grays inn road panther house energy addendum

february 2021



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issue details and contents...

ISSUE DETAILS

DATE OF ISSUE	DETAILS OF ISSUE	AUTHOR	CHECKED
19 th FEBRUARY 2021	ISSUE ONE	CLL	LN/MML/LA

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introduction...

OVERVIEW

The consented application for the redevelopment of 156-164 Gray's Inn Road, known as Panther House, was submitted in December 2015, with amendments agreed and permitted in early 2017.

The energy strategy approved as part of the consented scheme utilised gas boilers to provide heating and hot water to the residential element of the scheme. Since then, there has been a shift in the regulatory and policy backgrounds which discourage the use of combustible fossil fuels on site for heat (namely gas boilers in this case).

This document has been produced to summarise the changes to local and regional planning policy (particularly the London Plan), emerging policy (Future Homes Standard) and forthcoming regulatory change (Building Regulations Part L 2021), with a view to changing the use of gas boilers in favour of air source heat pumps for the residential units.

In light of these changes and consideration of updates to the carbon intensity of fuels, particularly the decrease in grid electricity reported to be included in the forthcoming update to SAP and adopted by the GLA, it is considered that the energy strategy should be revised to remove gas boilers in favour of heat pumps for the residential units.

No changes are proposed for the non-residential element of the consented scheme in terms of the energy strategy, although proposed minor architectural alterations to the commercial building (Panther House) have been reviewed and are considered to not have a significant impact on the consented scheme's energy model.

This addendum to the energy strategy aims to demonstrate that the revised residential energy strategy is an improvement on the consented scheme for the following key reasons:

- Utilising heat pumps rather than gas boilers accords with the current and emerging policy and anticipated future regulatory background
- Using heat pumps rather than gas boilers achieves a lower overall tonnage of CO₂ emissions, reducing the carbon footprint of the scheme and lowering the associated Carbon Offset Payment, when adopting SAP 10
- The revised energy strategy replaces gas-fired boilers with heat pumps that use electricity, meaning the scheme's CO₂ emissions will continue to decrease as grid electricity continues to decarbonise
- Replacing boilers with heat pumps eliminates gas being burned for heat, meaning lower impact on local air quality compared to the consented strategy.

The revised CO₂ emissions for the development have been estimated as **194.5 TCO₂** per year, with a total saving of **56.8 TCO₂** (a **22.6% reduction** against the Part L baseline). This is an improvement on the consented scheme's energy strategy, which had higher estimated CO₂ emissions of **199.7 TCO₂** per year and a lower saving of **50.1 TCO₂** (a **20.0% reduction** against the Part L baseline).

The Carbon Offset Payment reduces from £100,710 to £84,240.



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EMERGING NATIONAL POLICY

The government has committed to cutting greenhouse gas emissions to almost zero by 2050. The National Planning Policy Framework (NPPF) sets out the Government's planning policies on the delivery of sustainable development through the planning system in England and indicates how these are expected to be applied, informing Local Councils and communities with regards to local plans and planning applications.

The Future Homes Standard, launched by the Government in the 2019 Spring Statement proposed that by 2025 all new homes will incorporate world-leading levels of energy efficiency, with low-carbon heating. It indicated that, by 2025, new housing should not be fuelled by gas.

The Future Homes Standard consultation document was released on 1st October 2019, on changes to Building Regulations Part L (and Part F), including either a 20% reduction in CO₂ emissions against current Part L 2013 from energy efficiency measures, or a 31% reduction using energy efficiency and renewable technologies until 2025. Government responses on this consultation were released on 27th January 2021. After 2025, the Future Homes Standard is expected to require a 75-80% CO₂ emissions reduction.

BUILDING REGULATIONS

The element of the Building Regulations which governs energy consumption and CO₂ emissions from the operation of new buildings is Part L. For new builds, this is split into Part L1A (conservation of fuel and power in new dwellings) and Part L2A (conservation of fuel in power in new buildings other than dwellings). Part L only considers 'regulated' energy, i.e. that necessary for heating, cooling, hot water, ventilation and lighting. Therefore, small power and plug-in equipment is not included.

The current version of Building Regulations Part L is the 2013 edition incorporating 2016 amendments. Each time the Building Regulations is updated, there is a public consultation period, then a transition period ahead of full implementation. The next Building Regulations Part L update was previously anticipated in 2020 but is now most likely to be released in 2021.

Transitional arrangements were set out within the January 2021 Government responses on the Future Homes Standard. This proposed that where a residential building, or block in a phased masterplan has an initial notice in place by June 2022 and commences by June 2023, the existing Part L standards can be applied. After this, the new Part L standards apply.

SAP 10

The Standard Assessment Procedure (SAP) is the approved calculation methodology for demonstrating compliance with Building Regulations Part L1A. The non-residential equivalent is the Standard Building Energy Model (SBEM) methodology, which must be used for Part L2A.

An update to SAP is usually released as part of the public consultation period, which precedes implementation of a Building Regulations Part L update. The latest update, known as SAP 10, is intended to replace SAP 2012. The latest version of SAP 2012 for use in the existing Building Regulations Part L1A is v9.92, dated October 2013. SAP 2012 is still the only version of the methodology that it is

acceptable to use for Building Regulations Part L compliance until full implementation of the superseding Regulations.

The changes to SAP are often the precursor to changes in approaches for all buildings. The first version of SAP 10 was released on 24/07/18, with some important details likely to lead to a transition away from site-based fossil fuels and towards electricity. The key change identified by the industry has been to the carbon emission factors associated with fuels for different uses.

On 10/10/19, SAP 10 was updated to SAP 10.1 (still a consultation document, not adopted by GLA), with further amendments to carbon emission factors.

THE LONDON PLAN

The Mayor of London has declared a climate emergency and has set an ambition for London to be net zero-carbon. The new London Plan is currently in draft and is a material consideration in new planning decisions. As part of the draft new London Plan, Greater London Authority (GLA) have released the draft version of the Energy Assessment Guidance 2020, also a material consideration in new applications, which includes requirements for the latest structure, approach and contents of energy assessments for new buildings.

The GLA require all referable planning applications to be submitted with an Energy Assessment, to demonstrate how the London Plan CO_2 emissions reduction targets have been met in line with the Energy Hierarchy.

Energy Assessment Guidance

The Energy Hierarchy is presented in the GLA's Energy Assessment Guidance documentation and sets out expectations for how CO₂ emissions reductions should be achieved (following defined steps as follows: Use Less Energy - 'Be Lean', Supply Energy Efficiently - 'Be Clean' and Use Renewable Energy - 'Be Green').

The Energy Assessment Guidance documentation was updated in October 2018, following the release of SAP 10. This new guidance document was issued alongside the announcement that, from January 2019, the GLA's expectation was for SAP 10 carbon emission factors to be implemented. A calculation tool was developed to allow conversion of CO₂ emissions, at each stage of the Energy Hierarchy, from current SAP 2012 emission factors to SAP 10, for all major residential and non-residential applications.

In 2020 the Energy Assessment Guidance was further updated to restructure the Energy Hierarchy slightly, insomuch as there is a decoupling of district heating as a principle and CHP as the de facto technology. Whilst district heating is still favoured by the GLA, the use of CHP should now be considered as part of a wider feasibility study of all types of heat source and must be fully justified if selected. It is still necessary to offset remaining CO₂ emissions via a Carbon Offset Payment, after implementation of the Energy Hierarchy.



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Camden planning guidance

Camden's Local Plan 2017 aims to tackle the causes of climate change in the borough by ensuring developments use less energy and assess the feasibility of decentralised energy and renewable energy technologies. Green Action for Change: Camden's environmental sustainability plan (2011-2020) commits Camden to a 27% borough wide CO₂ reduction by 2017 and a 40% borough wide CO₂ reduction by 2020 (London carbon reduction target). This is delivered, among others, by policy CC1: Climate Change Mitigation, which promotes zero carbon development by following the London Plan's Energy Hierarchy and the associated targets for CO₂ emissions reductions.

Camden's 'Energy efficiency and adaptation' CPG January 2021 supports Local Plan Policy CC1 (and other relevant policies) and replaced CPG3 Sustainability (July 2015).

Policy relevant at the time of submission in December 2015 required Code for Sustainable Homes Level 4, with a target of 35% reduction in CO_2 emissions for major residential and non-residential schemes. Where the target was demonstrated to not be achievable, Carbon Offsetting was implemented at a price of £90 per tonne of CO_2 shortfall over 30 years (i.e. £2,700 per tonne CO_2).

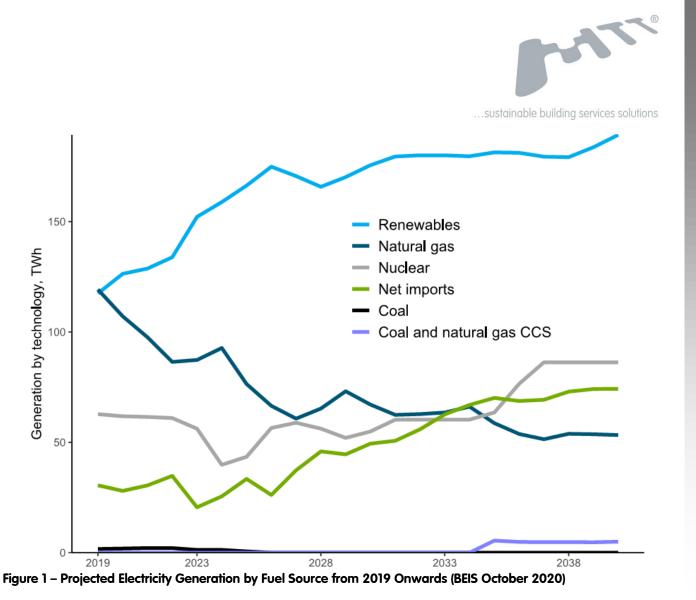
The Code for Sustainable Homes was withdrawn by the Government in April 2015, with an allowance for any Local Authority with this as an existing policy requirement to implement a 19% reduction in CO₂ emissions, equivalent to Code Level 4. This was adopted as an absolute minimum by Camden Council, as confirmed during the planning submission process, with the 35% CO₂ emissions reduction maintained as an aspirational target.

CARBON EMISSION FACTORS

Electricity

Carbon emissions factors allow the conversion of energy used in a building (in kWh) from a given fuel, to the equivalent CO_2 emissions. Amongst the two primary fuel sources in the UK, gas has a relatively constant CO_2 intensity; electricity, however, has more variation due to the mix of energy generation sources that constitute the grid.

The emission factor for grid electricity in SAP 2012 is $0.519 \text{ kgCO}_2/\text{kWh}$, i.e. roughly half a kilogram of carbon dioxide emissions for every kWh of regulated energy used in the building. Under SAP 10, this is due to reduce to $0.233 \text{ kgCO}_2/\text{kWh}$, i.e. less than half the previous CO₂ emissions for the same amount of energy used. This is to reflect the decarbonisation of grid electricity, by the phasing out of coal and gas, with a higher proportion of nuclear and renewable sources in the mix, as shown in Figure 1 below.



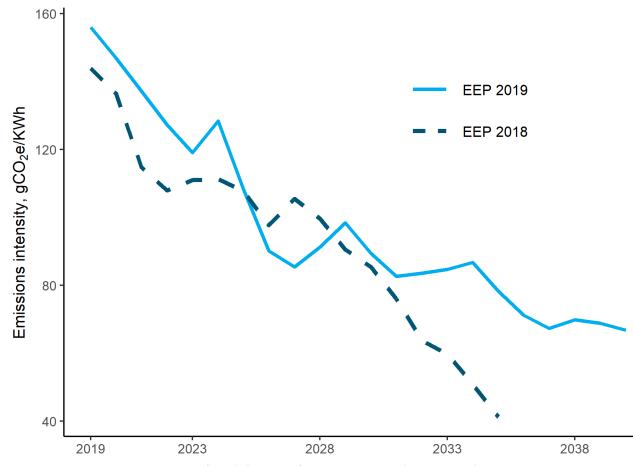
This change will be a major factor in the selection of energy strategies for new and existing buildings.

In SAP 10.1, the emission factor for grid electricity is 0.136 kgCO₂/kWh. This is a further step-change, which would appear to extend beyond the level of decarbonisation currently being achieved for grid electricity. At the time of writing, it is uncertain where the electricity carbon emission factor will lie in the official Building Regulations update.

The graph in Figure 2 shows the carbon intensity trajectory for two Energy & Emissions Projections (EEP), which differ based on the rate of uptake of renewables.

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for producing biogas is inefficient and the effectiveness of a generation plant can depend on weather, supply of organic materials and space.

Given the technology and availability of biogas is developing, its most effective application is seen as part of the UK's energy mix in the future, to supplement and decarbonise the network for the legacy of the UK's domestic gas reliance. Decarbonised electricity is the current preference of the Government for future applications.

Figure 2 – CO₂ Emissions Intensity of Grid Electricity from 2019 Onwards (BEIS October 2020)

Gas

Mains gas has also reduced from 0.216 in SAP 2012 to 0.210 in SAP 10, also reflecting decarbonisation, albeit less pronounced, due to the integration of green gas with natural gas in the network.

Green gas, biogas or biomethane, is generated from anaerobic digestion of organic material and can be added to natural gas in the network. Green gas is more sustainable than natural gas, given that it is not a fossil fuel and is generated from a renewable source: organic plant or animal material. Some biogas is made from plant material, green waste, food waste or agricultural waste that would have been thrown away anyway. Even animal waste and sewage can be used. The leftover organic material is nutrient rich and can be used as a substitute for chemical fertilisers. Biogas can therefore contribute to the circular economy.

Although burning green gas still emits greenhouse gases, it is considered to achieve a carbon balance because some of the organic matter used to harvest the green gas would have decomposed and released CO_2 anyway and the new organic matter being regrown to replenish the anaerobic digesters is absorbing CO_2 as it grows.

Issues with biogas include the current scale and reliability of supply (although this is improving), it requires refinement to extract impurities before it is suitable for inclusion into the network, the system



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CONSENTED STRATEGY

Policy Requirements

At the time of submission, Part L 2013 was still the current version of the Building Regulations. The prevailing version of the London Plan was the March 2015 edition, which was supported by the April 2015 version of the 'Energy Planning: Greater London Authority guidance on preparing energy assessments' document (these have since been superseded by the 2018 and 2020 revisions).

This is a mixed-use development with significant elements of existing and retained building fabric, particularly for the commercial elements within the scheme. For residential units, the Code for Sustainable Homes was withdrawn in April 2015, before submission of the planning application. The Government had stated that where Local Authorities has Code for Sustainable Homes requirements within their policies, they could require a 19% reduction in CO₂ emissions, equivalent to Code Level 4 performance.

This approach was adopted by Camden Council, whereby a 19% CO₂ emissions reduction was the minimum requirement, with a 35% CO₂ emissions reduction as the target within London Plan policy 5.2, Camden Local Plan policy CC1 and Camden's CPG1 Sustainability July 2015. Where it was not possible to achieve a 35% reduction in CO₂ emissions, carbon offsetting was applied up to this target.

The 2015 version of the policy required compliance with the following:

- 35% reduction in CO₂ emissions against Part L 2013, as an aspirational target with an absolute minimum of 19% for residential properties
- Carbon offset payment for all remaining residential CO₂ emissions, up to 35%, at \pounds 1,800 per tonne of CO₂ shortfall
- 35% reduction in CO₂ emissions against Part L 2013, as an aspirational target for commercial spaces
- Carbon offset payment for any commercial CO_2 emissions, up to the 35% target, at £1,800 per tonne of CO_2 shortfall
- Energy Hierarchy Part L compliance via Be Lean measures only
- Energy Hierarchy maximise renewable technologies including rooftop PV.

Consented Energy Strategy

Planning consent was granted for the residential properties based on gas boilers for heating and hot water, mechanical ventilation with heat recovery (MVHR), cooling and PV. For the commercial elements of the scheme, consent was granted based on high efficiency VRF (refrigerant-based system using electricity) heating and cooling, with heat recovery ventilation and high efficiency lighting.

The use of gas boilers in residential properties provides user familiarity and a consistent efficiency (as opposed to heat pumps whose efficiency, although normally far higher, varies with external climatic temperatures). However, this technology is considered to have reached its peak in terms of performance and is being eclipsed by technologies that offer equivalent outputs with cleaner fuels, higher efficiencies, lower CO₂ emissions and opportunities for further carbon reductions as time goes on.

REVISED STRATEGY

The policy changes and other drivers identified earlier in this document lead the design away from the used of gas and strongly towards electricity for the provision of heat, and hence the replacement of gas boilers with heat pump technology. Heat pumps essentially upgrade the ambient heat within atmospheric air, watercourses or the ground to a higher temperature for use as space heating or hot water, using refrigerant. Electricity is used to fuel this process; the heat generated is considered low carbon because one kilowatt of electricity can be converted into many kilowatts of heat. (Note: conventional heat pumps can achieve 3 to 5 or more kilowatts of heat for every 1kW of electricity used; this multiplier is known as the Coefficient of Performance, or COP)

The emergence of the consultation on note on SAP 10 and the subsequent adoption of the carbon intensity factors therein (which, as described previously, is more reflective of today's reality), means that the GLA's conversion spreadsheet has been used as a key tool in analysing the benefits of the revised strategy.

Revising the energy strategy as described in this document is considered a positive change and an improvement to the overall scheme. Given the changing policy background described earlier in this document, it is hoped that the move away from the consented strategy towards a strategy which replaces boilers with heat pumps will be viewed favourably.

The feasibility work undertaken has been centred around how to best incorporate heat pumps into the design, given the capabilities and constraints of the technology and the availability of appropriate products on the market.

Conventional heat pumps are excellent at producing low-temperature hot water, up to approximately 55°C, when the ambient temperature, i.e. local weather conditions, are mild. This is particularly the case for individual domestic-scale heat pumps providing space heating in a long-lag system, which can achieve a COP of up to 3.5-4.5. As the ambient temperature decreases, say to 0°C or below, the efficiency of the heat generation can decrease. Similarly, when producing heat at above 55°C, which is needed to deliver domestic hot water, the efficiency decreases, and it is usually necessary to utilise other means to deliver temperatures above 60°C. This can be in the form of electric emersion heaters in cylinders or via other means.

Residential Element – Gray's Inn Road

The options for how to integrate heat pumps have been reviewed and the most appropriate has been identified. Three communal air source, or air-to-water heat pumps are proposed on the roof of the residential properties within the Gray's Inn Road building, which will provide heating and hot water to all residential units.

Commercial Element – Panther House and Brain Yard

No changes are proposed to the energy strategy for the commercial element of the scheme.

The proposed architectural changes to the massing and façades of the commercial buildings are considered to be minor. They have been reviewed in the context of the energy modelling and our



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examination of the changes has concluded that alterations would have minimal impact on the overall energy calculations compared to our original calculations.

There has been a minor update to the floor area of the commercial element of the scheme and this has been reflected in the results on a pro rata basis.



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ANALYSIS UNDERTAKEN

In order to assess the impact of changing the scheme's energy strategy, the SAP calculations used to calculate CO₂ emissions and establish Carbon Offset Payments have been revised. The results have been combined with the previous results from the non-residential element of the consented scheme for comparison of the previous and proposed residential energy strategies.

Consented Scheme Results

The carbon offset payment included in the Section 106 agreement is £100,710, which was calculated by multiplying Camden's price per tonne of carbon (£2,700 – derived from £90 per tonne over 30 years), by the project's carbon shortfall up to the 35% CO₂ emissions reduction target.

It was necessary to demonstrate that the residential element of the scheme met Camden's requirement for a minimum 19% reduction in residential CO_2 emissions. Offsetting was required for the remaining CO_2 emissions up to 35%.

Table 1 Gray's Inn Road	Carbon dioxide emissions (Tonnes CO ₂ per annum) SAP2012					
Residential CO ₂ emissions After each stage of the energy hierarchy	Regulated Unregulated Total					
Part L 2013 compliant building	17.7	20.3	38.1			
Be Lean	17.3	20.3	37.6			
Be Clean	17.3	20.3	37.6			
Be Green	13.9	20.3	34.2			

Table 2		Carbon dioxide savings SAP2012			
Gray's Inn Road Residential CO2 emissions		(Tonnes CO ₂ per annum)		%	
Savings at e	ach stage of the energy hierarchy	Regulated	Total	Regulated	Total
Be Lean	Savings from demand reduction	0.5	0.5	2.8%	1.3%
Be Clean	Savings from decentralised energy	0.0	0.0	0.0%	0.0%
Be Green	Savings from renewable energy	3.4	3.4	18.9%	8.8%
	Total cumulative savings	3.9	3.9	21.7%	10.1%

Tables 1 and 2 above show the total tonnage of CO_2 and savings at each stage of the Energy Hierarchy, respectively. The residential units achieved a 21.7% reduction in CO_2 emissions, in compliance with Camden's policy.

Given that the target CO_2 emissions reduction of 35% was the same for residential and non-residential in Camden, the combined results were used to calculate the necessary offset payment. Table 3 below shows the overall site-wide tonnage of CO_2 at each stage of the Energy Hierarchy for the previously consented scheme.

Table 3 Gray's Inn Road & Panther House Combined Residential &Non-Residential CO2	Carbon dioxide emissions (Tonnes CO2 per annum) SAP2012				
After each stage of the energy hierarchy	Regulated Unregulated Total				
Part L 2013 compliant development	249.7	98.7	348.4		
Be Lean	203.0	98.7	301.8		
Be Clean	203.0	98.7	301.8		
Be Green	199.7	98.7	298.4		

Table 4 below shows the overall site-wide CO₂ savings in tonnes and as a percentage for each stage of the energy hierarchy. The site-wide CO₂ emissions saving was 20%, which is short of the 35% target, meaning an offset payment was required.

Table 4	Carbon dioxide savings SAP2012			
Gray's Inn Road & Panther House Combined Residential & Non-Residential CO ₂	(Tonnes CO ₂ per annum)		%	
Savings at each stage of the energy hierarchy	Regulated	Total	Regulated	Total
Be Lean Savings from demand reduction	46.7	46.7	18.7%	13.4%
Be Clean Savings from CHP	0.0	0.0	0.0%	0.0%
Be Green Savings from renewable energy	3.4	3.4	1.3%	1.0%
Total cumulative savings	50.1	50.1	20.0%	14.4%

Table 5 below shows the CO_2 emissions savings, the shortfall to the 35% target and the associated offset payment figure.

Total Target Savings (35%)	87.4 TCO ₂
Savings Achieved	50.1 TCO ₂
Shortfall	37.3 TCO ₂
Offset (Shortfall x £90 x 30 years)	£100,710

Table 5: Carbon Offset Calculation for Consented Scheme's Energy Strategy



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Revised Strategy Results

The latest iteration of the GLA's energy policy (April 2020) indicates that the results should be presented and any associated offsetting, in the event of a shortfall in CO₂ emissions to the relevant targets, should be set against SAP 10. Given it is proposed to change the only gas-based heating within the scheme, previously used for the residential units, to heat pumps to comply with emerging and future policy more closely, it is proposed to use SAP 10 results to assess CO₂ emissions for residential only.

Table 6 below shows that the overall CO_2 emissions for the residential units will be 8.7 tonnes per year using SAP 10. This is a reduction from the 13.9 tonnes CO_2 from the consented scheme's energy strategy under SAP 2012 of 5.2 tonnes CO_2 .

Table 6 Gray's Inn Road	Carbon dioxide emissions (Tonnes CO ₂ per annum) SAP10					
Residential CO ₂ emissions After each stage of the energy hierarchy	Regulated Unregulated Total					
Part L compliant building	19.3	20.3	39.6			
Be Lean	18.2	20.3	38.5			
Be Clean	18.2	20.3	38.5			
Be Green	8.7	20.3	29.0			

Table 7 below shows that the revised heat pump strategy achieves a 54.8% reduction in CO₂ emissions under SAP10, which exceeds the 35% target.

Table 7		Carbon dioxide savings SAP10			
Gray's Inn Road Residential CO2 emissions		(Tonnes CO ₂ per annum)		%	
Savings at e	ach stage of the energy hierarchy	Regulated	Total	Regulated	Total
Be Lean	Savings from demand reduction	1.1	1.1	5.8%	2.8%
Be Clean	Savings from decentralised energy	0.0	0.0	0.0%	0.0%
Be Green	Savings from renewable energy	9.5	9.5	49.0%	23.9%
	Total cumulative savings	10.6	10.6	54.8%	26.7%

When combined with the non-residential element of the scheme, the site-wide results are also 5.2 TCO₂ lower than the consented scheme's strategy. The results in Table 8 below are a combination of the updated residential emissions using the heat pump strategy under SAP 10 and the previous unchanged strategy as consented for the non-residential element of the scheme under SAP 2012.

Table 8 Gray's Inn Road & Panther House Combined Residential &Non-Residential CO2	Carbon dioxide emissions (Tonnes CO2 per annum) SAP10 & SAP2012				
After each stage of the energy hierarchy	Regulated Unregulated Toto				
Part L 2013 compliant development	251.3	98.7	350.0		
Be Lean	203.9	98.7	302.7		
Be Clean	203.9	98.7	302.7		
Be Green	194.5	98.7	293.2		

The overall site-wide CO₂ savings in tonnes and as a percentage for each stage of the energy hierarchy combined for the revised residential heat pump strategy under SAP 10 and the consented scheme's unchanged non-residential energy strategy under SAP 2012, are presented in Table 9.

This shows that the total cumulative CO_2 emissions savings are 56.8 tonnes, which is a 22.6% reduction.

The site-wide CO_2 emissions saving is short of the 35% target, meaning an offset payment is still required.

Table 9		Carbon dioxide savings SAP 10 & SAP2012				
Gray's Inn Road & Panther House Combined Residential & Non-Residential CO ₂		(Tonnes CO ₂ per annum)		%		
	each stage of the energy hierarchy	Regulated	Total	Regulated	Total	
Be Lean	Savings from demand reduction	47.3	47.3	18.8%	13.5%	
Be Clean	Savings from CHP	0.0	0.0	0.0%	0.0%	
Be Green	Savings from renewable energy	9.5	9.5	3.8%	2.7%	
	Total cumulative savings	56.8	56.8	22.6%	16.2%	

Table 10 below shows the CO₂ emissions savings, the shortfall to the 35% target and the associated offset payment figure for the development with the revised residential energy strategy.

Total Target Savings (35%)	87.9 TCO ₂
Savings Achieved	56.8 TCO ₂
Shortfall	31.2 TCO ₂
Offset (Shortfall x £90 x 30 years)	£84,240

Table 10: Carbon Offset Calculation for Revised Residential Energy Strategy



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CONCLUSION

The proposed revision to the energy strategy is an improvement on the consented scheme. The CO₂ emissions from the development will be lower and the use of heat pumps also benefits the scheme as the emissions will continue to decrease as grid electricity continues to decarbonise.

Although a robust and reliable source of heat, gas boilers are viewed less and less favourably due to concerns regarding air quality (from local combustion of gas and expulsion via flues), limitations with respect to efficiency and lower opportunities for decarbonisation due to the use of mains gas. The replacement of boilers with heat pumps helps the scheme's transition to net zero by taking advantage of the current and projected decarbonisation of grid electricity, providing all of the heat demand from highly efficient low-carbon plant.

Although a relatively minor change from gas boilers to heat pumps for the residential properties, the proposed energy strategy aligns more closely with the emerging Building Regulations and planning policies and could help to future proof the scheme against the Government's Future Homes Standards.

Results Comparison

The final table 11 below is a summary of the consented scheme's results compared with the revised residential strategy results.

	Consente	d Scheme	Revised	Strategy
Table 11Simple comparison between the ConsentedScheme and the Revised Strategy	Regulated (Tonnes CO2 per annum)	%	Regulated (Tonnes CO ₂ per annum)	%
Residential CO2 emissions Savings after all stages of the energy hierarchy	3.9	21.7%	10.6	54.8%
Combined Residential & Non-Residential CO ₂ Savings after all stages of the energy hierarchy	50.1	20%	56.1	22.6%
Shortfall	37.3	-	31.2	-
Offset (Shortfall x £90 x 30 years)	£100,710	-	£84,240	-

Table 11: Simple comparison between the Consented Scheme and the Revised Strategy



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17 Design SAP elmhurst energy

Property Referenc	e Apt 12				Issued on Date	15/02/2021
Assessment	012		Pro	op Type Ref		
Reference Property	12					
	12					
SAP Rating		83 B	DER	14.48	TER	25.61
Environmental		90 B	% DER <ter< th=""><th></th><th>43.46</th><th></th></ter<>		43.46	
CO ₂ Emissions (t/y	,	0.71	DFEE	42.82	TFEE	43.02
General Requirem	ents Compliance	Pass	% DFEE <tfee< th=""><th></th><th>0.47</th><th></th></tfee<>		0.47	
Assessor Details	Mrs. Caroline Kerss, Caroline limited.com	Kerss, Tel: 020	0778361133, ckers	s@mtt-	Assessor ID	T282-0001
Client						

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COM	MPLIANCE REPORT - Appro	ved Document L1A, 2013 Ec	dition, England	
DWELLING AS DES	SIGNED			
Mid-floor flat,	, total floor area 59 m	2		
It is not a com	vers items included with mplete report of regula			
la TER and DER Fuel for main h Fuel factor:1.5 Target Carbon I Dwelling Carbor	neating:Electricity (c) 55 (electricity) Dioxide Emission Rate ('	TER) 25.61 kgCO□/m² (DER) 14.48 kgCO□/m²OK		
1b TFEE and DFE Target Fabric E)43.0 kWh/m²/yr		
2 Fabric U-valu Element External wall Floor	Average 0.20 (max. 0.30)	Highest 0.25 (max. 0.70)	OK	
Openings	1.30 (max. 2.00)	0.12 (max. 0.35) 1.30 (max. 3.30)	OK OK	
2a Thermal brid Thermal bridgin	dging ng calculated using def	ault y-value of 0.15		
3 Air permeabil Air permeabilit Maximum	lity ty at 50 pascals:	3.00 (design value) 10.0		OK
4 Heating effic Main heating sy	ciency	Community heating sche		_
Secondary heati	ing system:	Room heaters - electri	ic	
Panel, convecto	or or radiant heaters			
5 Cylinder insu Hot water stora Permitted by DE	lation	Measured cylinder loss OK Yes (assumed)	s: 1.18 kWh/day	ок
			d to use of communi	
Hot water contr	rols:	Cylinderstat		OK
Minimum	fixed lights with low-e	nergy fittings:100%		ок
8 Mechanical ve	entilation ply and extract system	0.50		
Maximum MVHR efficiency		1.5 90%		OK
Minimum:		70%		0K
9 Summertime te Overheating ris Based on: Overshading:	emperature sk (Thames Valley):	Medium Average		OK
Windows facing Air change rate Blinds/curtains	e: s:	Average 18.00 m ² , No overhang 4.00 ach Dark-coloured curtain		
10 Key features Roof U-value Air permeabilit	s ty	0.12 W/m ² K 3.0 m ³ /m ² h		
Photovoltaic an	ing (electricity) rray	0.09 kW		









CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

 SAP 2012 WORKSHEET FOR New Build (As Designed)
 (Version 9.92, January 2014)

 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE
 09 Jan 2014

1. Overall dwelling dimensions								
Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) Dwelling volume	59.0000	Area (m2) 59.0000 (1b) (3a)+(3b)	x	height (m) 2.7000 3d)+(3e)		Volume (m3) 159.3000 159.3000	(4)	(3b)

2. Ventilation rate

					main heating		condary heating	0	ther	total	L m3	per hour	
Number of chimne	eys				0	+	0	+	0 =	() * 40 =	0.0000	(6a)
Number of open i	flues				0	+	0	+	0 =	() * 20 =	0.0000	(6b)
Number of interr	mittent far	15								() * 10 =	0.0000	(7a)
Number of passiv	ve vents									() * 10 =	0.0000	(7b)
Number of fluele		res								(* 40 =	0.0000	(7c)
										I	Air changes	per hour	
Infiltration due	e to chimne	eys, flues	and fans :	= (6a)+(6b)-	+(7a)+(7b)+	(7c) =				0.0000 /	(5) =	0.0000	(8)
Pressure test												Yes	
Measured/design	AP50											3.0000	
Infiltration rat	te											0.1500	(18)
Number of sides	sheltered											3	(19)
Shelter factor								(20) = 1 -	[0.075 x	(19)] =	0.7750	(20)
Infiltration rat	te adjusted	d to includ	e shelter fa	actor					(2	1) = (18) x	(20) =	0.1163	(21)
	-												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366	(22b)
Balanced mechar													(===;
If mechanical ve												0.5000	(23a)
If balanced with			ciency in %	allowing fo	or in-use fa	actor (from	n Table 4h)	=				76.5000	
Effective ac	0.2657	0.2628	0.2599	0.2454	0.2425	0.2279	0.2279	0.2250	0.2338	0.2425	0.2483	0.2541	(25)

Element				Gross	Openings	Net	Area	U-value	АхU	K-	value	АхК	
				m2	m2		m2	W/m2K	W/K	. k	J/m2K	kJ/K	
Opening Type 1	(Uw = 1.30))				18.	0000	1.2357	22.2433				(27
Spandrel						1.	4400	1.3000	1.8720	1			(26
xternal Wall	1			39.4200	19.4400	19.	9800	0.1500	2.9970	1			(29
ift				18.3600		18.	3600	0.2500	4.5900	l .			(29
xternal Roof	1			12.6000		12.	6000	0.1200	1.5120	l .			(30
Cotal net area	of externa	l elements	Aum(A, m2)			70.	3800						(31
abric heat lo	ss, W/K = S	um (A x U)					(26)(3	30) + (32) =	33.2143				(33
'hermal bridge 'otal fabric h	eat loss			-						(33)	+ (36) =	43.7713	(37
Ventilation he	Jan	Culated mon Feb	Mar (38)m	= 0.33 X (2 Apr	5)m x (5) Mav	T	Jul	Aug	Sep	Oct	Nov	Dec	
(38) m	13.9686	13.8158	13.6630	12.8991	12.7463	Jun 11.9824	11.9824	Aug 11.8297	12.2880	12.7463	13.0519	13.3575	130
		13.0130	13.0050	12.0391	12.7405	11.9024	11.9024	11.0257	12.2000	12./405	13.0315	13.3373	(50
	coeff												
		57 5871	57 4344	56 6705	56 5177	55 7538	55 7538	55 6010	56 0593	56 5177	56 8232	57 1288	(39
leat transfer	57.7399	57.5871	57.4344	56.6705	56.5177	55.7538	55.7538	55.6010	56.0593	56.5177	56.8232	57.1288 56.6323	
	57.7399		57.4344	56.6705	56.5177	55.7538	55.7538	55.6010	56.0593	56.5177	56.8232	57.1288 56.6323	
eat transfer	57.7399		57.4344 Mar	56.6705 Apr	56.5177 May	55.7538 Jun	55.7538 Jul	55.6010 Aug	56.0593 Sep	56.5177 Oct	56.8232 Nov		
eat transfer (57.7399 39)m / 12 =											56.6323	(3
leat transfer	57.7399 39)m / 12 = Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	56.6323 Dec	(3)
eat transfer (verage = Sum() LP	57.7399 39)m / 12 = Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	56.6323 Dec 0.9683	(3 (4 (4

4. Water heat	ing energy	requirement:	s (kWh/vear)									
Assumed occup	ancy											1.9532	(42)
Average daily	hot water	use (litres	/day)									80.5891	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wat	er use												
	88.6480	85.4244	82.2008	78.9773	75.7537	72.5301	72.5301	75.7537	78.9773	82.2008	85.4244	88.6480	(44)
Energy conte	131.4624	114.9778	118.6468	103.4392	99.2523	85.6472	79.3647	91.0722	92.1599	107.4035	117.2393	127.3143	(45)
Energy conten	t (annual)									Total = S	um(45)m =	1267.9796	(45)
Distribution	loss (46)m	= 0.15 x (45)m										
	19.7194	17.2467	17.7970	15.5159	14.8879	12.8471	11.9047	13.6608	13.8240	16.1105	17.5859	19.0971	(46)
Water storage	loss:												



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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF [WELLIN	G EMISSI	ONS FOR	R REGULA	TIONS CO	OMPLIAN	CE 09	Jan 2014	ļ			
Store volume a) If manufacturer decla Temperature factor from Enter (49) or (54) in (55 Total storage loss	n Table 2b	actor is kn	own (kWh/c	lay):							145.0000 1.1800 0.6000 0.7080	(48) (49)
21.9480 If cylinder contains ded	19.8240	21.9480 r storage	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(56)
21.9480 Primary loss 23.2624 Total heat required for w	19.8240 21.0112	21.9480 23.2624	21.2400 22.5120 ed for each	21.9480 23.2624 n month	21.2400 22.5120	21.9480 23.2624	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	
176.6728 Solar input 0.0000		163.8572 0.0000	147.1912 0.0000	144.4627 0.0000	129.3992 0.0000	124.5751 0.0000	136.2826 0.0000 Solar inpu	135.9119 0.0000 ut (sum of	152.6139 0.0000 months) = Su	160.9913 0.0000 am(63)m =	172.5247 0.0000 0.0000	(63)
Output from w/h 176.6728		163.8572	147.1912	144.4627	129.3992	124.5751			152.6139 h/year) = Su		172.5247 1800.2956	
Heat gains from water hea 79.8796	ating, kWh/1 70.8983	month 75.6184	69.3951	69.1697	63.4793	62.5571	66.4498	65.6448	71.8800	73.9837	78.5003	(65)
5. Internal gains (see Ta	able 5 and	5a)										
Metabolic gains (Table 5) Jan	, Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 97.6612 Lighting gains (calculate	97.6612 ed in Appen	97.6612 dix L, equa	97.6612 tion L9 or	97.6612 L9a), also	97.6612 see Table 5	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	
Appliances gains (calcula	ated in App		uation L13				7.3641	9.8841 130.1807	12.5501 139.6677	14.6478 151.6433	15.6151	
Cooking gains (calculated 32.7661							32.7661	32.7661	32.7661	32.7661	32.7661	
Pumps, fans 0.0000 Losses e.g. evaporation	0.0000	0.0000	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating gains (Tabl	Le 5)	-78.1289			-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	
Total internal gains	105.5034 343.4824	101.6376 332.6403	96.3821 315.2318	92.9701 297.7464	88.1657 280.7193	84.0821 269.5387	89.3143 274.7011	91.1733 283.5364	96.6129 301.1290	102.7551 321.3446	105.5112 336.3234	
6. Solar gains												
[Jan]			m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tabi	FF data le 6c	Acces facto Table (or	Gains W	
West		18.0		19.6403			1	.0000	0.770	00	132.2960	(80)
Solar gains 132.2960 Total gains 477.5703			621.5950 936.8267	761.7880 1059.5343		742.4257 1011.9644		495.6944 779.2308	307.0869 608.2160	164.9576 486.3022	108.7938 445.1172	
7. Mean internal temperat	ure (heati	ng season)										
Temperature during heatin Utilisation factor for ga	ng periods	in the livi	ng area fro	om Table 9,							21.0000	(85)
Jan tau 70.9600 alpha 5.7307	Feb 71.1482	Mar 71.3375 5.7558	Apr 72.2991	May 72.4945	Jun 73.4878 5.8992	Jul 73.4878 5.8992	Aug 73.6897 5.9126	Sep 73.0872 5.8725	Oct 72.4945 5.8330	Nov 72.1047 5.8070	Dec 71.7190 5.7813	
util living area 0.9909	0.9689	0.8885	0.6957	0.4919	0.3361	0.2424	0.2802	0.4923	0.8387	0.9761	0.9937	(86)
MIT 20.1932 Th 2 20.1012	20.4351 20.1033	20.7393 20.1055	20.9440 20.1164	20.9926 20.1185	20.9994 20.1294	20.9999 20.1294	20.9998 20.1316	20.9947 20.1251	20.8719 20.1185	20.4807 20.1142	20.1481 20.1098	
util rest of house 0.9882 MIT 2 19.0413	0.9604 19.3881	0.8642 19.8028	0.6539 20.0608	0.4467 20.1126	0.2905 20.1291	0.1944 20.1294	0.2274 20.1316	0.4316 20.1216	0.7965 19.9893	0.9681 19.4657	0.9917 18.9826	
Living area fraction MIT 19.5899	19.8868	20.2488	20.4815	20.5317	20.5436	20.5440	20.5451	fLA = 20.5375	Living area 20.4096	a / (4) = 19.9491	0.4763	
Temperature adjustment			20.4815	20.5317	20.5436	20.5440	20.5451	20.5375	20.4096	19.9491	0.0000 19.5377	(93)
adjusted MIT 19.5899	19.8868	20.2488	20.4015	20.3317	20.0400					10.0101		
adjusted MIT 19.5899 	nent									19.9191		
8. Space heating requirer Jan Utilisation 0.9862 Useful gains 470.9830 Ext temp. 4.3000	nent							Sep 0.4604 358.7600 14.1000	Oct 0.8114 493.4841 10.6000	Nov 0.9663 469.9373 7.1000	Dec 0.9901 440.7081 4.2000	(95)
8. Space heating requirer Jan Utilisation 0.9862 Useful gains 470.9830 Ext temp. 4.3000 Heat loss rate W 882.8373 Month fracti 1.0000	reb 0.9580 576.9927	Mar 0.8684 658.9712	Apr 0.6716 629.1534	May 0.4680 495.8564	Jun 0.3122 331.1380	Jul 0.2173 219.8726	Aug 0.2525 230.4209	0.4604 358.7600	Oct 0.8114 493.4841	Nov 0.9663 469.9373	0.9901 440.7081	(95) (96) (97)
8. Space heating requirer Jan Utilisation 0.9862 Useful gains 470.9830 Ext temp. 4.3000 Heat loss rate W 882.8373 Month fracti 1.0000 Space heating kWh 306.4197	Feb 0.9580 576.9927 4.9000 863.0446 1.0000	Mar 0.8684 658.9712 6.5000 789.6550	Apr 0.6716 629.1534 8.9000 656.3267	May 0.4680 495.8564 11.7000 499.1482	Jun 0.3122 331.1380 14.6000 331.3765	Jul 0.2173 219.8726 16.6000 219.8937	Aug 0.2525 230.4209 16.4000 230.4714	0.4604 358.7600 14.1000 360.8795	Oct 0.8114 493.4841 10.6000 554.4179	Nov 0.9663 469.9373 7.1000 730.1265	0.9901 440.7081 4.2000 876.2249 1.0000 324.0245	(95) (96) (97) (97a) (98)
Jan Utilisation 0.9862 Useful gains 470.9830 Ext temp. 4.3000 Heat loss rate W 882.8373 Month fracti 1.0000 Space heating kWh	Feb 0.9580 576.9927 4.9000 863.0446 1.0000	Mar 0.8684 658.9712 6.5000 789.6550 1.0000	Apr 0.6716 629.1534 8.9000 656.3267 1.0000	May 0.4680 495.8564 11.7000 499.1482 1.0000	Jun 0.3122 331.1380 14.6000 331.3765 0.0000	Jul 0.2173 219.8726 16.6000 219.8937 0.0000	Aug 0.2525 230.4209 16.4000 230.4714 0.0000	0.4604 358.7600 14.1000 360.8795 0.0000	Oct 0.8114 493.4841 10.6000 554.4179 1.0000 45.3347	Nov 0.9663 469.9373 7.1000 730.1265 1.0000	0.9901 440.7081 4.2000 876.2249 1.0000	(95) (96) (97) (97a) (98) (98)

Store volume												145.0000	(47)
a) If manufac Temperature Enter (49) or	factor from	m Table 2b	actor is kn	own (kWh/d	day):							1.1800 0.6000 0.7080	(49)
Total storage		19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	
If cylinder co	ontains ded:			21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	
Primary loss	21.9480 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
Total heat rec Solar input	176.6728 0.0000	155.8130 0.0000	163.8572 0.0000	147.1912 0.0000	144.4627 0.0000	129.3992 0.0000	124.5751 0.0000	136.2826 0.0000 Solar inn	135.9119 0.0000	152.6139 0.0000 months) = Su	160.9913 0.0000 m(63)m =	172.5247 0.0000 0.0000	(63)
Output from w/	′h 176.6728	155.8130	163.8572	147.1912	144.4627	129.3992	124.5751	136.2826	135.9119		160.9913	172.5247	(64)
Heat gains fro	om water hea 79.8796	ating, kWh/ 70.8983	month 75.6184	69.3951	69.1697	63.4793	62.5571	66.4498	65.6448	71.8800	73.9837	1800.2956 78.5003	
													(,
5. Internal ga	ains (see Ta	able 5 and	5a)										
Metabolic gair	ns (Table 5)), Watts							G - 1	0.1	N	D	
(66)m	Jan 97.6612	Feb 97.6612	Mar 97.6612	Apr 97.6612		Jun 97.6612	Jul 97.6612	Aug 97.6612	Sep 97.6612	Oct 97.6612	Nov 97.6612	Dec 97.6612	(66)
Lighting gains	15.1929	13.4942	10.9742	8.3082	6.2105	5.2431	5.6654	7.3641	9.8841	12.5501	14.6478	15.6151	(67)
Appliances gai	170.4180	172.1864	167.7301	158.2431	146.2675	135.0121	127.4928	125.7244	130.1807	139.6677	151.6433	162.8987	(68)
Cooking gains	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	
Pumps, fans Losses e.g. ev	0.0000 vaporation	0.0000 (negative v	0.0000 alues) (Tab	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
- Water heating	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	(71)
Total internal	107.3650	105.5034	101.6376	96.3821	92.9701	88.1657	84.0821	89.3143	91.1733	96.6129	102.7551	105.5112	(72)
iotar internal	345.2743	343.4824	332.6403	315.2318	297.7464	280.7193	269.5387	274.7011	283.5364	301.1290	321.3446	336.3234	(73)
6. Solar gains													
[Jan]				rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tabi		Acces facto Table (or	Gains W	
West			18.0	000						0.770	00	132.2960	(80)
		258.7991		621.5950		779.8255	742.4257	637.7327	495.6944 779.2308	307.0869 608.2160	164.9576 486.3022	108.7938 445.1172	
Solar gains	132.2960	258.7991	426.2053	621.5950	761.7880	779.8255	742.4257	637.7327					
Solar gains Total gains 7. Mean intern	132.2960 477.5703	258.7991 602.2815 ture (heati	426.2053 758.8456 ng season)	621.5950 936.8267	761.7880 1059.5343	779.8255 1060.5448	742.4257 1011.9644	637.7327 912.4338					
Solar gains Total gains	132.2960 477.5703	258.7991 602.2815 ture (heati	426.2053 758.8456 ng season)	621.5950 936.8267	761.7880 1059.5343	779.8255 1060.5448	742.4257 1011.9644	637.7327 912.4338					(84)
Solar gains Total gains 7. Mean interr	132.2960 477.5703 hal temperat	258.7991 602.2815 ture (heati	426.2053 758.8456 ng season) in the livi	621.5950 936.8267 	761.7880 1059.5343 om Table 9, 1	779.8255 1060.5448	742.4257 1011.9644	637.7327 912.4338				445.1172	(84)
Solar gains Total gains 7. Mean interr Temperature du	132.2960 477.5703 mal temperation ming heating actor for ga	258.7991 602.2815 ture (heati ng periods ains for li	426.2053 758.8456 ng season) in the livi ving area,	621.5950 936.8267 	761.7880 1059.5343 	779.8255 1060.5448 	742.4257 1011.9644	637.7327 912.4338	779.2308	608.2160	486.3022	445.1172	(84)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau	132.2960 477.5703 hal temperat rring heatin actor for gr Jan 70.9600 5.7307	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945	779.8255 1060.5448 	742.4257 1011.9644 Jul 73.4878	637.7327 912.4338 Aug 73.6897	779.2308 Sep 73.0872	008.2160 Oct 72.4945	486.3022 Nov 72.1047	445.1172 21.0000 Dec 71.7190	(84)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT	132.2960 477.5703 hal temperat rring heatin totor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440	761.7880 1059.5343 om Table 9, T Table 9a) May 72.4945 5.8330 0.4919 20.9926	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994	742.4257 1011.9644 	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998	Sep 73.0872 5.8725 0.4923 20.9947	Oct 72.4945 5.8330 0.8387 20.8719	Nov 72.1047 5.8070 0.9761 20.4807	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481	(84) (85) (86) (87)
Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living an	132.2960 477.5703 hal temperat interpretation data temperat Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885	621.5950 936.8267 ng area fr nil,m (see Apr 72.2991 5.8199 0.6957	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185	779.8255 1060.5448 	742.4257 1011.9644 Jul 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944	637.7327 912.4338 Aug 73.6897 5.9126 0.2802	Sep 73.0872 5.8725 0.4923	Oct 72.4945 5.8330 0.8387	Nov 72.1047 5.8070 0.9761	445.1172 21.0000 Dec 71.7190 5.7813 0.9937	(84) (85) (86) (87) (88)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2	132.2960 477.5703 mal temperad ring heatin actor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 house 0.9882 19.0413	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055	621.5950 936.8267 ng area fro n11,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164	761.7880 1059.5343 mm Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294	742.4257 1011.9644 Jul 73.4878 5.8992 0.2424 20.9999 20.1294	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917	 (84) (85) (86) (87) (88) (89) (90)
Solar gains Total gains 7. Mean inter Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of h MIT 2	132.2960 477.5703 hal temperat inctor for gr Jan 70.90600 5.7307 rea 0.9909 20.1932 20.1012 iouse 0.9882 19.0413 reaction 19.5899	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539	761.7880 1059.5343 mm Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905	742.4257 1011.9644 Jul 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826	 (84) (85) (86) (87) (88) (89) (90) (91)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of P MIT 2 Living area fr MIT	132.2960 477.5703 mal temperad ring heatin actor for gr Jan 70.9600 0.9909 20.1932 20.1012 nouse 0.9882 19.0413 raction 19.5899 ijustment	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291	742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294	637.7327 912.4338 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 21.126	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) =	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377	 (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fe tau alpha util living an MIT Th 2 util rest of H MIT 2 Living area fi MIT Temperature ac adjusted MIT	132.2960 477.5703 mal temperat ring heatin ring heatin rouse 0.9909 20.1932 20.1012 nouse 0.9882 19.0413 reaction 19.5899	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3861 19.8868 19.8868	426.2053 758.8456 in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 ng area fr nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	761.7880 1059.5343 mm Table 9, T Table 9a) May 72.4945 5.8330 0.4919 20.1185 0.4467 20.1126 20.5317 20.5317	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	742.4257 1011.9644 Jul 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	Oct 72,4945 5.8330 0.8387 20.8719 20.1185 19.9893 Living area 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) = 19.9491	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	 (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of h MIT 2 Living area fh MIT Temperature ac adjusted MIT	132.2960 477.5703 all temperal tring heatin totor for gi Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 nouse 0.9882 19.0413 raction 19.5899 djustment 19.5899	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	761.7880 1059.5343 om Table 9, T Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	Oct 72,4945 5.8330 0.8387 20.8719 20.1185 19.9893 Living area 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) = 19.9491	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	 (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of P MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heati	132.2960 477.5703 hal temperation tering heatin tector for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 touse 0.9882 19.0413 reaction 19.5899 ijustment 19.5899 ing requirer Jan	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	761.7880 1059.5343 mm Table 9, T Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	779.8255 1060.5448	742.4257 1011.9644	637.7327 912.4338	Sep 73.0872 5.8725 0.4923 20.9947 20.1216 fLA = 20.5375 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 19.9893 Living area 20.4096 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.4142 0.9681 19.4657 a / (4) = 19.9491 19.9491	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	 (84) (85) (85) (87) (88) (89) (90) (91) (92) (93)
Solar gains Total gains Total gains 7. Mean interr Temperature du Utilisation fe tau alpha util living an MIT Th 2 util rest of H MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heati Utilisation Useful gains Ext temp.	132.2960 477.5703 hal temperat ining heatin itotor for gi Jan 70.9000 5.7307 rea 0.9909 20.1932 20.1012 iouse 0.9882 19.0413 raction 19.5899 ijustment 19.5899 Jan 0.9882 470.9830 4.3000	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488	621.5950 936.8267 ng area fro nl,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	637.7327 912.4338 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 4 / (4) = 19.9491 19.9491 19.9491	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	 (84) (85) (86) (87) (88) (89) (91) (92) (93)
Solar gains Total gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of H MIT 2 Living area fi MIT Temperature ac adjusted MIT 8. Space heati 	132.2960 477.5703 Hal temperat Intring heatin Actor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 10.9882 19.0413 Faction 19.5899 Ing required Jan 0.9882 19.0413 Faction 19.5899 Ing required Jan 0.9862 470.9830 4.3000 W 882.8373 1.0000	258.7991 602.2815 ture (heati reb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488	621.5950 936.8267 ng area fr nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815	761.7880 1059.5343 mm Table 9, T Table 9a) May 72.4945 5.8330 0.4919 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564 11.7000 499.1482	779.8255 1060.5448 (h1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	742.4257 1011.9644	637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 20.5375 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096 20.4096 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 (4) = 19.9491 19.9491 19.9491	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9937 18.9826 0.4763 19.5377 0.0000 19.5377	 (84) (85) (85) (87) (88) (89) (91) (92) (93) (93) (94) (95) (96) (97)
Solar gains Total gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of h MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heati Useful gains Ext temp. Heat loss rate Month fracti Space heating	132.2960 477.5703 hal temperal aring heatin totor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 nouse 0.9882 19.0413 raction 19.5899 ljustment 19.5899 ljustment 19.5899 Jan 0.9862 470.9830 4.3000 W 882.8373 1.0000 kWh	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868 19.8868	426.2053 758.8456 ng season) in the liviv Mar 71.3375 5.7558 0.8885 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488 20.2488 20.2488 20.2488	621.5950 936.8267 ng area from ng area from 72.2991 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.1125 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564 11.7000 499.1482 1.0000	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436 	742.4257 1011.9644	637.7327 912.4338 Aug 73.6897 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375 20.5375 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096 20.4096 20.4096 20.4096	Nov 72.1047 5.8070 0.9761 20.1142 0.9681 19.9491 19.9491 19.9491 Nov 0.9663 469.9373 7.1000 730.1265	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 0.0000 19.5377 Dec 0.9901 440.7081 4.2000 876.2249 1.0000 324.0245	 (84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (94) (95) (96) (97) (98)
Solar gains Total gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of H MIT 2 Living area fi MIT Temperature ac adjusted MIT 8. Space heati 	132.2960 477.5703 hal temperat aring heatin totor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 rouse 0.9882 19.0413 action 19.5899 10.000 20.1012 10.000 20.1012 10.000 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.012 2	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2685 20.2655 1.0000 789.6550 1.00000	621.5950 936.8267 ng area fr nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 20.4815 20.4815 20.6716 629.1534 8.9000 656.3267 1.0000	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.1125 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564 11.7000 499.1482 1.0000	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436 20.5436 20.5436 31.3122 331.1380 14.6000 331.3765 0.0000	742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.5440 20.5440 20.5440 20.5440 20.5440 20.5440	637.7327 912.4338 Aug 73.6897 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 20.5451 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 20.1216 20.5375 20.5375 20.5375 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 19.9833 Living area 20.4096 20.4096 20.4096 20.4096 20.4096 20.4096 514.4179 1.0000 45.3347	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491 19.9491 19.9491 19.9491 19.9491 19.9491 7.1000 730.1265 1.0000	21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9937 18.9826 0.4763 19.5377 0.0000 19.5377 0.5377 0.9901 440.7081 4.2000 876.2249 1.0000	 (84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (94) (95) (96) (97) (97a) (98) (98)
Solar gains Total gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of P MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heating Utilisation Useful gains Ext temp. Heat loss rate Month fracti Space heating	132.2960 477.5703 hal temperat aring heatin totor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 rouse 0.9882 19.0413 action 19.5899 10.000 20.1012 10.000 20.1012 10.000 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.1012 20.012 2	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868	426.2053 758.8456 ng season) in the livi ving area, Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2685 20.2655 1.0000 789.6550 1.00000	621.5950 936.8267 ng area fr nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 20.4815 20.4815 20.6716 629.1534 8.9000 656.3267 1.0000	761.7880 1059.5343 om Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.1125 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564 11.7000 499.1482 1.0000	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436 20.5436 20.5436 31.3122 331.1380 14.6000 331.3765 0.0000	742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.5440 20.5440 20.5440 20.5440 20.5440 20.5440	637.7327 912.4338 Aug 73.6897 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 20.5451 	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 20.1216 20.5375 20.5375 20.5375 20.5375 20.5375	Oct 72.4945 5.8330 0.8387 20.8719 20.1185 19.9833 Living area 20.4096 20.4096 20.4096 20.4096 20.4096 20.4096 514.4179 1.0000 45.3347	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 (4) = 19.9491 19.9491 19.9491 19.9491 19.9491 19.9491 19.9491 7.1000 730.1265 1.0000 187.3362	445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 18.9826 0.4763 19.5377 0.0000 19.5377 0.9901 440.7081 4.2000 876.2249 1.0000 324.0245 51174.5846	 (84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (94) (95) (96) (97) (97a) (98) (98)

Store volume a) If manufacturer												
Temperature facto		actor is kno	own (kWh/d	lay):							145.0000 1.1800 0.6000	(48)
Enter (49) or (54) Total storage loss	in (55)										0.7080	(55)
21. If cylinder contain	9480 19.8240 s dedicated sola	21.9480 ar storage	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(56)
21.	9480 19.8240 2624 21.0112	21.9480 23.2624	21.2400 22.5120 ed for each	21.9480 23.2624 month	21.2400 22.5120	21.9480 23.2624	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	
176.		163.8572 0.0000	147.1912 0.0000	144.4627 0.0000	129.3992 0.0000	124.5751 0.0000	136.2826 0.0000 Solar inp	135.9119 0.0000 ut (sum of)	152.6139 0.0000 months) = Su	160.9913 0.0000 um(63)m =	172.5247 0.0000 0.0000	(63)
Output from w/h 176.	6728 155.8130	163.8572	147.1912	144.4627	129.3992	124.5751	136.2826	135.9119	152.6139 h/year) = Su	160.9913	172.5247 1800.2956	(64)
Heat gains from wat 79.	er heating, kWh/ 8796 70.8983	month 75.6184	69.3951	69.1697	63.4793	62.5571	66.4498	65.6448	71.8800	73.9837	78.5003	
5. Internal gains (
	n Feb 6612 97.6612	Mar 97.6612	Apr 97.6612	May 97.6612	Jun 97.6612	Jul 97.6612	Aug 97.6612	Sep 97.6612	Oct 97.6612	Nov 97.6612	Dec 97.6612	(66)
	1929 13.4942	10.9742	8.3082	6.2105	5.2431	5.6654	7.3641	9.8841	12.5501	14.6478	15.6151	(67)
	4180 172.1864	167.7301	158.2431	146.2675	135.0121	127.4928	125.7244	130.1807	139.6677	151.6433	162.8987	(68)
	7661 32.7661	iix L, equati 32.7661 0.0000	ion L15 or 32.7661 0.0000	L15a), also 32.7661 0.0000	see Table 32.7661 0.0000	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	
Losses e.g. evapora				-78.1289	-78.1289	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating gains		101.6376	96.3821	92.9701	88.1657	84.0821	89.3143	91.1733	96.6129	102.7551	105.5112	
Total internal gain 345.	S	332.6403	315.2318	297.7464	280.7193	269.5387	274.7011	283.5364	301.1290	321.3446	336.3234	
6. Solar gains												
[Jan]			rea m2	Solar flux Table 6a	Speci	g fic data			Acces facto	or	Gains W	
				W/m2	or	Table 6b	or Tab	le 6c	Table (ba		
West		18.00		19.6403		0.5400	1		1able 4 0.770		132.2960	(80)
Solar gains 132.	2960 258.7991 5703 602.2815		621.5950	19.6403	779.8255	0.5400	1				132.2960 108.7938 445.1172	(83)
Solar gains 132. Total gains 477.	2960 258.7991 5703 602.2815	426.2053 758.8456	621.5950 936.8267	19.6403 761.7880 1059.5343	779.8255 1060.5448	0.5400 742.4257 1011.9644	1 637.7327 912.4338	.0000	0.770	164.9576	108.7938	(83)
Solar gains 132. Total gains 477. 7. Mean internal te	2960 258.7991 5703 602.2815 	426.2053 758.8456 .ng season)	621.5950 936.8267	19.6403 761.7880 1059.5343	779.8255 1060.5448	0.5400 742.4257 1011.9644	1 637.7327 912.4338	.0000	0.770	164.9576	108.7938 445.1172	(83) (84)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for li	426.2053 758.8456 .ng season) in the livir ving area, r	621.5950 936.8267 ng area fro nil,m (see	19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a)	779.8255 1060.5448 Fh1 (C)	0.5400 742.4257 1011.9644	1 637.7327 912.4338	.0000 495.6944 779.2308	0.77(307.0869 608.2160	164.9576 486.3022	108.7938 445.1172 21.0000	(83) (84)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5.	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for li	426.2053 758.8456 .ng season) in the livir	621.5950 936.8267 ng area frc	19.6403 761.7880 1059.5343 m Table 9, 7	779.8255 1060.5448	0.5400 742.4257 1011.9644	1 637.7327 912.4338	.0000	0.770	164.9576	108.7938 445.1172	(83) (84)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area	2960 258.7991 5703 602.2815 meperature (heati heating periods for gains for li n Feb 9600 71.1482	426.2053 758.8456 .ng season) in the livir .ving area, r Mar 71.3375	621.5950 936.8267 ng area frc nil,m (see Apr 72.2991	19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945	779.8255 1060.5448 Th1 (C) Jun 73.4878	0.5400 742.4257 1011.9644 	1 637.7327 912.4338 Aug 73.6897	.0000 495.6944 779.2308 Sep 73.0872	0.77(307.0869 608.2160 Oct 72.4945	164.9576 486.3022 Nov 72.1047	108.7938 445.1172 21.0000 Dec 71.7190	(83) (84) (85)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor tau 70. alpha 5. util living area 0. MIT 20.	2960 258.7991 5703 602.2815 meerature (heati heating periods for gains for li n Feb 9600 71.1482 7307 5.7432	426.2053 758.8456 .ng season) in the livir ving area, r Mar 71.3375 5.7558	621.5950 936.8267 ng area fro hil,m (see Apr 72.2991 5.8199	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992	0.5400 742.4257 1011.9644 Jul 73.4878 5.8992	1 637.7327 912.4338 Aug 73.6897 5.9126	.0000 495.6944 779.2308 Sep 73.0872 5.8725	0.770 307.0869 608.2160 Oct 72.4945 5.8330	164.9576 486.3022 Nov 72.1047 5.8070	108.7938 445.1172 21.0000 Dec 71.7190 5.7813	(83) (84) (85) (85) (86) (87)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area 0. MIT 20. util rest of house 0. MIT 2 19.	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for 13 n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881	426.2053 758.8456 .ng season) in the livir ving area, r Mar 71.3375 5.7558 0.8885 20.7393	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199 0.6957 20.9440	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926	779.8255 1060.5448 Fh1 (C) Jun 73.4878 5.8992 0.3361 20.9994	0.5400 742.4257 1011.9644 	1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998	.0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	0.770 307.0869 608.2160 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826	(83) (84) (85) (86) (86) (87) (88) (89) (90)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area MIT 20. util rest of house 0. MIT 2 19. Living area fractio MIT 19.	2960 258.7991 5703 602.2815 meperature (heati heating periods for gains for li n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 n 5899 19.8868	426.2053 758.8456 .ng season) in the livir ving area, r Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642	621.5950 936.8267 936.8267 ng area frc hil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944	1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274	.0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	0.770 307.0869 608.2160 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377	(83) (84) (85) (85) (86) (88) (88) (90) (91) (92)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area 0. MIT 20. MIT 20. MIT 2 10. MIT 2 19. Living area fractio	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for li n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 m 5899 19.8868 ent	426.2053 758.8456 	621.5950 936.8267 ng area fro Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294	1 637.7327 912.4338 912.4338 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 21.1216	0.770 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) =	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Tau 70. alpha 5. util living area Util rest of house Util rest of house Util rest of house Util rest of nuse INIT 2 UVIIT 19. Temperature adjustm adjusted MIT 19. 8. Space heating re	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for li n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 m 5899 19.8868 ent 5899 19.8868	426.2053 758.8456 g season) in the livir ving area, r Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 ng area frc nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1126 0.4467 20.1126 20.5317 20.5317	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	1 637.7327 912.4338 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	0.770 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) = 19.9491	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains 132. Total gains 477. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area 0. MIT 20. Th 2 20. Util rest of house 0. MIT 2 19. Living area fractio MIT 2 19. Living area fractio MIT 19. Emperature adjust adjusted MIT 19. 8. Space heating re	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for lin n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 n 5899 19.8868 ent 5899 19.8868	426.2053 758.8456 	621.5950 936.8267 ng area frc Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.1294 20.5440	1 637.7327 912.4338 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	.0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 1LA = 20.5375 20.5375	0.770 307.0869 608.2160 0.8387 20.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491 19.9491	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains 132. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area 0. MIT 20. Th 2 20. util rest of house 0. MIT 2 19. Living area fractio MIT 19. Temperature adjustm adjusted MIT 19. 8. Space heating re subjusted Jacoba 470. Utilisation 0. Useful gains 470.	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for lin reb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 n 5899 19.8868 ent 5899 19.8868 rquirement rguirement rguirement rguirement rguirement	426.2053 758.8456 g season) in the livir Ving area, r Mar 71.3375 5.7558 0.8885 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 ang area fro Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1125 0.4467 20.5317 20.5317 20.5317 May 0.4680	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.1294 20.5440 20.5440 20.5440	1 637.7327 912.4338 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	0.770 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491 19.9491 19.9491	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(83) (84) (85) (85) (88) (89) (90) (91) (92) (93) (93)
Solar gains 132. Total gains 477. Total gains 477. 7. Mean internal te Temperature during Utilisation factor Jatau 70. alpha 5. util living area util living area Utilirest of house 0. MIT 20. Th 2 20. util rest of house 0. MIT 219. Living area fractio MIT 19. Living area fraction MIT 219. Living area fraction MIT 29. Utilisation 0. Useful gains 470. Est temp. 44. Heat loss rate W Month fracti 1.	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for li n Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 n 5899 19.8868 ent 5899 19.8868 ent 19.8868 ent 5899 19.8868	426.2053 758.8456 	621.5950 936.8267 ng area frc nil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564	779.8255 1060.5448 Fh1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440 20.5440 20.5440	1 637.7327 912.4338 912.4338 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.5451 20.5451 20.5451 20.5451 20.5451	.0000 495.6944 779.2308 Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.5375 20.5375 20.5375 20.5375	0.770 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 10.9893 Living area 20.4096 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.9491 19.9491 19.9491 19.9491	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	(83) (84) (85) (85) (87) (88) (89) (90) (91) (92) (93) (93) (94) (95) (96) (97)
Solar gains 132. Total gains 477. 7. Mean internal te 7. Mean internal te Temperature during Utilisation factor Ja tau 70. alpha 5. util living area 0. MIT 20. MIT 20. MIT 219. Living area fractio 0. MIT 19. Temperature adjustm adjusted MIT 19. 8. Space heating re 	2960 258.7991 5703 602.2815 mperature (heati heating periods for gains for lin r Feb 9600 71.1482 7307 5.7432 9909 0.9689 1932 20.4351 1012 20.1033 9882 0.9604 0413 19.3881 n 5899 19.8868 ent 5899 19.8868 ent s899 19.8868 ent rn Feb 9862 0.9580 9830 576.9927 3000 4.9000 8373 863.0446 0000 1.0000 4197 192.2269	426.2053 758.8456 g season) in the livir ving area, r 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488 20.2488	621.5950 936.8267 936.8267 ng area frc Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 	19.6403 761.7880 1059.5343 m Table 9, Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564 11.7000 499.1482	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 20.1294 20.5436 20.5436 20.5436 20.5436 20.5436 20.5436 30.3122	0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 20.1294 20.5440 20.5440 20.5440 20.5440 20.5440	1 637.7327 912.4338 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 20.5451 Aug 0.2525 230.4209 16.4000 230.4714	.0000 495.6944 779.2308 Sep 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375 20.5375 20.5375 Sep 0.4604 35.7600 14.1000 360.8795	0.770 307.0869 608.2160 0.8387 20.8719 20.1185 0.7965 19.9833 Living area 20.4096 20.4096 20.4096 0.8114 493.4841 10.6000 554.4179 1.0000 45.3347	Nov 72.1047 5.8070 0.9761 20.1142 19.4657 a / (4) = 19.9491 19.9491 19.9491 Nov 0.9663 469.9373 7.1000 730.1265	108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 0.0000 19.5377	(83) (84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (93) (95) (96) (97a (98) (98)

Store volume a) If manufacturer decl												(17)
Temperature factor fro	m Table 2b	actor is kno	own (kWh/d	lay):							145.0000 1.1800 0.6000	(48) (49)
Enter (49) or (54) in (5 Total storage loss		01 0105	01 010-	01 0405	01 010-	01 010-	01 0105	01 0105	01 0105	01 040-	0.7080	
21.9480 If cylinder contains ded			21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	
21.9480 Primary loss 23.2624 Total heat required for	19.8240 21.0112 water heati	21.9480 23.2624 ng calculate	21.2400 22.5120 ed for each	21.9480 23.2624 month	21.2400 22.5120	21.9480 23.2624	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	21.2400 22.5120	21.9480 23.2624	
176.6728 Solar input 0.0000	155.8130 0.0000	163.8572 0.0000	147.1912 0.0000	144.4627 0.0000	129.3992 0.0000	124.5751 0.0000	136.2826 0.0000 Solar inp	135.9119 0.0000 at (sum of)	152.6139 0.0000 months) = Si	160.9913 0.0000 um(63)m =	172.5247 0.0000 0.0000	(63)
Output from w/h 176.6728	155.8130	163.8572	147.1912	144.4627	129.3992	124.5751	136.2826	135.9119	152.6139 h/year) = Si	160.9913	172.5247	(64)
Heat gains from water he 79.8796	ating, kWh/ 70.8983	month 75.6184	69.3951	69.1697	63.4793	62.5571	66.4498	65.6448	71.8800	73.9837	78.5003	
5. Internal gains (see T												
Metabolic gains (Table 5 Jan (66)m 97.6612	Feb 97.6612	Mar 97.6612	Apr 97.6612	May 97.6612	Jun 97.6612	Jul 97.6612	Aug 97.6612	Sep 97.6612	Oct 97.6612	Nov 97.6612	Dec 97.6612	(66
Lighting gains (calculat 15.1929	13.4942	10.9742	8.3082	6.2105	5.2431	5.6654	7.3641	9.8841	12.5501	14.6478	15.6151	(67
Appliances gains (calcul 170.4180	ated in App 172.1864	endix L, equ 167.7301	uation L13 158.2431	or L13a), a 146.2675	lso see Tab 135.0121	le 5 127.4928	125.7244	130.1807	139.6677	151.6433	162.8987	(68
Cooking gains (calculate 32.7661	d in Append 32.7661	ix L, equat: 32.7661	ion L15 or 32.7661	L15a), also 32.7661	see Table 32.7661	5 32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	
Pumps, fans 0.0000 Losses e.g. evaporation	0.0000 (negative v	0.0000 alues) (Tabi	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70
-78.1289 Water heating gains (Tab	-78.1289		-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	(71
107.3650 Total internal gains	105.5034	101.6376	96.3821	92.9701	88.1657	84.0821	89.3143	91.1733	96.6129	102.7551	105.5112	(72
345.2743	343.4824	332.6403	315.2318	297.7464	280.7193	269.5387	274.7011	283.5364	301.1290	321.3446	336.3234	(73
6. Solar gains												
								FF	Acce	ss	Gains	
[Jan]			rea m2	Solar flux		g fic data	Specific				747	
[Jan]			m2	Table 6a W/m2	Speci	fic data	Specific or Tabi	data	fact Table	or	W	
[Jan] 		18.00	m2 000	Table 6a W/m2 19.6403	Speci or	fic data Table 6b 0.5400	or Tab: 1	data	fact	or 6d	W 132.2960	
West	258.7991 602.2815	18.00	m2 000 621.5950	Table 6a W/m2 19.6403	Speci or 	fic data Table 6b 0.5400 742.4257	or Tab: 1	data Le 6c	fact Table	or 6d		(80
West Solar gains 132.2960 Total gains 477.5703	258.7991 602.2815	18.00 426.2053 758.8456	m2 000 621.5950 936.8267	Table 6a W/m2 19.6403 761.7880 1059.5343	Speci or 779.8255 1060.5448	fic data Table 6b 0.5400 742.4257 1011.9644	or Tab: 1 637.7327 912.4338	data Le 6c .0000 495.6944	fact Table 0.77 307.0869	or 6d 00 164.9576	132.2960	(80
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera	258.7991 602.2815 ture (heati	18.0(426.2053 758.8456 ng season)	m2 000 621.5950 936.8267	Table 6a W/m2 19.6403 761.7880 1059.5343	Speci or 779.8255 1060.5448	fic data Table 6b 0.5400 742.4257 1011.9644	or Tab: 1 637.7327 912.4338	data Le 6c .0000 495.6944	fact Table 0.77 307.0869	or 6d 00 164.9576	132.2960 108.7938 445.1172	(80 (83 (84
West Solar gains 132.2960 Total gains 477.5703 	258.7991 602.2815 ture (heati 	18.00 426.2053 758.8456 ng season) in the livir ving area, r	m2 621.5950 936.8267 mg area fro nil,m (see	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a)	Speci or 779.8255 1060.5448 Th1 (C)	fic data Table 6b 0.5400 742.4257 1011.9644	0 or Tab. 1 637.7327 912.4338	data 6C .0000 495.6944 779.2308	facta Table 0 0.770 307.0869 608.2160	br 6d 100 164.9576 486.3022	132.2960 108.7938 445.1172 21.0000	(80 (83 (84
West Solar gains 132.2960 Total gains 477.5703 	258.7991 602.2815 ture (heati ng periods	18.00 426.2053 758.8456 ng season) in the livir	m2 000 621.5950 936.8267 ng area fro	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 5	Speci or 779.8255 1060.5448	fic data Table 6b 0.5400 742.4257 1011.9644	or Tab: 1 637.7327 912.4338	data Le 6c .0000 495.6944	fact Table 0.77 307.0869	or 6d 00 164.9576	132.2960 108.7938 445.1172	(80 (83 (84
West Solar gains 132.2960 Total gains 477.5703 	258.7991 602.2815 ture (heati 	18.00 426.2053 758.8456 ng season) in the livir ving area, r Mar 71.3375	m2 621.5950 936.8267 ng area fro nil,m (see Apr 72.2991	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945	Speci or 779.8255 1060.5448 Fh1 (C) Jun 73.4878	fic data Table 6b 0.5400 742.4257 1011.9644 	0 or Tab. 1 637.7327 912.4338 	data Le 6c .0000 495.6944 779.2308 Sep 73.0872	fact Table 0.77 307.0869 608.2160 Oct 72.4945	Do 00 164.9576 486.3022 Nov 72.1047	132.2960 108.7938 445.1172 21.0000 Dec 71.7190	(80 (83 (84
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan To.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012	258.7991 602.2815 ture (heati 	18.00 426.2053 758.8456 ng season) in the livir ving area, r Mar 71.3375 5.7558	m2 621.5950 936.8267 ng area fro nil, m (see Apr 72.2991 5.8199	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945 5.8330	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992	fic datā Table 6b 0.5400 742.4257 1011.9644 	ar Tab. 1 637.7327 912.4338 Aug 73.6897 5.9126	data Le 6c .0000 495.6944 779.2308 Sep 73.0872 5.8725	fact. Table 0.77 307.0869 608.2160 Oct 72.4945 5.8330	Do 164.9576 486.3022 Nov 72.1047 5.8070	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813	(80 (83 (84 (85 (85
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9682 MIT 2 19.0413	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351	18.00 426.2053 758.8456 ng season) in the livir ving area, r Mar 71.375 5.7558 0.8885 20.7393	m2 621.5950 936.8267 ng area fro hil,m (see Apr 72.2991 5.8199 0.6957 20.9440	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994	fic data Table 6b 0.5400 742.4257 1011.9644 	Aug 73.6897 5.9126 0.2802 20.9998	data e 6c .0000 495.6944 779.2308 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	facta Table - 0.77 307.0869 608.2160 0.82160 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9833	Nov 72.1047 5.8070 0.9761 20.1142 0.9681 19.4657	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1481 20.9917 18.9826	(80 (83 (84 (85 (85 (87 (88 (87 (88 (87 (88))))))))))))))))
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9882 MIT 2 19.0413 Living area fraction MIT 19.5899	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604	18.00 426.2053 758.8456 	m2 621.5950 936.8267 00 00 0111,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9a May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905	fic data Table 6b 0.5400 742.4257 1011.9644 	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274	data e 6c .0000 495.6944 779.2308 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216	factor Table 0 0.770 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965	Nov 72.1047 5.8070 0.9761 20.1142 0.9681 19.4657	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377	(80 (83 (84 (85 (85 (85 (85 (85 (85) (88 (85) (92)(91)(92)(91)
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9882 MIT 2 19.0413 Living area fraction	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881	18.00 426.2053 758.8456 	m2 621.5950 936.8267 ng area fro hil,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 5 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291	fic data Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316	data Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 21.126	fact Table 0 0.77 307.0869 608.2160 0 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) =	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763	(80 (83 (84 (85 (87 (88 (87 (88 (87 (88 (87 (88 (87)(90)(92))))))))))))))))))))))))))))))))
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9882 MIT 2 19.0413 Living area fraction MIT 19.5899 Temperature adjustment adjusted MIT 19.5899 8. Space heating require	258.7991 602.2815 ture (heati reb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	18.00 426.2053 758.8456 	m2 621.5950 936.8267 621.5950 936.8267 000 0011,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	fic data Table 6b 0.5400 742.4257 1011.9644 Jul 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.5440 20.5440	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	data Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 £LA = 20.5375	fact. Table 0 0.77 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) = 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(80) (83) (84) (84) (85) (86) (86) (82) (91) (92)
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 Util rest of house 0.9862 MIT 2 19.0413 Living area fraction MIT 19.5899 Benperature adjustment adjusted MIT 19.5899 8. Space heating require	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	18.00 426.2053 758.8456 	m2 621.5950 936.8267 equation (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	Speci or 779.8255 1060.5448 771 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	fic data Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	or Tab. 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.5451 20.5451	data Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.947 20.1216 fLA = 20.5375 20.5375	fact Table 0.77 307.0869 608.2160 0.82160 0.8387 20.8719 20.1185 0.7965 19.9893 Living are, 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 (4) = 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	(80) (83) (84) (84) (85) (86) (86) (82) (91) (92)
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9882 MIT 2 19.0413 Living area fraction MIT 19.5899 Temperature adjustment adjusted MIT 19.5899 8. Space heating require Utilisation 0.9862 Useful gains 470.9830 Ext temp. 4.3000	258.7991 602.2815 ture (heati reb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	18.00 426.2053 758.8456 ng season) in the livir ving area, r Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488	m2 621.5950 936.8267 936.8267 ong area fro hil,m (see Apr 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	fic data Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440 20.5440	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	data Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 £LA = 20.5375	fact. Table 0 0.77 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491 19.9491 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(80 (83 (84 (85 (86 (87 (88 (87 (88 (82 (91 (92 (93) (93)
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 0.1012 Util rest of house 0.9882 MIT 2 19.0413 Living area fraction MIT 19.5899 MIT 19.5899 MIT 2.5899 8. Space heating require Jan Utilisation 0.9862 Useful gains 470.9830 MEXt temp. 4.3000 Heat loss rate W 882.8373 Month fracti 1.0000	258.7991 602.2815 ture (heati 	18.00 426.2053 758.8456 	m2 621.5950 936.8267 936.8267 0 0 0 0 0 0 0 0 0 0 0 0 0	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	fic data Table 6b 0.5400 742.4257 1011.9644 	0r Tab. 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.5451 20.5451 20.5451 Aug 0.2525 230.4209	data le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.5375 20.5375 20.5375 20.5375	fact Table 0 0.77 307.0869 608.2160 0 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9833 20.4096 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) = 19.9491 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 0.0000 19.5377	(80 (83 (84 (85 (87 (88 (87 (88 (90 (91 (92 (93) (93) (93) (94 (95 (96) (97)
West Solar gains 132.2960 Total gains 477.5703 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 70.9600 alpha 5.7307 util living area 0.9909 MIT 20.1932 Th 2 20.1012 util rest of house 0.9882 MIT 2 19.0413 Living area fraction MIT 19.5899 Comperature adjustment adjusted MIT 19.5899 Comperature adjustment dijusted MIT 19.5893 Comperature adjustment dijusted MIT 10.000 MIE 0.9862 MIE 0.0982 MIE	258.7991 602.2815 ture (heati ng periods ains for li Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868	18.00 426.2053 758.8456 	m2 621.5950 936.8267 621.5950 936.8267 000 0111,m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 20.4815 20.6716 629.1534 8.9000 656.3267	Table 6a W/m2 19.6403 761.7880 1059.5343 m Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317	Speci or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436 20.5436 20.5436	fic data Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.5440 20.5440 20.5440 20.5440 20.5440	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 20.5451 20.5451	data le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.5375 20.5375 20.5375 20.5375 20.5375	fact Table 0 0.77 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 20.4096 20.4096 20.4096 20.4096 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 4(4) = 19.9491 19.9491 19.9491 19.9491 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 0.0000 19.5377 0.0000 19.5377 0.0000 19.5377	(80 (83 (84 (85 (87 (88 (87 (88 (90 (91 (92 (93) (93) (93) (94) (95) (96) (97 (97) (97) (98)

Store volume a) If manufac													
Temperature Enter (49) or	factor from	n Table 2b	actor is kno	own (kWh/d	ay):							145.0000 1.1800 0.6000	(48) (49)
Total storage		19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	0.7080	
If cylinder co				21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	
Primary loss Total heat rec	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Solar input Output from w,	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 months) = Si	0.0000	0.0000	(63)
-	176.6728	155.8130	163.8572	147.1912	144.4627	129.3992	124.5751	136.2826 Total p		152.6139 h/year) = S		172.5247 1800.2956	
Heat gains fro	79.8796	70.8983	75.6184	69.3951	69.1697	63.4793	62.5571	66.4498	65.6448	71.8800	73.9837	78.5003	(65)
5. Internal ga	ains (see Ta	able 5 and 5	āa)										
Metabolic gain	ns (Table 5)), Watts							C	0.1	N	D	
(66)m Lighting gains	Jan 97.6612	Feb 97.6612	Mar 97.6612	Apr 97.6612	May 97.6612	Jun 97.6612	Jul 97.6612	Aug 97.6612	Sep 97.6612	Oct 97.6612	Nov 97.6612	Dec 97.6612	(66)
	15.1929	13.4942	10.9742	8.3082	6.2105	5.2431	5.6654	7.3641	9.8841	12.5501	14.6478	15.6151	(67)
Appliances ga:	170.4180	172.1864	167.7301	158.2431	146.2675	135.0121	127.4928	125.7244	130.1807	139.6677	151.6433	162.8987	(68)
Cooking gains Pumps, fans	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	32.7661 0.0000	
Losses e.g. et					-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	
Water heating			101.6376	96.3821	92.9701	88.1657	84.0821	89.3143	91.1733	96.6129	102.7551	105.5112	
Total internal		343.4824	332.6403	315.2318	297.7464	280.7193	269.5387	274.7011	283.5364	301.1290	321.3446	336.3234	
6. Solar gains	3												
[Jan]				rea	Solar flux		g		FF	Acce		Gains W	
[oun]				m2	Table 6a	Sneci	fic data		data				
				m2		or	fic data Table 6b			fact Table			
West			18.00		W/m2 19.6403	or	Table 6b 0.5400	or Tab 1			5d	132.2960	
	132.2960 477.5703		18.00	621.5950	W/m2 19.6403	or 779.8255	Table 6b 0.5400 742.4257	or Tab 1	le 6c	Table	5d		(80)
West Solar gains Total gains	132.2960 477.5703	258.7991 602.2815	18.00 426.2053 758.8456	621.5950 936.8267	W/m2 19.6403 761.7880 1059.5343	or 779.8255 1060.5448	Table 6b 0.5400 742.4257 1011.9644	or Tab 1 637.7327 912.4338	le 6c .0000 495.6944	Table 0.77	5d 00 164.9576	132.2960	(80)
West Solar gains Total gains 7. Mean intern	132.2960 477.5703	258.7991 602.2815 cure (heatir	18.00 426.2053 758.8456 ng season)	621.5950 936.8267	W/m2 19.6403 761.7880 1059.5343	779.8255 1060.5448	Table 6b 0.5400 742.4257 1011.9644	or Tab 1 637.7327 912.4338	le 6c .0000 495.6944	Table 0.77	5d 00 164.9576	132.2960 108.7938 445.1172	(80) (83) (84)
West Solar gains Total gains 7. Mean intern Temperature du	132.2960 477.5703 mal temperative uring heating actor for ga	258.7991 602.2815 Cure (heating ng periods i ains for live	18.00 426.2053 758.8456 ng season) in the livir ring area, r	000 621.5950 936.8267 ng area fro nil,m (see	W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a)	779.8255 1060.5448	Table 6b 0.5400 742.4257 1011.9644	or Tab 1 637.7327 912.4338	le 6C .0000 495.6944 779.2308	Table (0.77) 307.0869 608.2160	6d 100 164.9576 486.3022	132.2960 108.7938 445.1172 21.0000	(80) (83) (84)
West Solar gains Total gains 7. Mean inter Temperature du Utilisation fa tau alpha	132.2960 477.5703 nal temperat rring heatin actor for gr Jan 70.9600 5.7307	258.7991 602.2815 ture (heating periods i	18.00 426.2053 758.8456 ng season) In the livir	621.5950 936.8267	W/m2 19.6403 761.7880 1059.5343 m Table 9, 7	779.8255 1060.5448	Table 6b 0.5400 742.4257 1011.9644	or Tab 1 637.7327 912.4338	le 6c .0000 495.6944	Table 0.77	5d 00 164.9576	132.2960 108.7938 445.1172	(80) (83) (84) (85)
West Solar gains Total gains 7. Mean inter Temperature du Utilisation fa tau alpha	132.2960 477.5703 nal temperat rring heatin actor for gr Jan 70.9600 5.7307	258.7991 602.2815 ture (heatin ng periods i nins for liv Feb 71.1482	18.00 426.2053 758.8456 ng season) nn the livir ring area, n Mar 71.3375	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991	W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945	or 779.8255 1060.5448 Th1 (C) Jun 73.4878	Table 6b 0.5400 742.4257 1011.9644 Jul 73.4878	0 or Tab 1 637.7327 912.4338 	le 6c .0000 495.6944 779.2308 Sep 73.0872	Table . 0.77 307.0869 608.2160 Oct 72.4945	6d 164.9576 486.3022 Nov 72.1047	132.2960 108.7938 445.1172 21.0000 Dec 71.7190	(80) (83) (84) (85)
West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living an MIT Th 2	132.2960 477.5703 hal temperat actor for gr Jan 70.9600 5.7307 cea 0.9909 20.1932 20.1012	258.7991 602.2815 ture (heatin ng periods i nins for liv Feb 71.1482 5.7432	18.00 426.2053 758.8456 ng season) in the livin mar 71.3375 5.7558	621.5950 936.8267 ng area fro nil,m (see Apr 72.2991 5.8199	W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945 5.8330	or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992	Table 6b 0.5400 742.4257 1011.9644 Jul 73.4878 5.8992	0 or Tab 1 637.7327 912.4338 Aug 73.6897 5.9126	le 6c .0000 495.6944 779.2308 Sep 73.0872 5.8725	Table 0.77 307.0869 608.2160 Oct 72.4945 5.8330	6d 164.9576 486.3022 Nov 72.1047 5.8070	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813	(80) (83) (84) (85) (85) (86)
West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of 1 MIT 2	132.2960 477.5703 hal temperat ring heatin actor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 house 0.9882 19.0413	258.7991 602.2815 	18.00 426.2053 758.8456 ng season) n the livir mar 71.3375 5.7558 0.8885 20.7393	621.5950 936.8267 ng area fro nil, m (see Apr 72.2991 5.8199 0.6957 20.9440	W/m2 19.6403 761.7880 1059.5343 m Table 9, 7 Table 9a) May 72.4945 5.8330 0.4919 20.9926	or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994	Table 6b 0.5400 742.4257 1011.9644 	Aug 73.6897 5.9126 0.2802 20.9998	Le 6C .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1947 20.1216	Table - 0.77 307.0869 608.2160 0.82 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893	Nov 72.1047 5.8070 0.9761 20.4807 20.4807 20.4807 20.9681 19.4657	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1498 0.9917 18.9826	(80) (83) (84) (85) (85) (85) (85) (88) (88) (88) (89) (90)
West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of h MIT 2 Living area fi MIT	132.2960 477.5703 hal temperating factor for gr Jan 70.9600 5.7307 cea 0.9909 20.1932 20.1012 house 0.9882 19.0413 caction 19.5899	258.7991 602.2815 cure (heatin ng periods i inis for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604	18.00 426.2053 758.8456 ng season) In the livii Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642	621.5950 936.8267 936.8267 936.8267 936.8267 936.8267 20.940 20.9440 20.1164 0.6539	W/m2 19.6403 761.7880 1059.5343 m Table 9,7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467	779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905	Table 6b 0.5400 742.4257 1011.9644 	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274	Le 6C .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1947 20.1216	Table - 0.77 307.0869 608.2160 0.8387 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965	Nov 72.1047 5.8070 0.9761 20.4807 20.4807 20.4807 20.9681 19.4657	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377	(80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92)
West Solar gains Total gains 7. Mean intern Temperature di Utilisation fa tau alpha util living an MIT Th 2 util rest of h MIT 2 Living area fn MIT Temperature ac	132.2960 477.5703 hal temperating factor for gr Jan 70.9600 5.7307 cea 0.9909 20.1932 20.1012 house 0.9882 19.0413 caction 19.5899	258.7991 602.2815 cure (heatin ng periods i fins for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881	18.00 426.2053 758.8456 758.8456 758.8456 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028	621.5950 936.8267 936.8267 ng area fro nil, m (see Apr 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608	W/m2 19.6403 761.7880 1059.5343 m Table 9,7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126	or 779.8255 1060.5448 ch1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291	Table 6b 	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316	Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 1LA =	Table - 0.77 307.0869 608.2160 0 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living area	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a / (4) =	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763	(80) (83) (84) (85) (85) (85) (85) (88) (89) (90) (91) (92)
West Solar gains Total gains 7. Mean intern Temperature di Utilisation fa tau alpha util living al MIT Th 2 util rest of h MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heat:	132.2960 477.5703 all temperal actor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 house 0.9882 19.0413 raction 19.5899 djustment 19.5899	258.7991 602.2815 ture (heating repriods is ining for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	18.00 426.2053 758.8456 ng season) In the livir Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 936.8267 936.8267 936.8267 936.8267 936.8267 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	W/m2 19.6403 761.7880 1059.5343 m Table 9, 1 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	0r 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	or Tab 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	Table 4 0.77 307.0869 608.2160 0.8387 20.8719 20.1185 0.7965 19.9893 Living are: 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(80) (83) (84) (85) (86) (87) (88) (88) (90) (91) (92)
West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living al MIT Th 2 util rest of h MIT 2 Living area fn MIT Temperature ac adjusted MIT 8. Space heat:	132.2960 477.5703 hal temperat uring heatin tetor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 20.1012 20.012 20.012 20.0132 20.012 20.0132 20.0122 20	258.7991 602.2815 ture (heating reperiods i fins for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868	18.00 426.2053 758.8456 ng season) in the livin Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 936.8267 936.8267 936.8267 0,8267 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	W/m2 19.6403 761.7880 1059.5343 m Table 9,7 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	or Tab 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.5451 20.5451	le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.91216 fLA = 20.5375 20.5375	Table - 0.77 307.0869 608.2160 0.8321 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9893 Living are. 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.4645 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377	(80) (83) (84) (85) (86) (87) (88) (88) (90) (91) (92)
West Solar gains Total gains 7. Mean intern Temperature di Utilisation fa tau alpha util living an MIT 1 2 util rest of P MIT 2 Living area fi MIT Temperature ac adjusted MIT 8. Space heat: Utilisation Useful gains Ext temp.	132.2960 477.5703 hal temperating factor for gr Jan 70.9600 5.7307 cea 0.9909 20.1932 20.1012 19.0413 caction 19.5899 ijustment 19.5899 ing requirer Jan 0.9862 470.9830 4.3000	258.7991 602.2815 Lure (heatin ng periods i ains for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868	18.00 426.2053 758.8456 ng season) In the livir Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488	621.5950 936.8267 936.8267 936.8267 936.8267 936.8267 936.8267 72.2991 5.8199 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815	W/m2 19.6403 761.7880 1059.5343 m Table 9, 1 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317	0r 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436	Table 6b 0.5400 742.4257 1011.9644 73.4878 5.8992 0.2424 20.9999 20.1294 0.1944 20.1294 20.5440 20.5440	or Tab 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451	le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1216 fLA = 20.5375	Table 4 0.77 307.0869 608.2160 0.8387 20.8719 20.1185 0.7965 19.9893 Living are: 20.4096	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000	(80) (83) (84) (85) (86) (87) (88) (88) (91) (92) (93) (93)
West Solar gains Total gains 7. Mean intern Temperature di Utilisation fa tau alpha util living an MIT Th 2 Util rest of h MIT 2 Living area fn MIT 2 Living area fn MIT Emperature ac adjusted MIT 8. Space heat: Utilisation Useful gains Ext temp. Heat loss rate Month fracti	132.2960 477.5703 hal temperat Tring heatin actor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 10.9882 19.0413 faction 19.5899 19.5892 19.589	258.7991 602.2815 ture (heating repriods is ining for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868	18.00 426.2053 758.8456 ng season) In the livii Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488	621.5950 936.8267 936.8267 936.8267 936.8267 936.8299 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 20.4815	W/m2 19.6403 761.7880 1059.5343 m Table 9,1 Table 9a) May 72.4945 5.8330 0.4919 20.9926 20.1185 0.4467 20.1126 20.5317 20.5317 20.5317 20.5317 May 0.4680 495.8564	0r 779.8255 1060.5448 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436	Table 6b 0.5400 742.4257 1011.9644 	0r Tab 1 637.7327 912.4338 Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.5451 20.5451 20.5451 20.5451 Aug 0.2525 230.4209	Le 6c .0000 495.6944 779.2308 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.5375 20.5375 20.5375	Table - 0.777 307.0869 608.2160 72.4945 5.8330 0.8387 20.1185 0.7965 19.9833 Living are: 20.4096 20.4096 20.4096	Nov 164.9576 486.3022 Nov 72.1047 5.8070 0.9761 20.1142 0.9681 19.9491 19.9491 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 Dec 0.9901 440.7081	(80) (83) (84) (85) (85) (86) (90) (91) (92) (93) (93) (94) (95) (95) (95) (97)
West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living an MIT Th 2 util rest of P MIT 2 Living area fin MIT Temperature ac adjusted MIT	132.2960 477.5703 hal temperat iring heatin ictor for gr Jan 70.9600 5.7307 rea 0.9909 20.1932 20.1012 house 0.9882 19.0413 conse 0.9882 19.0413 conse 19.5899 10.090 10.9862 10.000 10.9862 10.000 10.9862 10.000 10.9862 10.0000 10.0000 10.0000 10.0000 10.0000 10.000	258.7991 602.2815 cure (heating repriods is ining for liv Feb 71.1482 5.7432 0.9689 20.4351 20.1033 0.9604 19.3881 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868 19.8868	18.00 426.2053 758.8456 ag season) in the livin Mar 71.3375 5.7558 0.8885 20.7393 20.1055 0.8642 19.8028 20.2488 20.2488 20.2488 20.2488 20.2488 20.2488 20.2488	000 621.5950 936.8267 936.8267 936.8267 0.6957 20.9440 20.1164 0.6539 20.0608 20.4815 20.4815 20.4815 20.4815	W/m2 19.6403 761.7880 1059.5343 m Table 9.1 May 72.4945 5.8330 0.4919 20.9926 20.1126 20.1126 20.5317 20.5317 20.5317 20.5317 20.5317 20.5317 20.5317	Or 779.8255 1060.5448 Th1 (C) Jun 73.4878 5.8992 0.3361 20.9994 20.1294 0.2905 20.1291 20.5436 20.5436 20.5436 20.5436	Table 6b 0.5400 742.4257 1011.9644 	Aug 73.6897 5.9126 0.2802 20.9998 20.1316 0.2274 20.1316 20.5451 20.5451 20.5451 20.5451 20.5451	le 6c .0000 495.6944 779.2308 589 73.0872 5.8725 0.4923 20.9947 20.1251 0.4316 20.1251 0.4316 20.1251 20.5375 20.5375 20.5375 Sep 0.4604 358.7600 14.1000 360.8795	Table - 0.777 307.0869 608.2160 0.8387 72.4945 5.8330 0.8387 20.8719 20.1185 0.7965 19.9833 19.9833 19.9833 19.9833 19.9833 20.4096 20.4096 20.4096 20.4096 20.4096 554.4179 1.0000 45.3347	Nov 72.1047 5.8070 0.9761 20.4807 20.1142 0.9681 19.4657 a/(4)= 19.9491 19.9491 19.9491	132.2960 108.7938 445.1172 21.0000 Dec 71.7190 5.7813 0.9937 20.1481 20.1098 0.9917 18.9826 0.4763 19.5377 0.0000 19.5377 0.0000 19.5377 0.0000 19.5377 0.0000 19.5377	 (80) (83) (84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (94) (95) (96) (97) (98) (98)





PLIANCE	09 Jan	2014
	UJ Jan	2014



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Calculated for	June, July	and August.	See Table	10b									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate	W												
	0.0000	0.0000	0.0000	0.0000	0.0000	524.0856	412.5781	422.5677	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9972	0.9990	0.9981	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	522.6231	412.1678	421.7729	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1302.0056	1244.0407	1128.5118	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	561.1554	618.9135	525.8137	0.0000	0.0000	0.0000	0.0000	
Space cooling												1705.8826	
Cooled fraction									fC =	cooled area	/ (4) =	0.7627	(105)
Intermittency													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.0000	0.0000	100.2611	0.0000	0.0000	0.0000	0.0000	
Space cooling												207.2611	
Space cooling p	per m2											3.5129	(108)

9b. Energy requirements			
Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from community system Fraction of heat from community Heat pump Fraction of total space heat from community Heat pump Factor for control and charging method (Table 4c(3)) for community space heating Factor for control and charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating:		0.1000 0.9000 1.0000 1.0000 1.0000 1.1000	(302) (303a) (304a) (305) (305a)
Annual space heating requirement Annual space heating requirement Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.10 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating fuel for secondary/supplementary system		1174.5846 1162.8387 100.0000 117.4585	(307a) (308)
Water heating Annual water heating requirement Water heat from Heat pump = (64) x 1.00 x 1.00 Electricity used for heat distribution Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Annual totals kWh/year		1800.2956 1980.3252 31.4316 4.4250 46.8387	(310a) (313) (314)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6250) mechanical ventilation fans (SFP = 0.6250) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)		121.4663 121.4663 268.3112	(331)
Energy saving/generation technologies (Appendices M ,N and Q) PV Unit 0 (0.80 * 0.09 * 1080 * 0.80) = Total delivered energy for all uses	-62.1806	-62.1806 3635.0579	

12b. Carbon dioxide emissions - Community heating scheme					
	Energy	Emission factor		Emissions	
	kWh/year	kg CO2/kWh	k	g CO2/year	
Efficiency of heat source Heat pump	1100 5505	0.54.00		280.0000	
Space heating from Heat pump	1122.5585	0.5190		582.6079	
Electrical energy for heat distribution	31.4316	0.5190		16.3130	
Total CO2 associated with community systems				598.9209	(373)
(negative value allowed since DFEE <= TFEE)					
Space heating - secondary	117.4585	0.5190		60.9609	
Space and water heating				659.8818	
Space cooling	46.8387	0.5190		24.3093	
Pumps and fans	121.4663	0.5190		63.0410	
Energy for lighting	268.3112	0.5190		139.2535	(379)
Energy saving/generation technologies					
PV Unit	-62.1806	0.5190		-32.2717	(380)
Total CO2, kg/year				854.2139	(383)
Dwelling Carbon Dioxide Emission Rate (DER)				14.4800	(384)
16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY (SENERATION TECHNOLOGI	IS		14 4000	
DER				14.4800	ZCI
Total Floor Area			TFA	59.0000	
Assumed number of occupants			N	1.9532	
CO2 emission factor in Table 12 for electricity displaced from grid			EF	0.5190	
CO2 emissions from appliances, equation (L14)				17.1163	
CO2 emissions from cooking, equation (L16)				2.8115	
Total CO2 emissions				34.4078	
Residual CO2 emissions offset from biofuel CHP				0.0000	
Additional allowable electricity generation, kWh/m²/year				0.0000	
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000	
Net CO2 emissions				34.4078	ZC8

Page 5 of 8

Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwel						
Ground floor						
Total floor are Dwelling volume		a)+(1b)+(1c	:)+(1d)+(1e)(ln)	5	59.0000
2. Ventilation						
					main	
Number of chimn	evs				heating 0	+
Number of open Number of inter	flues	ıs			Ő	+
Number of passi Number of fluel	ve vents					
Number of fider	655 945 II.					
Infiltration du	e to chimne	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =
Pressure test Measured/design						
Infiltration ra Number of sides						
Shelter factor						
Infiltration ra	te adjusted	d to includ	le shelter	factor		
	Jan	Feb	Mar	Apr	May	Jun
Wind speed Wind factor	5.1000 1.2750	5.0000 1.2500	4.9000 1.2250	4.4000 1.1000	4.3000 1.0750	3.8000 0.9500
Adj infilt rate	0.3711	0.3638	0.3565	0.3202	0.3129	0.2765
Effective ac	0 5689					
3. Heat losses	and heat 10	oss paramet	er			
3. Heat losses	and heat 10	oss paramet	er			
3. Heat losses Element TER Opaque door	and heat 10	oss paramet	er			
3. Heat losses Element	and heat 10	oss paramet	er	Gross m2	Openings m2	Ne 1
3. Heat losses Element TER Opaque door TER Opening Typ External Wall 1 Lift	and heat l	oss paramet	er	Gross m2	Openings	Ne 1
3. Heat losses Element TER Opaque door TER Opening Typ External Wall 1 Lift External Roof 1 Total net area	and heat lo e (Uw = 1.4 of external	oss paramet 10) 1 elements	er	Gross m2 39.4200 18.3600	Openings m2	No 1 2 1
3. Heat losses Element TER Opaque door TER Opening Typ External Wall 1 Lift External Roof 1 Total net area Fabric heat los	e (Uw = 1.4 of externa s, W/K = Su	40) l elements um (A x U)	er Aum(A, m2)	Gross m2 39.4200 18.3600 12.6000	Openings m2	Ne 1 2 1 1 1
3. Heat losses Element TER Opaque door TER Opaque door TER Opening Typ External Wall 1 Lift External Roof 1 Total net area Fabric heat los Thermal mass pa Thermal bridges	e (Uw = 1.4 of externa: s, W/K = St rameter (TM (User def.	40) l elements um (A x U) 4P = Cm / T	.er Aum(A, m2) 'FA) in kJ/i	Gross m2 39.4200 18.3600 12.6000 m2K	Openings m2 14.7500	Ne 1 2 1 1 1
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ternal National Second Thermal mass pa Thermal bridges Total fabric he	and heat lo of external s, W/K = Su rameter (TT (User def: at loss	40) 1 elements 1m (A x U) 4P = Cm / T ined value	er 	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed	Openings m2 14.7500 area)	Ne 1 2 1 1 1
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ternal Nall Thermal mass pa Thermal bridges Total fabric he Ventilation hea	e (Uw = 1.4 of external s, W/K = Si rameter (TT (User defi at loss t loss cald	10) l elements im (A x U) MP = Cm / T ined value culated mon	er 	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2	Openings m2 14.7500 area) 5)m x (5)	No 1 1 2 1 1 1 1 7 1 7 1
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ternal National Second Thermal mass pa Thermal bridges Total fabric he	e (Uw = 1.4 of external s, W/K = Su rameter (TM (User def: at loss t loss cald Jan 29.9041 oeff	40) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635	er 	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787	Openings m2 14.7500 area) 5)m x (5) May 28.8576	Jun 28.2940
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door External Wall 1 External Roof 1 Total net area Tabric heat los Thermal bridges Total fabric hea (38)m	and heat lo of external s, W/K = Su rameter (TT (User def: at loss calo Jan 29,9041 oeff 61.8923	40) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635	er 	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787	Openings m2 14.7500 area) 5)m x (5)	Jun 28.2940
3. Heat losses Element TER Opaque door TER Opa	and heat 10 e (Uw = 1.4 of external s, W/K = Si rameter (TT (User def: at loss t loss calo Jan 29.9041 oeff 61.8923 9)m / 12 = Jan	A0) L elements Im (A x U) MP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb	er Aum(A, m2) 'FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 60.9669 Apr	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May	Jun 28.2940 60.2822 Jun
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ter Opaque door Ter Opaque door External Nall Total net area Fabric heat los Thermal mass pa Thermal mass pa Thermal bridges Total fabric hea (38)m Heat transfer c Average = Sum(3) HLP HLP HLP (average)	e (Uw = 1.4 of external s, W/K = St rameter (TM (User def: at loss t loss calc Jan 29.9041 oeff 61.8923 9)m / 12 =	40) l elements um (A x U) 4P = Cm / T ined value culated mon Feb 29.7635 61.7518	Aum(A, m2) PFA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 60.9669 Apr	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458	Jun 28.2940 60.2822
3. Heat losses Element TER Opaque door TER Opening Typ External Wall 1 Lift External Roof 1 Total net area Fabric heat los Thermal bridges Total fabric he Ventilation hea (38)m Heat transfer c Average = Sum(3	and heat lo e (Uw = 1.4 of external s, W/K = Si rameter (TT (User def: at loss t loss calo Jan 29.9041 oeff 61.8923 9)m / 12 = Jan	A0) L elements Im (A x U) MP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb	er Aum(A, m2) 'FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 60.9669 Apr	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May	Jun 28.2940 60.2822 Jun
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door External Mall Thermal mass pa Thermal mass pa Thermal mass pa Thermal bridges Total fabric heat (38)m Heat transfer c Average = Sum(3) HLP HLP (average)	and heat 1 of externa: s, W/K = Si rameter (TT (User def: at loss t loss cald Jan 29,9041 oeff 61.8923 9)m / 12 = Jan 1.0490	40) l elements im (A x U) MP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466	Aum(A, m2) FA) in kJ/1 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313	Jun 28.2940 60.2822 Jun 1.0217
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ter Opaque door Ter Opaque door External Nall Total net area Fabric heat los Thermal mass pa Thermal mass pa Thermal bridges Total fabric hea (38)m Heat transfer c Average = Sum(3) HLP HLP HLP (average)	and heat 1 of externa: s, W/K = Si rameter (TT (User def: at loss t loss cald Jan 29,9041 oeff 61.8923 9)m / 12 = Jan 1.0490	40) l elements im (A x U) MP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466	Aum(A, m2) FA) in kJ/1 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31	Jun 28.2940 60.2822 Jun 1.0217 30
3. Heat losses Element Element TER Opaque door TER Opaque door TER Opaque door Texternal Wall 1 Lift External Roof 1 Total net area Fabric heat los Thermal bridges Total fabric heat Ventilation head (38)m Heat transfer c Average = Sum(3) HLP HLP HLP (average) Days in month 4. Water heatin	and heat 10 e (Uw = 1.4 of external s, W/K = Su rameter (TT (User def: at loss cald Jan 29.9041 oeff 61.8923 9)m / 12 = Jan 1.0490 31 g energy re	A0) l elements Im (A x U) MP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 28	er Aum(A, m2) (FA) in kJ/1 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31	Jun 28.2940 60.2822 Jun 1.0217 30
3. Heat losses 3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door Texternal Wall 1 Internal Roof 1 Total net area Fabric heat los Thermal bridges Total fabric heat Ventilation head (38)m Heat transfer c Average = Sum(3) HLP HLP (average) Days in month 4. Water heatin Assumed occupan	and heat 10 e (Uw = 1.4 of external s, W/K = Si rameter (TT (User def: at loss cald Jan 29.9041 oeff 61.8923 9)m / 12 = Jan 1.0490 31 g energy re- cy	40) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 equirements	Aum(A, m2) FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31 : (kWh/year	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31	Jun 28.2940 60.2822 Jun 1.0217 30
3. Heat losses 3. Heat losses Sentimized and the sentimetry of the	and heat 10 e (Uw = 1.4 of external s, W/K = Si rameter (TT (User def: at loss cald Jan 29.9041 oeff 61.8923 9)m / 12 = Jan 1.0490 31 g energy re- cy	40) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 equirements	Aum(A, m2) FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31 : (kWh/year	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31	Jun 28.2940 60.2822 Jun 1.0217 30
3. Heat losses 3. Heat losses Setting Typ External Wall 1 Lift External Roof 1 Total net area Fabric heat los Thermal mass pa Thermal bridges Total fabric heat Ventilation head (38)m Heat transfer c Average = Sum(3) HLP HLP HLP (average) Days in month Assumed occupan	and heat lo e (Uw = 1.4 of external s, W/K = Su rameter (TT (User def: at loss cald Jan 29.9041 oeff 61.8923 9)m / 12 = Jan 1.0490 31 g energy re cy ot water u: Jan	40) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 equirements	Aum(A, m2) FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31 : (kWh/year	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31	Jun 28.2940 60.2822 Jun 1.0217 30
3. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TER Opaque door TER Opaque door Ter opaque door Thermal Nass pa Thermal mass pa Thermal bridges Total fabric heat Ventilation head (38)m Heat transfer c Average = Sum(3) HLP HLP (average) Days in month 	and heat 10 e (Uw = 1.4 of external s, W/K = Si rameter (TT (User def: at loss cald Jan 29.9041 off 61.8923 9)m / 12 = Jan 1.0490 31 g energy ra cy ot water us B8.6480	A0) l elements im (A x U) 4P = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 equirements se (litres/ Feb 85.4244	Aum (A, m2) FA) in kJ/i 0.050 * to thly (38)m Mar 29.6258 61.6140 Mar 1.0443 31 : (kWh/year day) Mar 82.2008	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30) Apr 78.9773	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31 	Jun 28.2940 60.2822 Jun 1.0217 30 Jun 72.5301
3. Heat losses S. Heat losses Element TER Opaque door TER Opaque door TER Opaque door TUR Opening Typ External Wall 1 Lift External Roof 1 Total net area Fabric heat los Thermal bridges Total fabric heat Ventilation hea (38)m Heat transfer c Average = Sum(3) HLP HLP (average) Days in month Assumed occupan Average daily h	e (Uw = 1.4 of external s, W/K = Su rameter (TH (User def: at loss t loss cald Jan 29.9041 oeff 61.8923 9)m / 12 = Jan 1.0490 31 g energy re 	A0) l elements um (A x U) AP = Cm / T ined value culated mon Feb 29.7635 61.7518 Feb 1.0466 28 equirements se (litres/ Feb 85.4244 114.9778	Aum (A, m2) PFA) in kJ/i 0.050 * to Mar 29.6258 61.6140 Mar 1.0443 31 : (kWh/year : (kWh/year : day) Mar 82.2008 118.6468	Gross m2 39.4200 18.3600 12.6000 m2K tal exposed = 0.33 x (2 Apr 28.9787 60.9669 Apr 1.0333 30) Apr 78.9773	Openings m2 14.7500 area) 5)m x (5) May 28.8576 60.8458 May 1.0313 31 	Jun 28.2940 60.2822 Jun 1.0217 30 Jun 72.5301

Enter (49) or (54) in (55)







 Area
 Storey height

 (m2)
 (m)

 59.0000 (1b)
 x
 2.7000 (2b)
 =
 Volume (m3) 159.3000 (1b) - (3b) $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) = 159.3000$ (5) ondary eating other m3 per hour total 0.0000 (6a) 0.0000 (6b) 20.0000 (7a) 0.0000 (7b) 0.0000 (7c) + -Air changes per hour 20.0000 / (5) = 0.1255 (8) Yes 5.0000 0.3755 (18) 3 (19) 0.7750 (20) 0.2911 (21) $(20) = 1 - [0.075 \times (19)] = (21) = (18) \times (20) =$ Jul 3.8000 0.9500 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Dec 4.7000 (22) 1.1750 (22a) Oct 4.3000 4.5000 0.2765 0.5382 0.2692 0.2911 0.5424 0.3129 0.5489 0.3274 0.3420 (22b) 0.5585 (25) A x U W/K 1.4400 17.6458 4.4406 3.3048 1.6380 A x K kJ/K U-value W/m2K K-value kJ/m2K rea m2 400 100 700 600 000 800 W/M2K 1.0000 1.3258 0.1800 0.1800 0.1300 (26) (27) (29a) (29a) (30) (31) (33) (26)...(30) + (32) = 28.4692 250.0000 (35) 3.5190 (36) 31.9882 (37) (33) + (36) =Jul 28.2940 Aug 28.1896 Oct Nov 28.8576 29.1025 Dec 29.3586 (38) Sep 28.5111 60.1778 60.4993 61.3468 (39) 60.9663 (39) 60.2822 60.8458 61.0907 Dec 1.0398 (40) 1.0333 (40) Aug 1.0200 Sep 1.0254 Oct 1.0313 Nov 1.0354 1.0217 31 (41) 30 31 31 30 31 1.9532 (42) 80.5891 (43) Jul Aug Sep Oct Nov Dec 72.5301 79.3647 82.2008 107.4035 85.4244 117.2393 75.7537 78.9773 88.6480 (44) 91.0722 92.1599 127.3143 (45) 1267.9796 (45) Total = Sum(45)m =11.9047 13.6608 13.8240 16.1105 17.5859 19.0971 (46) 145.0000 (47) 1.3665 (48) 0.5400 (49) 0.7379 (55)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage	loss												
	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)
If cylinder c	ontains ded:	icated solar	r storage										
	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat rea	quired for v	water heatir	ng calculat	ed for each	month								
	177.5994	156.6500	164.7839	148.0879	145.3894	130.2960	125.5018	137.2093	136.8087	153.5405	161.8881	173.4514	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar inpu	ut (sum of :	months) = Si	um(63)m =	0.0000	(63)
Output from w,	/h												
	177.5994	156.6500	164.7839	148.0879	145.3894	130.2960	125.5018	137.2093	136.8087	153.5405	161.8881	173.4514	(64)
								Total pe	er year (kW	h/year) = Su	um (64)m =	1811.2065	(64)
Heat gains fro	om water hea	ating, kWh/r	nonth										
	80.6209	71.5679	76.3597	70.1125	69.9111	64.1967	63.2984	67.1912	66.3622	72.6213	74.7011	79.2417	(65)

Metabolic gai	ns (Table 5)	, Watts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612	97.6612 (60
Lighting gain	s (calculate	d in Append	dix L, equa	tion L9 or	L9a), also	see Table 5						
	15.1904	13.4919	10.9724	8.3068	6.2094	5.2423	5.6644	7.3629	9.8824	12.5480	14.6454	15.6125 (6
Appliances ga	ins (calcula	ted in Appe	endix L, equ	uation L13	or L13a), a	lso see Tab	le 5					
	170.4180	172.1864	167.7301	158.2431	146.2675	135.0121	127.4928	125.7244	130.1807	139.6677	151.6433	162.8987 (68
Cooking gains	(calculated	l in Appendi	x L, equat:	ion L15 or	L15a), also	see Table	5					
	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661	32.7661 (69
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70
Losses e.g. e	vaporation (negative va	lues) (Tab	le 5)								
	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289	-78.1289 (7:
Water heating	gains (Tabl	.e 5)										
	108.3614	106.4998	102.6340	97.3785	93.9665	89.1621	85.0785	90.3107	92.1697	97.6093	103.7515	106.5076 (72
Total interna	l gains											
	349.2682	347.4766	336.6349	319.2268	301.7418	284.7148	273.5342	278.6963	287.5312	305.1234	325.3386	340.3172 (73

6. Solar gains													
[Jan]		Area m2		Solar flux g Table 6a Specific data W/m2 or Table 6b			Specific or Tab		Acce fact Table	or	Gains W		
West	lest		13.3	100	19.6403		0.6300	0	.7000	0.77	00	79.8909	(80)
Solar gains 79.8909 156.2835 Total gains 429.1590 503.7601		257.3767 594.0116	375.3685 694.5953	460.0282 761.7700	470.9208 755.6356	448.3358 721.8699	385.1138 663.8101	299.3397 586.8709	185.4435 490.5669	99.6145 424.9531	65.6984 406.0156		

	during heatir factor for ga					Ch1 (C)						21.0000 (
, orrespondence .	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
au	66.1992	66.3499	66.4983	67.2041	67.3378	67.9673	67.9673	68.0852	67.7235	67.3378	67.0678	66.7879
lpha	5.4133	5.4233	5.4332	5.4803	5.4892	5.5312	5.5312	5.5390	5.5149	5.4892	5.4712	5.4525
til living a	area											
	0.9950	0.9875	0.9607	0.8700	0.6991	0.5044	0.3665	0.4151	0.6761	0.9313	0.9886	0.9962 (
IT	20.0163	20.1941	20.4762	20.7830	20.9458	20.9924	20.9989	20.9979	20.9664	20.7137	20.3024	19.9829 (
'h 2	20.0427	20.0446	20.0466	20.0556	20.0573	20.0653	20.0653	20.0667	20.0622	20.0573	20.0539	20.0503 (
til rest of	house											
	0.9934	0.9836	0.9488	0.8366	0.6415	0.4335	0.2892	0.3319	0.5978	0.9048	0.9843	0.9950 (
UT 2 iving area :	18.7410 fraction	18.9998	19.4023	19.8198	20.0101	20.0607	20.0649	20.0659	20.0386 fLA =	19.7438 Living area	19.1656 / (4) =	18.6980 () 0.4763 ()
4IT Cemperature a	19.3484 adiustment	19.5686	19.9137	20.2786	20.4558	20.5045	20.5097	20.5098	20.4805	20.2057	19.7070	19.3100 (0.0000
adjusted MIT		19.5686	19.9137	20.2786	20.4558	20.5045	20.5097	20.5098	20.4805	20.2057	19.7070	19.3100 (

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9811	0.9469	0.8451	0.6666	0.4671	0.3260	0.3716	0.6339	0.9095	0.9823	0.9937	(94)
Useful gains	425.6451	494.2613	562.4713	587.0366	507.8048	352,9866	235.3628	246.6646	371.9888	446.1882	417.4318	403.4712	
Ext temp. Heat loss rate	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
	931.3807	905.8132	826.4732	693.7155	532,7512	355.9353	235.6880	247.3199	386.0128	584.4684	770.1725	926.9484	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97)
Space heating	kWh												
. ,	376.2673	276.5629	196.4175	76.8088	18.5601	0.0000	0.0000	0.0000	0.0000	102.8804	253.9733	389.4670	(98)
Space heating												1690.9373	(98
Space heating	per m2									(98)	/ (4) =	28.6600	(99)

8c. Space cooling requirement

Not applicable

elmhurst energy

Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requ													
Fraction of spa Fraction of spa Efficiency of m Efficiency of s Space heating m	ace heat fro ace heat fro main space l secondary/space	om secondar om main sy: heating sy:	ry/supplemen stem(s) stem 1 (in %	tary system)								0.0000 1.0000 93.5000 0.0000 1808.4891	(202) (206) (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating 1	requirement 376.2673	276.5629	196.4175	76.8088	18.5601	0.0000	0.0000	0.0000	0.0000	102.8804	253.9733	389.4670	(98)
Space heating e	efficiency 93.5000	(main heat: 93.5000	ing system 1 93.5000) 93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating f	fuel (main 1	heating sys	stem)										
Water heating m	402.4250 requirement	295.7892	210.0722	82.1485	19.8504	0.0000	0.0000	0.0000	0.0000	110.0326	271.6291	416.5423	(211)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating m		156.6500	164.7839	148.0879	145.3894	130.2960	125.5018	137.2093	136.8087	153.5405	161.8881	173.4514	(64)
Efficiency of w			05 0001	00 1570			70.0000	70.0000	70.0000	00.7740	0.6 01.05	79.8000	
(217)m Fuel for water	86.7694 heating, k	86.3150 Wh/month	85.2831	83.1579	80.8826	79.8000	79.8000	79.8000	79.8000	83.7740	86.0105	86.9093	(217)
Water heating f	204.6799 fuel used	181.4865	193.2198	178.0805	179.7537	163.2782	157.2704	171.9415	171.4394	183.2796	188.2190	199.5774 2172.2258	
Annual totals }	kWh/year												
Space heating f Space heating f												1808.4891 0.0000	
Electricity for central heat main heating Total electrici Electricity for Total delivered	ting pump g flue fan ity for the r lighting	above, kWl (calculated		x L)								30.0000 45.0000 75.0000 268.2664 4323.9813	(230e) (231) (232)
12a. Carbon dic	oxide emiss	ions - Ind:		ing system	s including	micro-CHP							
Space heating - Space heating - Water heating - Space and water Pumps and fans Energy for ligh Total CO2, kg/n Emissions per n Fuel factor (el Emissions per n Emissions per n Target Carbon I	- secondary (other fuel r heating m2/year m2 for spac lectricity) m2 for ligh m2 for pump) e and water ting s and fans	-	5705 4 4				Energy kWh/year 1808.4891 0.0000 2172.2258 75.0000 268.2664		ion factor kg CO2/kWh 0.2160 0.2160 0.2160 0.5190 0.5190	ļ	Emissions cg CO2/year 390.6337 0.0000 469.2008 859.8344 38.9250 139.2302 1037.9897 14.5735 1.5500 2.3598 0.6597 25.6100	(263) (264) (265) (267) (268) (272) (272a) (272b) (272c)







17 Design SAP elmhurst energy

Property Reference	e Apt 13				Issued on Date	17/02/2021
Assessment Reference	013		Pro	op Type Ref		
Property	13					
SAP Rating		84 B	DER	13.52	TER	23.27
Environmental		89 B	% DER <ter< th=""><th></th><th>41.90</th><th></th></ter<>		41.90	
CO ₂ Emissions (t/y	ear)	1.03	DFEE	43.23	TFEE	45.40
General Requirem	ents Compliance	Pass	% DFEE <tfee< th=""><th></th><th>4.78</th><th></th></tfee<>		4.78	
Assessor Details	Mrs. Caroline Kerss, Caroline limited.com	Kerss, Tel: 02	0778361133, ckers	s@mtt-	Assessor ID	T282-0001
Client						

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COM	4FLIANCE REPORT - App	roved Document L1A, 2013 Ed	aition, England	
DWELLING AS DES	SIGNED			
Mid-floor flat,	. total floor area 95	m ²		
It is not a com	vers items included w mplete report of regu			
la TER and DER Fuel for main h Fuel factor:1.5 Target Carbon D Dwelling Carbor	neating:Electricity (55 (electricity) Dioxide Emission Rate n Dioxide Emission Ra			
1b TFEE and DFE Target Fabric E Dwelling Fabric	EE Energy Efficiency (TF c Energy Efficiency (EE)45.4 kWh/m²/yr DFEE)43.2 kWh/m²/yrOK		
2 Fabric U-valu	1es			
Element External wall	Average 0.15 (max. 0.30)	Highest 0.15 (max. 0.70)	OK	
Floor Roof Openings	(no floor) 0.12 (max. 0.20) 1.30 (max. 2.00)	Highest 0.15 (max. 0.70) 0.12 (max. 0.35) 1.30 (max. 3.30)	OK OK	
2a Thermal brid Thermal bridgin	dging ng calculated using d	efault y-value of 0.15		
3 Air permeabil	lity	3.00 (design value) 10.0		ок
4 Heating effic Main heating sy	ciency	Community heating sch		
Secondary heati	ing system:	Room heaters - electr:	ic	
Panel, convecto	or or radiant heaters			
5 Cylinder insu				
Hot water stora Permitted by DE	35CG 2.86	Measured cylinder los: OK	s: 1.69 kWh/day	
pipewor	ck insulated:	Yes (assumed)		0K
6 Controls Space heating c	controls:	Charging system linked	d to use of commun	ity heating, TRVsOK
Hot water contr	cols:	Cylinderstat		OK
7 Low energy li Percentage of f Minimum		-energy fittings:100% 75%		OK
8 Mechanical ve Continuous supp Specific fan po	oly and extract system			
Maximum MVHR efficiency		1.5		OK
Minimum:		89% 70%		ок
9 Summertime te Overheating ris Based on:		Medium		ок
Overshading: Windows facing	East:	Average 22.00 m², No overhang 9.00 m², No overhang		
Windows facing Air change rate Blinds/curtains	e: s:	9.00 m², No overhang 4.00 ach Dark-coloured curtain	or roller blind,	closed 0% of daylight
10 Key features Roof U-value	3	0.12 W/m²K		
Air permeabilit Secondary heati Photovoltaic ar	ing (electricity)	3.0 m³/m²h 0.15 kW		
FUOLOVOILAIC AI	ταy	0.13 KW		









CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions									
Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) Dwelling volume	95.0000	Area (m2) 95.0000 (1b) (3a)+(3b	x	height (m) 2.7000 3d)+(3e)	(2b)	=	Volume (m3) 256.5000 256.5000	(1b) - (4)	(3b)

					main heating	s	econdary heating	0	ther	tota	al	m3	per hour	
lumber of chim					Ō	+	Ō	+	0 =		0 * 40		0.0000	
lumber of open					0	+	0	+	0 =		0 * 20		0.0000	
umber of inte		ns									0 * 10		0.0000	
umber of pass											0 * 10		0.0000	
umber of flue	eless gas fi	res									0 * 40) =	0.0000	(7
													per hour	
nfiltration d	lue to chimne	eys, flues	and fans	= (6a)+(6b)-	-(7a)+(7b)+	(7c) =				0.0000	/ (5)	=	0.0000	
ressure test													Yes	
easured/desig													3.0000	
nfiltration r													0.1500	
umber of side	es sheltered												2	(1
nelter factor													0 0500	
								(20) = 1 -	[0.075 x	(19)]	=	0.8500	(2
nfiltration r		d to includ	e shelter f	actor				($[0.075 \times 1) = (18)$			0.8500	
	rate adjusted				May	Tup	Tul		(2	1) = (18) :	x (20)	=	0.1275	
nfiltration r	ate adjusted Jan	Feb	Mar	Apr	May	Jun 3 8000	Jul 3 8000	Aug	(2 Sep	1) = (18) : Oct	x (20) Nov	=	0.1275 Dec	(2
nfiltration r ind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	4.3000	3.8000	3.8000	Aug 3.7000	(2 Sep 4.0000	1) = (18) : Oct 4.3000	x (20) Nov 4.5	=	0.1275 Dec 4.7000	(2
nfiltration r ind speed ind factor	Jan 5.1000 1.2750	Feb	Mar	Apr				Aug	(2 Sep	1) = (18) : Oct	x (20) Nov 4.5	=	0.1275 Dec	(2
nfiltration r nd speed nd factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	4.3000 1.0750	3.8000 0.9500	3.8000 0.9500	Aug 3.7000 0.9250	(2 Sep 4.0000 1.0000	1) = (18) : Oct 4.3000 1.0750	x (20) Nov 4.5 1.1	= 5000 250	0.1275 Dec 4.7000 1.1750	(2 (2 (2
filtration r nd speed nd factor lj infilt rat	Jan 5.1000 1.2750 0.1626	Feb 5.0000 1.2500 0.1594	Mar 4.9000 1.2250 0.1562	Apr 4.4000 1.1000 0.1403	4.3000	3.8000	3.8000	Aug 3.7000	(2 Sep 4.0000	1) = (18) : Oct 4.3000	x (20) Nov 4.5 1.1	=	0.1275 Dec 4.7000	(2 (2 (2
filtration r nd speed nd factor ij infilt rat Balanced mech	Jan 5.1000 1.2750 Ce 0.1626 manical vent:	Feb 5.0000 1.2500 0.1594 ilation wit	Mar 4.9000 1.2250 0.1562	Apr 4.4000 1.1000 0.1403	4.3000 1.0750	3.8000 0.9500	3.8000 0.9500	Aug 3.7000 0.9250	(2 Sep 4.0000 1.0000	1) = (18) : Oct 4.3000 1.0750	x (20) Nov 4.5 1.1	= 5000 250	0.1275 Dec 4.7000 1.1750	(2 (2 (2
nfiltration r ind speed ind factor ij infilt rat Balanced mech f mechanical	Jan 5.1000 1.2750 Ce 0.1626 manical vent: ventilation	Feb 5.0000 1.2500 0.1594 ilation wit	Mar 4.9000 1.2250 0.1562 h heat reco	Apr 4.4000 1.1000 0.1403 very	4.3000 1.0750 0.1371	3.8000 0.9500 0.1211	3.8000 0.9500 0.1211	Aug 3.7000 0.9250 0.1179	(2 Sep 4.0000 1.0000	1) = (18) : Oct 4.3000 1.0750	x (20) Nov 4.5 1.1	= 5000 250	0.1275 Dec 4.7000 1.1750 0.1498	(2 (2 (2 (2 (2
filtration r ind speed ind factor ij infilt rat Balanced mech	Jan 5.1000 1.2750 Ce 0.1626 manical vent: ventilation	Feb 5.0000 1.2500 0.1594 ilation wit	Mar 4.9000 1.2250 0.1562 h heat reco	Apr 4.4000 1.1000 0.1403 very	4.3000 1.0750 0.1371	3.8000 0.9500 0.1211	3.8000 0.9500 0.1211	Aug 3.7000 0.9250 0.1179	(2 Sep 4.0000 1.0000	1) = (18) : Oct 4.3000 1.0750	x (20) Nov 4.5 1.1	= 5000 250	0.1275 Dec 4.7000 1.1750 0.1498 0.5000	

m2 m2 m2 W/m2K W/K kJ/m2K Opening Type 1 (Uw = 1.30) 31.0000 1.2357 38.3080 38.3080 Spandrel 2.2800 1.3000 2.9640 External Wall 1 91.8000 33.2800 58.5200 0.1500 8.7780 External Roof 1 22.4000 22.4000 0.1200 2.6680 114.2000 Total net area of external elements Aum (A, m2) 114.2000 (26)(30) + (32) = 52.7380	kJ/K	kJ/K
Spandrel 2.2800 1.3000 2.9640 External Wall 1 91.8000 33.2800 58.5200 0.1500 8.7780 External Roof 1 22.4000 22.4000 0.1200 2.6880 Total net area of external elements Aum (A, m2) 114.2000 114.2000		
External Wall 1 91,8000 33.2800 58,5200 0.1500 8.7780 External Roof 1 22,4000 22.4000 0.1200 2.6880 Total net area of external elements Aum(A, m2) 114.2000 114.2000 114.2000		
External Roof 1 22.4000 22.4000 0.1200 2.6880 Total net area of external elements Aum(A, m2) 114.2000 114.2000 114.2000		
Total net area of external elements Aum(A, m2) 114.2000		
Fabric heat loss, W/K = Sum (A x U) (26)(30) + (32) = 52.7380		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	50.0000
hermal bridges (Default value 0.150 * total exposed area)	17.1300	
ortal fabric heat loss (33) + (36)		
Jentilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov	Dec	Dec
(38)m 24.0656 23.7958 23.5260 22.1770 21.9072 20.5582 20.5582 20.2883 21.0978 21.9072 22.44	68 22.9864	22.9864
	48 92.8544	92.8544
eat transfer coeff		
	91.9775	91.9775
ieat transfer coeff 93.9336 93.6638 93.3940 92.0450 91.7752 90.4261 90.4261 90.1563 90.9658 91.7752 92.31 .verage = Sum(39)m / 12 =		
eat transfer coeff 93.9336 93.6638 93.3940 92.0450 91.7752 90.4261 90.4261 90.1563 90.9658 91.7752 92.31	Dec	Dec

ssumed occupa verage daily		use (litres	/day)									2.6882 98.0440
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
aily hot wate	er use											
	107.8484	103.9267	100.0049	96.0831	92.1614	88.2396	88.2396	92.1614	96.0831	100.0049	103.9267	107.8484
nergy conte	159.9361	139.8811	144.3448	125.8433	120.7496	104.1977	96.5545	110.7977	112.1210	130.6662	142.6324	154.8896
nergy content	t (annual)									Total = Su	1m (45) m =	1542.6141
istribution 1	loss (46)m	$= 0.15 \times ($	45)m									
	23,9904	20.9822	21.6517	18.8765	18,1124	15.6297	14.4832	16.6197	16.8182	19.5999	21.3949	23.2334

Page 3 of 8



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMI

(1) OL	factor from (54) in (55	m Table 2b	actor is kn	own (kWh/d	.ay):							1.6900 0.6000 1.0140	(49)
Total storage		28.3920	31.4340	30.4200	31.4340	30.4200	31.4340	31.4340	30.4200	31.4340	30.4200	31.4340	
If cylinder c	ontains ded: 31.4340	icated sola 28.3920	ar storage 31.4340	30.4200	31.4340	30.4200	31.4340	31.4340	30.4200	31.4340	30.4200	31.4340	(57)
Primary loss Total heat re	23.2624 quired for v 214.6325	21.0112 water heati: 189.2843	23.2624 ng calculat. 199.0412	22.5120 ed for each 178.7753	23.2624 1 month 175.4460	22.5120 157.1297	23.2624	23.2624 165.4941	22.5120 165.0530	23.2624 185.3626	22.5120 195.5644	23.2624	
Solar input Output from w	0.0000 /h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp	0.0000 ut (sum of	0.0000 months) = S	0.0000 um(63)m =	0.0000 0.0000	
output from w	214.6325	189.2843	199.0412	178.7753	175.4460	157.1297	151.2509	165.4941 Total p	165.0530 er year (kW	185.3626 h/year) = S	195.5644 um(64)m =	209.5860 2186.6201	
Heat gains fr	om water hea 96.9359	ating, kWh/1 86.0330	(month 91.7518	84.1885	83.9064	76.9914	75.8615	80.5974	79.6258	87.2036	89.7709	95.2579	(65)
5. Internal g	ains (see Ta	able 5 and	5a)										
Metabolic gai	ns (Table 5), Watts							6 m	Ort	Nee	Dee	
(66)m Lighting gain					May 134.4085 L9a), also		Jul 134.4085	Aug 134.4085	Sep 134.4085	Oct 134.4085	Nov 134.4085	Dec 134.4085	(66)
Appliances ga						7.6295 lso see Tab	8.2439 ble 5	10.7158	14.3827	18.2621	21.3146	22.7222	
Cooking gains	247.9820 (calculated 36.4408		244.0707 lix L, equat 36.4408					182.9466 36.4408	189.4311 36.4408	203.2360 36.4408	220.6622 36.4408	237.0404 36.4408	
Pumps, fans Losses e.g. e	0.0000 vaporation	0.0000 (negative v	0.0000 values) (Tab	0.0000 ele 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating	gains (Tab	le 5)			-107.5268			-107.5268	-107.5268	-107.5268	-107.5268	-107.5268	
Total interna	130.2901 l gains 463.7025	128.0253 461.5391	446.6845	116.9285 422.6064	112.7774 397.9766	106.9324 374.3459	101.9644 359.0507	108.3298 365.3147	110.5914 377.7278	117.2092 402.0299	124.6818 429.9812	128.0348 451.1200	
	1001/020	101100001	11010010	12210001	03713700	0,110100		00010117	0,1,1,2,10	10210233	12919012	10111200	(,,,,,
6. Solar gain	s												
[Jan]				m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
East West			22.0 9.0	000	19.6403 19.6403		0.5400 0.5400	1 1	.0000 .0000	0.77 0.77		161.6951 66.1480	
Solar gains Total gains	227.8432 691.5457						1278.6220 1637.6727			528.8719 930.9019	284.0936 714.0748	187.3671 638.4871	
7. Mean inter													
												21.0000	(85)
Temperature d Utilisation f	actor for ga		ving area,	nil,m (see	Table 9a)								(00)
Utilisation f tau						Th1 (C) Jun 72.9570 5.8638	Jul 72.9570 5.8638	Aug 73.1754 5.8784	Sep 72.5242 5.8349	Oct 71.8846 5.7923	Nov 71.4644 5.7643	Dec 71.0491 5.7366	
Utilisation f tau alpha	actor for ga Jan 70.2328 5.6822	ains for li Feb 70.4351	ving area, Mar 70.6386	nil,m (see Apr 71.6739	Table 9a) May 71.8846	Jun 72.9570	72.9570	73.1754	72.5242	71.8846	71.4644	Dec 71.0491	
Utilisation f tau alpha util living a MIT Th 2	actor for ga Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927	ains for li Feb 70.4351 5.6957	ving area, Mar 70.6386 5.7092	nil,m (see Apr 71.6739 5.7783	Table 9a) May 71.8846 5.7923	Jun 72.9570 5.8638	72.9570 5.8638	73.1754 5.8784	72.5242 5.8349	71.8846 5.7923	71.4644 5.7643	Dec 71.0491 5.7366	(86)
Utilisation f tau alpha util living a MIT Th 2 util rest of	actor for ga Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707	ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490	Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907	72.9570 5.8638 0.2429 20.9999 20.1236 0.1946	73.1754 5.8784 0.2832 20.9998 20.1260 0.2295	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424	71.8846 5.7923 0.8632 20.8457 20.1117 0.8240	71.4644 5.7643 0.9846 20.4073 20.1070 0.9791	Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954	(86) (87) (88) (89)
Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f	actor for ga Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930 18.9041	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951	Ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117	Jun 72.9570 5.8638 0.3366 20.9993 20.1236	72.9570 5.8638 0.2429 20.9999 20.1236	73.1754 5.8784 0.2832 20.9998 20.1260	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148	71.8846 5.7923 0.8632 20.8457 20.1117	71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563	Dec 71.0491 5.7366 0.9965 20.0572 20.1022	(86) (87) (88) (89) (90) (91)
	actor for g Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930 18.9041 raction 19.2915 djustment	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852	ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635 20.0479	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054	Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233	72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236	73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA =	71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are	71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) =	Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232	(86) (87) (88) (89) (90) (91) (92)
Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT Temperature a	actor for gr Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930 15.9041 raction 19.2915 djustment 19.2915	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347	ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528 20.0608 20.0608	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635 20.0479 20.3357 20.3357	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919	Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064	72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236 20.4068 20.4068	73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA = 20.3989	71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416	71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960	Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000	(86) (87) (88) (89) (90) (91) (92)
Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT Temperature a adjusted MIT Utilisation Useful gains Ext temp.	actor for ge Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930 18.9041 raction 19.2915 djustment 19.2915 djustment 19.2915 djustment 19.2915 djustment 19.2915 djustment 19.2915 djustment 19.2915	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347 19.6347 	ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528 20.0608 20.0608	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635 20.0479 20.3357 20.3357	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919	Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064	72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236 20.4068 20.4068	73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA = 20.3989	71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416	71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960	Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000	(86) (88) (90) (91) (92) (93) (93)
Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT Temperature a adjusted MIT 8. Space heat 	actor for gr Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 house 0.9930 18.9041 raction 19.2915 djustment 19.2915 	ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347 19.6347 Feb 0.9666 876.9192 4.9000	wing area, Mar 70.6386 5.7092 0.9026 20.0974 0.8801 19.7528 20.0608 20.0608 20.0608	nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635 20.0479 20.3357 20.3357 20.3357	Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919 20.3919	Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064 20.4064	72.9570 5.8638 0.2429 20.9999 20.1236 20.1236 20.4068 20.4068 20.4068 20.4068	73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084 20.4084	72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.3989 20.3989 20.3989 Sep 0.4624 569.4339	71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416 20.2416 20.2416	<pre>71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960 19.6960 19.6960 Nov 0.9759 696.8590 7.1000</pre>	Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000 19.2366	 (86) (87) (88) (89) (91) (92) (93) (93) (94) (95) (96) (97)

Enter (49) or	factor from	m Table 2b	actor is kr	iown (kWh/c	lay):							1.6900	(49)
Total storage		28.3920	31.4340	30.4200	31.4340	30.4200	31.4340	31.4340	30.4200	31.4340	30.4200	1.0140 31.4340	
If cylinder co				30.4200	31.4340	30.4200	31.4340	31.4340	30.4200	31.4340	30.4200	31.4340	
Primary loss Total heat req	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
Solar input	214.6325 0.0000	189.2843 0.0000	199.0412 0.0000	178.7753 0.0000	175.4460 0.0000	157.1297 0.0000	151.2509 0.0000	165.4941 0.0000 Solar inp	165.0530 0.0000 ut (sum of	185.3626 0.0000 months) = S	195.5644 0.0000 um(63)m =	209.5860 0.0000 0.0000	(63)
Output from w/	′h 214.6325	189.2843	199.0412	178.7753	175.4460	157.1297	151.2509	165.4941 Total p	165.0530 er year (kW	185.3626 M/year) = S		209.5860 2186.6201	
Heat gains fro	om water he 96.9359	ating, kWh/ 86.0330	'month 91.7518	84.1885	83.9064	76.9914	75.8615	80.5974	79.6258	87.2036	89.7709	95.2579	(65)
5. Internal ga	ains (see T	able 5 and	5a)										
Metabolic gain	ns (Table 5), Watts											
(66)m					May 134.4085			Aug 134.4085	Sep 134.4085	Oct 134.4085	Nov 134.4085	Dec 134.4085	(66)
Lighting gains	22.1078	19.6359	15.9690	12.0896	9.0371	7.6295	8.2439	10.7158	14.3827	18.2621	21.3146	22.7222	(67)
Appliances gai Cooking gains	247.9820	250.5553	244.0707	230.2658	212.8396	196.4615	185.5198	182.9466	189.4311	203.2360	220.6622	237.0404	(68)
Pumps, fans Losses e.g. ev	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	36.4408 0.0000	
	-107.5268	-107.5268			-107.5268	-107.5268	-107.5268	-107.5268	-107.5268	-107.5268	-107.5268	-107.5268	(71)
Total internal	130.2901	128.0253	123.3223	116.9285	112.7774	106.9324	101.9644	108.3298	110.5914	117.2092	124.6818	128.0348	(72)
TOCAT INCOLNAL	463.7025	461.5391	446.6845	422.6064	397.9766	374.3459	359.0507	365.3147	377.7278	402.0299	429.9812	451.1200	(73)
6. Solar gains	3												
[Jan]				m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
East West			22.0 9.0	0000	19.6403 19.6403		0.5400 0.5400	1	.0000	0.77 0.77		161.6951 66.1480	
Solar gains	227.8432	115 7096	734 0202	1070.5246	1311 9691	1343 0329	1278.6220	1000 2174	853.6958	528.8719	284.0936	187.3671	(83)
Total gains	691.5457				1709.9448					930.9019	714.0748	638.4871	
Total gains		907.2487	1180.7047	1493.1311	1709.9448	1717.3788	1637.6727	1463.6321					
Total gains	nal tempera	907.2487 ture (heati ng periods	1180.7047 .ng season) in the livi	1493.1311	1709.9448	1717.3788	1637.6727	1463.6321		930.9019		638.4871 21.0000	(84)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha	nal tempera nring heati actor for g Jan 70.2328 5.6822	907.2487 ture (heati ng periods	1180.7047 .ng season) in the livi	1493.1311	1709.9448	1717.3788	1637.6727	1463.6321				638.4871	(84)
Total gains 7. Mean intern Temperature du Utilisation fa tau	nal tempera nring heati actor for g Jan 70.2328 5.6822	907.2487 ture (heati ng periods ains for li Feb 70.4351	1180.7047 ing season) in the livi ving area, Mar 70.6386	1493.1311 .ng area fro nil,m (see Apr 71.6739	1709.9448 om Table 9, Table 9a) May 71.8846	1717.3788 Th1 (C) Jun 72.9570	1637.6727 Jul 72.9570	1463.6321	Sep 72.5242	930.9019 Oct 71.8846	Nov 71.4644	638.4871 21.0000 Dec 71.0491	(84)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2	al tempera aring heati Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957	1180.7047 .ng season) .ving area, Mar 70.6386 5.7092	1493.1311 .ng area fro nil,m (see Apr 71.6739 5.7783	1709.9448 om Table 9, Table 9a) May 71.8846 5.7923	1717.3788 Th1 (C) Jun 72.9570 5.8638	Jul 72.9570 5.8638	Aug 73.1754 5.8784	Sep 72.5242 5.8349	0ct 71.8846 5.7923	Nov 71.4644 5.7643	638.4871 21.0000 Dec 71.0491 5.7366	(84) (85) (86) (87)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2	nal tempera actor for g Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 nouse 0.9930 18.9041	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667	1180.7047 ing season) in the livi ving area, Mar 70.6386 5.7092 0.9026 20.7059	1493.1311 	1709.9448 om Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993	Jul 72.9570 5.8638 0.2429 20.9999	Aug 73.1754 5.8784 0.2832 20.9998	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531	Nov 714.0748 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449	(84) (85) (86) (87) (88) (89) (90)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT	al tempera airing heati actor for g Jan 70.2328 5.6822 crea 0.9947 20.1029 20.0927 house 0.9930 18.9041 creation 19.2915	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707	1180.7047 ing season) in the livi ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801	1493.1311 .ng area frc nil,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635	1709.9448 mm Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907	Jul 72.9570 5.8638 0.2429 20.9999 20.1236 0.1946	Aug 73.1754 5.8784 0.2832 20.9998 20.1260 0.2295	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240	Nov 714.0748 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	nal tempera ring heati gctor for g Jan 70.2328 5.6822 rea 0.9947 20.0927 nouse 0.9930 18.9041 reaction 19.2915 ijustment	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852	1180.7047 ing season) in the livi ving area, 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528	1493.1311 	1709.9448 m Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233	Jul 72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236	Aug 73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA =	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are	Nov 714.0748 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) =	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad	nal tempera aring heati tector for g Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 nouse 0.9930 18.9041 19.2915 Hjustment 19.2915	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347 ment	1180.7047 ing season) in the livi ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528 20.0608 20.0608	1493.1311 	1709.9448 om Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064	Jul 72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236 20.4068 20.4068	Aug 73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA = 20.3989	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416	Nov 714.0748 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp.	al tempera aring heati actor for g Jan 70.2328 5.6822 crea 0.9947 20.1029 20.0927 100use 0.9930 18.9041 creation 19.2915 ijustment 19.2915 ing requires Jan 0.9910 685.3037 4.3000	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347 ment Feb 0.9666	1180.7047 ing season) in the livi ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528 20.0608 20.0608	1493.1311 .ng area frc ni1,m (see Apr 71.6739 5.7783 0.7055 20.9384 20.1093 0.6635 20.0479 20.3357 20.3357 20.3357	1709.9448 om Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064	Jul 72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236 20.4068 20.4068	Aug 73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.1148 fLA = 20.3989	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416	Nov 714.0748 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000	(84) (85) (87) (88) (90) (91) (92) (93) (93)
Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 Living area fr MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati 	al tempera rring heati actor for g Jan 70.2328 5.6822 rea 0.9947 20.1029 20.0927 10.9930 18.9041 caction 19.2915 19.2915 Jan 0.9910 685.3037 4.3000 W 1408.2056 1.0000	907.2487 ture (heati ng periods ains for li Feb 70.4351 5.6957 0.9772 20.3667 20.0951 0.9707 19.2852 19.6347 19.6347 Feb 0.9666 876.9192 4.9000	1180.7047 .ng season) in the livi ving area, Mar 70.6386 5.7092 0.9026 20.7059 20.0974 0.8801 19.7528 20.0608 20.0608 20.0608 20.0608	1493.1311 	1709.9448 m Table 9, Table 9a) May 71.8846 5.7923 0.4946 20.9921 20.1117 0.4490 20.1054 20.3919 20.3919 20.3919 May 0.4635 792.5338	1717.3788 Th1 (C) Jun 72.9570 5.8638 0.3366 20.9993 20.1236 0.2907 20.1233 20.4064 20.4064 20.4064	Jul 72.9570 5.8638 0.2429 20.9999 20.1236 0.1946 20.1236 20.4068 20.4068 20.4068	Aug 73.1754 5.8784 0.2832 20.9998 20.1260 0.2295 20.1260 20.4084 20.4084 20.4084	Sep 72.5242 5.8349 0.5048 20.9938 20.1189 0.4424 20.3989 20.3989 20.3989	Oct 71.8846 5.7923 0.8632 20.8457 20.1117 0.8240 19.9531 Living are 20.2416 20.2416 20.2416	Nov 714.0748 Nov 71.4644 5.7643 0.9846 20.4073 20.1070 0.9791 19.3563 a / (4) = 19.6960 19.6960 19.6960 19.6960 0.9759 696.8590 7.1000	638.4871 21.0000 Dec 71.0491 5.7366 0.9965 20.0572 20.1022 0.9954 18.8449 0.3232 19.2366 0.0000 19.2366	(84) (85) (86) (87) (88) (90) (91) (92) (93) (93) (93) (93) (94) (95) (96) (97)

8c. Space cooling requirement





PLIAN	ICE	09 Jan 1	2014



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Calculated for	June, July	and August.	See Table	10b									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate	W												
	0.0000	0.0000	0.0000	0.0000	0.0000	850.0057	669.1534	685.1881	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9970	0.9989	0.9979	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	847.4626	668.4310	683.7320	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2096.5915	2001.5434	1799.5020	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	899.3728	991.8356	830.1329	0.0000	0.0000	0.0000	0.0000	
Space cooling												2721.3413	
Cooled fractio									fC =	cooled area	/ (4) =	0.7895	(105)
Intermittency													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling	kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	177.5078	195.7570	163.8420	0.0000	0.0000	0.0000		
Space cooling													
Space cooling	per m2											5.6538	(108)

9b. Energy requirements			
Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from community system Fraction of heat from community Heat pump Fraction of total space heat from community Heat pump Factor for control and charging method (Table 4c(3)) for community space heating Factor for control and charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating:		0.1000 0.9000 1.0000 1.0000 1.0000 1.0000 1.1000	(302) (303a) (304a) (305) (305a)
Annual space heating requirement Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.10 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating fuel for secondary/supplementary system		2067.9977 2047.3177 100.0000 206.7998	(307a) (308)
Water heating Annual water heating requirement Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.10 Electricity used for heat distribution Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Annual totals kWh/year		2186.6201 2405.2821 44.5260 4.7790 112.3890	(310a) (313) (314)
Electricity for pumps and fans: (BalancedMithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7500) mechanical ventilation fans (SFP = 0.7500) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)		234.6975 234.6975 390.4303	(331)
Energy saving/generation technologies (Appendices M ,N and Q) PV Unit 0 (0.80 \star 0.15 \star 1080 \star 0.80) = Total delivered energy for all uses	-103.6344	-103.6344 5293.2820	

12b. Carbon dioxide emissions - Community heating scheme			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump	4500 0440	0 54.00	280.0000 (367a)
Space heating from Heat pump	1590.2142 44.5260	0.5190	825.3212 (367)
Electrical energy for heat distribution Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)	44.5260	0.5190	23.1090 (372) 848.4302 (373)
Space heating - secondary Space and water heating	206.7998	0.5190	107.3291 (374) 955.7593 (376)
Space cooling	112.3890	0.5190	58.3299 (377)
Pumps and fans	234.6975	0.5190	121.8080 (378)
Energy for lighting	390.4303	0.5190	202.6333 (379)
Energy saving/generation technologies PV Unit Total CO2, kg/year Dwelling Carbon Dioxide Emission Rate (DER)	-103.6344	0.5190	-53.7862 (380) 1284.7442 (383) 13.5200 (384)
16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRIC DER Total Floor Area Assumed number of occupants CO2 emissions factor in Table 12 for electricity displaced from grid CO2 emissions from appliances, equation (L14) CO2 emissions from cooking, equation (L16) Total CO2 emissions Residual CO2 emissions offset from biofuel CHP Additional allowable electricity generation, kWh/m²/year Resulting CO2 emissions offset from additional allowable electricity generation Net CO2 emissions		25	13.5200 ZC1 TFA 95.0000 N 2.6882 EF 0.5190 15.4683 ZC2 1.9317 ZC3 30.9201 ZC4 0.0000 ZC5 0.0000 ZC5 0.0000 ZC7 30.9201 ZC8

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

			09 Jan 201	. 4	9.92, Janua:	
1. Overall dwell	ing dimen.	sions 				
Ground floor Total floor area Dwelling volume	a TFA = (1	a)+(1b)+(1c	c)+(1d)+(1e)	(ln)	!	95.0000
2. Ventilation r						s
Number of chimne Number of open f Number of interm Number of passiv Number of fluele	flues mittent fa ve vents				main heating 0 0	+
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50 te		and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =
Shelter factor Infiltration rat	e adjuste:	d to includ	de shelter i	factor		
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500
Effective ac	0.3977 0.5791	0.3899 0.5760	0.3821 0.5730	0.3431 0.5589	0.3353 0.5562	0.2963 0.5439
Element TER Opaque door TER Opening Type External Wall 1 External Roof 1 Total net area c			Aum(A. m2)	Gross m2 91.8000 22.4000	Openings m2 23.7500	2 21
Fabric heat loss	s, W/K = S nameter (T	um (A x U) MP = Cm / 1	PFA) in kJ/r		area)	111
Thermal mass par Thermal bridges Total fabric bea						
Thermal bridges Total fabric hea Ventilation heat	at loss : loss cal Jan	Feb	Mar	Apr	May	Jun
Thermal bridges Total fabric hea Ventilation heat (38)m Heat transfer co	at loss cal Jan 49.0162 peff 100.6312	Feb 48.7563 100.3713	Mar 48.5015		May 47.0809	Jun 46.0386 97.6537
Thermal bridges Total fabric hea Ventilation heat (38)m Heat transfer cc Average = Sum(35) HLP HLP (average)	at loss cal Jan 49.0162 Deff 100.6312 3)m / 12 =	Feb 48.7563 100.3713	Mar 48.5015 100.1165	Apr 47.3048	May 47.0809 98.6959 May	46.0386 97.6537 Jun
Thermal bridges Total fabric hea Ventilation heat (38)m Heat transfer cc Average = Sum(35 HLP	at loss cal Jan 49.0162 Deff 100.6312 3)m / 12 =	Feb 48.7563 100.3713	Mar 48.5015 100.1165	Apr 47.3048 98.9198 Apr	May 47.0809 98.6959 May	46.0386 97.6537 Jun
Thermal bridges Total fabric heat (38)m Heat transfer cc 1 Average = Sum(39 HLP HLP (average) Days in month 	at loss cal Jan (49.0162) reff (100.6312) m / 12 = Jan 1.0593 31 g energy r	Feb 48.7563 100.3713 Feb 1.0565 28 equirements	Mar 48.5015 100.1165 Mar 1.0539 31 31	Apr 47.3048 98.9198 Apr 1.0413 30	May 47.0809 98.6959 May 1.0389 31	46.0386 97.6537 Jun 1.0279 30
Thermal bridges Total fabric heat (38)m Heat transfer cc 1 Average = Sum(39 HLP HLP (average) Days in month 	at loss cal Jan 49.0162 beff 100.6312))m / 12 = Jan 1.0593 31 g energy r 29 yt water u	Feb 48.7563 100.3713 Feb 1.0565 28 equirements se (litres/	Mar 48.5015 100.1165 Mar 1.0539 31 s (kWh/year) (day)	Apr 47.3048 98.9198 Apr 1.0413 30	May 47.0809 98.6959 May 1.0389 31	46.0386 97.6537 Jun 1.0279 30
Thermal bridges Total fabric heat (38)m Heat transfer cc 1 Average = Sum(39 HLP HLP (average) Days in month 	at loss cal Jan 49.0162 beff Jan 1.0593 31 genergy r cy twater u Jan use 007.8484 1.59.9361	Feb 48.7563 100.3713 Feb 1.0565 28 equirements se (litres, Feb	Mar 48.5015 100.1165 Mar 1.0539 31 (kWh/year) (day) Mar	Apr 47.3048 98.9198 Apr 1.0413 30	May 47.0809 98.6959 May 1.0389 31	46.0386 97.6537 Jun 1.0279 30 Jun
Thermal bridges Total fabric heat Ventilation heat (38)m Heat transfer cc 1 Average = Sum(35 HLP HLP (average) Days in month 4. Water heating Assumed occupanc Average daily ho Daily hot water Energy conten 1 Energy content 1 Energy content 1	at loss cal Jan 49,0162 beff Jan 1.0593 31 31 9 energy r bergy	Feb 48.7563 100.3713 Feb 1.0565 28 equirements se (litres) Feb 103.9267 139.8811 = 0.15 x (4	Mar 48.5015 100.1165 Mar 1.0539 31 (kWh/year) (day) Mar 100.0049 144.3448	Apr 47.3048 98.9198 Apr 1.0413 30 Apr 96.0831 125.8433	May 47.0809 98.6959 May 1.0389 31	46.0386 97.6537 Jun 1.0279 30 Jun 88.2396 104.1977



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16





 Area
 Storey height

 (m2)
 (m)

 95.0000 (1b)
 x
 2.7000 (2b)
 =
 Volume (m3) 256.5000 (1b) - (3b) $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) = 256.5000$ (5) ondary eating other m3 per hour total 0.0000 (6a) 0.0000 (6b) 30.0000 (7a) 0.0000 (7b) 0.0000 (7c) + -Air changes per hour 30.0000 / (5) = 0.1170 (8) Yes 5.0000 0.3670 (18) 2 (19) 0.8500 (20) 0.3119 (21) $(20) = 1 - [0.075 \times (19)] = (21) = (18) \times (20) =$ Jul 3.8000 0.9500 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Dec 4.7000 (22) 1.1750 (22a) Oct 4.3000 4.5000 0.2963 0.5439 0.2885 0.5416 0.3119 0.5486 0.3353 0.3509 0.5616 0.3665 (22b) 0.5672 (25) A x U W/K 2.2800 28.4640 12.2490 2.9120 АхК kJ/K U-value W/m2K K-value kJ/m2K rea m2 800 700 500 1.0000 1.3258 0.1800 0.1300 (26) (27) (29a) (30) (31) (33) (26)...(30) + (32) = 45.9050 250.0000 (35) 5.7100 (36) 51.6150 (37) (33) + (36) =Jul 46.0386 Aug 45.8456 Sep 46.4401 Oct 47.0809 Nov 47.5338 Dec 48.0074 (38) 97 6537 97 4606 98.0551 99.6224 (39) 98.9187 (39) 98.6959 99.1489 Dec 1.0487 (40) 1.0412 (40) Jul Aug 1.0259 Sep 1.0322 1.0279 1.0389 1.0437 31 (41) 30 30 31 31 31 ------2.6882 (42) 98.0440 (43) Jul Aug Sep Oct Nov Dec 88.2396 92.1614 110.7977 96.0831 112.1210 100.0049 130.6662 103.9267 142.6324 107.8484 (44) 154.8896 (45) 96.5545 Total = Sum(45)m = 1542.6141 (45) 14.4832 16.6197 16.8182 19.5999 21.3949 23.2334 (46) 300.0000 (47) 2.1127 (48) 0.5400 (49) 1.1409 (55)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder co	ontains dedi	cated sola	r storage										
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat req	quired for w	water heatin	ng calculate	ed for each	month								
	218.5649	192.8362	202.9736	182.5808	179.3784	160.9353	155.1833	169.4265	168.8586	189.2950	199.3700	213.5184	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar inpu	it (sum of :	months) = Si	um(63)m =	0.0000	(63)
)utput from w/	'h												
	218.5649	192.8362	202.9736	182.5808	179.3784	160.9353	155.1833	169.4265	168.8586	189.2950	199.3700	213.5184	(64)
								Total pe	er year (kW	h/year) = Si	um(64)m =	2232.9211	(64)
Heat gains fro		ating, kWh/m											
	100.0818	88.8745	94.8977	87.2329	87.0523	80.0358	79.0074	83.7433	82.6703	90.3496	92.8153	98.4038	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
 Metabolic gains (Table 5), Watts

 Jan
 Feb
 Mar
 Apr
 May
 Jun
 Jul
 Aug
 Sep
 Oct
 Nov
 Dec

 (66)m
 134.4085
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 Losses e.g. evaporation (negative values) (Table 5) -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 -107.5268 (71) Water heating gains (Table 5) 134.5185 132.2537 127.5507 121.1569 117.0058 111.1608 106.1928 112.5582 114.8198 121.4376 128.9102 132.2632 (72) Total internal gains 470.9269 468.7640 453.9101 429.8326 405.2034 381.5729 366.2776 372.5411 384.9536 409.2550 437.2057 458.3443 (73)

6. Solar gair													
[Jan]			A	m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tabi		Acce fact Table	or	Gains W	
East West			15.2 6.2	400 300	19.6403 19.6403		0.6300 0.6300		.7000 .7000	0.77 0.77		91.4754 37.3945	
Solar gains Total gains	128.8698 599.7967	252.0967 720.8607	415.1673 869.0774	605.4968 1035.3294	742.0591 1147.2625	759.6295 1141.2024	723.1982 1089.4759	621.2166 993.7577	482.8568 867.8104	299.1340 708.3890	160.6855 597.8912	105.9763 564.3205	

emperature c	luring heatir	a periods i	n the livin	g area from	Table 9. T	'h1 (C)						21.0000 (85
Jtilisation f						(0)						11.0000 (,
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
au	65.5584	65.7282	65.8955	66.6926	66.8439	67.5574	67.5574	67.6911	67.2808	66.8439	66.5386	66.2223	
lpha	5.3706	5.3819	5.3930	5.4462	5.4563	5.5038	5.5038	5.5127	5.4854	5.4563	5.4359	5.4148	
til living a	irea												
	0.9975	0.9928	0.9738	0.8991	0.7380	0.5385	0.3930	0.4480	0.7249	0.9549	0.9939	0.9982 (86
ГТ	19.9121	20.0945	20.3908	20.7317	20.9282	20.9894	20.9984	20.9969	20.9520	20.6469	20.2097	19.8817 (87
12	20.0342	20.0365	20.0387	20.0491	20.0510	20.0601	20.0601	20.0618	20.0566	20.0510	20.0471	20.0430 (88
til rest of	house												
	0.9966	0.9904	0.9653	0.8703	0.6807	0.4634	0.3098	0.3583	0.6459	0.9355	0.9915	0.9975 (89
IT 2	18.5832	18.8502	19.2775	19.7509	19.9870	20.0537	20.0596	20.0606	20.0217	19.6519	19.0270	18.5451 (90
iving area f	raction								fLA =	Living area	/ (4) =	0.3232 (91
IT emperature a	19.0126 djustment	19.2523	19.6373	20.0679	20.2912	20.3561	20.3630	20.3632	20.3224	19.9734	19.4092	18.9770 (0.0000	92
djusted MIT	19.0126	19.2523	19.6373	20.0679	20.2912	20.3561	20.3630	20.3632	20.3224	19.9734	19.4092	18.9770 (93

8. Space heating requirement Jul 0.3367 366.8524 Apr 0.8709 901.6789 8.9000 May 0.6959 798.3791 11.7000 Aug 0.3874 384.9605 Oct 0.9335 661.3079 10.6000
 Nov
 Dec

 0.9893
 0.9966 (94)

 591.5213
 562.3811 (95)

 7.1000
 4.2000 (96)
 Sep 0.6694 580.9305 14.1000 0.4874 556.2550 Utilisation 0.9953 Useful gains 597.0022 Ext temp. 4.3000 Heat loss rate W 0.9878 0.9609 835.1210 6.5000 4.9000 14.6000 16.6000 16.4000
 1480.5498
 1440.5628
 1315.2591
 1104.7223

 Month fracti
 1.0000
 1.0000
 1.0000

 Space heating kWh
 1.0000
 1.0000
 1.0000
 847.9124 1.0000 562.1013 0.0000 367.4677 0.0000 386.2534 0.0000 610.1344 0.0000 925.1185 1220.4462 1472.1238 (97) 1.0000 1.0000 1.0000 (97a) 0.0000 196.2751 452.8259 676.8485 (98) 657.3594 489.5402 357.2228 146.1913 36.8527 0.0000 0.0000 0.0000 Space heating Space heating per m2 3013.1160 (98) 31.7170 (99) (98) / (4) =

8c. Space cooling requirement

Not applicable



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements	- Individua	l heating s	ystems, inc	luding micr	o-CHP							
Fraction of space heat f Fraction of space heat f Efficiency of main space Efficiency of secondary/ Space heating requiremen	rom seconda rom main sy heating sy supplementa	ary/suppleme stem(s) stem 1 (in	ntary syste: %)								0.0000 1.0000 93.5000 0.0000 3222.5840	(202) (206) (208)
Jan Space heating requiremen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
657.3594	489.5402	357.2228	146.1913	36.8527	0.0000	0.0000	0.0000	0.0000	196.2751	452.8259	676.8485	(98)
Space heating efficiency 93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main 703.0582	523.5724	382.0565	156.3543	39.4147	0.0000	0.0000	0.0000	0.0000	209.9199	484.3058	723.9022	(211)
Water heating requiremen 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requiremen 218.5649	t 192.8362	202.9736	182.5808	179.3784	160.9353	155.1833	169.4265	168.8586	189.2950	199.3700	213.5184	(64)
Efficiency of water heat (217)m 87.5701	er 87.1960	86.3070	84.2281	81.4411	79.8000	79.8000	79.8000	79.8000	84.9104	86.9366	79.8000 87.6806	
Fuel for water heating, 249.5885	kWh/month 221.1526	235.1763	216.7695	220.2555	201.6733	194.4653	212.3140	211.6022	222.9350	229.3280	243.5183	(219)
Water heating fuel used Annual totals kWh/year											2658.7784	(219)
Space heating fuel - mai Space heating fuel - sec											3222.5840 0.0000	
Electricity for pumps an central heating pump main heating flue fan Total electricity for th Electricity for lighting Total delivered energy f	e above, kW (calculate	d in Append	ix L)								30.0000 45.0000 75.0000 390.3596 6346.7220	(230e) (231) (232)
12a. Carbon dioxide emis												
Space heating - main sys Space heating - secondar Water heating (other fue Space and water heating Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for spa Fuel factor (electricity Emissions per m2 for lig	y 1) .ce and wate 7)	r heating					Energy kWh/year 3222.5840 0.0000 2658.7784 75.0000 390.3596		ion factor kg CO2/kWh 0.2160 0.2160 0.5190 0.5190	k	Emissions G CO2/year 696.0781 0.0000 574.2961 1270.3743 38.9250 202.5966 1511.8959 13.3724 1.5500 2.1326	(263) (264) (265) (267) (268) (272) (272a)
Emissions per m2 for pum Target Carbon Dioxide Em	ps and fans		3.3724 * 1.	55) + 2.132	6 + 0.4097,	rounded to	2 d.p.				0.4097 23.2700	(272c)







appendix b...



...sustainable building services solutions

appendix b..

GLA Carbon Emission Reporting Spreadsheet

BACKGROUND AND PURPOSE

The GLA has decided that from January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants are encouraged to use the SAP 10.0 emission factors for referable applications when estimating CO2 emission performance against London Plan policies. This is a new approach being taken by the GLA to reflect the decarbonisation of the electricity grid, which is not currently taken into account by Part L of Building Regulations. This approach will remain in place until Government adopts new Building Regulations with updated emission factors

This GLA Carbon Emission Reporting Spreadsheet facilitates the use of the SAP 10.0 emission factors and ensures a consistent and transparent process for updating Par L 2013 CO₂ emission performance. In particular, the approach has been developed to ensure that SAP 10.0 results can still be validated against supporting Part L 2013 BRUKL and SAP outputs.

From January 2019 all GLA referable applications (including refurbishments) are expected to use this spreadsheet to report the anticipated carbon performance of a development. This includes planning applicants who are continuing to use SAP 2012 emission factors; although doing so will need to be supported by sufficient justification in line with the Energy Assessment Guidance. Applicants are required to submit this spreadsheet to the GLA alongside the energy assessment. It should be used for both domestic and non-domestic uses. The GLA will not accept the use of alternative methodologies or tools. This is to ensure consistency and to minimise the need for clarifications during the determination period

Planning applicants should use Part L 2013 BRUKL and SAP outputs to fill in this spreadsheet which serves as a the final step in reporting the carbon emission performance of the proposed energy strategy. It is solely for the purpose of reporting to the GLA and does not replace Part L calculations submitted for Building Regulations approva

The spreadsheet has been developed to fit as wide a range of policy compliant approaches for referable schemes as possible. Any planning applicants with a policy compliant approach that the spreadsheet does not serve should contact the GLA at: environment@london.gov.uk. Applicants must not amend or alter the spreadsheet to suit non-policy compliant strategies. Any unauthorised amendment to the spreadsheet will invalidate the CO2 emission calculations.

Applicants should note that we will update the spreadsheet from time to time to ensure it remains fit for purpose. Applicants are expected to use the latest version at the time of the planning submission

Any feedback on this spreadsheet should be sent to: environment@london.gov.uk

METHODOLOGY

Applicants are required to complete all light blue input cells in the applicable tabs ('Carbon Factors', 'Baseline', 'Be Lean', 'Be Clean', 'Be Green' and 'GLA Summary Tables'). Input Data

For all applications, the input data required includes: · Bespoke Carbon Factors (if applicable) Type of units modelled · Area of units modelled (m²) Number of units modelled Total area represented by model (m²) • Regulated energy consumption by end use (kWh p.a. for residential and kWh/m² p.a. for non-residential) • Regulated energy consumption by fuel type (kWh/m² p.a. for non-residential) • TER, DER and BER figures (kgCO₂/m² p.a.) • TFEE and DFEE figures for residential (kWh//m² p.a.) Unregulated figures (tCO₂ p.a.) [In the 'GLA Summary tables' tab only]
 Actual and notional building cooling demand (MJ/m²) [In the 'GLA Summary tables' tab only] Distribution loss factor (if applicable) [In the 'Development information' tab, Table 4] Applicants should update the highlighted cells with the type, area and number of modelled units. The consumption figures (kWh p.a. for

domestic and kWh/ m^2 p.a. for non-domestic) from the Part L modelling output reports should be reported and used to estimate the CO₂ emissions for each stage of the Energy Hierarchy. The TER, DER and BER figures from the Part L 2013 modelling output sheets should also be reported for cross-reference purposes. The applicant should ensure that the manually calculated TER, DER and BER figures are equal to the figures reported within the output sheets. TFEE and DFEE information should also be provided as well as unregulated uses consumption figures and cooling demand performance

The total carbon emissions figures in the 'GLA Summary tables' tab are now calculated based on the area input for 'Total area represented by model (m?). This input requirement has been added to ensure that the carbon emission figures align with the development area schedule (included within the DAS) rather than the number of representative models.

Required Part L Outputs for the GLA spreadsheet

Domestic Part L Outputs:

For the domestic conversion applicants are required to use the outputs from the SAP TER and DER worksheets. To assist in the conversion process the required SAP worksheet rows have been referenced in each input cell. For Space Heating and Hot Water applicants will be required to manually convert the SAP energy requirements to energy consumption by fuel type, the appropriate SAP rows for this calculation have also been listed. Note. The SAP worksheet rows are based on a communal heating system, which is an expectation for GLA referrable schemes. Applicants proposing individual systems must first seek confirmation from the GLA as to whether the approach will be acceptable. Non-domestic Part L Outputs:

The required Part L outputs from non-domestic modelling will be energy consumption by **fuel type** (e.g. grid electricity, natural gas). The energy consumption by end use (e.g. heating, hot water, cooling etc.) included in the BRUKL documents are no longer used to estimate the CO₂ emission performance with SAP 10.0 emission factors in this spreadsheet. This decision has been taken as the consumption figures provided in the BRUKL may include a mixture of fuel types, for instance heating may include energy consumption from gas boilers and electrically driven heat pumps. The required data can be found in: • SBEM software: the required data is included in the output file ending "*sim.csv"

Government approved software (such as IES and TAS); the required data is included in the output file ending in "*BRUKL.inp"

The above output files should be appended to the energy assessment document.

Regarding the non-domestic uses, the applicant can determine whether each individual unit will be modelled independently and apportioned to the entire scheme or whether a single model will be generated for the entire development. The applicant should, however, include the results from all BRUKL outputs generated for the proposed development under the "NON-DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS" sections. Applicants are generally encouraged to model each individual typology independently.

Note: GLA are aware that the Part L outputs for grid supplied electricity consumption does not account for power factor correction. Where power factor correction is present applicants may be required to amend the electricity consumption by the appropriate adjustment factor. The power factor correction is found in Table 1 of the Government's Approved Document L2A (ADL2A). Applicants should note in the appropriate cells where power factor correction has been applied.

Carbon Factors

The carbon factors for SAP 2012 and SAP 10.0 scenarios have been provided in the 'Development Information' tab. The table has been prepopulated with grid electricity and gas factors. Additional space has been included for alternative fuel factors that are included in Table 12 of the SAP 2012 and SAP 10.0 methodology documents. For applications with non-domestic buildings connecting to external heat networks a bespoke carbon factor needs to be introduced, the applicant should provide the full calculation behind the introduced bespoke carbon factor.

Validation Check

A validation check is required for each model entered to ensure that the conversion is robust. Applicants must ensure that the calculated TER/DER/BER in this spreadsheet matches the actual values from the Part L 2013 BRUKL and SAP worksh

Martine Martine <t< th=""><th></th><th>ENERGY</th><th>CONSUM</th><th>PTION AN</th><th>D CO₂ ANA</th><th>LYSIS</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>DEMAND</th></t<>		ENERGY	CONSUM	PTION AN	D CO ₂ ANA	LYSIS																					DEMAND
				Taria	VALIDAT	ION CHECK		REGULATED EN	ERGY CONSUMF	TION PER UNIT	(kWh p.a.) - TER	WORKSHEET			REGULAT	TED CO ₂ EMISSIONS P	ER UNIT (kgCO ₂ p.a.)				REGULATED CO	D2 EMISSIONS PER U	INIT			Efficiency
NUMP	iit identifier (e.g. plot number, velling type etc.)	floor area (m²)	Number of	represented by model	TER 2012	TER 2012 (kgCO ₂ / m ²)			Water	Domestic Hot				Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	emissions	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	emissions	TER SAP 10.0	Target Fabri Energy Efficiency (TFEE)
		Worksheet	:				Worksheet		Worksheet		Worksheet	Worksheet															
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		ESTIC ENE	ERGY CON	Total area represented by model	N AND CO ₂ VALIDAT Calculated TER 2012	ANALYSIS	REGULA	ATED ENERGY CO	DNSUMPTION BY	END USE (kWh/r Fuel type	n² p.a.) TER - SO	URCE: BRUKL OU	UTPUT	REGULATED ENER	RGY CONSUMPTION B	Y FUEL TYPE (kWh/m			*SIM.CSV FILE 2012 CO ₂ emissions	REGULAT	ED ENERGY CONSUMPT	TION BY FUEL TYPE Unregulated Grid			REGULATED C SAP10.0 CO ₂ emissions	CO₂ EMISSIONS BRUKL TER SAP10.0	
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The applicant s						energy consumpti	ion figures, the 'be	lean' DER, the DFEE	and the regulated er	nergy demand of	the 'be lean' scen	ario.					:	SAP 2012 CO ₂ PE	RFORMANCE				SAP	10.0 CO ₂ PERFORM	IANCE			
DOMESTIC	ENERGIC	CONSON		_	ION CHECK			REGULATED ENER	GY CONSUMPTION	I PER UNIT (kWh	p.a.) - 'BE LEAN'	SAP DER WORK	SHEET				REGULATE	ED CO ₂ EMISSION	S PER UNIT (kgCO ₂ p.a.)				REGULAT	TED CO ₂ EMISSIONS	S PER UNIT			
Unit identifier (e.g. plot number, dwelling type etc.)	floor area		Total area represented by model (m ²)	DER 2012	DER Worksheet DER 2012 (kgCO ₂ / m ²)	Space Heating	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Secondary Heating system	Fuel type Space Heating	Lighting	Auxiliary	Cooling		Space Heating CO ₂ emissions (kgCO ₂ p.a.)	Domestic Hot Water CO ₂ emissions (kgCO ₂ p.a.)		Auxiliary Cooling CO ₂ emissions CO ₂ emission (kgCO ₂ p.a.) (kgCO ₂ p.a.)	s (kgCO ₂ p.a.)	Space Heating CO ₂ emissions (kgCO ₂ p.a.)	Domestic Hot Water CO ₂ emissions (kgCO ₂ p.a.)	Lighting CO ₂ emissions (kgCO ₂ p.a.)	Auxiliary CO ₂ emissions C (kgCO ₂ p.a.)	CO ₂ emissions		SAP 10.0 CO ₂ emissions (kgCO ₂ p.a.)	DER SAP 10.0
					DER Sheet (Row 384)	DER Sheet [(Row 307a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet [Row 310b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 309]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315														
1 2 3 4 11 12 13 14 15	50 55 51 93 59 95 131 158	1 1 3 3 1 1	50 55 58 51 279 177 285 131 158	23.1 20.0 18.0 20.9 15.4 16.8 14.9 19.3 18.6	23.1 20.0 18.0 20.9 15.5 16.8 14.9 19.3 18.6	2451.8501 2014.5548 1651.9532 1986.1943 2539.5143 1355.1279 2340.0168 6795.2273 8186.2161	Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas	1913.5756 2012.122 2076.6454 1942.5564 2518.7417 2106.8794 2538.3101 2587.7282 2605.4919	Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas	0 0 0 0 0 0 0 0	Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas Natural Gas	390.4303	177.9375 188.2312 194.4075 179.9962 277.9516 196.4662 309.6975 428.2022 569.9113	0 0 0 0 70.708 76.9967		530 435 357 429 549 233 505 1,468 1,768	413 435 449 544 455 548 559 563	120 131 137 122 200 139 203 244 269	92 0 98 0 101 0 93 0 144 0 102 0 161 0 222 37 296 40	1,156 1,088 1,043 1,064 1,437 989 1,416 2,530 2,936	515 423 347 417 533 285 491 1,427 1,719	402 423 436 529 442 532 543 543 547	54 59 62 55 90 63 91 110 121	41 44 45 45 65 46 72 100 133	0 0 0 0 0 16 18	429 465 485 436 694 492 703 840 920	1,012 948 890 922 1,217 835 1,187 2,196 2,538	20.2 17.2 15.3 18.1 13.1 14.2 12.5 16.8 16.1
Sum NON-DOM	1,244 ESTIC ENER			VALIDAT	- D2 ANALYSIS ION CHECK	41,790	N/A REGL	34,621	N/A NSUMPTION BY EN	0 D USE (kWh/m² p	N/A	5,104 R - SOURCE: BR	4,091 RUKL OUTPUT	148	N/A REGULATED END	9,027 ERGY CONSUMPTION	7,478 BY FUEL TYPE (kW	2,649 h/m² p.a.) 'BE LE	2,123 77 AN' BER - SOURCE: BRUKLIN	21,354 P or *SIM.CSV FILE	8,776	7,270	1,189 REGULAT	953 TED CO ₂ EMISSIONS	34 S PER UNIT	9,243	18,223	14.6
Building Use	Model Area (m²)	Number of	Total area represented by model (m ²)	1	BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m ² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m ² p.a.)	Fuel type Domestic Hot Water			Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)	Natural Gas	Grid Electricity	Equipment			2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity	Equipment				SAP 10.0 CO ₂ emissions (kgCO ₂ p.a.)	BRUKL BER SAP 10.0 (kgCO ₂ / m ²)
															0.216 kgCO ₂ /kWh	0.519 kgCOykWh	0.519 kgCQyKWh				0.210 kgCOy/kWh	0.233 kgCO ₂ /kWh	0.233 kgCOyKWh					
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Sum SITE-WIDE		0 CONSUM	0 PTION AN	0.0 ND CO2 AN/	ALYSIS	0	NA	0	N/A PEGULAT	N/A	N/A	D	0	0	0	0	0	N/A	N/A N/A	0 REGULATED CO ₂	0	0	0				0 REGILIATED	0.0
	ENERGY C		PTION AN			0 Space Heating (kWh p.a.)	N/A	0 Domestic Hot Water		N/A ED ENERGY CO Secondary Heating System		0 Lighting (KWh p.a.)	0 Auxiliary (KWh p.a.)	0 Cooling (KWh p.a.)	0	0	0	N/A	N/A N/A			0	0					0.0 CO ₂ EMISSIONS Calculated BER SAP 10.0

The applicant	hould comple	lete all the ligh	t blue cells inc	luding informat	tion on the 'be cle	ean' energy consun	nption figures and	the 'be clean' DER.													SAP 2012 CO ₂ PERI	FORMANCE					
DOMESTIC	ENERGY	Y CONSUI	IPTION A	ND CO2 AN	ALYSIS	1												1									
Unit identifier			Total area		ION CHECK					TED ENERGY CON											-	PER UNIT (kgCO ₂ p.a.)				L	
(e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	Calculated DER 2012 (kgCO ₂ / m ²)	DER Workshee DER 2012 (kgCO ₂ / m ²)	t Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Domestic Hot	Space and Domestic Hot Water from CHP	Fuel type CHP	Total Electricity generated by CHP (-)	Secondary Heating system	Fuel type Secondary Heating	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Wate	r Space Heating and DHW from CHP	Electricity generate by CHP	d Lighting	Auxiliary	Cooling	2012 CO ₂ emissions (kgCO ₂ p.a.)	Space Heating	Domestic Hot Water
					DER Sheet	DER Sheet	Select fuel type	DER Sheet	Select fuel type	DER Sheet	if applicable Select fuel type	if applicable DER Sheet	DER Sheet	Select fuel type	DER Sheet	DER Sheet	DER Sheet			if applicable	if applicable					J	
					(Row 384)	[Row 307b ÷ (Row 367b x 0.01)]		[Row 310b ÷ (Row 367b x 0.01)]		[(Row 307a + 310a) ÷ (Row 362 x 0.01)]		[(Row 307a + 310a) × (Row 361 ÷ 362)]	[Row 309]		Row 332	(Row 313 + 331)	Row 315										
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4 11 12	51 93 59	1 3 3	51 279 177	20.9 15.4 16.8	20.9 15.5 16.8	1986.1943 2539.5143 1355.1279	Natural Gas Natural Gas Natural Gas	1942.5564 2518.7417 2106.8794	Natural Gas Natural Gas Natural Gas						235.8981 384.9323 268.3112	179.9962 277.9516 196.4662	0 0 0	429 549 293	420 544 455			122 200 139	93 144 102	0	1,064 1,437 989	417 533 285	408 529 442
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Sum	1,244	15	1,244	17.2		41,790	N/A	34,621	N/A	0	N/A	0	0	N/A	5,104	4,091	148	9,027	7,478	0	0	2,649	2,123	77	21,354	8,776	7,270
NON-DOM	ESTIC EN	IERGY CO	NSUMPTI		D2 ANALYSIS	5			REGULATED E	NERGY CONSUMPT	ION BY END USE (kWh/m² p.a.) 'BE C	LEAN' BER - SOUR	CE: BRUKL OUTPU	π			R	EGULATED ENERGY (CONSUMPTION BY FU	EL TYPE (kWh/m² p.a.)) 'BE CLEAN' BER - S	DURCE: BRUKLII	NP or *SIM.CSV FI	FILE		
Building Use		a Number of		Calculated BER 2012 (kaCO ₂ / m ²)	BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m ² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m ² p.a.)	Fuel type Domestic Hot			Electricity generated by CHP			Liahtina	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)	Natural Gas		Bespoke DH Factor					2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity
	(m²)	units	by model (m²)	(kgc027 iii)	(kgc027 iii)			((-)						0.216 kgC0 &Wh	0.510 kaCO /kWb	0.000 kaCO /kWh	if applicable	0.510 kaCO /kWb	4			0.210 kaCO (kWb	0.222 kaCO /kWb
										1		if applicable						0.216 kgcOykwn	0.519 kgCOvkwn	0.000 kgcOykwn	0.519 kgCOgkwn	0.519 kgCO _g /kWh				0.210 kgCOvkwn	0.233 kgCO ₂ /kWh
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											REGULATED EN	ERGY CONSUMPTI	ON												REGULATED CO2 EMISSIONS		
Use		Total Area (n	1²)	Calculated BER 2012	-					Space and		Electricity	6 ·														
				(kgCO ₂ / m ²)		Space Heating		Domestic Hot Water		Space and Domestic Hot Water from CHP		generated by CHP	Secondary Heating System		Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)								2012 CO ₂ emissions (kgCO ₂ p.a.)		
						(kWh p.a.)	All4	(kWh p.a.)	NA	(kWh n.a.)	the the	(kWh p.a.)	(kWh p.a.)	4NP	(1111 p.u.)	(kiiii p.a.)	(kiiii p.a.)								(ngoo ₂ p.a.)		
Sum		1,244		17.2		(kWh p.a.) 41,790	HIP	(kWh p.a.) 34,621	HIP	(kWh p.a.)	Alle	(kWh p.a.) If applicable 0	(kWh p.a.) 0	HIR.	5,104	4,091	148								21,354		

	SAP 10.0 CO ₂	PERFORMANCE				
RE	GULATED CO2 EMISSI	ONS PER UNIT (kgCO ₂	p.a.)			
Space Heating and DHW from CHP	Electricity generated by CHP	Lighting	Auxiliary	Cooling	SAP 10.0 CO ₂ emissions (kgCO ₂ p.a.)	Calculated DER SAP 10.0 (kgCO ₂ / m ²)
if applicable	if applicable					
		54 59	41 44	0	1,012 948	20.2 17.2
		62 55	45 42	0	890 922 1,217	15.3 18.1 13.1
		90 63 91	65 46 72	0 0 0	1,217 835 1,187	13.1 14.2 12.5
		110	100 133	16 18	2,196	16.8 16.1
0	0					
		1.189	953	34	18.223	14.6
	U	1,189	953	34	18,223	14.6
REGUI Bespoke DH Factor	ATED CO2 EMISSION	S PER UNIT	953	34		
REGUI Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-)	S PER UNIT	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34		BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-)	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	и	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO, EMISSION Ectivity generated by CHP (-) If applicable 0.233 kgCOykWh	S PER UNIT Equipment 0.233 kgC0ykWh	953	34	SAP 10.0 CO2 emissions (kgCO2 p.a.)	BRUKI. BER SAPIO.0 (kgCC; / m ²)
Bespoke DH Factor	ATED CO ₂ EMISSION Electricity generated by CHP (-) if applicable	S PER UNIT Equipment	953	34	SAP 10.0 CO ₂	BRUKL
Bespoke DH Factor	ATED CO, EMISSION Ecticity generated by CHP (-) If applicable 0.233 kgCOykWh	S PER UNIT Equipment 0.233 kgC0ykWh	953	34	SAP 10.0 CO2 emissions (kgCO2 p.a.)	BRUKL BER SAP10.0 (kgCC; / m ²) 0.0
Bespoke DH Factor	ATED CO, EMISSION Ecticity generated by CHP (-) If applicable 0.233 kgCOykWh	S PER UNIT Equipment 0.233 kgC0ykWh	953	34	SAP 10.0 CO2 emissions (kgCO2 p.a.)	BRUKL BER SAP10.0 (kgCC; / m ²)
Bespoke DH Factor	ATED CO, EMISSION Ecticity generated by CHP (-) If applicable 0.233 kgCOykWh	S PER UNIT Equipment 0.233 kgC0ykWh	953	34	0 REGULATED SAP 10.0 CO, emissions (kgC0; p.a.)	BRUKI. BER SAP10.0 (kgCQ./m) 0.0 0.0 CO, EMISSIONS LUNT Calculated BER SAP10.0
Bespoke DH Factor	ATED CO, EMISSION Ecticity generated by CHP (-) If applicable 0.233 kgCOykWh	S PER UNIT Equipment 0.233 kgC0ykWh	953	34	SAP 10.0 CO2 emissions (kgCO2 p.a.)	BRUKI. BER SAP10.0 (kgCQ./m) 0.0 0.0 CQ. EMISSIONS UNIT

The applicant should c					energy consumption	figures and the 'I	'be green' DER.																			SAP 2012 C	D ₂ PERFORMANCE									SAP 10.0	CO ₂ PERFORMANCE					
DOMESTIC ENE	RGY CONSU	UMPTION AND		LYSIS ON CHECK						R	EGULATED ENERG	Y CONSUMPTION P	PER UNIT (kWh p.:	.) - 'BE GREEN' SAP	P DER WORKSHEE	ग										REGULATED CO, EM	SSIONS PER UNIT (kg	00, p.a.)								REGULATED C	CO ₂ EMISSIONS PER					
Unit identifier (e.g. plot Mode number, floor dwelling type (n etc.)	i total area Number n units	Total area r of represented by model	Calculated DER 2012	DER Worksheet DER 2012	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot	Space Heating (Heat source 2)	Fuel type Space Heating	Domestic Hot Wat (Heat source 2)	ter Fuel type) Domestic Hot	Space and Domestic Hot	Fuel type CHP	Total Electricity generated by	Secondary Heating system	Fuel type Secondary	Electricity generated by	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot W	ater Space Heating : DHW from CH	and Electricity gene IP by CHP	ted Electricity general by renewable	ed Lighting	Auxiliary	Cooling		2012 CO ₂ emissions (kgCO ₂ p.a.)	Space Heating	Domestic Hot Wate	r Space Heating and DHW from CHP	Electricity generated by CHP	Electricity generated by renewable	Lighting	Auxiliary	Cooling		SAP 10.0 CO ₂ emissions (kgCO ₂ p.a.)	Calculated DER SAP 10.0
etc.)	"	(m²)	(kgCO ₂ / m ⁻)	(kgCO ₂ / m ⁻)			(Heat Source 1)										Heating																								(kgCO ₂ p.a.)	(kgCO ₂ / m ⁻)
				DER Sheet (Row 384)	DER Sheet [Row 307b + (Row 367b x	Select fuel type	DER Sheet [Row 310b + (Row 367b x 0.01	Select fuel type	e DER Sheet [Row 307c + (Row 367c x 0.01)	Select fuel type	If acolicable DER Sheet (Row 310c + (Row 367c x 0.01	Select fuel type	e DER Sheet ((Row 307a + 310a) +	if applicable Select fuel type	If applicable DER Sheet ((Row 307a + 310a) × (Row	DER Sheet Row 309	Select fuel type	If applicable DER Sheet I Row 333	ER Sheet Row 332 (I	DER Sheet Row 313 + 331)	DER Sheet Row 315			¥ applicable	i apolicable	if applicable								if applicable	if apolicable	if applicable						
1 5	0 1 5 1	50 55	21.0 17.6	21.0 17.6	0.01)]						from sore x cor	<i>n</i>	(Row 362 x		361 + 362)]		Grid Electricity Grid Electricity	-55.2717 -62.1806	231.8095 252.201	143.2265 150.0148	47.9818 31.795	513 415	347 358			-29 -32	120 131	74 78	25 17	-	1,051 966	230 186	156 161			-13 -14	54 59	33 35	11 7	-	472 434	9.4 7.9
3 5 4 5 11 5	8 1 1 1 3 3	58 51 279 177 285 131 158	21.0 17.6 15.6 18.9 14.1 14.5 13.5 18.0 17.4	21.0 17.6 15.6 18.9 14.1	770.2627143 623.4516786 505.8226786 620.0055 803.5553571 415.2995357 731.1248929 2190.949429 2649.365964	Grid Electricity Grid Electricity Grid Electricity	703.0509643 672.9581429 832.3392857	Grid Electricity Grid Electricity Grid Electricity	· · ·							143.061 175.3551 227.2682	Grid Electricity Grid Electricity Grid Electricity	-55.2717 -62.1806 -62.1806 -55.2717 -103.6344 -62.1806 -103.6344 -46.0881 -172.7239	264.3093 235.8981 384.9323 268.3112 390.4303 470.6313 518.1402	143.2285 150.0148 153.256 141.1992 248.7566 152.8978 279.2235 439.4622 594.2065	47,3828 31,795 35,4933 63,3053 131,0295 46,8387 112,389 66,9339 67,0341	513 415 337 413 535 277 487 1,459 1,764	365 349 432			-32 -29 -54	137 122 200	80 73 129	25 17 18 33 68		1,051 966 905 1,310 854 1,285 2,352 2,752	230 186 151 185 240 124 219 655 792	164 157 194			-14 -13 -24	62 55 90	36 33 58	8 15 31 11 26 16 16		472 434 406 432 588 383 577 1,056 1,235	9.4 7.9 7.0 8.5 6.3 6.5 6.1
13 5	9 3 5 3 31 1 98 1	177 285 131	14.5 13.5 18.0	14.1 14.5 13.5 18.0 17.4	415.2995357 731.1848929 2190.949429	Grid Electricity Grid Electricity Grid Electricity	707.259 859.0293214 889.765	Grid Electricity Grid Electricity Grid Electricity	<u>,</u>							117.4585 206.7998 619.6625	Grid Electricity Grid Electricity Grid Electricity	-62.1806 -103.6344 -145.0881	268.3112 390.4303 470.6313	152.8978 279.2235 439.4622	46.8387 112.389 66.9339	277 487 1.459	367 446 462 455			-32 -54 -75	200 139 203 244 269	79 145 228	24 58 35		854 1,285 2,352	124 219 655	165 200 207			-14 -24 -34	63 91 110 121	36 65 102	11 26 16		383 577 1,056	6.5 6.1 8.1 7.8
15 1	58 1	158	17.4	17.4	2649.365964	Grid Electricity	896.8908571	Grid Electricity								749.3156	Grid Electricity	-172.7239	518.1402	594.2065	67.0341	1,764	465			-90	269	308	35		2,752	792	209			-40	121	138	16		1,235	7.8
									_				_																													
		1,244 CONSUMPTION				N/A	11,717	N/A	0	NA	0	N/A	0	N/A	0	3,736	NA	-1,361	5,104	3,664	1,183	8,795	6,081	0							19,335	3,948	2,730	0	0		1,189	854	276	NA	8,680	7.0
Use Area	per Number	Total area r of represented	Calculated BER 2012	BRUKL BER 2012	Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot		REGULA	TED ENERGY CON	SUMPTION BY END	i USE (kWh/m² p.a.	'BE GREEN' BER -	Electricity generated by CHP (·)	OUTPUT		Electricity generated by (i	Lighting Wh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)	Natural Gas	Grid Electricit	REGULATED EN y Bespoke DH Fa	ctor Electricity gene by CHP	ted Electricity general by renewable technology	/m² p.a.) "BE GREEN" ed Enter Carbon Fac 1	BER - SOURCE: BRU tor Enter Carbon Fact 2	KLINP or "SM.CSV FI tor Enter Carbon Fact 3	LE or Equipment	2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity	Bespoke DH Facto	REGULATED CO2 E or Electricity generated by CHP (·)	MISSIONS PER UNIT Electricity generated by renewable	Enter Carbon Facto 1	r Enter Carbon Factor 2	7 Enter Carbon Facto 3	or Equipment	SAP 10.0 CO ₂ emissions	BRUKL BER SAP 10.0
unit	(m²) units	by model (m²)	(kgCO ₂ / m ⁴)	(kgCO ₂ / m*)			(KWIN/M* p.a.)	water							(-)			Electricity generated by (i renewable technology (-)				6.216.bcCo.640				(-) ¥ applicable Wh 0.519 koCO_kW				0.519.6-00-84	_	0.210 kgCO_848b	0.222 kaCO-6485	0.000 kcCQ_8Wb	(+) If applicable h 0.233 kgCO+/kWh	(-) if applicable	0.000 kaCO-8Wb	0.000 kaCO-6486	0.000 kaCO-ikWi	0.222 kcCO-6Wb	_	(kgCO ₂ / m ²)
																																	0.122 NO.04 NO.				2000 8000 8800					
									the second se	dir.	4P	48	÷	4P		48-	4P																									
Sum					0	N/A	0	N/A							0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	0	0	0	0	0	0	0	0	0	0.0
SITE-WIDE ENE	RGY CONSU	UMPTION AND	D CO2 ANAL	YSIS								REGULATE	ED ENERGY CONS	UMPTION																	REGULATED CO ₂										REGULATED CO	EMISSIONS
			Calculated BER 2012																												EMISSIONS										-COOLATED CO	r ====0000048
Use	Total Area	ia (m²)	BER 2012 (kgCO ₂ / m ²)		Space Heating (kWh p.a.)		Domestic Hot Water (kWh p.a.)		Space Heating (Heat source 2) (kWh p.a.)		Domestic Hot Wat (Heat source 2) (kWh p.a.)	ter	Space and Domestic Hol Water from CH (kWh p.a.)		Electricity generated by CHP (kWh p.a.) // applicable	Secondary Heating system (kWh p.a.)		Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)										2012 CO ₂ emissions										SAP 10.0 CO ₂ emissions	Calculated BER SAP 10.0
						42h		the state	(kWh p.a.)	the second	(kWh p.a.)	the state	(kWh p.a.)	, ⁴³ 2	(kWh p.a.) If applicable		ji dir			,																				÷10°		
Sum	1,244	4	15.5	-	13,210		11,717		0		0		•		0	3,736		-1,361	5,104	3,664	1,183										19,335										8,680	7.0

SAP 2012 Performance

Domestic
 Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emission (Tonnes CO	ns for domestic buildings 2 per annum)
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	21.6	
After energy demand reduction (be lean)	21.4	
After heat network connection (be clean)	21.4	
After renewable energy (be green)	19.3	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.2	1%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.0	9%
Cumulative on site savings	2.3	10%
Annual savings from off-set payment	19.3	
	(Tonne	is CO ₂)
Cumulative savings for off-set payment	580	
Cash in-lieu contribution (£)	0	

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

Regulated non-domestic carbon dioxide savings	
(Tonnes CO ₂ per annum)	(%)
0.0	0%
0.0	0%
0.0	0%
0.0	0%
0.0	
(Tonne	s CO ₂)
0	
0	
	(Tonnes CO, per annum) 0.0 0.0 0.0 0.0 0.0 (Tonne 0

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	21.6		
Be lean	21.4	0.2	1%
Be clean	21.4	0.0	0%
Be green	19.3	2.0	9%
Total Savings	-	2.3	10%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set		580.0	

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	19.3	
After energy demand reduction (be lean)	18.2	
After heat network connection (be clean)	18.2	
After renewable energy (be green)	8.7	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	1.1	6%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	9.5	49%
Cumulative on site savings	10.6	55%
Annual savings from off-set payment	8.7	
	(Tonne	s CO ₂)
Cumulative savings for off-set payment	260	
Cash in-lieu contribution (£)	0	
	A recommended price of £95 pe e is inputted in the 'Development	

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	0.0	0%
Annual savings from off-set payment	0.0	-
	(Tonne	s CO ₂)
Cumulative savings for off-set payment	0	
Cash in-lieu contribution (£)*	0	
	A recommended price of £95 pe e is inputted in the 'Development	

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	19.3		
Be lean	18.2	1.1	6%
Be clean	18.2	0.0	0%
Be green	8.7	9.5	49%
Total Savings	-	10.6	55%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	260.4	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	0.00	0.00	

	Area weighted non-domestic cooling demand (MJ/m ²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional		

