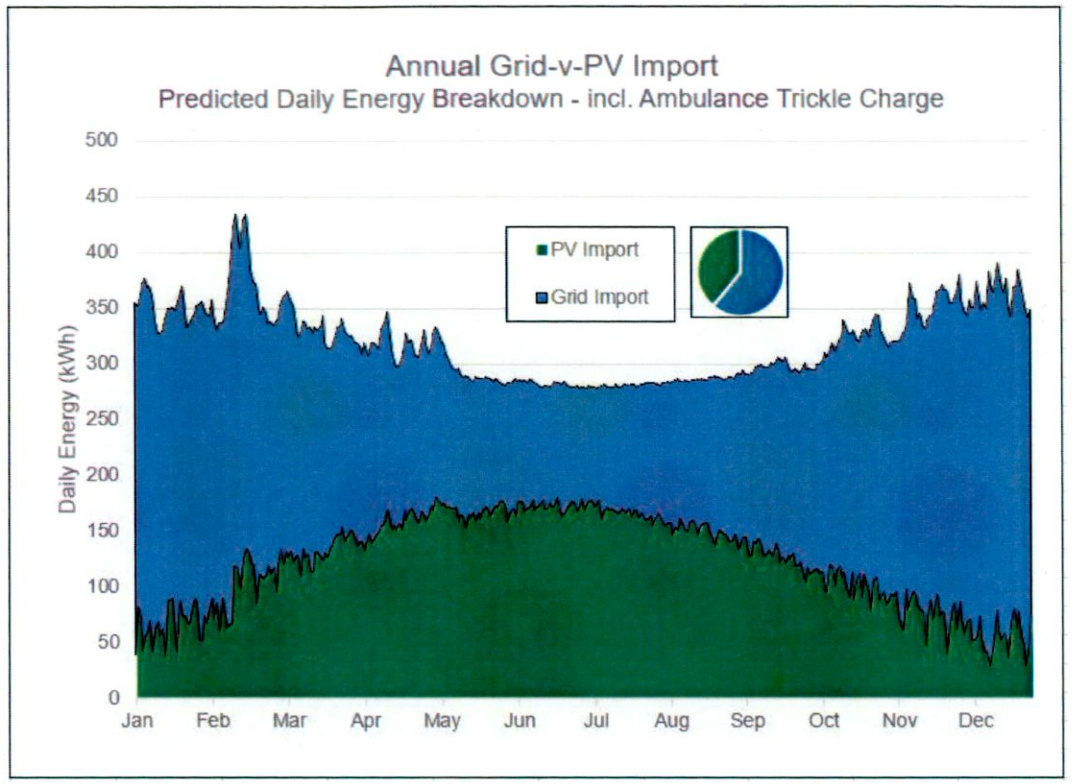


Fig 6.2.4 – Annual Grid vs PV Import

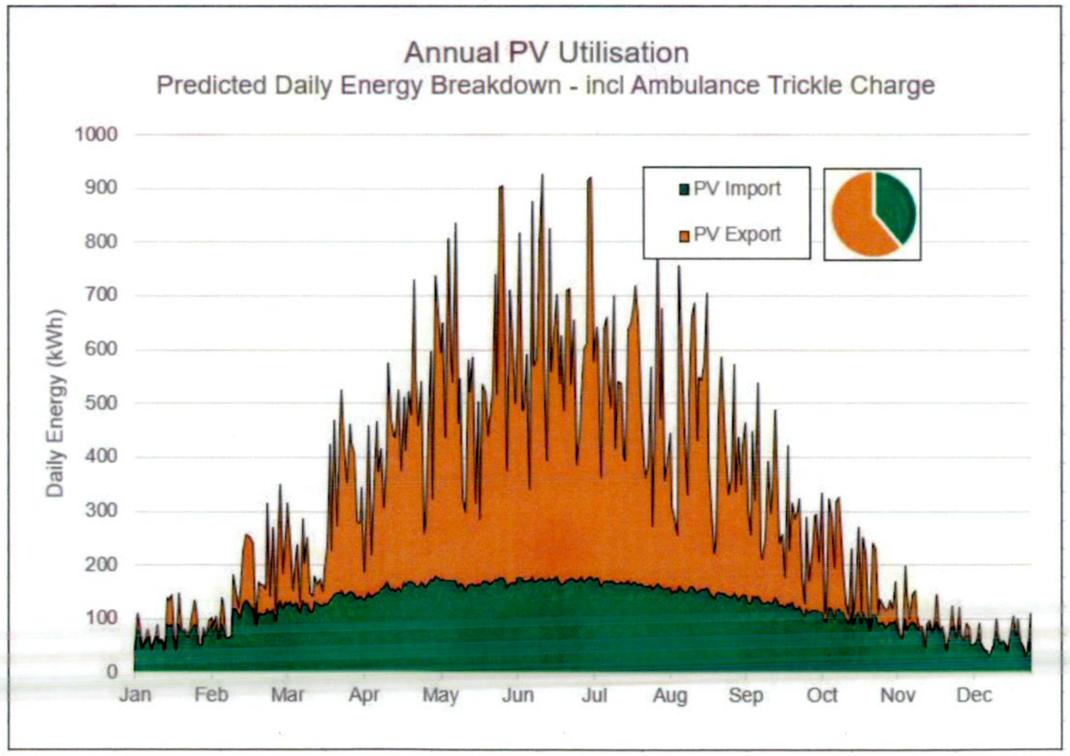


Fig 6.2.5 – Annual PV Utilisation

6.3 Ambulance Trickle Chargers

Trickle Charge data was determined based on existing Naas Ambulance Centre.

This data was provided in metered Electrical Current (Amps) data at five-minute intervals for the period of 24th February to 5th March, as illustrated in Figure 6.3.

As it was subsequently advised that Belgard/ Glen Abbey Ambulance Centre would have approximately three times the number of ambulance vehicles as Naas, the data was used on a pro-rata basis (i.e. tripled) for inclusion within the annual energy analysis undertaken, equating to a total of 4.9 MWh/annum (4.1 kWh/m2.annum), which may be compared against the building energy in Section 7.0 below.

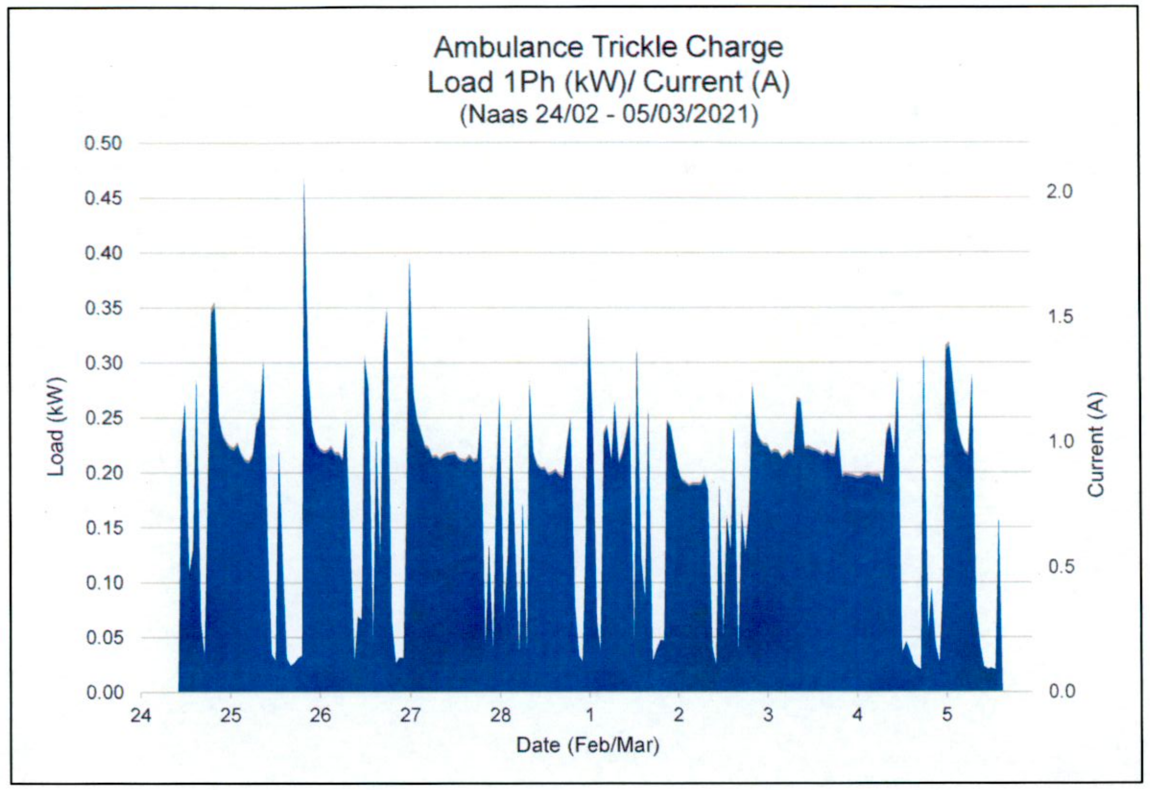


Fig 6.3 – Ambulance Trickle Charge

6.4 Ambulance EV Chargers

An estimation of Annual electrical energy consumption associated with EV charging was also included within the analysis, as summarised in Figure 6.4.

National Ambulance Service (NAS) data for 2019 indicated that there was a total of 300,000 ambulance calls per annum throughout Ireland, for a vehicular fleet of 500. Allowing an assumed increase of call frequency for ambulances within Dublin (covering shorter distances than rural areas), an estimated average of 2.5 calls per ambulance per day was assumed.

It has been advised that it is envisaged that 3 no. Electric Vehicle (EV) ambulances would be utilised at Belgard, so allowing an assumed average distance of 15 km per call, this equated to a combined (for 3 no. EV's) total distance of 110 km approx. per day.

The EV charge rate of a Nissan NV 400 ambulance (15 km/hr) was then utilised to determine an overall daily electrical energy usage of 17 kWh for "topping up" the vehicles.

The estimated annual electrical energy for EV charging (6.2 MWh/annum or 5.2 kWh/m2.annum); based on the assumptions above regarding vehicular usage, were determined for the three vehicles to be slightly higher than ambulance trickle charging (for all vehicles), with all assessed in the context of the overall building energy in Section 7.0 below.

However, in terms of carbon neutrality, it may be noted that this EV charging would of course offset diesel/ petrol operational fuel usage for the Centre (and has not been assessed within the report).

Ambulance Usage			
Total Amb Calls IRL	300000	per annum	2019
Total Amb Calls IRL	500	ambulances	2019
	600	per amb per annum	
	1.6	calls per amb.day	
Allow for Dub Freq	150%		
	2.5	calls per amb.day	
Belgard (EV's)	3	ambulances	
Total Calls	7	calls per day	
Coverage Radius	5	km	
Average Distance	15	km/ call	
Total Distance	111	km/day	
Charge Rate	15	km/hr charge	
Total Hours Charging	7.3	hrs per day	
	2.4	hrs per day per EV	
Charger Output	7	kW	
Total Daily EV Energy	17	kWh/day	
Annual EV Energy	**6.2**	**MWh/ann**	
Area	1190	m^2	
Annual EV Energy	**5.2**	**kWh/m2.ann**	
Average Hourly Charge	0.71	kW	

Fig 6.4 – Ambulance EV Chargers

7.0 CARBON NEUTRAL APPROACH

A typical energy analysis for Part L and BER Compliance examines the energy saving potential of various measures based on "Regulated Loads" for the building, associated with energy consumed for Space and Water heating, Cooling, Lighting and Auxiliary energy, consumed by fans, pumps and system controls. Energy consumed within the building for equipment associated with operational requirements, including computers/ IT etc. is not included within the analysis. To allow the building to be demonstrated as performing to an "Energy Positive" or "Carbon Neutral" performance, the non-regulated energy consumed for equipment was included in the analysis. This predicted energy usage was then converted to carbon emissions utilising current CO2 emissions factor for electricity of 0.409 $kgCO_2/kWh$.

The "Unregulated" loads analysed for this particular building consists of IT equipment, kitchen appliances, garage workshop equipment, Ambulance Trickle Charging, and Electric Vehicle Charging. Analysis of these loads was outlined in Section 6.0 above.

With all "Regulated" and "Unregulated" loads taken into account, it can be seen in Fig's 7.1 and 7.2 that an effectively "Carbon Neutral" performance was determined for the building (i.e., the building offsets the same carbon that it consumes, by the carbon free electricity generated by the photovoltaic panels).

It can be seen in Fig 7.2 that the current overall carbon balance was predicted to be borderline neutral. However, this includes allowance for operational energy for ambulance trickle charging and EV vehicle charging, which are technically remote energy uses from the buildings; nor has, for example, the displaced ambulance fuel (diesel/petrol) for EV usage been accounted for.

In summary, the proposed building design therefore enables a pathway towards carbon neutrality – even allowing for the 24/7 operation of the building.

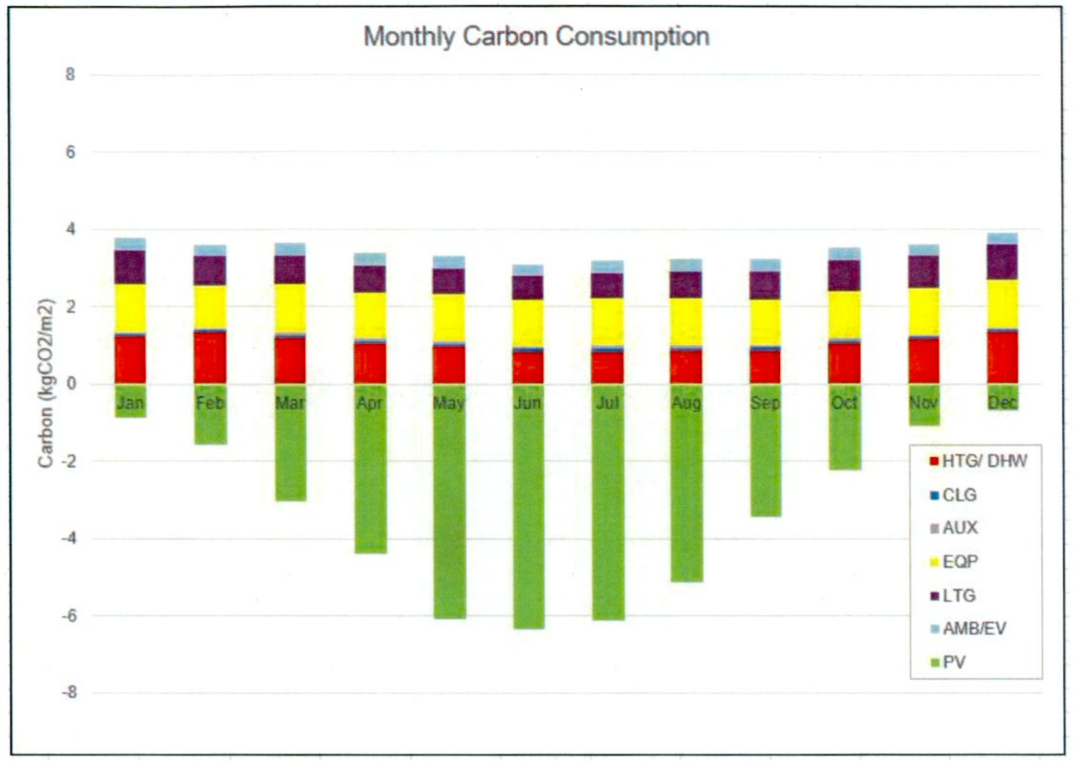


Fig 7.1 – Monthly Carbon Consumption

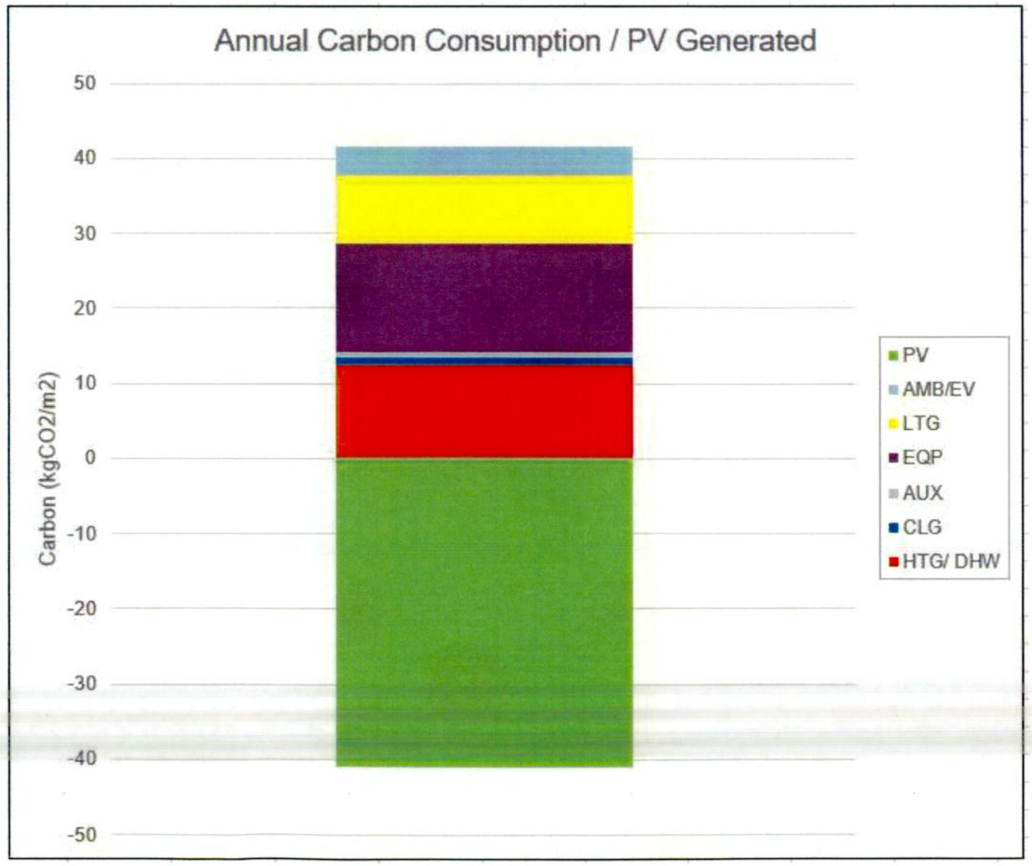


Fig 7.2 – Annual Carbon Consumption

8.0 PART L COMPLIANCE

An assessment of Part L Compliance is based on Regulated Loads; Building and HVAC related only (Heating, Hot Water, Fans & Pumps, Cooling and Lighting).

Operational "Unregulated Loads" are excluded – Equipment, IT, Trickle Chargers, EV, External Lighting etc.

Fig 8.1 indicates the benchmarks within Section 2 of the Building Regulations relating to "Major Renovation" projects with extensions/refurbishments of this nature. However, it may be noted that there is truly no representative benchmark for this building – particularly accounting for the 24/7 operation.

The building as proposed with PV would be "Primary Energy Negative" i.e., the total PV generated exceeds the Annual Regulated Loads.

Omitting the PV was predicted to still result in Part L Compliance, due to improved fabric and HVAC (particularly Heat Pump performance)- but only marginally so, as per Fig 8.2.

Therefore, any omission of fabric/ services improvements proposed, in addition to total omission of PV, may result in non-compliance, albeit the Part L benchmarks are extremely onerous for a building with 24/7 operation, even allowing for the caveat included in Part L which states "To allow flexibility in application the values in Table 13 can be increased by 15%".

Conversely, reduction in PV (or even omission) can be accommodated whilst maintaining Part L Compliance, however this would impact on overall Carbon Neutrality.

Table 13 Whole Building Cost Optimal Level	
Building Type	**Major Renovation - Cost Optimal Performance kWh/m²/yr** primary energy
Retail Air Conditioned	338
Office Natural Ventilated offices and other Buildings	124
Office Air Conditioned	180
Hotel Air Conditioned	342
Schools	60
Other Air Conditioned Buildings	338
Other Naturally Ventilated Buildings	124

Fig 8.1 – Part L Energy Benchmarks

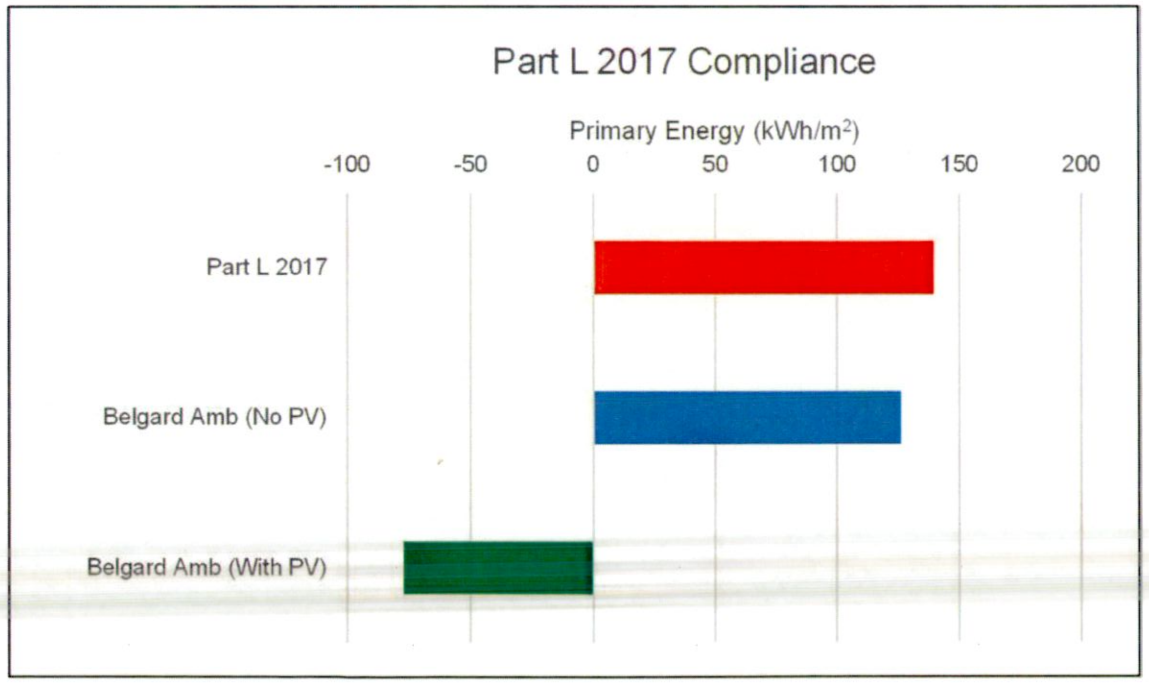


Fig 8.2 – Part L Compliance

9.0 APPENDIX A

Table A – SOLAR GAIN RESULTS

Zone Name	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)
Meeting Room 16 persons	10.6	27.3	825	2539	-67.5
Ambulance Officers 4 persons	10.8	25.4	1097	2599	-57.8
Additional Offices 4 persons	4.5	20.3	649	1078	-39.8
Kitchen/Canteen	14.4	41.4	1293	3453	-62.6
Kitchen 3	5.5	24.8	651	1315	-50.5
Emergency Control Room/Training Room 1	23.3	85.0	2417	5608	-56.9
Combined Drug/Main Store 1	21.3	56.4	1840	5114	-64.0
Lobby 1	2.9	11.3	219	699	-68.7
Shift Supervisors 4 persons	6.0	23.3	860	1438	-40.2
TV/Staff/Rest Room 1	8.8	35.4	802	2117	-62.1
Admin 4 persons	10.0	23.8	1069	2404	-55.5
Clinical Coordinators 4 persons	9.4	20.6	819	2270	-63.9
Clinical Leads 4 persons	5.9	23.1	862	1430	-39.7
Clinical Director	2.9	11.5	554	704	-21.3
GCC Manager	2.9	11.4	560	698	-19.8
Lockers 1	25.8	48.2	1995	6199	-67.8
Study 1	2.7	11.1	272	654	-58.4

10.0 APPENDIX B

Table B1 – CIBSE TM52 Category II Report

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Meeting Room 16 persons	3672	110	0	0	0	Pass
Ambulance Officers 4 persons	3672	110	7	10	0	Pass
Additional Offices 4 persons	3672	110	3	3	0	Pass
Kitchen/Canteen	2448	73	0	0	0	Pass
Kitchen 3	2448	73	0	0	0	Pass
Reflection 1	612	18	0	0	0	Pass
Emergency Control Room/Training Room 1	3672	110	0	0	0	Pass
Combined Drug/Main Store 1	3672	110	0	0	0	Pass
Lobby 1	3672	110	0	0	0	Pass
Shift Supervisors 4 persons	3672	110	0	0	0	Pass
TV/Staff/Rest Room 1	2448	73	0	0	0	Pass
Admin 4 persons	3672	110	12	10	0	Pass
Clinical Coordinators 4 persons	3672	110	3	3	0	Pass
Clinical Leads 4 persons	3672	110	2	2	0	Pass
Clinical Director	3672	110	3	3	0	Pass
GCC Manager	3672	110	1	1	0	Pass
Study 1	3672	110	0	0	0	Pass
Lockers 1	3672	110	0	0	0	Pass

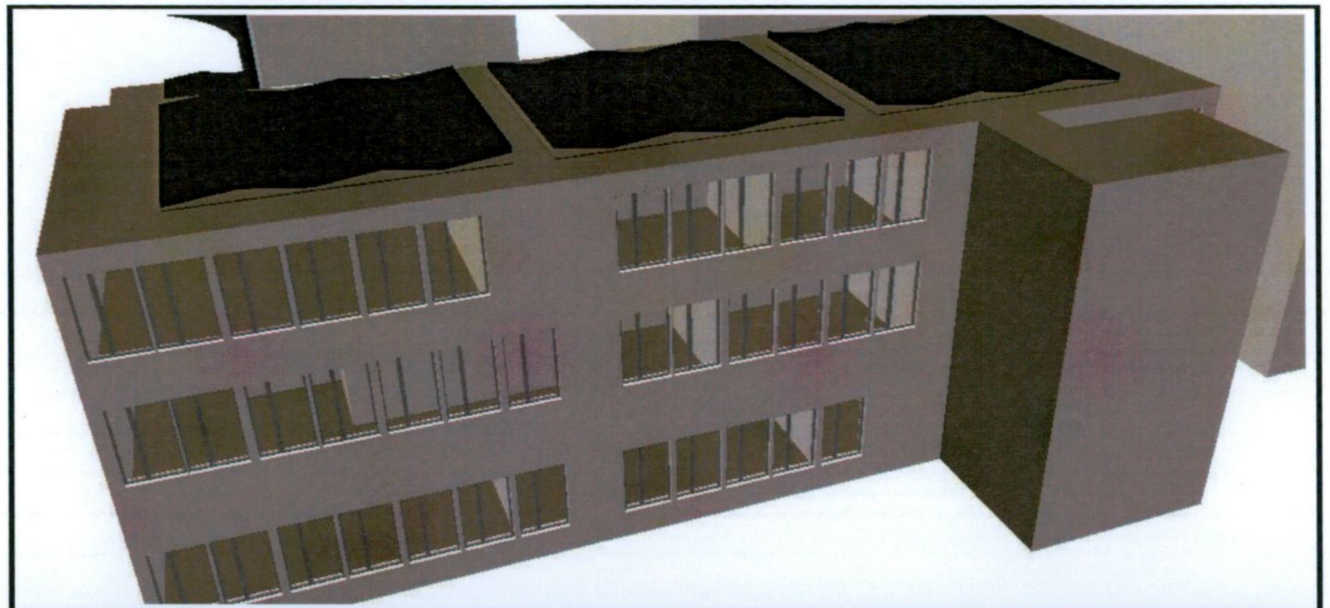
10.0 APPENDIX B

Table B2 – Free Area Opening Requirements

Zone Name	Floor Area (m^2)	FAO Required (m^2)
Meeting Room 16 persons	27.3	1.4
Ambulance Officers 4 persons	25.4	1.3
Additional Offices 4 persons	20.3	1.0
Kitchen/Canteen	41.5	2.1
Kitchen 3	24.8	1.2
Reflection 1	13.8	0.7
Clean Store	9.9	0.5
NAS CRR Bulk Store	22.8	1.1
Store 4	6.0	0.3
Emergency Control Room/Training Room 1	85.0	4.2
Combined Drug/Main Store 1	56.4	2.8
Lobby 1	11.3	0.6
Shift Supervisors 4 persons	23.3	1.2
TV/Staff/Rest Room 1	35.4	1.8
Admin 4 persons	23.8	1.2
Clinical Coordinators 4 persons	20.6	1.0
Clinical Leads 4 persons	23.1	1.2
Clinical Director	11.5	0.6
GCC Manager	11.4	0.6
Study 1	11.1	0.6
Lockers 1	64.5	3.2
Staircore 2 - New Stair	57.1	2.9
Utility	9.2	0.5
WC 5	11.4	0.6
WC 8	4.7	0.2

11.0 APPENDIX C

Table C – PROPOSED BUILDING FABRIC AND HVAC ASSUMPTIONS



Building Fabric -			
Element	U-Value W/m²K	Glazing Performance Details	
External Wall Upgrade	0.2	Light Transmittance	
Roof Upgrade	0.15	Double Glazing	0.69
Ground Floor Upgrade	0.15	Solar Transmittance (g-Value)	
New Double Glazing	1.2	Double Glazing	0.39
Air Permeability	Building Upgrade	3.0	m³/hr.m²@50Pa

Thermal Bridges to new Build			
Junction	Ψ Value W/m K	Junction	Ψ Value W/m K
Roof to Wall	0.180	Lintel above Window or Door	0.450
Wall – Ground Floor	0.240	Sill below Window	0.080
Wall – Wall (Corner)	0.140	Jamb at Window or Door	0.090
Wall – Floor (int not ground floor)	0.110		

Heating System			
Heating – New Air Source Heat Pump Space Heating System to all areas -			
Fuel Type	100 % Electricity	ASHP Seasonal Efficiency	3.19
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%
Heating System Controls			
Multiple pressure sensors in system	Yes	Provision for metering	Yes
Alarm for "out of range" values	Yes	Central Time Control	Yes
Room by room temperature control	Yes	Weather Compensation	Yes

Hot Water System -			
HWS - New Air Source Heat Pump DHW system			
Fuel Type	100 % Electricity	ASHP seasonal Efficiency	3.19
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%
Hot Water System Controls			
Hot Water Storage	**Yes**	**Factory Insulated**	**100mm**
Secondary Circulation	**Yes**	**Time Control on Secondary Circ**	**Yes**

HVAC System -		
Natural Ventilation - to all areas		
Natural Ventilation (NV)	Manually Openable Windows 5% (of floor area) free area opening required to all rooms in accordance with TGD Part F	
Extract Only - toilets and kitchen		
Extract Ventilation (Ex)	Extract Fan Specific Fan Power (W/ l.s)	0.5
Heat Recovery Ventilation - Lockers / Changing		
70% Heat Recovery Plate Heat Exchanger	Extract Fan Specific Fan Power (W/ l.s)	1.3

Lighting - Proposed			
Space Type	Presence Detection Switching	Daylight Control	Lighting loads W/m²
Training	Auto On/Off	Dimming	8
Circulation	Auto On/Off	Dimming	5
Photocopy	Auto On/Off	Dimming	5
Meeting	Auto On/Off	Dimming	8
Staffroom	Auto On/Off	Dimming	8
Garage	Auto On/Off	Dimming	5
4 pers Office	Auto On/Off	Dimming	8
1 pers Office	Auto On/Off	Dimming	8
Lockers	Auto On/Off	Dimming	5
Store	Auto On/Off	Dimming	5
Lobby	Auto On/Off	Dimming	5
WC	Auto On/Off	Dimming	5

Controls - Proposed	
Automatic monitoring and targeting with alarms for out-of-range values	Yes
Power factor correction to achieve a whole building power factor of at least	>95%

Proposed Renewables			
Type	Location	Area m²	Annual Yield MWh
Photovoltaic Panels (PV)	Roof	276	36.5
Photovoltaic Panels (PV)	Walls	94	8.5
Photovoltaic Panels (PV)	Canopy	547	74.8
Total	Roof, Walls, Canopy	917	119.8