

62 Avenue Road, St Johns Wood, Camden, NW8 6HT.

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Planning Ref No: 2016/4931/P



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Sustainability Report and Energy Statement//62 Avenue Rd/Camden/NW8 6HT

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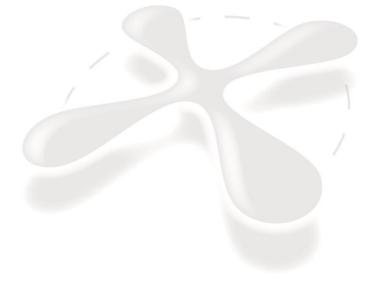
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Executive Summary

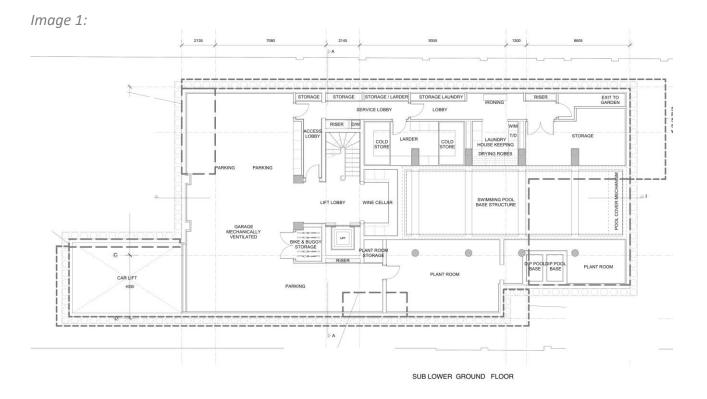
This document has been prepared by **Leema Technologies Ltd** for **VV Media**, setting out the sustainability commitments in support of the detailed planning application for the development of: **62 Avenue Road, St Johns Wood, Camden, NW8 6HT.**

Each commitment accords with London Borough of Camden planning policy and support policies. Targets set out within the strategy are for the residential development application area.

The application site is located in the London Borough of Camden, Greater London. The development of **62 Avenue Road, St Johns Wood, Camden, NW8 6HT** includes the demolition of the existing outdated dwelling. The proposal involves the erection of a new 4 storey family home. Comprising of basement, lower ground, ground and first floor levels with Garage, swimming pool and plant located in the basement and lower ground levels.

A bin store containing recycling and general waste bins shall be provided. Landscaping shall be provided to the front and rear gardens, with car parking spaces also available on the front forecourt of the property. The landscaping shall contribute towards the biodiversity of the area. Additionally bird/bat boxes shall also be provided.

Dedicated cycle storage is being provided in the basement / garage area as indicated in *Image 1*: below.



A site specific Flood Risk Assessment has been carried out for this site, which should be read in conjunction with this Report.

Energy efficiency measures will be implemented to provide carbon savings of 37.8% in comparison to a baseline building that is fully compliant with the standard set by Part L 2013. The energy efficiency measures include: improved fabric insulation; improved air tightness; improvements to Thermal Bridging and the use of Photovoltaic panels and Air Source Heap Pump. This will ensure the development achieves a good portion of the part L 2013 compliance through energy efficiency measures alone. With the use renewable technologies (Photovoltaic system & ASHP) to assist in achieving the remainder.

The carbon emissions at the end of the 'be clean' stage are identical to those at the end of the 'be lean' stage. In addition to the improved fabric, the property will be served by a **4kw Photovoltaic** (27.2m² array PV Collector). This renewable system will be sufficient to provide carbon savings in addition to the 'be lean' measures and will satisfy the requirement to achieve a total carbon emissions saving of more than the required 35% relative to the baseline case for the dwelling.

Please note that this development is unsuitable to incorporate a green roof.

The aim of this document is to clearly and comprehensively demonstrate how the proposed development complies with, and wherever possible, exceeds sustainability policy requirements as well as following best practice sustainability principles.

The technical appendix contains a number of documents referred to in the Sustainability Statement which detail how key sustainability measures outlined in the statement can be achieved.

Key Targets:

- The site will achieve a 37.8% improvement in CO2 emissions over TER (Part L 2013 compliant).
- Improvements to the fabric efficiency that will be 32.8% improvement against Part L 2013
- A PV collector installation of 4kw (27.2m² array) will be provided.
- Secondary hearting supplied by Air Source Heat Pump.
- Water consumption will not exceed 105 litres per person per day.
- Space for 4 bicycles is being provided.

The client recognises the importance of ensuring development is sustainable and commits to ensuring the redevelopment of **62 Avenue Road** delivers on sustainability, where feasible, during both the construction and occupation phase.

1. Introduction

This Sustainability Statement presents the commitments made by the client and:

- outlines the national, regional and local policy that applies to the proposed development;
- details the assessment methodology to be used in conducting a sustainability assessment;
- assesses the proposed development and outlines targets and measures which will be implemented to achieve sustainability requirements and where necessary, comments and links to further information about the measures are included in the table;

• makes a conclusion about the sustainability of the proposed development

1.1. Project Description

The application site is located at **62 Avenue Road, Camden. NW8 6HT** and includes the demolition of the existing outdated dwelling. The proposal involves the erection of a new 4 storey 7x bedroom family home. The dwelling will comprise of a basement, lower ground, ground and first floor levels. The development also offers extensive gardens and landscaped amenity space.

A bin store containing recycling and general waste bins are being provided in the basement, along with dedicated cycle storage.

2. Policy: context and compliance

Camden Planning Guidance (CPG23) on Sustainability provides further guidance on reducing carbon emissions, in line with Policy CS13 and DM22. Within this document it is stated that developments should target a 35% reduction in carbon emissions. Sustainable development is a core principle underpinning planning, and has a key role to play in the creation of sustainable communities. In order to ensure the implementation of sustainable developments and to determine the target of standards to be met by the proposed development, it is necessary to review the relevant national, regional and local planning policies with respect to sustainability and the site location. A summary of the planning policy context for the site and propose development is provided below.

2.2. National Planning Policy Framework (DCLG, March 2012)

The National Planning Policy Framework (NPPF) was published on 27th March 2012, and contains the Government's planning policies for England and explains how these are expected to be applied. Section 38 (6) requires that applications for development must be determined in accordance with the development plan, unless material considerations indicate otherwise. The NPPF is a material consideration in planning decisions.

The Framework is a key output resulting from the Plan for Growth and the Government's proposals to reform the planning system. It sets the planning agenda for supporting and proactively driving sustainable economic growth.

The Ministerial Foreword to NPPF states that:

"The purpose of planning is to help sustainable development. Sustainable means ensuring that better lives for ourselves don't mean worse lives for future generations. Development means growth. We must accommodate the new ways by which we will earn our living in a competitive world... We must respond to the changes that new technologies offer us. Our lives, and the places in which we live them, can be better, but they will certainly be worse if things stagnate." Paragraph 9 is also of relevance and states that "pursuing sustainable development involves seeking positive improvements in the quality of the built, natural and historic environment, as well as in people's quality of life, including (but not limited to):

- Replacing poor design with better design;
- Improving the conditions in which people live, work, travel and take leisure; and
- Widening the choice of high quality homes".

The Core Principles of the NPPF are found in paragraph 17, which advises that within the overarching roles that the planning system ought to play, a set of core land-use planning principles should underpin both plan-making and decision-taking. Among these 12 principles, is that planning should amongst other matters, *"proactively drive and support sustainable economic development to deliver the homes, business and industrial units, infrastructure and thriving local places that the country needs... taking account of the needs of the residential and business communities."*

Also in paragraph 17, one of these core principles states that planning should also "always seek to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings."

Paragraph 20 states that to help achieve economic growth, local planning authorities should plan proactively to meet the development needs of business and support an economy fit for the 21st century.

Paragraph 49 confirms that housing application should be considered in the context of the presumption in favour of sustainable development.

Paragraph 56 confirms that the Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people. Furthermore, paragraph 57 states that it is important to plan positively for the achievement of high quality and inclusive design for all development, including individual buildings.

Paragraph 58 states that planning decisions should aim to ensure that development responds to local character and reflect the identity of local surroundings, while not preventing or discouraging appropriate innovation.

Paragraph 60 adds that planning policies and decisions should not attempt to impose architectural styles or particular tastes and they should not stifle innovation, originality or initiative through unsubstantiated requirements to conform to certain development forms or styles. It is, however, proper to seek to promote or reinforce local distinctiveness.

Furthermore, Paragraph 63 advises that in determining planning applications, great weight should be given to outstanding or innovative designs which help raise the standard of the design more generally in the area.

Paragraph 187 advises that local planning authorities should look for solutions rather than problems, and decision-takers at every level should seek to approve applications for sustainable development where possible. Local planning authorities should work proactively with applicants to secure developments that improve the economic, social and environmental conditions of the area.

For the purposes of pre-application engagement and front loading, paragraph 188 states that "early engagement has significant potential to improve the efficiency and effectiveness of the planning application system for all parties. Good quality pre-application discussion enables better coordination between public and private resources and improved outcomes for the community".

In addition, paragraph 190 advises, "the more issues that can be resolved at pre-application stage, the greater the benefits".

In determining planning applications, paragraph 197 concludes, *"in assessing and determining development proposals, local planning authorities should apply the presumption in favour of sustainable development."*

2.3. Regional policy

The current London Plan was adopted in July 2011 and is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London to 20131. The Policies relevant to this report are found in chapter 5 of the London Plan.

Policy 5.2 CO2 minimisation in new development

The new LP has moved away from the Merton Rule type renewable energy target found in the 2008 LP towards an overall CO2 emissions reduction target expressed as a percentage, bringing it in line with national policy. However, the required targets are in advance of national targets in the Building Regulations. These are as follows:

Year	Domestic Buildings	Non Domestic Buildings
2010-2013	44%	44%
2013-2016	55%	55%
2016-2019	Zero carbon	As per Building Regs
2019-2031	Zero carbon	Zero carbon

These CO2 reductions should be expressed in terms of non-regulated emissions as well as regulated emissions.

Policy 5.3 Sustainable Design and Construction

This policy condenses much of the requirements of various policies and guidance in the 2008 LP into one policy. It requires new development to demonstrate how it will meet the minimum standards outlined in a yet to be published SPG and lists the areas concerned. The list contains most of the issues addressed in both the Code for Sustainable Homes (Code) and BREEAM standards.

Policy 5.6 Decentralised energy in development proposals

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

B. Major development proposals should select energy systems in accordance with the following hierarchy:

- 1. Connection to existing heating or cooling networks;
- 2. Site wide CHP network;

- 3. Communal heating and cooling;
- C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

2.4. Local policy

Camden Replacement Unitary Development Plan 2006, Saved Policies

The Replacement Unitary Development Plan (UDP) is was replaced by the Core Strategy in November 2010, in accordance with the Planning and Compulsory Purchase Act 2005 which replaces UDPs with Local Development Frameworks (LDF). However, as part of the transitional arrangements, the 'saved policies' will retain their 'development plan' status in planning decisions for three years after adoption of the LDF. Therefore, the Sustainability Statement includes relevant saved policies from the Replacement UDP.

Policy SD9 Resources and energy

The UDP includes a raft of policies under the heading Sustainable Development but Policy SD9 is the most relevant to key sustainability issues for this development and has therefore been considered whilst developing the Sustainability Statement. Policy SD9 covers three main areas:

A - Air quality

Where the Council considers that development could potentially cause significant harm to air quality, applicants will be required to submit an air quality assessment. The Council will not grant planning permission for development that would significantly harm air quality, unless mitigation measures are adopted to reduce the impact to acceptable levels.

B – Water

In considering proposals for development, the Council will need to be satisfied that adequate provision can be made for water supply and waste treatment. The Council will only grant planning permission for development that it considers is sited and designed in a manner that does not cause harm to the water environment, water quality or drainage systems and prevents or mitigates flooding. The Council will require developers to include measures to conserve water and where appropriate incorporate Sustainable Urban Drainage Systems.

C - Use of energy and resources

The Council will seek developments that conserve energy and resources through:

- a) designs for energy efficiency;
- b) renewable energy use;
- c) optimising energy supply;

d) the use of recycled and renewable building materials. The Council will require major developments to demonstrate the energy demand of their proposals and how they would generate a proportion of the site's electricity and heating needs from renewables wherever

feasible. The Council may use conditions or planning obligations to secure recycling of materials on site and/or use of recycled aggregates in major schemes.

2.5 Policy DP22 Promoting sustainable design and construction *Camden Core Strategy, adopted 10th November 2010*

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

- a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
- b) incorporate green/brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

- c) adopting the government target that all new build housing will be zero carbon by 2016 (Code for Sustainable Homes Level 6), along with the stepped targets of Code 3 by 2010 and Code 4 by 2013;
- expecting developments of 500sqm of residential floors-pace (except new build) or 5 or more dwellings to achieve 'excellent' in Eco-Homes assessments from 2013 and at least 'very good' prior to 2013;
- e) expecting non-domestic developments of 500sqm of floor-space to achieve 'very good' in BREEAM, with the aim of increasing the target to a rating of at least 'excellent' in 2016, if feasible, and zero carbon from 2019, in line with the government's ambitions.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

- f) summer shading and planting;
- g) limiting run-off;
- h) reducing water consumption;
- i) reducing air pollution; and
- j) not locating vulnerable uses in basements in flood-prone areas.

Policy DP23 Water

The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:

a) incorporating water efficient features and equipment and capturing, retaining and reusing surface water and grey water on-site;

b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;

c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 2 as being at risk of surface water flooding are designed to cope with the potential flooding; d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and e) encouraging the provision of attractive and efficient water features.

Policy CS13 - Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and expect all development to meet the highest feasible environmental standards during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) promoting the efficient use of land and buildings;

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

1. ensuring developments use less energy,

2. Where appropriate, making use of: Bloomsbury and proposed Euston Road decentralised energy networks;

3. generating renewable energy on-site; and

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

Local energy generation

The Council will promote local energy generation and networks by:

e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:

- housing estates with community heating or the potential for community heating and other uses with large heating loads;
- the growth areas of King's Cross, Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;
- schools to be redeveloped as part of Building Schools for the Future programme;
- existing or approved combined heat and power/local energy networks (see Map 4); and other locations where land ownership would facilitate their implementation.

f) protecting existing local energy networks where possible (e.g. at Gower Street and

Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Water and surface water flooding

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

g) protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;

h) making sure development incorporates efficient water and foul water infrastructure;

i) requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross (see Map 5).

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

j) taking measures to reduce its own carbon emissions;

k) trialling new energy efficient technologies, where feasible; and

I) raising awareness on mitigation and adaptation measures.

Camden Planning Guidance, December 2006

This document is due to be replaced with updated guidance in March 2011 and as yet there is no draft document available. The Sustainability Statement therefore uses the 2006 document to inform targets and measures. In particular, the following sections of the guidance document are relevant to the statement:

- Energy and onsite renewable facilities
- Sustainable design and construction
- Water

Compliance with Policy

Any development must comply with all relevant local, regional and national policies covering energy and the environment. Wherever possible, best practice sustainability guidance will be targeted.

2.5. Summary of references

The Table below sets out a list of the documents used to research and identify the Sustainability Statement requirements.

Table – Summary of reference	
Reference	Document
LPlan	London Plan - Feb 2008
LPlan-DR	Draft Replacement London Plan – Oct 2009 EAD: late 2011
LHDG-DR	Draft London Housing Design Guide – July 2009 EAD: Summer 2010
IH SPG	Interim Housing SPG – April 2010 (Mayor of London)
UDP2006-saved	Camden Unitary Development Plan – June 2006, Saved Policies
Core2010	Camden Core Strategy - 2010
DP2010	Camden Development Policies - 2010
PG2006	Camden Planning Guidance – December 2006
Cycle Parking	Cycle Parking - Proposed-TfL-Guidelines
Travel planning	Guidance for residential travel planning in London-2008
BRE SCD	BRE London Sustainability Checklist for Developments 2010

Table – Summary of references

3. Sustainability Assessment

In this section we give a summary of the Sustainability Strategy for the redevelopment of **62 Avenue Road**. We have developed a target driven approach, with targets being drawn from relevant Policy Context section above.

Development proposals of any scale are required to demonstrate sustainability principles in a supporting statement. The information provided should be proportionate to the scale of the proposed development and its likely impact on, and vulnerability to, climate change. Minimum information requirements are set out within London Plan Sustainable Design and Construction SPG and included within the council's local validation requirements.

The purpose of this section is to evidence the requirements set out within the London Plan Sustainable Design and Construction SPG. This development is considered a 'Minor Application' and therefore this Sustainability Statement is proportionate to the scale of this proposed development.

3.1. Land use and re-use of land

The development is located on a site there is currently has a single dwelling and ancillary buildings on this site plus amenity space/garden. The London Plan encourages the re-use of existing buildings, however as this development results in the demolition of one dwelling to be replaced by a larger and more energy efficient family home which we believe is considered favourable by London Borough of Camden. The diversion of materials from landfill shall be considered by the Main Contractor in their Site Waste Management Plan.

3.2. Surface Water Run-off, SUDs and Flood Risk Assessment

• Flood Risk Assessment Full report completed separately.

3.3. Landscaping and Biodiversity

Landscaping is being proposed for the front gardens and the rear gardens. The landscaping will consist of native species and contribute towards the biodiversity of the site. Additionally bird/bat boxes will also be included in each dwelling. The exact location of the bird/bat boxes will be confirmed as the design progresses.

Fig1: Proposed Landscaping.



• **Biodiversity and Ecology** Full report completed separately.

3.4. Re-use of building

The London Plan encourages the re-use of existing buildings, however as this development results in the demolition of one dwelling to be replaced by a new larger family home. The diversion of materials from landfill shall be considered by the Main Contractor in their Site Waste Management Plan.

3.5. Energy and CO2 Emissions

An Energy Assessment has been prepared by **Leema Technologies Ltd** for the proposed development at **62 Avenue Road**, Camden. It sets out the energy efficiency and carbon reduction measures that will be incorporated into the development.

Energy efficiency measures will be implemented to provide carbon savings of **37.8%** in comparison to a baseline building that is fully compliant with the standard set by Part L 2013. The energy efficiency measures include: improved fabric insulation; improved air tightness; Improvements to Thermal Bridging and the use of Photovoltaic panels. This will ensure the development achieves part L2013 compliance through energy efficiency measures alone.

The proposed development is to have localised heating and hot water systems. It is considered the development infrastructure is not adequate to provide centralized heating and hot water from CHP and concerns over pollution to the air quality have also steered the development away from this solution.

For the purposes of this development, CHP has been considered but disregarded due to the factors outlined above.

The London Heat Map has been utilised to check if the development can connect into an existing distribution network. Currently there are no existing or proposed heat distribution networks in the vicinity. The development will not be provided with a communal heating system due to the technical and management disadvantages.

3.6. Overheating

The glazing on the rear elevation shall be set back to reduce solar gain. Additionally the glazing shall be specified to performance levels that will help reduce solar gain.

Internal blinds shall also be specified to the glazing of the rear elevation. The dual aspect of the dwelling will allow for adequate cross ventilation to counterbalance the solar gain.

3.7. Water Efficiency

• Water Consumption

Water consumption shall meet the requirements of the London Plan policy and the London Borough of Camden Local plan to ensure that water consumption would be no more than 105L/per person/ per day. This will be achieved by specifying low water flow rate sanitary ware and domestic white goods.

• Water Monitoring

A water meter shall be specified to monitor the water supply to each dwelling.

3.8. Materials and Waste

• Household Waste and Recycling

Internal recycling and refuse bins shall be provided in the kitchen.

• Construction Waste

The Main Contractor shall be required to prepare a Construction Method Statement which shall include a Site Waste Management Plan. This plan shall also include the excavation waste generated in the construction of the basement and demolition waste generated from the demolition of the existing dwelling and ancillary buildings. The Main Contractor shall ensure that as much of the waste as possible is re-used where possible and/or diverted from landfill.

• Green Guide Rating of Major Building Elements

Environmentally low impact materials will be specified for the building envelope elements (roof, windows, internal walls, external walls and upper and ground floors) using the BRE Green Guide.

• Sustainably Sourced Timber

Timber and wood-derived products will be sourced in accordance with UK Governments Timber Procurement Policy and have FSC certification.

• Insulation

All insulation used in the building fabric and building services shall have low Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP). Additionally all insulation shall have a Green Guide Rating of A/A+ and be responsibly sourced.

3.9. Public Transport, Cycling & Walking

• Cycling

Dedicated cycle storage is being provided within the basement / lower ground level of the dwelling.

• Public Transport

The site is located in an area with excellent transport links. The site has access to several bus services and tube stations within the immediate vicinity. With South Hempstead Train Station less than a kilometre away.

• Walking and Amenities

The local area is largely residential and offers a variety of shops and local amenities. The site is also well situated in terms of access to public space; being a short distance from Regents Park. The site, amenities and public transport are all accessible along safe pedestrian routes.

3.10. Light Pollution

Lighting will be appropriate for the intended use; provide the minimum amount of light necessary to achieve its purpose; provide adequate protection from glare and light spill and be energy efficient.

3.11. Site Contamination

There is no change of use on this site, a dwelling was previously located on this site. A site contamination investigation was not considered applicable to this development.

3.12. Noise from Plant

There is no external mechanical equipment being specified as part of this development.

3.13. Air Pollution

The Main Contractor shall conduct a pre-construction dust monitoring risk assessment, using competent person(s) in line with Best Practice Guidance ensuring that suitable, adequate and effective mitigation control measures are implemented where there is a potential for dust / odour and NOx emissions.

Any systems installed in the dwelling (gas boilers) shall have low emissions.

3.14. Amenity Space

The proposed dwelling shall be provided with accessible and private amenity space.

4. Technical Detail

In addition to this document which sets out the overarching strategy and targets a separate Technical Appendix has been provided which give additional detail on how key targets are to be met.

This document includes:

Sustainability Report and Energy Statement//62 Avenue Rd/Camden/NW8 6HT

Re-devel the energy	ses the energy strategy for the opment detailing the embracement of gy hierarchy to deliver significant n in associated site-wide CO2 s.

Flexibility through the detailed design process is important and so the information in these sections is provided only to show how the targets could be achieved and are based upon the design proposals as they stand. These documents do not represent a firm commitment to use the exact specifications shown; rather they are put forward to give an indication of how the targets set out in this document can be achieved.

5. Conclusion

5.1 Summary

- The proposed redevelopment at 62 Avenue Road has sustainability at the core of its design principles.
- Design principles address the need to tackle climate change and energy consumption, community cohesion, place-making, transport, resources and sustainable construction.
- The proposed development will meet good and best practice in terms of sustainable construction methods.

5.2 Conclusion

This Sustainability Statement has demonstrated how redevelopment at 62 Avenue Road meets planning policy sustainability requirements at the National, Regional and Local level. The application has been shown to be a sustainable development that commits to apply sustainable principles and practices.

The client recognises the importance of ensuring development is sustainable and as outlined in the Sustainability Statement proposes measures to address relevant policy targets across a wide range of issues including energy consumption and CO² emissions, sustainable construction, water management, waste management, place-making and community cohesion.

The proposed redevelopment aspires to provide a high quality development that serves the local community and aids the region's commitment to meeting on-going sustainability targets. The measures proposed in the Sustainability Statement support the delivery of sustainable practices during the construction and occupation phases and therefore contribute to local sustainability targets.

APPENDICES

Appendix A: Energy Statement



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Appendix A

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Energy Statement:

62 Avenue Road, St Johns Wood, Camden, NW8 6HT Planning Ref No: 2016/4931/P

Client: V V Media

Date: 28th Jan 2017



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Appendix A – SAP Calculations

1.0 Executive Summary

The proposed development of a new 4 storey family home set over Basement, Lower Ground, Ground and first floor levels at **62 Avenue Road, St Johns Wood, Camden, NW8 6HT** is required to achieve a minimum 35% reduction in Regulated Carbon Emissions against Part L 2013.

The Baseline carbon emissions derived from the SAP calculations (using SAP 2012 confirms total carbon emissions of 11.98 tonnes CO_2 /pa for Hierarchy A.

Applying a range of energy demand reduction techniques such as significant improvements in the insulation levels to the building envelope, air tightness, reducing heat loss through thermal bridging, utilising highly efficient boilers with modern controls, and the use of Photovoltaic panels and ASHP we are able to reduce the carbon emissions by 37.8% to 7.44 tonnes CO₂/pa for Hierarchy B.

Combined Heat and Power is discounted due to lack of onsite infrastructure and the scale of the development. District Heating is also not a viable option for this development

This results in a total reduction of 4.54 tonnes CO₂/annum.

Air pollution is minimized through the use of low NOx boilers that have 40% lower NOx emissions than Code for Sustainable Homes best practice.

2.0 Introduction

The proposed development of a new family home at 62 Avenue Road is required to achieve a 35% reduction in Regulated Carbon Emissions over Part L 2013 Baseline regulations.

This report is based upon the requirements set out in 'Energy Planning: Greater London Authority guidance on preparing energy assessments (April 2014)' and in line with the London Borough of Camden Policies.

Please note, the Code for Sustainable Homes has been deregulated, and therefore excluded from this assessment.

This will report will outline the following requirements:

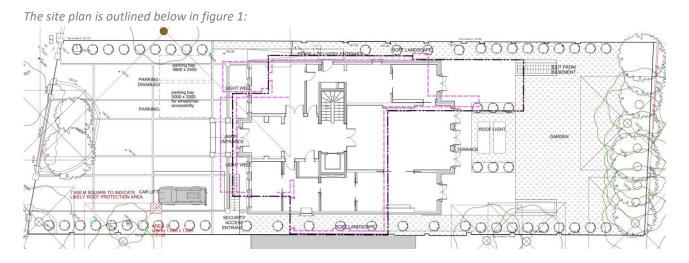
- a) Calculate the Baseline carbon emissions (Target Emission Rate) using SAP 2013. (HIERARCHY A)
- b) Provide a specification to achieve an 'energy demand reduction' to reduce carbon emissions. (HIERARCHY B)
- c) Review Combined Heat & Power. (HIERARCHY C)

- d) Review local district heating systems
- e) Review and implement renewable energy technology to further reduce carbon emissions. (HIERARCHY D)
- f) Summarise the findings to confirm a minimum of 35 reduction in annual carbon emissions in line with the Energy Hierarchy is achievable with the proposed development.

This report will start with the proposed methods of reducing carbon emissions using a fabric first approach, energy efficiency and then finally, renewable energy technology.

It will also consider other factors such as air pollution.

The proposed dwellings will be assessed using SAP 2012 (Part L 2013) On-Construction Domestic Energy Assessor and non-domestic energy assessor.



3.0 Energy Statement

3.1 Carbon emissions of the Baseline development and energy demand reduction: (Hierarchy A & B)

The Baseline scenario will use the input information to achieve the 'energy demand reduction' for the development. SAP 2012 will then calculate the baseline carbon emissions using the Target Emission Rate (TER) and the 'energy demand reduction' carbon emissions based (Dwelling Emission Rate or DER) upon the results for the dwelling.

The current input specification is as follows:

Table 1: Proposed U values for the building envelope

Element	Building Regs (W/m2.K)	Proposed (W/m2.K)	Improvement
Walls	0.30 W/m².K	0.18 W/m².K	40%
Mansard	0.20 W/m².K	0.18 W/m ² .K	10%
Roof	0.20 W/m ² .K	0.11 W/m ² .K	45%
Floor	0.25 W/m².K	0.12 W/m ² .K	52%
Windows	2.00 W/m ² .K	1.42W/m².K	30%
Doors	2.00 W/m ² .K	1.6 W/m ² .K	20%

The proposed dwelling is to exceed the current building regulations Part L1a by 32.8% on the fabric values. In addition, the target design air permeability is to be $5m^3/hr/m^2$. This is a 50% improvement on current building regulation values.

Thermal bridge is an area of building fabric that is less well insulated than surrounding areas, and therefore allows a greater rate of heat loss, as a result of the construction of the building; thermal bridges typically occur where structural members penetrate through insulation layers, at corners and junctions between elements (i.e. between floors, walls and roofs) and around openings such as windows and external doors.

In order to combat this the design of the dwelling will consider the impact and will adopt thermal bridging measures such as Accredited Construction Detail. This format will aim to reduce the thermal bridging by 50%.

The baseline results (TER) result in total carbon emissions of 13.13 tonnes CO_2 /annum. To achieve a 35% reduction, then the development therefore needs to achieve a total reduction of 3.2 tonnes CO_2 /annum.

The proposed input data outlined in Table 1 results using the DER multiplied by the floor area achieve a total of 9.17 tonnes CO_2 /annum. This is a reduction of 2.81 tonnes CO_2 /annum, equivalent to a reduction of 23.4%.

3.2 Combined Heat & Power and District Heating: (Hierarchy C)

The proposed development is to have on-site heating and hot water systems. it is considered the development infrastructure is not adequate to provide centralized heating and hot water from

CHP and concerns over pollution to the air quality have also steered the development away from this solution.

For the purposes of this development, CHP has been considered but disregarded due to the factors outlined above.

Consideration for district heating has been researched. Referring to the Heat Map (<u>http://www.londonheatmap.org.uk</u>) in figure 2, we can see the current district heating by the North Circular Road (red circle), this is approximately 2 miles from the proposed site.

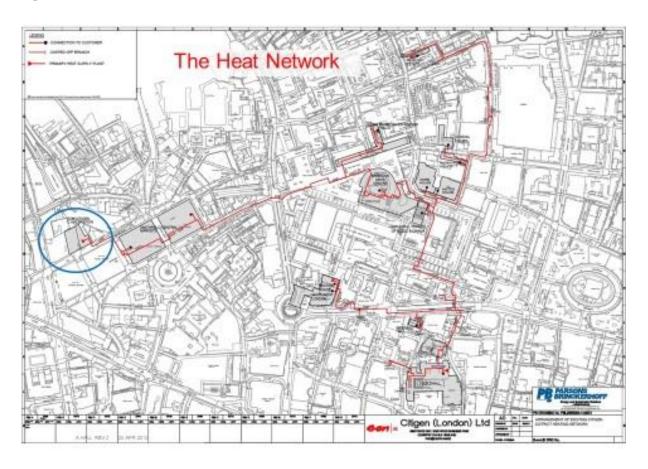


Figure 2: District heat network local to the site

At this stage, the proposed development is decentralized but could be adapted in the future should the district heating system be implemented.

3.3 Renewable Energy (Hierarchy D)

The project team wishes to utilise Photovoltaic panels (PV) to provide renewable energy for the development.

Air source heat pumps are currently discounted due to the fact that they are ineffective at significantly reducing on-site carbon emissions

Wind turbines are not viable in this built up area and biomass fired boilers are likely to increase local air pollution and infrastructure for storage and delivery is not adequate given the nature of the development and location.

Biomass boilers can cause air pollution issues so have been discounted. See Appendix A for further details.

3.3.1 Photovoltaic panels

Photovoltaic (PV) systems generate electricity from sunshine (direct or indirect).

This development benefits from a tall building with horizontal roof-space, so the panels can be angled to the south for maximum effect.

For this development, it is proposed to apply a PV system to meet and exceed the required 20% reduction in carbon emissions.



Figure 2: Typical PV installation to pitched roof

It has been calculated that a 4kWp PV system (16 PV panels at 250W each) at an angle of 30 degrees, south facing will reduce the carbon emissions by a further 5.1% to annual carbon emissions of 9.84tonnes CO2/year for Hierarchy D.

See Appendix B for SAP calculations.

3.4 Results

The results for each Hierarchy (excluding Hierarchy C) are summarised in table 4 below:

Table 4: Summary of results for each Hierarchy (A, B & D)

Regulated Carbon dioxide emissions and savings									
Hierarchy	Total regulated emissions (Tonnes Co2/year)	Co2 Savings (Tonnes CO2/year)	Percentage saving						
Building Regulations 2013 Part L	11.98	NA	NA						
Energy demand reductions	9.17	2.81	23.4%						
After CHP	9.17	2.81	0.0%						
After Low to Zero Carbon Technologies	7.44	4.54	37.8%						

Baseline Hierarchy A (Target Emission rate) achieves 11.98CO₂/annum for the Baseline.

Applying the energy demand reduction (Hierarchy B) features (indicated in Tables 1 and 2), reduces the carbon emissions by 23.4% to 9.17 tonnes CO₂/annum. (*See Appendix A for SAPs*)

No CHP or district heating has been applied so there is no benefit from Hierarchy C.

For renewable energy, apply 4kWp PV via 16 Photovoltaic panels located on the roof provides a further reduction 0.67tonnes CO_2 /annum for Hierarchy D. (See Appendix B for SAPs with PV)

The results indicate the total carbon dioxide savings are 37.8%.

3.5 Air pollution

The only potential source of pollution from the development is the gas fired system boilers.

The boilers have been selected for the excellent efficient, but also the low NOx emissions (Nitrogen Oxide).

The Code for Sustainable Homes awards full credits if the NOx emissions are below 40 mg/kWh. The proposed Ideal Logix + System 18 boiler has dry NOx emissions of 24mg/kWh. This is 40% better than the Code for Sustainable Homes best practice.

4.0 Summary

The proposed development 62 Avenue Road, Camden, NW8 6HT is required to achieve a minimum 35% reduction in Regulated Carbon Emissions against Part L 2013.

Please note, the Code for Sustainable Homes has been deregulated, and therefore excluded from this assessment.

The Baseline carbon emissions derived from the SAP calculations (using SAP 2012) confirms total carbon emissions of 11.98 tonnes CO_2 /annum for Hierarchy A.

Applying a range of energy demand reduction techniques such as significant improvements in the insulation levels to the building envelope, air tightness, reducing heat loss through thermal bridging and utilising highly efficient boilers with modern controls reduce the carbon emissions by 23.4% to 9.17 tonnes CO₂/annum for Hierarchy B.

The building fabric has an improvement of 34% over Part L 2013.

Combined Heat and Power is discounted due to lack of onsite infrastructure and the scale of the development. District Heating is approximately 2 miles from the site and cannot currently be connected.

Applying 4kwp Photovoltaic array of panels to the flat roof, facing south, and adopting the use of an Air Source Heat Pump, provides a further reduction of 14.4% in carbon emissions to 7.44 tonnes CO_2 /annum for Hierarchy D.

This results in a total reduction of 4.54 tonnes CO_2 /annum which achieves a cumulative reduction of 37.8%.

5.0 Notes

This report has been generated for the purpose of demonstrating how the proposed development can achieve a minimum 35% reduction in regulated carbon emissions. The developed detail design may result in different solutions.

This is not a design report or specification. Leema Technologies Ltd recommends that the client appoints a specialist engineer to advise and design an integrated heating and hot water system and photovoltaic panels system that will allow the energy generation to achieve the required energy generation on site to satisfy the Planning Condition that may be associated with any Planning Permission granted and meet all requirements of Building Regulations.

The results of this report are based on the following drawing references provided by BB Partnership Architects Limited:-

EZR-32	Proposed Basement
EZR-33	Proposed Lower Ground
EZR-34	Proposed Ground Floor
EZR-35	Proposed 1st Floor Plan
EZR-36	Proposed 2nd Floor Plan
EZR-37	Proposed Front Elevation
EZR-38	Proposed Rear Elevation
EZR-39	Proposed Side Elevation
EZR-40	Proposed Side Elevation
EZR-41	Proposed Section AA
EZR-42	Proposed Section BB
EZR-43	Proposed Site Plans

SAP assessments were carried out by accredited Energy Assessor (Mark Fagan: Leema Technologies Ltd) using SAP 2012.

Floor areas have been calculated from the drawings provided.

A full energy assessment for the whole building will be required to meet Part L 2013. At this stage, the client and design team should review the information and ensure the targets are met in accordance with the Planning Policy targets set.

Appendix A: SAP Calculations

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.5 Printed on 07 February 2017 at 12:27:55									
Project Informatio	-								
Assessed By:	()		Building Type:	Detached House					
Dwelling Details:									
NEW DWELLING	DESIGN STAGE		Total Floor Area: 1	222.77m²					
Site Reference :	62 Avenue Rd		Plot Reference:	Base Rev 2					
Address :	62, Avenue Road,	LONDON, NW8 6HT							
Client Details:									
Name:	B B Partnership Lte	b							
Address :	Studio 33-334, 10	Hornsey Street, London, N7 8EL							
-	s items included wi te report of regulati	thin the SAP calculations. ons compliance.							
1a TER and DER		•							
	ng system: Mains ga	IS							
Fuel factor: 1.00 (m	nains gas)								
-	xide Emission Rate (11.98 kg/m²						
Ŭ	ioxide Emission Rate	e (DER)	7.45 kg/m ²		OK				
1b TFEE and DFI			55.7 kWh/m ²						
Dwelling Fabric En	gy Efficiency (TFEE) ergy Efficiency (DFE		42.8 kWh/m ²		OK				
2 Fabric U-values Element External v Floor Roof Openings	vall	Average 0.18 (max. 0.30) 0.12 (max. 0.25) 0.11 (max. 0.20) 1.23 (max. 2.00)	Highest 0.18 (max. 0.70) 0.12 (max. 0.70) 0.11 (max. 0.35) 1.60 (max. 3.30)		ОК ОК ОК ОК				
2a Thermal bridg		sing user-specified y-value of 0							
Reference	e: ACD	sing user-specified y-value of o							
3 Air permeabilit	-								
Air permeab Maximum	ility at 50 pascals		3.00 (design val 10.0	ue)	ок				
4 Heating efficien	ncy								
Main Heatin	g system:	Boiler systems with radiators or Data from manufacturer Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %	-	ains gas	ок				
Main Heatin	g system 2:	Heat pumps with radiators or ur Dimplex EDL200UK-630	derfloor heating - elect	ric					

Regulations Compliance Report

Secondary heating system:	None		
5 Cylinder insulation			
Hot water Storage: Primary pipework insulated:	Measured cylinder loss: 1.61 kW Permitted by DBSCG: 2.24 kWh No primary pipework	•	ок
6 Controls			
Space heating controls	Time and temperature zone con	trol	ок
Space heating controls 2:	Not applicable (boiler provides D		ΟΚ
Hot water controls:	No cylinder	.,	
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights with lo	ow-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Continuous supply and extract s	system		
Specific fan power:	-	0.56	
Maximum		1.5	ОК
MVHR efficiency:		92%	
Minimum		70%	ΟΚ
9 Summertime temperature			
Overheating risk (Thames valley Based on: Overshading: Windows facing: South West Windows facing: South West Windows facing: South West Windows facing: South West Windows facing: North East Windows facing: South East Windows facing: North West Windows facing: South East Roof windows facing: Unspecifie Ventilation rate: Blinds/curtains:		Not significant Average or unknown 20.14m ² 20.14m ² 20.14m ² 20.14m ² 16.78m ² 4.68m ² 10.08m ² 2.8m ² 3.66m ² 2.4m ² 4.84m ² 1.81m ² 2.56m ² 2.74m ² 4.76m ² 6.13m ² 5.00 Closed 100% of daylight hours	OK
10 Key features			
Thermal bridging		0.023 W/m²K	

,, ,	
Thermal bridging	0.023 W/m²K
Air permeablility	3.0 m³/m²h
Roofs U-value	0.11 W/m²K

Regulations Compliance Report

Floors U-value Floors U-value Photovoltaic array 0.12 W/m²K 0.12 W/m²K



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	on: 1.0.4.5									
Address :	62, Avenue	Road, L(ONDON	I, NW8 6	6HT						
1. Overall dwelling dime	nsions:										
				Area	a(m²)		Av. Hei	ght(m)	-	Volume(m ³)	_
Basement				3	82.22	(1a) x	3.	.2	(2a) =	1223.1	(3a)
Ground floor				3	19.56	(1b) x	3.	.2	(2b) =	1022.59	(3b)
First floor				3	01.73	(1c) x	;	3	(2c) =	905.19	(3c)
Second floor				2	19.26	(1d) x	2.	.8	(2d) =	613.93	(3d)
Total floor area TFA = (1a	a)+(1b)+(1c)+((1d)+(1e)	+(1r	1) 12	222.77	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)	+(3e)+	(3n) =	3764.81	(5)
2. Ventilation rate:											
	main heating		condar eating	у	other		total			m ³ per hou	•
Number of chimneys	0	+	0	+	0	=	0	X	40 =	0	(6a)
Number of open flues	0	+	0	<u> </u> + [0] = [0	x	20 =	0	(6b)
Number of intermittent fa	ns			- 7		Ē	4	x	10 =	40	(7a)
Number of passive vents						Ē	0	х	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	X	40 =	0	(7c)
									Air cl	nange <mark>s per</mark> ho	ur
Infiltration due to chimney							40		÷ (5) =	0.01	(8)
If a pressurisation test has b Number of storeys in th			a, proceed	a to (17), (otherwise c	continue m	om (9) to (1	16)		0	(9)
Additional infiltration	ie arrening (ne	•)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or	timber f	rame or	0.35 fo	r masonr	y constr	uction			0	(11)
if both types of wall are p deducting areas of openir			onding to	the great	er wall are	a (after					
If suspended wooden f	• ·		ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else e	enter 0								0	(13)
Percentage of windows	s and doors dr	aught str	ipped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	(15) =		0	(16)
Air permeability value,				•	•	•	etre of ei	nvelope	area	5	(17)
If based on air permeabil Air permeability value applie	•						is beina us	ed		0.26	(18)
Number of sides sheltere							0.00			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.22	(21)
Infiltration rate modified for	or monthly wir	d speed									-
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Monthl	y avera	ge wind	speed f	rom Tabl	e 7								_	
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind F	actor (2	22a)m =	(22)m ÷	- 4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjuste	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m			•	-	
,	0.28	0.28	0.27	0.24	0.24	0.21	0.21	0.2	0.22	0.24	0.25	0.26]	
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						, [
				endix N, (2	3b) = (23a	a) x Fmv (e	equation (N	N5)), othe	rwise (23b	(23a) = (23a)			0	(23a) (23b)
				ciency in %						(200)			0	(23b) (23c)
			-	-	-					2b)m + (2	23b) × [′	1 – (23c)	-	(200)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat rec	covery (N	MV) (24b)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
,				ntilation of	•	•								
	. ,		r`´´	i i	, , ,	,	r È	<u> </u>	ŕ	.5 × (23b			1	(04.)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
				nole hous)m = (22I	· ·					0.5]				
(24d)m=	. ,	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(24d)
Effec	ctive air	change	rate - ei	nter (<mark>24a</mark>) or (24k	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53]	(25)
3. Hea	at iosse	es and he	eat loss	paramet	ər:									
ELEN	IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²⊷		A X k kJ/K
Doors ⁻	Type 1					3.09	x	1	=	3.09				(26)
Doors ⁻	Type 2					2.4	x	1	=	2.4				(26)
Doors ⁻	Туре З					2.69	x	1	=	2.69				(26)
Window	ws Type	e 1				3.356	s x1	/[1/(1.4)+	0.04] =	4.45				(27)
Window	ws Type	e 2				3.356	s x1	/[1/(1.4)+	0.04] =	4.45				(27)
Window	ws Type	e 3				3.356	s x1	/[1/(1.4)+	0.04] =	4.45				(27)
Window	ws Type	e 4				3.356	s x1	/[1/(1.4)+	0.04] =	4.45				(27)
Window	ws Type	e 5				2.34	x1.	/[1/(1.4)+	0.04] =	3.1				(27)
Window	ws Type	e 6				3.36	x1.	/[1/(1.4)+	0.04] =	4.45				(27)
Window	ws Type	e 7				1.4	x1.	/[1/(1.4)+	0.04] =	1.86				(27)
Window	ws Type	e 8				1.83	x1.	/[1/(1.4)+	0.04] =	2.43				(27)
Window	ws Type	e 9				2.4	x1,	/[1/(1.4)+	0.04] =	3.18				(27)
Window	ws Type	e 10				2.42	x1,	/[1/(1.4)+	0.04] =	3.21				(27)
Window	ws Type	e 11				1.81	x1.	/[1/(1.4)+	0.04] =	2.4				(27)

Windo	ws Type	9 12				1.28	x1.	/[1/(1.4)+	0.04] =	1.7				(27)
Windo	ws Type	e 13				1.37	x1.	/[1/(1.4)+	0.04] =	1.82				(27)
Windo	ws Type	e 14				2.38	x1.	/[1/(1.4)+	0.04] =	3.16				(27)
Rooflig	ghts					6.13	x1.	/[1/(1.7) +	0.04] =	10.421				(27b)
Floor 7	Гуре 1					382.2	2 X	0.13	= [49.6886	3			(28)
Floor 7	Гуре 2					319.5	6 ×	0.13	= [41.5428	ĭ		\exists	(28)
Walls	Type1	765	.4	113.9	94	651.4	6 ×	0.18	=	117.26	i T		\dashv	(29)
Walls	Type2	213	.1	11.7	6	201.3	4 X	0.18	=	36.24	i T		\dashv	(29)
Roof -	Type1	62.6	6	6.13	3	56.53	3 X	0.13	=	7.35	i T		\dashv	(30)
Roof -	Type2	158.	87	0		158.8	7 X	0.13		20.65			\dashv	(30)
Total a	area of e	lements	, m²						(31)					
I otal area of elements, m ² 1901.81 (31) * for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions														
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				446.48	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	67459.01	(34)
Therm	al mass	parame	ter (TMF	- = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-			tails of the	construct	ion are no	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
			tailed calc x Y) cal	culated	using An	pendix l	<						29.23	(36)
	-		· ·	own (36) =									29.23	(00)
	abr <mark>ic he</mark>								(33) +	(36) =			475.71	(37)
Ventila	ation hea	at loss <mark>ca</mark>	alculated	monthly	y 🗸				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	670.75	668.83	666.94	658.08	656.42	648.71	648.71	647.28	651.68	656.42	659.78	663.28		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	1146.46	1144.54	1142.65	1133.79	1132.13	1124.42	1124.42	1122.99	1127.39	1132.13	1135.49	1138.99		
Heat lo	oss para	meter (H	HLP), W	/m²K				-		Average = = (39)m ÷		12 /12=	1133.78	(39)
(40)m=	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.93	0.93	0.93		
Numb	or of day	in moi	nth (Tab	lo 10)						Average =	Sum(40)1	12 /12=	0.93	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			I			I	I		I			I	1	
4. Wa	ater heat	ting enei	rgy requ	irement:								kWh/ye	ear:	
A			NI										1	(()
if TF	ied occu A > 13.9 A £ 13.9	9, N = 1		: [1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.		33	J	(42)
Annua	l averag	e hot wa		ge in litre							13	7.07]	(43)
		-		usage by a r day (all w		-	-	to achieve	a water us	se target o	f			
				1			, I	A	San	Oct	Nov	Dee	1	
Hot wat	Jan er usage ii	Feb n litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec	J	
	5		-											
(44)m=	150.78	145.3	139.82	134.33	128.85	123.37	123.37	128.85	134.33	139.82	145.3	150.78]	

Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	223.6	195.57	201.81	175.94	168.82	145.68	134.99	154.9	156.75	182.68	199.41	216.55		
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	2156.71	(45)
(46)m=	33.54	29.33	30.27	26.39	25.32	21.85	20.25	23.24	23.51	27.4	29.91	32.48		(46)
	storage		includir	na anv so	olar or M	/WHRS	storage	within s	ame ves	موا		150	l	(47)
-		. ,			velling, e		-			001		150		(47)
	•	•			•			• •	ers) ente	er '0' in (47)			
	storage			,					,	,	,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	66		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
			storage	•				(48) x (49) =		0	.9		(50)
				•	oss fact									(54)
		-	ee secti		e 2 (kW	n/iitre/ua	iy)					0		(51)
	•	from Ta		011 4.0								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)								0	.9		(55)
Wat <mark>er</mark>	storage	loss cal	culated	ⁱ or each	month			((56)m = (55) × (41)ı	m				
(56)m=	27.75	25.06	27.75	26.85	27.75	26.85	27.75	27.75	26.85	27.75	26.85	27.75		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, <u>(</u> 57)i	n = (56)m	x [(50) – (I H11) <mark>]</mark> ÷ (5	0), else (5	7)m = (56)	m w <mark>here (</mark>	H11) is fro	m Append	lix H	
(57)m=	27.75	25.06	27.75	26.85	27.75	26.85	27.75	27.75	26.85	27.75	26.85	27.75		(57)
	L											0		(58)
	•		inual) fro		month (59)m –	(58) ÷ 36	35 v (41)	m			0		(00)
	•				`	,	· ·	· · /	a cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi			for oach	month	(61)m –	(60) · 20	L	l						
(61)m=				0	(61)m = 0	$(00) \div 30$			0	0	0	0		(61)
						-	-						(E0) m + $(C1)$ m	
(62)m=	274.61	241.64	252.82	225.3	219.83	195.04	186	205.91	206.12	233.69	(40)111 + 248.78	267.56	(59)m + (61)r I	(62)
									if no sola					(02)
					NWHRS						UT IO WAIE	er neaung)		
(auu a (63)m=		0			0				0	0	0	0		(63)
				Ū	Ŭ	Ŭ	Ů	Ů	Ů	Ŭ	Ū	Ŭ		()
	274.61	ater hea 241.64	1	225.2	210.02	105.04	106	205.01	206.12	233.69	248.78	267.56		
(64)m=	274.01	241.04	252.82	225.3	219.83	195.04	186	205.91				267.56	2757.29	(64)
	. ,								out from wa					(04)
-			<u> </u>		i		<u> </u>	1 · · ·	n] + 0.8 x	- /	· ,	<u> </u>]	
(65)m=	115.16	101.88	107.91	97.99	96.94	87.93	85.69	92.31	91.61	101.55	105.8	112.81	 	(65)
				. ,	-	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	and 5a):									
Metab	olic gain		5), Wat	ts	r	r	r	r	1	r		r	I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(66)m= 216.58 216.58 216	6.58	216.58 216.58	3 2	16.58 216.58	216	.58 216.58	216.58	3 216.58	216.58		(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	.66	58.03 43.38	_	6.62 39.57	51.		87.66	102.32	109.07		(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m= 1035.53 1046.28 1019.2 961.55 888.78 820.39 774.7 763.95 791.03 848.68 921.45 989.84 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m= 44.66 44.66 44	.66	44.66 44.66	4	4.66 44.66	44.	66 44.66	44.66	44.66	44.66		(69)	
Pumps and fans gains (Ta	ble 5a	a)	-	!								
i i	3	3 3	Τ	3 3	3	3	3	3	3		(70)	
Losses e.g. evaporation (negative values) (Table 5)												
(71)m= -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 -173.26 (71)												
Water heating gains (Table 5)												
(72)m= 154.78 151.61 145	5.04	136.1 130.29) 1	22.12 115.18	124	.08 127.24	136.49	9 146.94	151.63		(72)	
Total internal gains =				(66)m + (67)m	ר + (68	3)m + (69)m + (70)m +	(71)m + (72)r	n			
(73)m= 1387.41 1383.12 133	1.86	1246.65 1153.4	3 10	070.11 1020.42	1030).44 1078.28	1163.8	1 1261.67	1341.51		(73)	
6. Solar gains:												
Solar gains are calculated using	solar	flux from Table 6	a and	associated equa	tions	to convert to the	e applic	able orientati	on.			
Orientation: Access Facto	or	Area		Flux		g_ Table Ch		FF Table Ca		Gains		
Table 6d	_	m²		Table 6a		Table 6b		Table 6c		(VV)		
Northeast 0.9x 0.77	x	2.34	x	11.28	x	0.63	x	0.7	=	16.14	(75)	
Northeast 0.9x 0.77] ×	3.36	x	11.28	×	0.63	x	0.7	=	34.76	(75)	
Northeast 0.9x 0.77] ×	1.4	×	11.28	x	0.63	x	0.7	=	9.65	(75)	
Northeast 0.9x 0.77] x	1.83	x	11.28	x	0.63	x	0.7	=	12.62	(75)	
Northeast 0.9x 0.77	×	2.4	x	11.28	x	0.63	x	0.7	=	8.28	(75)	
Northeast 0.9x 0.77	x	2.42	x	11.28	x	0.63	x	0.7	=	16.69	(75)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.63	×	0.7	=	6.24	(75)	
Northeast 0.9x 0.77	x	2.34	x	22.97	x	0.63	x	0.7	=	32.85	(75)	
Northeast 0.9x 0.77	x	3.36	x	22.97	x	0.63	×	0.7	=	70.75	(75)	
Northeast 0.9x 0.77	x	1.4	x	22.97	x	0.63	x	0.7	=	19.65	(75)	
Northeast 0.9x 0.77	x	1.83	x	22.97	x	0.63	x	0.7	=	25.69	(75)	
Northeast 0.9x 0.77	x	2.4	x	22.97	x	0.63	×	0.7	=	16.85	(75)	
Northeast 0.9x 0.77	x	2.42	x	22.97	x	0.63	×	0.7	=	33.97	(75)	
Northeast 0.9x 0.77	x	1.81	x	22.97	x	0.63	×	0.7	=	12.7	(75)	
Northeast 0.9x 0.77] x	2.34	x	41.38	x	0.63	×	0.7	= =	59.18	(75)	
Northeast 0.9x 0.77] x	3.36	x	41.38	x	0.63	۲ × آ	0.7	=	127.47	(75)	
Northeast 0.9x 0.77] x	1.4	x	41.38	x	0.63	x	0.7	=	35.41	(75)	
Northeast 0.9x 0.77] x	1.83	x	41.38	x	0.63	×	0.7	=	46.28	(75)	
Northeast 0.9x 0.77] x	2.4	x	41.38] x	0.63	×	0.7	= =	30.35	(75)	
Northeast 0.9x 0.77] x	2.42	x	41.38] x	0.63	- x	0.7		61.21	(75)	
Northeast 0.9x 0.77	」] x]	1.81	x	41.38	」 】 ×	0.63	- x	0.7	=	22.89	(75)	
				L	1 .	0.00					· · · /	

Northeast 0.9x	0.77] x	2.34	×	67.96	×	0.63	x	0.7	=	97.2	(75)
Northeast 0.9x	0.77) x	3.36	x	67.96	x	0.63	x	0.7	=	209.34	(75)
Northeast 0.9x	0.77	x	1.4	x	67.96	x	0.63	x	0.7	=	58.15	(75)
Northeast 0.9x	0.77	x	1.83	x	67.96	×	0.63	x	0.7	=	76.01	(75)
Northeast 0.9x	0.77	x	2.4	x	67.96	×	0.63	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	2.42	x	67.96	×	0.63	x	0.7	=	100.52	(75)
Northeast 0.9x	0.77	x	1.81	x	67.96	×	0.63	x	0.7	=	37.59	(75)
Northeast 0.9x	0.77	x	2.34	x	91.35	×	0.63	x	0.7	=	130.65	(75)
Northeast 0.9x	0.77	x	3.36	x	91.35	×	0.63	x	0.7] =	281.4	(75)
Northeast 0.9x	0.77	x	1.4	x	91.35	×	0.63	x	0.7	=	78.17	(75)
Northeast 0.9x	0.77	x	1.83	x	91.35	x	0.63	x	0.7	=	102.17	(75)
Northeast 0.9x	0.77	x	2.4	x	91.35	×	0.63	x	0.7] =	67	(75)
Northeast 0.9x	0.77	x	2.42	x	91.35	×	0.63	x	0.7	=	135.12	(75)
Northeast 0.9x	0.77	x	1.81	x	91.35	×	0.63	x	0.7	=	50.53	(75)
Northeast 0.9x	0.77	x	2.34	x	97.38	×	0.63	x	0.7	=	139.29	(75)
Northeast 0.9x	0.77	x	3.36	x	97.38	×	0.63	x	0.7	=	300	(75)
Northeast 0.9x	0.77	x	1.4	x	97.38	×	0.63	x	0.7	=	83.33	(75)
Northeast 0.9x	0.77	x	1.83	X	97.38	х	0.63	х	0.7	=	108.93	(75)
Northeast 0.9x	0.77	x	2.4	x	97.38	x	0.63	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	2.42	x	97.38	×	0.63	x	0.7	=	144.05	(75)
Northeast 0.9x	0.7 <mark>7</mark>	x	1.81	x	97.38	x	0.63	x	0.7	=	53.87	(75)
Northeast 0.9x	0.77	x	2.34	x	91.1	х	0.63	x	0.7	=	130.3	(75)
Northeast 0.9x	0.77	x	3.36	x	91.1	×	0.63	x	0.7	=	280.64	(75)
Northeast 0.9x	0.77	x	1.4	x	91.1	×	0.63	x	0.7	=	77.96	(75)
Northeast 0.9x	0.77	x	1.83	x	91.1	×	0.63	x	0.7	=	101.9	(75)
Northeast 0.9x	0.77	x	2.4	x	91.1	×	0.63	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	134.75	(75)
Northeast 0.9x	0.77	x	1.81	x	91.1	x	0.63	x	0.7	=	50.39	(75)
Northeast 0.9x	0.77	x	2.34	x	72.63	×	0.63	x	0.7	=	103.88	(75)
Northeast 0.9x	0.77	x	3.36	×	72.63	×	0.63	x	0.7	=	223.73	(75)
Northeast 0.9x	0.77	x	1.4	×	72.63	×	0.63	x	0.7	=	62.15	(75)
Northeast 0.9x	0.77	x	1.83	×	72.63	×	0.63	x	0.7	=	81.24	(75)
Northeast 0.9x	0.77	x	2.4	×	72.63	×	0.63	x	0.7	=	53.27	(75)
Northeast 0.9x	0.77	×	2.42	x	72.63	x	0.63	x	0.7	=	107.43	(75)
Northeast 0.9x	0.77	×	1.81	x	72.63	×	0.63	x	0.7	=	40.17	(75)
Northeast 0.9x	0.77	×	2.34	×	50.42	×	0.63	x	0.7	=	72.12	(75)
Northeast 0.9x	0.77	×	3.36	×	50.42	×	0.63	x	0.7	=	155.32	(75)
Northeast 0.9x	0.77	×	1.4	×	50.42	×	0.63	x	0.7	=	43.15	(75)
Northeast 0.9x	0.77	×	1.83	×	50.42	×	0.63	x	0.7	=	56.4	(75)
Northeast 0.9x	0.77	×	2.4	×	50.42	×	0.63	x	0.7	=	36.98	(75)
Northeast 0.9x	0.77	×	2.42	×	50.42	×	0.63	x	0.7	=	74.58	(75)

Northeast 0.9x	0.77	x	1.81	x	50.42	×	0.63	x	0.7	=	27.89	(75)
Northeast 0.9x	0.77	x	2.34	x	28.07	×	0.63	x	0.7	=	40.14	(75)
Northeast 0.9x	0.77	x	3.36	x	28.07	×	0.63	x	0.7	=	86.46	(75)
Northeast 0.9x	0.77	x	1.4	x	28.07	×	0.63	x	0.7	=	24.02	(75)
Northeast 0.9x	0.77	x	1.83	x	28.07	×	0.63	x	0.7	=	31.39	(75)
Northeast 0.9x	0.77	x	2.4	x	28.07	×	0.63	x	0.7	=	20.59	(75)
Northeast 0.9x	0.77	x	2.42	x	28.07	×	0.63	x	0.7	=	41.52	(75)
Northeast 0.9x	0.77	x	1.81	x	28.07	×	0.63	x	0.7	=	15.53	(75)
Northeast 0.9x	0.77	x	2.34	x	14.2	×	0.63	x	0.7	=	20.31	(75)
Northeast 0.9x	0.77	x	3.36	×	14.2	×	0.63	x	0.7	=	43.73	(75)
Northeast 0.9x	0.77	x	1.4	x	14.2	×	0.63	x	0.7	=	12.15	(75)
Northeast 0.9x	0.77	x	1.83	x	14.2	x	0.63	x	0.7	=	15.88	(75)
Northeast 0.9x	0.77	x	2.4	x	14.2	x	0.63	x	0.7	=	10.41	(75)
Northeast 0.9x	0.77	x	2.42	×	14.2	×	0.63	x	0.7	=	21	(75)
Northeast 0.9x	0.77	x	1.81	x	14.2	×	0.63	x	0.7	=	7.85	(75)
Northeast 0.9x	0.77	x	2.34	x	9.21	×	0.63	x	0.7	=	13.18	(75)
Northeast 0.9x	0.77	x	3.36	x	9.21	×	0.63	x	0.7	=	28.39	(75)
Northeast 0.9x	0.77	x	1.4	×	9.21	x	0.63	x	0.7	=	7.88	(75)
Northeast 0.9x	0.77	x	1.83	x	9.21	x	0.63	×	0.7	=	10.31	(75)
Northeast 0.9x	0.77	x	2.4	x	9.21	×	0.63	x	0.7	=	6.76	(75)
Northeast 0.9x	0.77	x	2.42	x	9.21	×	0.63	x	0.7	=	13.63	(75)
Northeast 0.9x	0.77	x	1.81	x	9.21	х	0.63	x	0.7	=	5.1	(75)
Southeast 0.9x	0.77	x	1.28	x	36 .79	×	0.63	x	0.7	=	28.79	(77)
Southeast 0.9x	0.77	x	2.38	×	36.79	×	0.63	x	0.7	=	<mark>5</mark> 3.52	(77)
Southeast 0.9x	0.77	x	1.28	x	62.67	×	0.63	x	0.7	=	49.03	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	×	0.63	x	0.7	=	91.17	(77)
Southeast 0.9x	0.77	×	1.28	x	85.75	×	0.63	x	0.7	=	67.09	(77)
Southeast 0.9x	0.77	×	2.38	x	85.75	X	0.63	x	0.7	=	124.75	(77)
Southeast 0.9x	0.77	X	1.28	X	106.25	×	0.63	X	0.7	=	83.13	(77)
Southeast 0.9x	0.77	X	2.38	X	106.25	×	0.63	X	0.7	=	154.57	(77)
Southeast 0.9x	0.77	×	1.28	X	119.01	X	0.63	X	0.7	=	93.11	(77)
Southeast 0.9x	0.77	×	2.38	X	119.01	X	0.63	x	0.7	=	173.13	(77)
Southeast 0.9x	0.77	X	1.28	X	118.15	X	0.63	x	0.7	=	92.44	(77)
Southeast 0.9x	0.77	×	2.38	X	118.15	×	0.63	x	0.7	=	171.87	(77)
Southeast 0.9x	0.77	X	1.28	×	113.91	×	0.63	x	0.7	=	89.12	(77)
Southeast 0.9x	0.77	X	2.38	×	113.91	X	0.63	X	0.7	=	165.71	(77)
Southeast 0.9x	0.77	X	1.28	x	104.39	X	0.63	X	0.7	=	81.67	(77)
Southeast 0.9x	0.77	X	2.38	×	104.39	X	0.63	X	0.7	=	151.86	(77)
Southeast 0.9x	0.77	X X	1.28	x	92.85	X	0.63	X	0.7	=	72.64	(77)
Southeast 0.9x	0.77	X	2.38	x	92.85	X	0.63	x	0.7	=	135.07	(77)
	0.77	x	1.28	X	69.27	x	0.63	x	0.7	=	54.19	(77)

Southeast 0.9x	0.77] ×	2.38	x	69.27	x	0.63	x	0.7	=	100.76	(77)
Southeast 0.9x	0.77	x	1.28	x	44.07	x	0.63	x	0.7	=	34.48](77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	64.11] (77)
Southeast 0.9x	0.77	x	1.28	x	31.49	x	0.63	x	0.7	=	24.64	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	45.81	(77)
Southwest _{0.9x}	0.77	x	3.36	x	36.79		0.63	x	0.7	=	226.42	(79)
Southwest0.9x	0.77	x	3.36	x	36.79		0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	x	3.36	x	36.79	İ	0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	x	3.36	x	36.79		0.63	x	0.7	=	188.69	(79)
Southwest0.9x	0.77	x	3.36	x	62.67		0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67		0.63	x	0.7	=	385.68	(79)
Southwest0.9x	0.77	x	3.36	x	62.67		0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67		0.63	x	0.7	=	321.4	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	439.76	(79)
Southwest0.9x	0.77	x	3.36	×	106.25		0.63	x	0.7	=	653.85	(79)
Southwest0.9x	0.77	×	3.36	х	106.25		0.63	x	0.7	=	6 <mark>53.85</mark>	(79)
Southwest _{0.9x}	0.77	×	3.36	×	106.25		0.63	×	0.7	=	6 <mark>53.85</mark>	(79)
Southwest _{0.9x}	0.77	×	3.36	X	106.25		0.63	х	0.7	=	5 <mark>44.88</mark>	(79)
Southwest _{0.9x}	0.77	×	3.36	x	119.01		0.63	x	0.7	=	732.37	(79)
Southwest _{0.9x}	0.77	×	3.36	x	119.01		0.63	x	0.7	=	732.37	(79)
Southwest _{0.9x}	0.77	X	3.36	X	119.01		0.63	X	0.7	=	7 <mark>32.37</mark>	(79)
Southwest _{0.9x}	0.77	×	3.36	X	119.01		0.63	X	0.7	=	610.31	(79)
Southwesto.9x	0.77	X	3.36	X	118.15		0.63	X	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	X	3.36	x	118.15		0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	×	3.36	x	118.15		0.63	x	0.7	=	727.07	(79)
Southwest0.9x	0.77	x	3.36	×	118.15		0.63	x	0.7	=	605.9	(79)
Southwest _{0.9x}	0.77) ×]	3.36	x	113.91		0.63	X	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	x x	3.36	x	113.91		0.63	X	0.7	=	700.98	(79) (79)
Southwest0.9x	0.77] ×] ~	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	x x	3.36 3.36	x x	113.91 104.39		0.63	x x	0.7	=	584.15	(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	104.39		0.63	×	0.7	=	642.4 642.4	(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	104.39		0.63	×	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	104.39		0.63	x	0.7	=		(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	92.85		0.63	×	0.7	=	535.33 571.39	(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77] ^] x	3.36	x	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77) ^ x	3.36	x	92.85		0.63	x	0.7	=	476.16	(79)
	5	1	0.00			I	0.00		<u> </u>		1.0.10	_``′

Southwest0.9x	0.77) ×	3.36	×	69.27		0.63	x	0.7	=	426.26	(79)
Southwest _{0.9x}	0.77	 x	3.36	x	69.27		0.63	x	0.7	=	426.26](79)
Southwest _{0.9x}	0.77	x x	3.36	x l	69.27		0.63	x	0.7	=	426.26	(79)
Southwest _{0.9x}	0.77	x	3.36	x	69.27		0.63	x	0.7	=	355.22	(79)
Southwest _{0.9x}	0.77	×	3.36	×	44.07		0.63	x	0.7	=	271.2	(79)
Southwest _{0.9x}	0.77	x	3.36	×	44.07		0.63	x	0.7	=	271.2	(79)
Southwest0.9x	0.77	×	3.36	×	44.07		0.63	x	0.7	=	271.2	(79)
Southwest _{0.9x}	0.77	x	3.36	×	44.07		0.63	x	0.7	=	226	(79)
Southwest _{0.9x}	0.77	×	3.36	x	31.49		0.63	x	0.7	=	193.77	(79)
Southwest0.9x	0.77	x	3.36	x	31.49		0.63	x	0.7	=	193.77	(79)
Southwest _{0.9x}	0.77	x	3.36	x	31.49		0.63	x	0.7	=	193.77	(79)
Southwest _{0.9x}	0.77	x	3.36	x	31.49		0.63	x	0.7	=	161.48	(79)
Northwest 0.9x	0.77	x	1.37	×	11.28	x	0.63	x	0.7	=	9.45	(81)
Northwest 0.9x	0.77	x	1.37	×	22.97	x	0.63	x	0.7	=	19.23	(81)
Northwest 0.9x	0.77	x	1.37	×	41.38	x	0.63	x	0.7	=	34.65	(81)
Northwest 0.9x	0.77	x	1.37	x	67.96	x	0.63	x	0.7	=	56.9	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.63	x	0.7	=	76.49	(81)
Northwest 0.9x	0.77	x	1.37	X	97.38	х	0.63	x	0.7	=	81.55	(81)
Northwest 0.9x	0.77	x	1.37	x	91.1	x	0.63	x	0.7	=	76.29	(81)
Northwest 0.9x	0.77	x	1.37	x	72.63	×	0.63	x	0.7	=	60.82	(81)
Northwest 0.9x	0.77	x	1.37	X	50.42	x	0.63	x	0.7	=	42.22	(81)
Northwest 0.9x	0.77	x	1.37	×	28.07	х	0.63	x	0.7	=	23.5	(81)
Northwest 0.9x	0.77	×	1.37	x	14.2	x	0.63	x	0.7	=	11.89	(81)
Northwest 0.9x	0.77	x	1.37	×	9.21	x	0.63	x	0.7	=	7.72	(81)
Rooflights 0.9x	1	x	6.13	x	26.46	x	0.63	x	0.7	=	64.39	(82)
Rooflights 0.9x	1	x	6.13	×	53.3	x	0.63	x	0.7	=	129.69	(82)
Rooflights 0.9x	1	x	6.13	×	91.66	x	0.63	x	0.7	=	223.02	(82)
Rooflights 0.9x	1	x	6.13	x	139.87	x	0.63	x	0.7	=	340.3	(82)
Rooflights 0.9x	1	x	6.13	×	176.97	x	0.63	x	0.7	=	430.56	(82)
Rooflights 0.9x	1	x	6.13	×	183.63	x	0.63	x	0.7	=	446.78	(82)
Rooflights 0.9x	1	x	6.13	x	173.81	x	0.63	x	0.7	=	422.88	(82)
Rooflights 0.9x	1	x	6.13	×	145.57	x	0.63	x	0.7	=	354.17	(82)
Rooflights 0.9x	1	x	6.13	×	108.61	x	0.63	x	0.7	=	264.25	(82)
Rooflights 0.9x	1	×	6.13	×	64.26	x	0.63	x	0.7	=	156.36	(82)
Rooflights 0.9x	1	x	6.13	×	33.27	x	0.63	x	0.7	=	80.95	(82)
Rooflights 0.9x	1	x	6.13	×	21.59	x	0.63	x	0.7	=	52.52	(82)

Solar g	gains in	watts, ca	alculated	for eacl	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	1128.48	1980.04	2855.17	3769.99	4425.75	4480.65	4283.84	3782.91	3170.97	2228.46	1362.37	958.71		(83)
Total g	jains – ir	nternal a	ind solar	(84)m =	= (73)m -	⊦ (83)m	, watts							
(84)m=	2515.88	3363.16	4187.03	5016.64	5579.18	5550.76	5304.26	4813.35	4249.26	3392.27	2624.04	2300.22	I	(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)			[21	(85)
Utilisa	ation fac	tor for g	ains for l	iving are	ea, h1,m	(see Ta	ble 9a)					-		
Stroma I	SAP 201	2 version:	1.0.4.3r(s	AP 9 92)		w.stroffia.o	, Jul	Aug	Sep	Oct	Nov	Dec	Page	9 of 11

(86)m=	1	1	1	1	0.99	0.94	0.83	0.89	0.99	1	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	19.67	19.8	20.01	20.3	20.6	20.84	20.95	20.93	20.71	20.33	19.95	19.65		(87)
Temp	erature	during h	neating p	beriods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	20.14	20.14	20.14	20.14	20.15	20.15	20.15	20.15	20.15	20.15	20.14	20.14		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	1	1	1	0.98	0.9	0.71	0.8	0.98	1	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.31	18.49	18.8	19.24	19.67	20.01	20.13	20.11	19.84	19.28	18.71	18.28		(90)
					-		-		f	LA = Livin	g area ÷ (4	4) =	0.04	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2			-		
(92)m=	18.36	18.54	18.85	19.28	19.71	20.04	20.16	20.14	19.87	19.32	18.77	18.34		(92)
Apply	adjustn	nent to t	he mear	interna	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.36	18.54	18.85	19.28	19.71	20.04	20.16	20.14	19.87	19.32	18.77	18.34		(93)
		ting requ					_							
				mperatui using Ta		ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g		<u> </u>		Jun		<u>, tug</u>	000	001	1100	000		
(94)m=	1	1	1	1	0.98	0.9	0.72	0.79	0.97	1	1	1		(94)
Us <mark>efu</mark>	<mark>II g</mark> ains,	hmGm	, W = (9	4)m x (84	4)m	r								
(95)m=	<mark>25</mark> 15.85	3362.87	4184.91	4999.23	5458.45	4973.43	3795	3819.34	4129.97	3388.6	2623.91	2300.2		(95)
Mo <mark>nt</mark> ł	nly aver	age exte	rnal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			1	· · · ·	1	r		x [(93)m		-				
				11768.84		6117.64		4200.1	6507.02			16104.44		(97)
•		<u> </u>			· · · ·	r	i	24 x [(97]	````	<u> </u>	<u> </u>	40070.05		
(98)m=	10122.14	8233.16	7388.14	4874.12	2682.08	0	0	0	0	4822.77		10270.35		
								lota	l per year	(kwh/year) = Sum(9	8)15,912 =	56040.38	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								45.83	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
	e heatir	-	4 fra									r		
	-			econdar		mentary	system		(004)				0	(201)
				nain syst	. ,			(202) = 1 -	· · ·				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space	e heatin	g require	ement (c	alculate	d above)								
	10122.14	8233.16	7388.14	4874.12	2682.08	0	0	0	0	4822.77	7647.62	10270.35		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
	10825.82	8805.52	7901.76	5212.96	2868.54	0	0	0	0	5158.04		10984.33		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	59936.24	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)									
	r								
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		
			Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	E	0	(21
Water heating									
Output from water heater (calculated above)						-	-		
274.61 241.64 252.82 225.3 219.83 1	195.04	186	205.91	206.12	233.69	248.78	267.56		
Efficiency of water heater	-							79.8	(216
(217)m= 90.18 90.16 90.1 89.97 89.59	79.8	79.8	79.8	79.8	89.94	90.12	90.19		(21
Fuel for water heating, kWh/month									
$(219)m = (64)m \times 100 \div (217)m$								1	
(219)m= 304.51 268.02 280.59 250.43 245.37 2	244.41	233.08	258.04	258.29	259.82	276.05	296.65		_
			Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			3175.28	(219
Annual totals					k	Wh/year		kWh/yea	ı r
Space heating fuel used, main system 1								59936.24	
Water heating fuel used								3175.28	
Electricity for pumps, fans and electric keep-hot									
central heating pump:							30		(230
boiler with a fan-assisted flue							45		(230
Total electricity for the above, kWh/year			sum	of (230a).	(<mark>2</mark> 30g) =			75	(23
Electricity for lighting								1974 10	 (23)
Electricity for lighting								1874.19	(232
Electricity for lighting 12a. CO2 emissions – Individual heating system	ns includ	ding mi	cro-CHP		-			1874.19	(232
			cro-CHP		Emiss	ion fac	tor	1874.19 Emission	J
	Ene		cro-CHP		Emiss kg CO2		tor		s
12a. CO2 emissions – Individual heating system	Ene	rgy n/year	cro-CHP			2/kWh	tor =	Em <mark>issio</mark> n	s
	Ene kWh	ergy n/year x	cro-CHP		kg CO	2/kWh		Emission kg CO2/ye	s ear
12a. CO2 emissions – Individual heating system Space heating (main system 1)	Ene kWr (211)	rgy h/year x x	cro-CHP		kg CO2	2/kWh 16 19	=	Emission kg CO2/ye 12946.23	s ear
12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Ene kWr (211) (215) (219)	ergy n/year x x x	сто-СНР + (263) + (kg CO2 0.2 0.5	2/kWh 16 19	=	Emission kg CO2/ye 12946.23 0	s ear (26)
12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Ene kWr (211) (215) (219)	rgy /year x x x + (262) -			kg CO2 0.2 0.5	2/kWh 16 19 16	=	Emission kg CO2/ye 12946.23 0 685.86	s ear (26) (26)
12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Ene kWr (211) (215) (219) (261)	rgy /year x x x + (262) - x			kg CO: 0.2 0.5	2/kWh 16 19 16 19	= =	Emission kg CO2/ye 12946.23 0 685.86 13632.09	s ar (26 (26 (26 (26

TER =

11.98 (273)

	nt L1A, 2013 Edition, uary 2017 at 12:30:0	England assessed by Stroma FSAF	P 2012 program, Ve	rsion: 1.0.4.5	
Project Information	•	-			
Assessed By:	0		Building Type:	Detached House	
Dwelling Details:					
NEW DWELLING	DESIGN STAGE		Total Floor Area: 1	222.77m²	
Site Reference :	62 Avenue Rd		Plot Reference:	Lean Rev2	
Address :	62, Avenue Road,	_ONDON, NW8 6HT			
Client Details:					
Name:	B B Partnership Lto	1			
Address :	Studio 33-334, 10 I	Hornsey Street, London, N7 8EL			
-	s items included wi e report of regulati	thin the SAP calculations. ons compliance.			
1a TER and DER					
	ng system: Mains ga	S			
Fuel factor: 1.00 (m	iains gas) kide Emission Rate (TER)	11.98 kg/m²		
-	ioxide Emission Rate		9.17 kg/m ²		ок
1b TFEE and DFI			J		
	gy Efficiency (TFEE)		55.7 kWh/m ²		
	ergy Efficiency (DFE		42.8 kWh/m ²		ОК
2 Fabric U-values Element External w Floor Roof Openings	/all	Average 0.18 (max. 0.30) 0.12 (max. 0.25) 0.11 (max. 0.20) 1.23 (max. 2.00)	Highest 0.18 (max. 0.70) 0.12 (max. 0.70) 0.11 (max. 0.35) 1.60 (max. 3.30)		ОК ОК ОК ОК
2a Thermal bridg		ing user-specified y-value of 0			
Reference		ing user-specified y-value of 0			
3 Air permeabilit	y				
Air permeab Maximum	ility at 50 pascals		3.00 (design val 10.0	ue)	ОК
4 Heating efficier			10.0		UN
Main Heating		Boiler systems with radiators or un Data from manufacturer Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %	derfloor heating - m	ains gas	ок
Secondary h	eating system:	None			
5 Cylinder insula	tion				
Hot water St		Measured cylinder loss: 1.61 kWh/ Permitted by DBSCG: 2.24 kWh/da	•		ОК

Primary pipework insulated: 6 Controls	No primary pipework		
Space heating controls	Time and temperature zone cont	rol	ОК
Hot water controls: Boiler interlock:	No cylinder Yes		ок
7 Low energy lights	165		<u> </u>
Percentage of fixed lights with lo	ow-energy fittings	100.0%	
Minimum		75.0%	ОК
8 Mechanical ventilation			
Continuous supply and extract s	ystem		
Specific fan power:		0.56	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum		70%	OK
9 Summertime temperature			
Overheating risk (Thames valley	/):	Not significant	OK
Based on:		A	
Overshading: Windows facing: South West		Average or unknown 20.14m ²	
Windows facing: South West Windows facing: South West		20.14m ²	
Windows facing: South West		20.14m ²	
Windows facing: South West		16.78m ²	
Windows facing: North East		4.68m ²	
Windows facing: North East		10.08m ²	
Windows facing: North East		2.8m ²	
Windows facing: North East		3.66m ²	
Windows facing: North East		2.4m ²	
Windows facing: North East		4.84m ²	
Windows facing: North East		1.81m ²	
Windows facing: South East		2.56m ²	
Windows facing: North West		2.74m ²	
Windows facing: South East		4.76m ²	
Roof windows facing: Unspecifie	d	6.13m ²	
Ventilation rate: Blinds/curtains:		5.00	
Dillus/curtains.		Closed 100% of daylight hours	6
10 Key features			
Thermal bridging		0.023 W/m²K	

0 0	
Air permeablility	3.0 m³/m²h
Roofs U-value	0.11 W/m²K
Floors U-value	0.12 W/m²K
Floors U-value	0.12 W/m²K

				User D	Details:						
Assessor Name: Software Name:	Stroma F	SAP 201			Stroma Softwa	are Ver	sion:		Versio	on: 1.0.4.5	
A dalama a a	60 Avenu	o Dood J			Address:	: Lean R	ev2				
Address : 1. Overall dwelling dime	62, Avenu	le Road, L		I, INVV8 (
	11310113.			Are	a(m²)		Av. Hei	aht(m)		Volume(m ³	;)
Basement					· ·	(1a) x		.2	(2a) =	1223.1	(3a)
Ground floor				3	19.56	(1b) x	3	.2	(2b) =	1022.59	(3b)
First floor				3	01.73	(1c) x		3	(2c) =	905.19	(3c)
Second floor				2	19.26	(1d) x	2	.8	(2d) =	613.93	(3d)
Total floor area TFA = (1a	a)+(1b)+(1c)	+(1d)+(1e	e)+(1r	1) <u>1</u> 2	222.77	(4)			J		
Dwelling volume)+(3c)+(3d))+(3e)+	(3n) =	3764.81	(5)
2. Ventilation rate:											
	main heatin		econdar neating	у	other		total			m ³ per hou	r
Number of chimneys		+	0] + [0] = [0	×	40 =	0	(6a)
Number of open flues	0	+	0	ī + [0] = [0	x	20 =	0	(6b)
Number of intermittent fa	ns						0	x	10 =	0	(7a)
Number of passive vents						Ī	0	X	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	× ·	40 =	0	(7c)
									Air ch	hanges per ho	our
Infiltration due to chimney							0		÷ (5) =	0	(8)
If a pressurisation test has b			ed, procee	d to (17),	otherwise c	continue fr	om (9) to (*	16)			
Number of storeys in th Additional infiltration	ie dweiling (ns)						[(0)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel	or timber	frame or	0.35 fo	r masonr	v constr	uction	[(9)	-1]x0.1 =	0	(10)
if both types of wall are pr	resent, use the	value corres				-	uouon			0	
deducting areas of openir If suspended wooden f	•		ed) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, ent		•		. (000	,					0	(13)
Percentage of windows			ripped							0	(14)
Window infiltration		5			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	· (15) =		0	(16)
Air permeability value,	q50, expres	sed in cub	oic metre	s per ho	our per se	quare m	etre of ei	nvelope	area	3	(17)
If based on air permeabil	ity value, the	en (18) = [(1	7) ÷ 20]+(8	3), otherw	ise (18) = (16)				0.15	(18)
Air permeability value applie	s if a pressurisa	ation test has	s been dor	e or a de	gree air pei	rmeability	is being us	ed			
Number of sides sheltere	d				(00)	0.075	0)1			2	(19)
Shelter factor					(20) = 1 -		9)] =			0.85	(20)
Infiltration rate incorporat	•		_		(21) = (18)) x (20) =				0.13	(21)
Infiltration rate modified for		- i	i		1.	-			<u> </u>	1	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	

Monthl	y avera	ige wind	speed f	rom Tabl	e 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjuste	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-		-	-	
,	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						, 	
				endix N, (2	(23a) = (23a	a) x Fmv (e	equation (1	N5)) . othe	rwise (23b	(23a) = (23a)			0.5	(23a) (23b)
				ciency in %						(_000)			0.5	(23b)
			-	entilation	-					2b)m + (i	23b) × [⁻	1 – (23c)		(200)
, (24a)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat red	covery (N	MV) (24t)m = (22	2b)m + (2	23b)		•	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation o then (24)	•	•				5 v (23h				
(24c)m=	. ,	0	0		0 = (200)		0	(22) = (22)			0	0	1	(24c)
d) If	<mark>na</mark> tural			nole hous	se positiv	/e input	ventilatio		oft					
		1	1)m = (22l		· ·	24d)m =	1	· ·	r -			1	(0.1.1)
(24d)m=		0	0	0	0	0	0	0	0	0	0	0	J	(24d)
(25)m=	o.27	0.27	rate - ei	nter (24a 0.25	0.25 or	0) or (24	c) or (24 0.23	0.23	x (25) 0.24	0.25	0.25	0.26	1	(25)
(25)11=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.20		(23)
				paramet										
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²·		A X k kJ/K
Doors	Type 1					3.09	x	1.6	=	4.944				(26)
Doors	Type 2					2.4	x	1.6	=	3.84				(26)
Doors	Туре 3					2.69	x	1.6	=	4.304				(26)
Windo	ws Type	e 1				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 2				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 3				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 4				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 5				2.34	x1	/[1/(1.2)+	0.04] =	2.68				(27)
Windov	ws Type	e 6				3.36	x1	/[1/(1.2)+	0.04] =	3.85				(27)
Windov	ws Type	e 7				1.4	x1	/[1/(1.2)+	0.04] =	1.6				(27)
Windov	ws Type	e 8				1.83	x1	/[1/(1.2)+	0.04] =	2.1				(27)
Windov	ws Type	e 9				2.4	x1	/[1/(1.2)+	0.04] =	2.75				(27)
Windov	ws Type	e 10				2.42	x1	/[1/(1.2)+	0.04] =	2.77				(27)
Window	ws Type	e 11				1.81	x1	/[1/(1.2)+	0.04] =	2.07				(27)

vvincio		10							0.041 F					(07)
	ws Type					1.28		/[1/(1.2)+	Ļ	1.47				(27)
	ws Type					1.37		/[1/(1.2)+		1.57				(27)
	ws Type	914				2.38		/[1/(1.2)+		2.73				(27)
Rooflig						6.13	x1,	/[1/(1.4) +	0.04] =	8.582				(27b)
Floor T						382.2	2 X	0.12	= [45.8664	4			(28)
Floor T						319.5	6 ×	0.12	= [38.3472	2			(28)
Walls 7	Type1	765	4	113.9	94	651.4	6 ×	0.18	=	117.26				(29)
Walls 7	Гуре2	213	1	11.7	6	201.3	4 ×	0.18	=	36.24				(29)
Roof 7	Гуре1	62.6	6	6.13	;	56.53	3 X	0.11	=	6.22				(30)
Roof 7	Гуре2	158.	87	0		158.8	7 X	0.11	=	17.48				(30)
Total a	rea of e	lements	, m²			1901.8	31							(31)
				effective wi			ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
		s, W/K :			is and pan	uuons		(26)(30)	+ (32) =				417.19	(33)
		Cm = S(•)				. , . ,		(30) + (32	2) + (32a).	(32e) =	67459.01	(34)
				⁻ = Cm ÷	- TFA) ir	n kJ/m²K				tive Value	· · · ·	()	100	(35)
			•	tails of the				ecisely the	indicative	e values of	TMP in Ta	able 1f	100	
can b <mark>e l</mark>	ised inste	ad of a de	tailed calc	ulation.										
	-		· ·	culated u			<						44.04	(36)
	of therma abric he		are not kr	10wn (36) =	= 0.15 x <mark>(</mark> 3	:1)			(33) +	(36) =			101.00	
			alculator	d monthly						= 0.33 × (25)m x (5)		461.23	(37)
ventila	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	337.39		329.47	309.67	305.71	285.9	285.9	281.94	293.82	305.71	313.63	321.55		(38)
Heat tr	ansfor (coefficier	$h = \frac{1}{10}$						(30)m	= (37) + (3	38)m			
(39)m=	798.62	794.66	790.7	770.9	766.94	747.14	747.14	743.18	755.06	766.94	774.86	782.78	1	
()														
		104.00	790.7			1							769.91	(39)
Heat lo	oss para	imeter (H		/m²K					/	Average = = (39)m ÷	Sum(39)1		769.91	(39)
Heat Ic (40)m=	oss para 0.65			/m²K 0.63	0.63	0.61	0.61	0.61	/	I Average =	Sum(39)1		769.91	_
(40)m=	0.65	meter (H 0.65	HLP), W/ 0.65	0.63	0.63	0.61		0.61	(40)m 0.62	L Average = = (39)m ÷	Sum(39) ₁ - (4) 0.63	0.64	769.91 0.63	(39)
(40)m=	0.65 er of day	meter (H 0.65 vs in moi	HLP), W/ 0.65 hth (Tab	0.63 le 1a)			0.61	I	(40)m 0.62	Average = = (39)m ÷ 0.63 Average =	Sum(39)1 (4) 0.63 Sum(40)1	0.64		_
(40)m= Numbe	0.65 er of day Jan	meter (H 0.65 /s in moi Feb	HLP), W/ 0.65 nth (Tab Mar	0.63 le 1a) Apr	Мау	Jun	0.61 Jul	Aug	(40)m 0.62 Sep	Average = = (39)m ÷ 0.63 Average = Oct	Sum(39)1. (4) 0.63 Sum(40)1	0.64 12 /12= Dec		(40)
(40)m=	0.65 er of day	meter (H 0.65 vs in moi	HLP), W/ 0.65 hth (Tab	0.63 le 1a)			0.61	I	(40)m 0.62	Average = = (39)m ÷ 0.63 Average =	Sum(39)1 (4) 0.63 Sum(40)1	0.64		_
(40)m= Numbe (41)m=	0.65 er of day Jan 31	meter (F 0.65 /s in moi Feb 28	HLP), W/ 0.65 nth (Tab Mar 31	0.63 le 1a) Apr 30	Мау	Jun	0.61 Jul	Aug	(40)m 0.62 Sep	Average = = (39)m ÷ 0.63 Average = Oct	Sum(39)1. (4) 0.63 Sum(40)1	0.64 	0.63	(40)
(40)m= Numbe (41)m=	0.65 er of day Jan 31	meter (F 0.65 /s in moi Feb 28	HLP), W/ 0.65 nth (Tab Mar 31	0.63 le 1a) Apr	Мау	Jun	0.61 Jul	Aug	(40)m 0.62 Sep	Average = = (39)m ÷ 0.63 Average = Oct	Sum(39)1. (4) 0.63 Sum(40)1	0.64 12 /12= Dec	0.63	(40)
(40)m= Numbe (41)m= 4. Wa Assum	0.65 er of day Jan 31 ater heat	imeter (F 0.65 /s in moi Feb 28 ting ener	HLP), W/ 0.65 nth (Tab Mar 31 gy requ	0.63 le 1a) Apr 30 irement:	May 31	Jun 30	0.61 Jul 31	Aug 31	(40)m 0.62 Sep 30	Average = = (39)m ÷ 0.63 Average = Oct 31	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30	0.64 	0.63	(40)
(40)m= Numbe (41)m= 4. Wa Assum	0.65 er of day Jan 31 ater heat	imeter (H 0.65 /s in moi Feb 28 ting ener upancy, H 9, N = 1	HLP), W/ 0.65 nth (Tab Mar 31 gy requ	0.63 le 1a) Apr 30	May 31	Jun 30	0.61 Jul 31	Aug 31	(40)m 0.62 Sep 30	Average = = (39)m ÷ 0.63 Average = Oct 31	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30	0.64 12 /12= Dec 31	0.63	(40) (41)
(40)m= Numbe (41)m= 4. Wa Assum if TF if TF Annua	0.65 er of day Jan 31 ater heat A > 13.9 A \pm 13.9 I averag	imeter (F 0.65 /s in moi Feb 28 ing enel ipancy, I 9, N = 1 9, N = 1 ie hot wa	HLP), W/ 0.65 Inth (Tab Mar 31 rgy requ N + 1.76 x ater usag	0.63 le 1a) Apr 30 irement: (1 - exp ge in litre	May 31 (-0.0003	Jun 30 349 x (TF ay Vd,av	0.61 Jul 31 FA -13.9 erage =	Aug 31)2)] + 0.((25 x N)	(40)m 0.62 30 0013 x (⁻ + 36	Average = = (39)m ÷ 0.63 Average = Oct 31	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30 	0.64 12 /12= Dec 31	0.63	(40) (41)
(40)m= Numbe (41)m= 4. Wa Assum if TF if TF Annua <i>Reduce</i>	0.65 er of day Jan 31 ater heat ed occu A > 13.9 A \pm 13.9 I averag the annual	imeter (F 0.65 /s in moi Feb 28 ing ener 28 ing ener 9, N = 1 9, N = 1 9, N = 1 9, N = 1 9, N = 1	HLP), W/ 0.65 nth (Tab Mar 31 rgy requ N + 1.76 x ater usag <i>hot water</i>	0.63 le 1a) Apr 30 irement: (1 - exp ge in litre usage by s	May 31 (-0.0003 es per da 5% if the d	Jun 30 349 x (TF ay Vd,av Iwelling is	0.61 Jul 31 FA -13.9 erage = designed t	Aug 31)2)] + 0.((25 x N)	(40)m 0.62 30 0013 x (⁻ + 36	Average = = (39)m ÷ 0.63 Average = Oct 31	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30 	0.64 0.64 0.12 /12= Dec 31 kWh/yu 33	0.63	(40) (41) (42)
(40)m= Numbe (41)m= 4. Wa Assum if TF if TF Annua <i>Reduce</i>	0.65 er of day Jan 31 ater heat ed occu A \geq 13.9 A £ 13.9 I averag the annual e that 125	imeter (F 0.65 /s in moi Feb 28 ing ene 28 ing ene 29 ing ene 20 ing br>ing ene 20 ing ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ing ene 20 ing ene 20 ing ing ene 20 ing ing ene 20 ing ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ene 20 ing ing ene 20 ing ing ing ing ing ing ing ene ing ing ene ing ing in in in i i in in i i i i i i	HLP), W/ 0.65 hth (Tab Mar 31 rgy requ N + 1.76 x ater usag hot water person per	0.63 le 1a) Apr 30 irement: (1 - exp ge in litre usage by s r day (all w	May 31 (-0.0003 es per da 5% if the d rater use, l	Jun 30 349 x (TF ay Vd,av Iwelling is hot and co	0.61 Jul 31 FA -13.9 erage = designed t	Aug 31)2)] + 0.0 (25 x N) to achieve	(40)m 0.62 30 0013 x (⁻ + 36 <i>a water us</i>	Average = = (39)m ÷ 0.63 Average = Oct 31 TFA -13. se target o	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30 4. 9) 14.	0.64 0.64 0.12 /12= Dec 31 kWh/yu 33	0.63	(40) (41) (42)
(40)m= Numbe (41)m= 4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not more</i>	0.65 er of day Jan 31 ater heat ded occu A > 13.9 $A \pm 13.9$ I averag the annua e that 125 Jan	imeter (F 0.65 /s in moi Feb 28 ing ener 28 ing ener 28 ing ener 9, N = 1 9, N = 1 9, N = 1 9, N = 1 9, N = 1 He hot wa al average litres per f	HLP), W/ 0.65 Inth (Tab Mar 31 rgy requ N + 1.76 x ater usag hot water person per Mar	0.63 le 1a) Apr 30 irement: (1 - exp ge in litre usage by s	May 31 (-0.0003 es per da 5% if the d rater use, l May	Jun 30 349 x (TF ay Vd,av Iwelling is hot and co Jun	0.61 Jul 31 FA -13.9 erage = designed to Id) Jul	Aug 31)2)] + 0.((25 x N) to achieve Aug	(40)m 0.62 30 0013 x (⁻ + 36	Average = = (39)m ÷ 0.63 Average = Oct 31	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30 	0.64 0.64 0.12 /12= Dec 31 kWh/yu 33	0.63	(40) (41) (42)
(40)m= Numbe (41)m= 4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not more</i>	0.65 er of day Jan 31 ater heat ded occu A > 13.9 $A \pm 13.9$ I averag the annua e that 125 Jan	imeter (F 0.65 /s in moi Feb 28 ing ener 28 ing ener 28 ing ener 9, N = 1 9, N = 1 9, N = 1 9, N = 1 9, N = 1 He hot wa al average litres per f	HLP), W/ 0.65 hth (Tab Mar 31 gy requ N + 1.76 x ater usag hot water person per Mar	0.63 le 1a) Apr 30 irement: (1 - exp ge in litre usage by s r day (all w Apr	May 31 (-0.0003 es per da 5% if the d rater use, l May	Jun 30 349 x (TF ay Vd,av Iwelling is hot and co Jun	0.61 Jul 31 FA -13.9 erage = designed to Id) Jul	Aug 31)2)] + 0.((25 x N) to achieve Aug	(40)m 0.62 30 0013 x (⁻ + 36 <i>a water us</i>	Average = = (39)m ÷ 0.63 Average = Oct 31 TFA -13. se target o	Sum(39)1 · (4) 0.63 Sum(40)1 Nov 30 4. 9) 14.	0.64 0.64 	0.63	(40) (41) (42)

Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	m x nm x D	OTm / 360	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	235.37	205.86	212.43	185.2	177.7	153.34	142.1	163.06	165	192.3	209.91	227.95]	
lf instan	taneous v	, ater heatii	ng at point	of use (no	o hot water	^r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	2270.22	(45)
(46)m=	35.31	30.88	31.86	27.78	26.66	23	21.31	24.46	24.75	28.84	31.49	34.19		(46)
	storage								!		·		,	
-		. ,		• •			-		ame ves	sel		201		(47)
	•	•			/elling, e			• •			47)			
	storage		not wate	er (this ir	iciudes i	nstantar	ieous co	iod idmo	ers) ente	er 'O' in (47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.61	1	(48)
			m Table			,	• /					54]	(49)
			⁻ storage		ear			(48) x (49) =			87]	(50)
b) If m	nanufact	urer's de	eclared o	cylinder	loss fact								1	
		-			le 2 (kW	h/litre/da	ay)					0		(51)
	•	from Ta	ee secti	on 4.3								0	1	(52)
			m Table	2b								0 0		(52) (53)
			. storage		ear			(47) x (51) x (52) x (53) =		0]	(54)
		(54) in (5	-	,, j					/ (- / (.87		(55)
Water	storage	loss cal	culated	for each	month			((56)m =	(55) × (41)	m				
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)
· · ·		L s dedica <mark>te</mark>	l d solar sto	rage, <u>(</u> 57)	l m = (56)m	x [(50) – (I H11)] ÷ (5	0), else (5	7)m = (56)	l m where (L H11) is fro	m Append	J lix H	
(57)m=	2 <mark>6.95</mark>	24.34	2 6.95	26.08	26.95	26.08	26.95	26.95	26.08	2 <mark>6.95</mark>	26.08	26.95		(57)
Primar	v circuit	loss (ar	nnual) fro	om Table	33							0		(58)
					month (59)m =	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	a cylinde	r thermo	ostat)			
(59)m=	43.31	39.12	43.31	41.92	43.31	41.92	43.31	43.31	41.92	43.31	41.92	43.31		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	neat requ	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	, (59)m + (61)r	n
(62)m=	305.64	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter 'C	' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	305.64	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21		
								Out	out from w	ater heate	r (annual)₁	12	3097.53	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	134.47	119.22	126.84	115.98	115.3	105.39	103.46	110.43	109.26	120.15	124.19	132]	(65)
inclu	ıde (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Number Letter Lotes Lotes <thlotes< th=""></thlotes<>	(66)m= 216.58 216.58 2	216.58	216.58 216.58	3 2	16.58 216.58	216	.58 216.58	216.58	3 216.58	216.58	l	(66)
(87)m 108.12 94.26 78.66 58.03 43.30 36.62 39.57 51.44 68.04 87.66 102.32 109.07 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m 103.53 104.28 1019.2 981.58 888.78 80.39 774.7 763.95 791.03 848.68 821.45 989.44 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m 44.66 44.68 44.66 44.66 44.66 (69) Pumps and fans gains (Table 5a) (70)m 10 10 10 10 10 10 10 (70)m (71) (71) Value 41.72.4 173.26								210.00	210.00	210.00		(00)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (66) 1055.53 1046.22 1019.2 91.55 888.78 80.39 774.7 783.95 791.03 848.68 921.45 989.84 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (90) 90) 90) 90) 90) 90) 90) 90)		<u> </u>	· · · · ·	_				87.66	102 32	109.07		(67)
(68) 1035.53 1046.28 1019.2 961.55 888.78 820.39 774.7 763.95 791.03 848.68 921.45 989.84 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) 44.66									102.02	100.07		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (99)m= 44.66 </td <td></td> <td>r</td> <td></td> <td>· ·</td> <td>i i</td> <td><u>,</u></td> <td></td> <td></td> <td>3 921.45</td> <td>989.84</td> <td></td> <td>(68)</td>		r		· ·	i i	<u>,</u>			3 921.45	989.84		(68)
(69)m 44.66 <td< td=""><td>. ,</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>000.01</td><td></td><td>()</td></td<>	. ,									000.01		()
Pumps and fans gains (Table 5a) (70)me 10		i	· · · ·	_					44.66	44 66		(69)
(70)m= 10									11.00	11.00		()
	· · · · · · · · · · · · · · · · · · ·	1		Τ	10 10	1	0 10	10	10	10		(70)
	Losses e.g. evaporation	(negati	ve values) (Ta	able	5)							
(72)me 180.74 177.41 170.49 161.08 154.97 146.37 139.06 148.43 151.75 161.49 172.49 177.42 (72) Total internal gains = (86)m + (69)m + (70)m + (71)m + (72)m (73) (73)me 145.92 1364.32 1278.64 1185.11 1101.35 1061.79 1109.81 1195.81 1294.23 1374.31 (73) Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation: Orientation: - Access Factor Area Flux Q Fable 6a Table 6a Table 6a Colspan="4">(W) Northeast 0.9x 0.77 × 2.34 × 11.28 × 0.63 × 0.7 = 46.67 (W) Northeast 0.9x 0.77 × 1.48 × 0.63 × 0.7 = 8.28 (75) Northeast 0.9x 0.77 × 2.44 × 11.28 0.63 × 0.7 <t< td=""><td></td><td><u> </u></td><td></td><td>-</td><td>, </td><td>-173</td><td>.26 -173.26</td><td>-173.2</td><td>6 -173.26</td><td>-173.26</td><td></td><td>(71)</td></t<>		<u> </u>		-	, 	-173	.26 -173.26	-173.2	6 -173.26	-173.26		(71)
(72)me 180.74 177.41 170.49 161.08 154.97 146.37 139.06 148.43 151.75 161.49 172.49 177.42 (72) Total internal gains = (86)m + (69)m + (70)m + (71)m + (72)m (73) (73)me 145.92 1364.32 1278.64 1185.11 1101.35 1061.79 1109.81 1195.81 1294.23 1374.31 (73) Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation: Orientation: - Access Factor Area Flux Q Fable 6a Table 6a Table 6a Colspan="4">(W) Northeast 0.9x 0.77 × 2.34 × 11.28 × 0.63 × 0.7 = 46.67 (W) Northeast 0.9x 0.77 × 1.48 × 0.63 × 0.7 = 8.28 (75) Northeast 0.9x 0.77 × 2.44 × 11.28 0.63 × 0.7 <t< td=""><td>Water heating gains (Tat</td><td>ole 5)</td><td>Į</td><td>_</td><td></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td></t<>	Water heating gains (Tat	ole 5)	Į	_			I					
(13)me [142.37] [141.52] [128.42] [128.42] [129.42] [137.43] (73) 6. Solar gains Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Fr Gains Orientation: Access Factor Area Flux 9_ Flux 0.63 × 0.77 = 1.2.62 (75) Northeast 0.9x 0.77 × 1.83 × 1.128 × 0.63 × 0.77 = 1.2.26 (75) Northeast 0.9x 0.77 × 2.44 × 1.128 × 0.63 × 0.77 = 6.24 (75) Northeast 0.9x 0.77 × 2.44 ×		<u> </u>	161.08 154.9	7 1	46.37 139.06	148	.43 151.75	161.49	9 172.49	177.42		(72)
(73)me 1420.37 1415.92 1364.32 1278.64 1186.11 1101.33 1061.79 1109.8 1196.81 1294.23 1374.31 (73) Gains Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Mar File Q_ FF Gains Northeast 0.9x 0.77 × 2.36 × 11.28 × 0.63 × 0.77 = 16.14 (75) Northeast 0.9x 0.77 × 1.83 × 11.28 × 0.63 × 0.77 = 9.476 (75) Northeast 0.9x 0.77 × 1.83 × 11.28 × 0.63 × 0.77 = 9.452 (75) Northeast 0.9x 0.77 × 2.44 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 2.44 × 12.27 <td>Total internal gains =</td> <td></td> <td>Į</td> <td>_</td> <td>(66)m + (67)m</td> <td>1 1 + (68</td> <td>B)m + (69)m + (7</td> <td>70)m +</td> <td>(71)m + (72)n</td> <td>ı</td> <td></td> <td></td>	Total internal gains =		Į	_	(66)m + (67)m	1 1 + (68	B)m + (69)m + (7	70)m +	(71)m + (72)n	ı		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6d Area m ² Flux fuel flux flux flux flux flux flux flux flu		364.32	1278.64 1185.1	1 11	01.35 1051.3	106	.79 1109.8	1195.8	1 1294.23	1374.31		(73)
Orientation:Access Factor Table 6dArea m2Flux Table 6a g_{-} Table 6bFF Table 6cGains (W)Northeast $0.9x$ 0.77 x 2.34 x 11.28 x 0.63 x 0.7 $=$ 16.14 (75) Northeast $0.9x$ 0.77 x 3.36 x 11.28 x 0.63 x 0.7 $=$ 34.76 (75) Northeast $0.9x$ 0.77 x 1.4 x 11.28 x 0.63 x 0.7 $=$ 9.66 (75) Northeast $0.9x$ 0.77 x 1.4 x 11.28 x 0.63 x 0.7 $=$ 9.66 (75) Northeast $0.9x$ 0.77 x 2.44 x 11.28 x 0.63 x 0.7 $=$ 8.28 (75) Northeast $0.9x$ 0.77 x 2.42 x 11.28 x 0.63 x 0.7 $=$ 8.28 (75) Northeast $0.9x$ 0.77 x 2.42 x 11.28 x 0.63 x 0.7 $=$ 6.24 (75) Northeast $0.9x$ 0.77 x 2.34 x 22.97 x 0.63 x 0.7 $=$ 9.285 (75) Northeast $0.9x$ 0.77 x 2.44 x 22.97 x 0.63 x 0.7 $=$ 25.69 $($	6. Solar gains:		I		k							
Table 6d m^2 Table 6aTable 6bTable 6c(W)Northeast 0.9x0.77 \times 2.34 \vee 11.28 \times 0.63 \times 0.77 $=$ 16.14(75)Northeast 0.9x0.77 \times 3.36 \times 11.29 \times 0.63 \times 0.77 $=$ 34.76(75)Northeast 0.9x0.77 \times 1.411.28 \times 0.63 \times 0.77 $=$ 9.65(75)Northeast 0.9x0.77 \times 2.44 \times 11.28 \times 0.63 \times 0.77 $=$ 12.62(75)Northeast 0.9x0.77 \times 2.44 \times 11.28 \times 0.63 \times 0.77 $=$ 6.24(75)Northeast 0.9x0.77 \times 2.44 \times 11.28 \times 0.63 \times 0.77 $=$ 6.24(75)Northeast 0.9x0.77 \times 2.44 \times 11.28 \times 0.63 \times 0.77 $=$ 6.24(75)Northeast 0.9x0.77 \times 2.34 \times 22.97 \times 0.63 \times 0.77 $=$ 6.24(75)Northeast 0.9x0.77 \times 1.83 \times 22.97 \times 0.63 \times 0.77 $=$ 25.69(75)Northeast 0.9x0.77 \times 1.84 22.97 \times 0.63 \times 0.77 $=$ 19.65(75)Northeast 0.9x0.77 \times 2.44 \times 22.97 \times 0.63<	Solar gains are calculated usi	ing solar	flux from Table 6	a and	associated equa	tions	to convert to the	e applic	able orientatio	on.		
Northeast $0.9x$ 0.77 x 2.34 x 11.28 x 0.63 x 0.7 z 16.14 (75) Northeast $0.9x$ 0.77 x 3.36 x 11.28 x 0.63 x 0.7 z 34.76 (75) Northeast $0.9x$ 0.77 x 1.4 11.28 x 0.63 x 0.7 z 34.76 (75) Northeast $0.9x$ 0.77 x 1.4 11.28 x 0.63 x 0.7 z 9.65 (75) Northeast $0.9x$ 0.77 x 2.44 x 11.28 x 0.63 x 0.7 z 8.28 (75) Northeast $0.9x$ 0.77 x 2.44 x 11.28 x 0.63 x 0.7 z 8.28 (75) Northeast $0.9x$ 0.77 x 2.42 x 11.28 x 0.63 x 0.7 z 8.28 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 z 2.85 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 z z 6.24 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 z z <td< td=""><td></td><td>ctor</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>		ctor										
Northeast 0.77 × 3.36 × 11.28 × 0.63 × 0.77 = 34.76 (75) Northeast 0.9x 0.77 × 1.4 11.28 × 0.63 × 0.77 = 34.76 (75) Northeast 0.9x 0.77 × 1.43 × 11.28 × 0.63 × 0.77 = 34.76 (75) Northeast 0.9x 0.77 × 2.4 × 11.28 × 0.63 × 0.77 = 34.76 (75) Northeast 0.9x 0.77 × 2.44 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 1.81 × 11.28 × 0.63 × 0.77 = 6.24 (75) Northeast 0.9x 0.77 × 2.34 × 22.97 × 0.63 × 0.77 = 32.85 (75) Northeast	Table 6d		m²		Table 6a		Table 6b		Table 6c		(VV)	
Northeast 0.9x 0.77 × 1.4 × 1128 × 0.63 × 0.77 = 9.65 (75) Northeast 0.9x 0.77 × 1.83 × 11.28 × 0.63 × 0.77 = 12.62 (75) Northeast 0.9x 0.77 × 2.4 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 2.42 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 2.42 × 11.28 × 0.63 × 0.77 = 6.24 (75) Northeast 0.9x 0.77 × 2.34 × 22.97 × 0.63 × 0.77 = 32.85 (75) Northeast 0.9x 0.77 × 1.4 × 22.97 × 0.63 × 0.77 = 19.65 (75) Northeast 0.9x 0.77 × 1.4 × <td>Northeast 0.9x 0.77</td> <td>×</td> <td>2.34</td> <td>x</td> <td>11.28</td> <td>x</td> <td>0.63</td> <td>×</td> <td>0.7</td> <td>=</td> <td>16.14</td> <td>(75)</td>	Northeast 0.9x 0.77	×	2.34	x	11.28	x	0.63	×	0.7	=	16.14	(75)
Northeast 0.9x 0.77 × 1.83 × 1.28 × 0.63 × 0.77 = 12.62 (75) Northeast 0.9x 0.77 × 2.4 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 2.42 × 11.28 × 0.63 × 0.77 = 8.28 (75) Northeast 0.9x 0.77 × 2.42 × 11.28 × 0.63 × 0.77 = 6.24 (75) Northeast 0.9x 0.77 × 2.34 × 22.97 × 0.63 × 0.77 = 6.24 (75) Northeast 0.9x 0.77 × 2.34 × 22.97 × 0.63 × 0.77 = 70.75 (75) Northeast 0.9x 0.77 × 1.4 × 22.97 × 0.63 × 0.77 = 25.69 (75) Northeast 0.9x 0.77 × 2.42 × </td <td>Northeast 0.9x 0.77</td> <td>×</td> <td>3.36</td> <td>x</td> <td>11.28</td> <td>×</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td>=</td> <td>34.76</td> <td>(75)</td>	Northeast 0.9x 0.77	×	3.36	x	11.28	×	0.63	x	0.7	=	34.76	(75)
Northeast $0.9x$ 0.77 x 2.4 x 11.28 x 0.63 x 0.7 $=$ 8.28 (75) Northeast $0.9x$ 0.77 x 2.42 x 11.28 x 0.63 x 0.7 $=$ 16.69 (75) Northeast $0.9x$ 0.77 x 1.81 x 11.28 x 0.63 x 0.7 $=$ 6.24 (75) Northeast $0.9x$ 0.77 x 2.34 x 22.97 x 0.63 x 0.7 $=$ 32.85 (75) Northeast $0.9x$ 0.77 x 2.34 x 22.97 x 0.63 x 0.7 $=$ 70.75 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 $=$ 19.65 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 $=$ 25.69 (75) Northeast $0.9x$ 0.77 x 2.4 x 22.97 x 0.63 x 0.7 $=$ 33.97 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 2.44 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 <	Northeast 0.9x 0.77	×	1.4	x	11.28	x	0.63	x	0.7	=	9.65	(75)
Northeast 0.9x 0.77 x 2.42 x 11.28 x 0.63 x 0.77 = 16.69 (75) Northeast 0.9x 0.77 x 1.81 x 11.28 x 0.63 x 0.77 = 16.69 (75) Northeast 0.9x 0.77 x 1.81 x 11.28 x 0.63 x 0.77 = 6.24 (75) Northeast 0.9x 0.77 x 2.34 x 22.97 x 0.63 x 0.77 = 32.85 (75) Northeast 0.9x 0.77 x 1.4 x 22.97 x 0.63 x 0.77 = 19.65 (75) Northeast 0.9x 0.77 x 1.83 x 22.97 x 0.63 x 0.77 = 16.85 (75) Northeast 0.9x 0.77 x 2.4 x 22.97 x 0.63 x 0.77 = 12.7 (75) Northeast 0.9x 0.77 x 1.81	Northeast 0.9x 0.77	x	1.83	x	11.28	×	0.63	x	0.7	=	12.62	(75)
Northeast 0.9x 0.77 x 1.81 x 11.28 x 0.63 x 0.7 = 6.24 (75) Northeast 0.9x 0.77 x 2.34 x 22.97 x 0.63 x 0.7 = 6.24 (75) Northeast 0.9x 0.77 x 2.34 x 22.97 x 0.63 x 0.7 = 32.85 (75) Northeast 0.9x 0.77 x 3.36 x 22.97 x 0.63 x 0.7 = 19.65 (75) Northeast 0.9x 0.77 x 1.4 x 22.97 x 0.63 x 0.7 = 19.65 (75) Northeast 0.9x 0.77 x 1.83 x 22.97 x 0.63 x 0.7 = 16.85 (75) Northeast 0.9x 0.77 x 2.44 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast 0.9x 0.77 x 1.81 x	Northeast 0.9x 0.77	x	2.4	x	11.28	×	0.63	×	0.7	=	8.28	(75)
Northeast 0.9x 0.77 x 2.34 x 22.97 x 0.63 x 0.7 = 32.85 (75) Northeast 0.9x 0.77 x 3.36 x 22.97 x 0.63 x 0.7 = 32.85 (75) Northeast 0.9x 0.77 x 3.36 x 22.97 x 0.63 x 0.7 = 70.75 (75) Northeast 0.9x 0.77 x 1.4 x 22.97 x 0.63 x 0.7 = 19.65 (75) Northeast 0.9x 0.77 x 1.83 x 22.97 x 0.63 x 0.7 = 16.85 (75) Northeast 0.9x 0.77 x 2.42 x 22.97 x 0.63 x 0.7 = 16.85 (75) Northeast 0.9x 0.77 x 1.81 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast 0.9x 0.77 x 1.81 x <td>Northeast 0.9x 0.77</td> <td>x</td> <td>2.42</td> <td>x</td> <td>11.28</td> <td>x</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td>=</td> <td>16.69</td> <td>(75)</td>	Northeast 0.9x 0.77	x	2.42	x	11.28	x	0.63	x	0.7	=	16.69	(75)
Northeast $0.9x$ 0.77 x 3.36 x 22.97 x 0.63 x 0.7 $=$ 70.75 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 $=$ 19.65 (75) Northeast $0.9x$ 0.77 x 1.4 x 22.97 x 0.63 x 0.7 $=$ 19.65 (75) Northeast $0.9x$ 0.77 x 1.83 x 22.97 x 0.63 x 0.7 $=$ 16.85 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 $=$ 13.97 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 1.81 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 2.34 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 46.28 (75) Northeast $0.9x$ 0.77 <td>Northeast 0.9x 0.77</td> <td>x</td> <td>1.81</td> <td>x</td> <td>11.28</td> <td>×</td> <td>0.63</td> <td>×</td> <td>0.7</td> <td>=</td> <td>6.24</td> <td>(75)</td>	Northeast 0.9x 0.77	x	1.81	x	11.28	×	0.63	×	0.7	=	6.24	(75)
Northeast 0.9x 0.77 x 1.4 x 22.97 x 0.63 x 0.7 = 19.65 (75) Northeast 0.9x 0.77 x 1.83 x 22.97 x 0.63 x 0.7 = 19.65 (75) Northeast 0.9x 0.77 x 1.83 x 22.97 x 0.63 x 0.7 = 25.69 (75) Northeast 0.9x 0.77 x 2.4 x 22.97 x 0.63 x 0.7 = 16.85 (75) Northeast 0.9x 0.77 x 2.42 x 22.97 x 0.63 x 0.7 = 33.97 (75) Northeast 0.9x 0.77 x 1.81 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast 0.9x 0.77 x 1.81 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast 0.9x 0.77 x 3.36 x	Northeast 0.9x 0.77	x	2.34	x	22.97	x	0.63	x	0.7	=	32.85	(75)
Northeast $0.9x$ 0.77 x 1.83 x 22.97 x 0.63 x 0.7 = 25.69 (75) Northeast $0.9x$ 0.77 x 2.4 x 22.97 x 0.63 x 0.7 = 16.85 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 = 13.97 (75) Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast $0.9x$ 0.77 x 1.81 x 22.97 x 0.63 x 0.7 = 12.7 (75) Northeast $0.9x$ 0.77 x 2.34 x 41.38 x 0.63 x 0.7 = 12.747 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 = 12.747 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.44 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.44 x 41.38 x 0.63 x 0.7 = 61.21 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 <	Northeast 0.9x 0.77	x	3.36	x	22.97	×	0.63	×	0.7	=	70.75	(75)
Northeast 0.9x 0.77 × 2.4 × 22.97 × 0.63 × 0.7 = 16.85 (75) Northeast 0.9x 0.77 × 2.42 × 22.97 × 0.63 × 0.7 = 16.85 (75) Northeast 0.9x 0.77 × 2.42 × 22.97 × 0.63 × 0.7 = 13.97 (75) Northeast 0.9x 0.77 × 1.81 × 22.97 × 0.63 × 0.7 = 12.7 (75) Northeast 0.9x 0.77 × 2.34 × 41.38 × 0.63 × 0.7 = 59.18 (75) Northeast 0.9x 0.77 × 2.34 × 41.38 × 0.63 × 0.7 = 127.47 (75) Northeast 0.9x 0.77 × 1.4 × 41.38 × 0.63 × 0.7 = 46.28 (75) Northeast 0.9x 0.77 × 2.4 ×	Northeast 0.9x 0.77	x	1.4	x	22.97	×	0.63	×	0.7	=	19.65	(75)
Northeast $0.9x$ 0.77 x 2.42 x 22.97 x 0.63 x 0.7 $=$ 33.97 (75) Northeast $0.9x$ 0.77 x 1.81 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 2.34 x 41.38 x 0.63 x 0.7 $=$ 59.18 (75) Northeast $0.9x$ 0.77 x 3.36 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 3.36 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 $=$ 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 $=$ 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 $=$ 61.21 (75)	Northeast 0.9x 0.77	x	1.83	x	22.97	x	0.63	×	0.7	=	25.69	(75)
Northeast $0.9x$ 0.77 x 1.81 x 22.97 x 0.63 x 0.7 $=$ 12.7 (75) Northeast $0.9x$ 0.77 x 2.34 x 41.38 x 0.63 x 0.7 $=$ 59.18 (75) Northeast $0.9x$ 0.77 x 3.36 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 $=$ 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 $=$ 30.35 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 $=$ 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 $=$ 61.21 (75)	Northeast 0.9x 0.77	x	2.4	x	22.97	x	0.63	×	0.7	=	16.85	(75)
Northeast $0.9x$ 0.77 x 2.34 x 41.38 x 0.63 x 0.7 $=$ 59.18 (75) Northeast $0.9x$ 0.77 x 3.36 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 $=$ 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 $=$ 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 $=$ 61.21 (75)	Northeast 0.9x 0.77	x	2.42	x	22.97	x	0.63	×	0.7	=	33.97	(75)
Northeast $0.9x$ 0.77 x 3.36 x 41.38 x 0.63 x 0.7 $=$ 127.47 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 $=$ 35.41 (75) Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 $=$ 46.28 (75) Northeast $0.9x$ 0.77 x 2.44 x 41.38 x 0.63 x 0.7 $=$ 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 $=$ 61.21 (75)	Northeast 0.9x 0.77	x	1.81	x	22.97	x	0.63	×	0.7	=	12.7	(75)
Northeast $0.9x$ 0.77 x 1.4 x 41.38 x 0.63 x 0.7 = 35.41 (75) Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 = 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 = 61.21 (75)	Northeast 0.9x 0.77	×	2.34	x	41.38	x	0.63	×	0.7	= =	59.18	(75)
Northeast $0.9x$ 0.77 x 1.83 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 = 46.28 (75) Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 = 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 = 61.21 (75)	Northeast 0.9x 0.77	x	3.36	x	41.38	×	0.63	×	0.7	=	127.47	(75)
Northeast $0.9x$ 0.77 x 2.4 x 41.38 x 0.63 x 0.7 = 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 = 30.35 (75) Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.7 = 61.21 (75)	Northeast 0.9x 0.77	x	1.4	x	41.38	×	0.63	×	0.7	=	35.41	(75)
Northeast $0.9x$ 0.77 x 2.42 x 41.38 x 0.63 x 0.77 = 61.21 (75)	Northeast 0.9x 0.77	x	1.83	x	41.38	×	0.63	×	0.7	=	46.28	(75)
	Northeast 0.9x 0.77	×	2.4	x	41.38	×	0.63	×	0.7		30.35	(75)
Northeast 0.9x 0.77 x 1.81 x 41.38 x 0.63 x 0.7 = 22.89 (75)	Northeast 0.9x 0.77	×	2.42	x	41.38	×	0.63	×	0.7	=	61.21	(75)
	Northeast 0.9x 0.77	×	1.81	x	41.38	×	0.63	×	0.7	=	22.89	(75)

Northeast 0.9x	0.77] x	2.34	×	67.96) ×	0.63	x	0.7	=	97.2	(75)
Northeast 0.9x	0.77	x	3.36	x	67.96	x	0.63	x	0.7	=	209.34	(75)
Northeast 0.9x	0.77) x	1.4	x	67.96	x	0.63	x	0.7	=	58.15	(75)
Northeast 0.9x	0.77	x	1.83	x	67.96	x	0.63	x	0.7	=	76.01	(75)
Northeast 0.9x	0.77) x	2.4	x	67.96	x	0.63	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	2.42	x	67.96	x	0.63	x	0.7	=	100.52	(75)
Northeast 0.9x	0.77	x	1.81	x	67.96	x	0.63	x	0.7	=	37.59	(75)
Northeast 0.9x	0.77	x	2.34	x	91.35	×	0.63	x	0.7	=	130.65	(75)
Northeast 0.9x	0.77	x	3.36	x	91.35	×	0.63	x	0.7	=	281.4	(75)
Northeast 0.9x	0.77	x	1.4	x	91.35	x	0.63	x	0.7	=	78.17	(75)
Northeast 0.9x	0.77	x	1.83	x	91.35	×	0.63	x	0.7	=	102.17	(75)
Northeast 0.9x	0.77	x	2.4	x	91.35	x	0.63	x	0.7	=	67	(75)
Northeast 0.9x	0.77	x	2.42	x	91.35	×	0.63	x	0.7	=	135.12	(75)
Northeast 0.9x	0.77	x	1.81	x	91.35	x	0.63	x	0.7	=	50.53	(75)
Northeast 0.9x	0.77	x	2.34	x	97.38	×	0.63	x	0.7	=	139.29	(75)
Northeast 0.9x	0.77	x	3.36	x	97.38	×	0.63	x	0.7	=	300	(75)
Northeast 0.9x	0.77	x	1.4	x	97.38	x	0.63	x	0.7	=	83.33	(75)
Northeast 0.9x	0.77	x	1.83	X	97.38	х	0.63	х	0.7	=	108.93	(75)
Northeast 0.9x	0.77	x	2.4	x	97.38] x	0.63	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	2.42	x	97.38	×	0.63	x	0.7	=	144.05	(75)
Northeast 0.9x	0.77	x	1.81	x	97.38	x	0.63	x	0.7	=	53.87	(75)
Northeast 0.9x	0.77	x	2.34	×	91.1	х	0.63	x	0.7	=	130.3	(75)
Northeast 0.9x	0.77	x	3.36	x	91.1	×	0.63	x	0.7	=	2 <mark>80.64</mark>	(75)
Northeast 0.9x	0.77	x	1.4	x	91.1	×	0.63	x	0.7	=	77.96	(75)
Northeast 0.9x	0.77	x	1.83	x	91.1	×	0.63	x	0.7	=	101.9	(75)
Northeast 0.9x	0.77	x	2.4	x	91.1	×	0.63	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	134.75	(75)
Northeast 0.9x	0.77	x	1.81	x	91.1	×	0.63	x	0.7	=	50.39	(75)
Northeast 0.9x	0.77	x	2.34	×	72.63	×	0.63	x	0.7	=	103.88	(75)
Northeast 0.9x	0.77	x	3.36	x	72.63	×	0.63	x	0.7	=	223.73	(75)
Northeast 0.9x	0.77	x	1.4	×	72.63	×	0.63	x	0.7	=	62.15	(75)
Northeast 0.9x	0.77	x	1.83	×	72.63	×	0.63	x	0.7	=	81.24	(75)
Northeast 0.9x	0.77	x	2.4	x	72.63	×	0.63	x	0.7	=	53.27	(75)
Northeast 0.9x	0.77	x	2.42	x	72.63	×	0.63	x	0.7	=	107.43	(75)
Northeast 0.9x	0.77	×	1.81	x	72.63	×	0.63	x	0.7	=	40.17	(75)
Northeast 0.9x	0.77	x	2.34	X	50.42	X	0.63	x	0.7	=	72.12	(75)
Northeast 0.9x	0.77	×	3.36	x	50.42	X	0.63	x	0.7	=	155.32	(75)
Northeast 0.9x	0.77	×	1.4	×	50.42	×	0.63	x	0.7	=	43.15	(75)
Northeast 0.9x	0.77	×	1.83	×	50.42	×	0.63	x	0.7	=	56.4	(75)
Northeast 0.9x	0.77	×	2.4	×	50.42	×	0.63	x	0.7	=	36.98	(75)
Northeast 0.9x	0.77	×	2.42	×	50.42	×	0.63	x	0.7	=	74.58	(75)

Northeast 0.9x	0.77	1 🗸	4.04	۱.	50.40	1 🗸	0.00	v	0.7	=	07.00	(75)
Northeast 0.9x	0.77) ×]	1.81	x	50.42	×	0.63	x	0.7	1	27.89	4
Northeast 0.9x	0.77) ×]	2.34	X	28.07	X	0.63	x	0.7	=	40.14	(75)
Northeast 0.9x	0.77] ×] ×	3.36	X	28.07	X X	0.63	x	0.7	=	86.46	(75) (75)
Northeast 0.9x	0.77	X 	1.4	X	28.07	X X	0.63	x	0.7	1	24.02	
Northeast 0.9x	0.77	X	1.83	X	28.07	X	0.63	x	0.7	=	31.39	(75)
Northeast 0.9x	0.77	X	2.4	x	28.07	X	0.63	x	0.7	=	20.59	(75) (75)
Northeast 0.9x	0.77] X] V	2.42	X	28.07	×	0.63	x	0.7	=	41.52	(75)
Northeast 0.9x] ×] v	1.81	x	28.07	×		x		=	15.53	(75)
Northeast 0.9x	0.77	x x	2.34	x x	14.2	x x	0.63	x x	0.7	=	20.31	(75)
Northeast 0.9x	0.77] ^] x	3.36	x	14.2	x	0.63	x	0.7		43.73	(75)
Northeast 0.9x	0.77] ^] x	1.4	x	14.2	x	0.63	x	0.7		12.15 15.88	(75)
Northeast 0.9x		1	2.4	1		1		x				(75)
Northeast 0.9x	0.77] X] V	2.4	x x	14.2	x x	0.63	x	0.7	- _	10.41 21	(75)
Northeast 0.9x	0.77	x x	1.81	x	14.2	x	0.63	x	0.7		7.85	(75)
Northeast 0.9x	0.77] ^] x	2.34	x	9.21	x	0.63	x	0.7		13.18	(75)
Northeast 0.9x] ^] x		x		x		x		-		(75)
Northeast 0.9x	0.77	」^]x	3.36		9.21	×	0.63	×	0.7	=	28.39 7.88	(75)
Northeast 0.9x	0.77] ^] x	1.4	x	9.21	×	0.63	x	0.7		10.31	(75)
Northeast 0.9x	0.77] ^] x	2.4	x	9.21		0.63	x	0.7	=	6.76	(75)
Northeast 0.9x	0.77] ^] x	2.42		9.21	x	0.63	x	0.7	-	13.63	(75)
Northeast 0.9x	0.77	」 ^] x	1.81	x	9.21	×	0.63	x	0.7	-	5.1	(75)
Southeast 0.9x	0.77] ^] x	1.28	x	36.79	×	0.63	x	0.7	-	28.79	(77)
Southeast 0.9x	0.77] ^] x	2.38	x	36.79	x x	0.63	x	0.7	=	53.52	_(<i>TT</i>)
Southeast 0.9x	0.77) ^ x	1.28	x	62.67	x x	0.63	x	0.7	=	49.03](<i>11)</i>](77)
Southeast 0.9x	0.77) ^ x	2.38	x	62.67	x	0.63	x	0.7	=	91.17	(77)
Southeast 0.9x	0.77) ×	1.28	x	85.75	x	0.63	x	0.7	=	67.09	(77)
Southeast 0.9x	0.77	」 】 ×	2.38	x	85.75	 x	0.63	x	0.7	=	124.75](77)
Southeast 0.9x	0.77) x	1.28	x	106.25	x	0.63	x	0.7	=	83.13	
Southeast 0.9x	0.77) x	2.38	x	106.25	x	0.63	x	0.7	=	154.57	(77)
Southeast 0.9x	0.77) x	1.28	x	119.01	x	0.63	x	0.7	=	93.11	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	×	0.63	x	0.7	=	173.13	(77)
Southeast 0.9x	0.77	x	1.28	x	118.15	×	0.63	x	0.7	=	92.44	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	×	0.63	x	0.7	=	171.87	(77)
Southeast 0.9x	0.77	x	1.28	x	113.91	x	0.63	x	0.7	=	89.12	(77)
Southeast 0.9x	0.77	x	2.38	×	113.91	×	0.63	x	0.7	=	165.71	(77)
Southeast 0.9x	0.77	x	1.28	x	104.39	x	0.63	x	0.7	=	81.67	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	×	0.63	x	0.7	=	151.86	(77)
Southeast 0.9x	0.77	x	1.28	x	92.85	×	0.63	x	0.7	=	72.64	(77)
Southeast 0.9x	0.77	×	2.38	x	92.85	×	0.63	x	0.7	=	135.07	(77)
Southeast 0.9x	0.77	x	1.28	x	69.27	x	0.63	x	0.7	=	54.19	(77)
L		-		1								-

Southeast 0.9x	0.77] ×	2.38	×	69.27	×	0.63	x	0.7	=	100.76	(77)
Southeast 0.9x	0.77) ×	1.28	x	44.07	x	0.63	x	0.7	 =	34.48](77)
Southeast 0.9x	0.77) ×	2.38	x	44.07	x	0.63	x	0.7	=	64.11](77)
L Southeast 0.9x	0.77	」 】 ×	1.28	x	31.49	 x	0.63	x	0.7	=	24.64](77)
L Southeast 0.9x	0.77	」 】 ×	2.38	x	31.49	l X	0.63	x	0.7	=	45.81](77)
Southwest _{0.9x}	0.77) x	3.36	x	36.79]	0.63	x	0.7	=	226.42](79)
Southwest0.9x	0.77	x	3.36	x	36.79]	0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	×	3.36	x	36.79	1	0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	x	3.36	x	36.79	İ	0.63	x	0.7	=	188.69	(79)
Southwest0.9x	0.77	×	3.36	x	62.67	İ	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67	İ	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	×	3.36	x	62.67	Ì	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67		0.63	x	0.7	=	321.4	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75]	0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75]	0.63	x	0.7	=	439.76	(79)
Southwest0.9x	0.77	x	3.36	×	106.25		0.63	x	0.7	=	653.85	(79)
Southwest0.9x	0.77	x	3.36	x	106.25		0.63	x	0.7	=	653.85	(79)
Southwest _{0.9x}	0.77] x	3.36	x	106.25		0.63	x	0.7	=	653.85	(79)
Southwest _{0.9x}	0.7 <mark>7</mark>	×	3.36	x	106.25		0.63	×	0.7	=	5 <mark>44.88</mark>	(79)
Southwest _{0.9x}	0.77	x	3.36	×	119.01		0.63	x	0.7	=	732.37	(79)
Southwest _{0.9x}	0.77	x	3.36	x	119.01		0.63	×	0.7	=	732.37	(79)
Southwest0.9x	0.77	x	3.36	x	119.01		0.63	x	0.7	=	7 <mark>32.37</mark>	(79)
Southwest _{0.9x}	0.77	x	3.36	x	119.01		0.63	x	0.7	=	610.31	(79)
Southwest _{0.9x}	0.77	x	3.36	x	118.15		0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	x	3.36	×	118.15		0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	X	3.36	×	118.15	ļ	0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	x	3.36	×	118.15		0.63	x	0.7	=	605.9	(79)
Southwest _{0.9x}	0.77	x	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	x	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	×	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest0.9x	0.77	×	3.36	X	113.91		0.63	x	0.7	=	584.15	(79)
Southwest _{0.9x}	0.77	×	3.36	X	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	×	3.36	×	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	x	3.36	X	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	×	3.36	×	104.39		0.63	x	0.7	=	535.33	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	X	3.36	x	92.85		0.63	x	0.7	=	476.16	(79)

Southwest0.9x	0.77) ×	3.36	x	69.27		0.63	x	0.7	=	426.26	(79)
Southwest _{0.9x}	0.77) ^ x	3.36	x	69.27		0.63	x	0.7	=	426.26](79)
Southwest _{0.9x}	0.77	l x	3.36	x	69.27		0.63	x	0.7	 =	426.26	(79)
Southwest _{0.9x}	0.77	l x	3.36	x	69.27		0.63	x	0.7	=	355.22	(79)
Southwest _{0.9x}	0.77) ^ x	3.36	x	44.07		0.63	x	0.7	=	271.2](79)
Southwest _{0.9x}	0.77	l x	3.36	x	44.07		0.63	x	0.7	 =	271.2	(79)
Southwest0.9x	0.77	l x	3.36	x	44.07		0.63	x	0.7	 =	271.2	(79)
Southwest _{0.9x}	0.77	×	3.36	x	44.07		0.63	x	0.7	 =	226](⁷ 9)
Southwest _{0.9x}	0.77	l x	3.36	x	31.49		0.63	x	0.7	=	193.77	(79)
Southwest0.9x	0.77	l x	3.36	x	31.49		0.63	x	0.7	=	193.77](79)
Southwest _{0.9x}	0.77] x	3.36	x	31.49		0.63	x	0.7	=	193.77](79)
Southwest _{0.9x}	0.77	x	3.36	x	31.49		0.63	x	0.7	=	161.48	(79)
Northwest 0.9x	0.77	x	1.37	x	11.28	x	0.63	x	0.7	=	9.45	(81)
Northwest 0.9x	0.77	×	1.37	x	22.97	x	0.63	x	0.7	=	19.23	(81)
Northwest 0.9x	0.77	x	1.37	x	41.38	x	0.63	x	0.7	=	34.65	(81)
Northwest 0.9x	0.77	×	1.37	x	67.96	x	0.63	x	0.7	=	56.9	(81)
Northwest 0.9x	0.77	×	1.37	x	91.35	x	0.63	x	0.7	i =	76.49	(81)
Northwest 0.9x	0.77	×	1.37	×	97.38	х	0.63	x	0.7	=	81.55	(81)
Northwest 0.9x	0.77	x	1.37	x	91.1	x	0.63	x	0.7	=	76.29	(81)
Northwest 0.9x	0.77	x	1.37	x	72.63	×	0.63	x	0.7	=	60.82	(81)
Northwest 0.9x	0.77	x	1.37	x	50.42	x	0.63	x	0.7	=	42.22	(81)
Northwest 0.9x	0.77	x	1.37	x	28.07	х	0.63	x	0.7	=	23.5	(81)
Northwest 0.9x	0.77	×	1.37	x	14.2	x	0.63	x	0.7	=	11.89	(81)
Northwest 0.9x	0.77	x	1.37	x	9.21	x	0.63	x	0.7	=	7.72	(81)
Rooflights 0.9x	1	x	6.13	x	26.46	x	0.63	x	0.7	=	64.39	(82)
Rooflights 0.9x	1	x	6.13	x	53.3	x	0.63	x	0.7	=	129.69	(82)
Rooflights 0.9x	1	x	6.13	x	91.66	x	0.63	x	0.7	=	223.02	(82)
Rooflights 0.9x	1	x	6.13	x	139.87	x	0.63	x	0.7	=	340.3	(82)
Rooflights 0.9x	1	x	6.13	x	176.97	x	0.63	x	0.7	=	430.56	(82)
Rooflights 0.9x	1	x	6.13	x	183.63	x	0.63	x	0.7	=	446.78	(82)
Rooflights 0.9x	1	x	6.13	x	173.81	x	0.63	x	0.7	=	422.88	(82)
Rooflights 0.9x	1	x	6.13	x	145.57	x	0.63	x	0.7	=	354.17	(82)
Rooflights 0.9x	1	×	6.13	×	108.61	x	0.63	x	0.7	=	264.25	(82)
Rooflights 0.9x	1	×	6.13	×	64.26	x	0.63	x	0.7	=	156.36	(82)
Rooflights 0.9x	1	×	6.13	×	33.27	x	0.63	x	0.7	=	80.95	(82)
Rooflights 0.9x	1	×	6.13	×	21.59	x	0.63	x	0.7	=	52.52	(82)

Solar gains in v	watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m .	(82)m				
(83)m= 1128.48	1980.04	2855.17	3769.99	4425.75	4480.65	4283.84	3782.91	3170.97	2228.46	1362.37	958.71		(83)
Total gains – ir	nternal a	nd solar	(84)m =	- (73)m -	⊦ (83)m	, watts							
(84)m= 2548.85	3395.95	4219.48	5048.63	5610.85	5582.01	5335.14	4844.7	4280.77	3424.27	2656.6	2333.02		(84)
7. Mean interr	nal temp	erature	(heating	season)								
Temperature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)													
Stroma ESA	2 Version:	1.0.4.3r(s	AP 9 B2)	http://www	w.stroffia.o	Jul	Aug	Sep	Oct	Nov	Dec	Page	9 of 11

(86)m=	1	1	0.99	0.96	0.88	0.73	0.58	0.64	0.87	0.98	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	19.1	19.34	19.71	20.2	20.61	20.88	20.96	20.95	20.73	20.18	19.55	19.08		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	20.38	20.39	20.39	20.4	20.41	20.42	20.42	20.42	20.41	20.41	20.4	20.39		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.86	0.69	0.51	0.58	0.84	0.98	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	17.72	18.07	18.62	19.34	19.92	20.29	20.39	20.38	20.11	, 19.31	18.4	17.7		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.04	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	17.78	18.13	18.66	19.38	19.95	20.31	20.41	20.4	, 20.13	19.35	18.45	17.76		(92)
Apply	adjustn	nent to t	he mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.78	18.13	18.66	19.38	19.95	20.31	20.41	20.4	20.13	19.35	18.45	17.76		(93)
		ting requ												
				mperatur using Ta		ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g			Iviay	Jun	Jui	<u> Aug</u>	0ep	001	INOV	Dec		
(94)m=	1	0.99	0.98	0.93	0.84	0.68	0.51	0.58	0.82	0.96	0.99	1		(94)
Us <mark>efu</mark>	l <mark>l g</mark> ains,	hmGm	, W = (9	4)m x (84	4)m	r								
(95)m=	<mark>25</mark> 41.08	3366.13	<mark>4</mark> 119.5	4718.43	47 <mark>3</mark> 0.21	3809.43	2739.03	2798.47	3527.43	33 <mark>02.46</mark>	2639.61	2328.02		(95)
Month	-			perature										
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			r	al tempe		-		1		Ē	0-0-0			(07)
		10510.26		8075.4	6328.18		2849.76		4555.29		8795.3	10615.4	I	(97)
Space (98)m=	e neatin 6116.7	<u> </u>		r each m 2417.02			n = 0.02	24 X [(97])m – (95 0)mj x (4 ⁻ 2534.7	<i>'</i>	6165.81		
(00)11-	0110.7	4000.00	4000.41	2417.02	1100.00	Ŭ	Ű		l per year				31746.48	(98)
Snoo	- hootin	a roquir	omont in	k/M/b/m2	woor			1014	i por your	(ittin#jour) – C um(o	C)15,912 —		(99)
				kWh/m ²	•								25.96	(99)
			nts – Ind	ividual h	eating sy	ystems i	ncluding	i micro-C	CHP)					
	e heatir on of sp	-	at from s	econdar	v/supple	mentarv	v svstem						0	(201)
	-			nain syst		,	-	(202) = 1 -	- (201) =				1	(202)
				main sys	. ,			(204) = (2		(203)] =			1	(204)
			•	ing syste				() (_		(/]			90.9	(206)
	-	-		ementar		a cyctor	- 0/							(208)
EIIICIE	-		· · ·										0	
Creat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space	6116.7	4800.86	· · ·	alculate	1188.89	0	0	0	0	2534.7	4432.09	6165.81		
(211)~						Ĺ	Ĺ	Ľ	Ĺ			0.00.01		(211)
رد ۱۱/۱۱)III X (20 5281.47		00 ÷ (20 2658.98		0	0	0	0	2788.45	4875.79	6783.07		(211)
			L						l (kWh/yea				34924.62	(211)

Space heating fuel (secondary), kWh/month

Space nealin	•		• • •	monun									
$= \{[(98)m \times (20)]$	r	<u> </u>	<u> </u>			0						1	
(215)m= 0	0	0	0	0	0	0		0 al (kWh/yea		0	0		
							TULA	a (Kvvi/yea	ar) =Sum(213) _{15,101}	2	0	(215)
Water heating	-	tor (oolo	ulated a	hava)									
Output from w	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21]	
Efficiency of w	i ater hea	iter										80.8	(216)
(217)m= 90.36	90.3	90.17	89.84	88.98	80.8	80.8	80.8	80.8	89.85	90.23	90.38		(217)
Fuel for water	heating,	kWh/mo	onth									1	
(219)m <u>= (64)</u>	r				· · · · ·			· · · · ·			1	1	
(219)m= 338.24	298.25	313.51	281.85	278.68	273.94	262.82	288.77	288.37	292.24	307.98	329.96		_
							lota	al = Sum(2				3554.59	(219)
Annual totals Space heating		ad main	evetom	1					k	Wh/yea	r	kWh/yea 34924.62	r T
			System	I								34924.02	
Water heating	tuel use	d										3554.59	
Electricity for p	oumps, f	ans and	electric	keep-ho	t								
mechanical v	entilatio	n - balan	nced, ext	ract or p	ositive i	nput fror	n outside	e			3600.97		(230a)
central heatir	ng pump	:									120		(230 <mark>c</mark>)
Tota <mark>l elec</mark> tricity	y for the	above, I	kWh/yea	r			sum	of (230a)	(<mark>2</mark> 30g) =			3720.97	(231)
Elec <mark>tricity</mark> for li	ighting											1 <mark>8</mark> 74.19	(232)
12a. CO2 em	issions -	– Individ	ual heat	ing syste	ems inclu	uding mi	icro-CHF						
					_								
						ergy /h/year			kg CO	ion fac	tor	Em <mark>issio</mark> ns kg CO2/ye	
Space heating	(main a	votom 1	۱ ۱			I) x					_		_
)						0.2		=	7543.72	(261)
Space heating	(second	dary)			(21:	5) x			0.5	19	=	0	(263)
Water heating					(219	9) x			0.2	16	=	767.79	(264)
Space and wa	ter heati	ng			(261	1) + (262)	+ (263) + ((264) =				8311.51	(265)
Electricity for p	oumps, f	ans and	electric	keep-ho	t (23 ⁻	l) x			0.5	19	=	1931.18	(267)
Electricity for li	ighting				(232	2) x			0.5	19	=	972.71	(268)
Total CO2, kg/	/year							sum c	of (265)(271) =		11215.4	(272)
Dwelling CO2	2 Emissi	on Rate	•					(272)	÷ (4) =			9.17	(273)
EI rating (secti	ion 14)											88	(274)
0 (

••	uary 2017 at 12:30:4	, England assessed by Stroma FSA 18	AP 2012 program, Ve	rsion: 1.0.4.5	
Assessed By:	()		Building Type:	Detached House	
Dwelling Details:	U		_ and ing type:		
NEW DWELLING	DESIGN STAGE		Total Floor Area: 1	222.77m ²	
Site Reference :	62 Avenue Rd		Plot Reference:	Clean Rev2	
Address :	62, Avenue Road,	LONDON, NW8 6HT			
Client Details:					
Name:	B B Partnership Lto	b			
Address :	Studio 33-334, 10	Hornsey Street, London, N7 8EL			
•	s items included wi te report of regulati	thin the SAP calculations. ons compliance.			
1a TER and DER					
	ng system: Mains ga	IS			
Fuel factor: 1.00 (m	•••••••••••••••••••••••••••••••••••••••				
•	xide Emission Rate (· · · · ·	11.98 kg/m²		
Dwelling Carbon D 1b TFEE and DFI	ioxide Emission Rate	e (DER)	7.45 kg/m²		ОК
	gy Efficiency (TFEE)		55.7 kWh/m ²		
Dwelling Fabric En	ergy Efficiency (DFE	E)	42.8 kWh/m ²	_	ОК
2 Fabric U-values	s				
Element		Average	High <mark>est</mark>		
External w	vall	0.18 (max. 0.30)	0.18 (max. 0.70)		OK
Floor Roof		0.12 (max. 0.25)	0.12 (max. 0.70)		OK
Openings		0,11 (max. 0.20) 1.23 (max. 2.00)	0.11 (max. 0.35) 1.60 (max. 3.30)		OK OK
2a Thermal bridg					
Thermal b	oridging calculated us	sing user-specified y-value of 0			
Reference 3 Air permeabilit					
	ility at 50 pascals		3.00 (design val	ue)	
Maximum	inty at 00 passais		10.0		ок
4 Heating efficier	ncy				
Main Heatin		Boiler systems with radiators or u	nderfloor heating - ma	ains gas	
		Data from manufacturer Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %	-	-	ОК
					U.
Main Heatin	g system 2:				
		Heat pumps with radiators or und Dimplex EDL200UK-630	erfloor heating - elect	ric	

Secondary heating system:	None		
5 Cylinder insulation			
Hot water Storage: Primary pipework insulated:	Measured cylinder loss: 1.61 kW Permitted by DBSCG: 2.24 kWh No primary pipework	•	ок
6 Controls			
Space heating controls	Time and temperature zone con	trol	ок
Space heating controls 2:	Not applicable (boiler provides D		ΟΚ
Hot water controls:	No cylinder	.,	
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights with lo	ow-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Continuous supply and extract s	system		
Specific fan power:	-	0.56	
Maximum		1.5	ОК
MVHR efficiency:		92%	
Minimum		70%	ΟΚ
9 Summertime temperature			
Overheating risk (Thames valley Based on: Overshading: Windows facing: South West Windows facing: South West Windows facing: South West Windows facing: South West Windows facing: North East Windows facing: South East Windows facing: North West Windows facing: South East Roof windows facing: Unspecifie Ventilation rate: Blinds/curtains:		Not significant Average or unknown 20.14m ² 20.14m ² 20.14m ² 20.14m ² 16.78m ² 4.68m ² 10.08m ² 2.8m ² 3.66m ² 2.4m ² 4.84m ² 1.81m ² 2.56m ² 2.74m ² 4.76m ² 6.13m ² 5.00 Closed 100% of daylight hours	OK
10 Key features			
Thermal bridging		0.023 W/m²K	

,, ,	
Thermal bridging	0.023 W/m²K
Air permeablility	3.0 m³/m²h
Roofs U-value	0.11 W/m²K

Floors U-value Floors U-value Photovoltaic array 0.12 W/m²K 0.12 W/m²K



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201			Stroma Softwa	are Ver	sion:		Versic	on: 1.0.4.5	
	00.4	.			Address:	Clean F	Rev2				
Address : 1. Overall dwelling dime	62, Avenue	Road, L	ONDON	I, NVV8 (6HT						
				Δre	a(m²)		Av. Hei	aht(m)		Volume(m ³	\ \
Basement					<u>, ,</u>	(1a) x		.2	(2a) =	1223.1	(3a)
Ground floor				3	19.56	(1b) x	3	.2	(2b) =	1022.59	 (3b)
First floor				3	01.73	(1c) x		3	(2c) =	905.19	(3c)
Second floor				2	19.26	(1d) x	2	.8	(2d) =	613.93](3d)
Total floor area TFA = (1	la)+(1b)+(1c)+	(1d)+(1e)+(1r	n) 12	22.77	(4)	L		J		
Dwelling volume						(3a)+(3b)	+(3c)+(3d))+(3e)+	.(3n) =	3764.81	(5)
2. Ventilation rate:											
	main heating		condar eating	у	other		total			m ³ per hou	r
Number of chimneys	0	+	0	+	0] = [0	×	40 =	0	(6a)
Number of open flues	0	+	0] + [0] = [0	x	20 =	0	(6b)
Number of intermittent fa	ans					Γ	0	×	10 =	0	(7a)
Number of passive vents	s					Ē	0	X ·	10 =	0	(7b)
Number of flueless gas f	fires					Ē	0	× 4	40 =	0	(7c)
									Air ch	nanges per ho	ur
Infiltration due to chimne	•						0		÷ (5) =	0	(8)
If a pressurisation test has			d, procee	d to (17), d	otherwise o	continue fro	om (9) to (16)			-
Number of storeys in t Additional infiltration	the dwelling (na	5)						[(0)	41-0-4	0	(9)
Structural infiltration: () 25 for steel o	timber f	rame or	0 35 fo	masonr	v constr	uction	[(9)	-1]x0.1 =	0	(10) (11)
if both types of wall are p	present, use the va	lue corres				-	aotion			0	
deducting areas of open If suspended wooden	• ·		ad) ar 0	1 (000)	d) alaa	ontor O					
If no draught lobby, er			su) 01 0.	i (Seale	u), eise					0	(12) (13)
Percentage of window			rinned							0	(13)
Window infiltration		auginton	ippeu		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10) -			(15) =		0	(16)
Air permeability value	, q50, expresse	d in cub	ic metre	s per ho	our per so	quare m	etre of e	nvelope	area	3	(17)
If based on air permeabi				•	•	•		•		0.15	(18)
Air permeability value appli	es if a pressurisation	on test has	been dor	e or a deg	gree air pei	rmeability	is being us	ed			
Number of sides shelter	ed				()					2	(19)
Shelter factor					(20) = 1 - [9)] =			0.85	(20)
Infiltration rate incorpora	-				(21) = (18)) x (20) =				0.13	(21)
Infiltration rate modified		i		_			1		_	1	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Monthl	y avera	ige wind	speed f	rom Tabl	e 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjuste	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-		-	-	
,	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se							
				endix N, (2	(23a) = (23a	a) x Fmv (e	equation (1	N5)) . othe	rwise (23b	(23a) = (23a)			0.5	(23a) (23b)
				ciency in %						(_000)			0.5	(23b)
			-	entilation	-					2b)m + (i	23b) × [⁻	1 – (23c)		(200)
, (24a)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat red	covery (N	MV) (24t)m = (22	2b)m + (2	23b)		•	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
,				ntilation o then (24)	•	•				5 v (23h				
(24c)m=	. ,	0	0		0 = (200)		0	(22) = (22)			0	0	1	(24c)
d) If	<mark>na</mark> tural			nole hous	se positiv	/e input	ventilatio		oft					
		1	1)m = (22l		· ·	24d)m =	1	· ·	r -			1	(0.1.1)
(24d)m=		0	0	0	0	0	0	0	0	0	0	0	J	(24d)
(25)m=	o.27	0.27	rate - ei	nter (24a 0.25	0.25 or	0) or (24	c) or (24 0.23	0.23	x (25) 0.24	0.25	0.25	0.26	1	(25)
(25)11=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.20		(23)
				paramet										
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²·		A X k kJ/K
Doors	Type 1					3.09	x	1.6	=	4.944				(26)
Doors	Type 2					2.4	x	1.6	=	3.84				(26)
Doors	Туре 3					2.69	x	1.6	=	4.304				(26)
Windo	ws Type	e 1				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 2				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 3				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 4				3.356	3 x1	/[1/(1.2)+	0.04] =	3.84				(27)
Windov	ws Type	e 5				2.34	x1	/[1/(1.2)+	0.04] =	2.68				(27)
Windov	ws Type	e 6				3.36	x1	/[1/(1.2)+	0.04] =	3.85				(27)
Windov	ws Type	e 7				1.4	x1	/[1/(1.2)+	0.04] =	1.6				(27)
Windov	ws Type	e 8				1.83	x1	/[1/(1.2)+	0.04] =	2.1				(27)
Windov	ws Type	e 9				2.4	x1	/[1/(1.2)+	0.04] =	2.75				(27)
Windov	ws Type	e 10				2.42	x1	/[1/(1.2)+	0.04] =	2.77				(27)
Window	ws Type	e 11				1.81	x1	/[1/(1.2)+	0.04] =	2.07				(27)

Windo	ws Type	. 10					1	/[1// 1 2] .	0.041					(07)
						1.28	- ,	/[1/(1.2)+	l	1.47				(27)
	ws Type					1.37		/[1/(1.2)+	- L	1.57				(27)
	ws Type	914				2.38		/[1/(1.2)+	L I	2.73				(27)
Rooflig						6.13	x1.	/[1/(1.4) +	0.04] =	8.582				(27b)
Floor T						382.2	2 X	0.12	=	45.8664	4		\downarrow	(28)
Floor T						319.5	6 ×	0.12	= [38.3472	2			(28)
Walls 7	ype1	765	.4	113.9	94	651.4	6 ×	0.18	=	117.26				(29)
Walls 7	ype2	213	.1	11.7	6	201.3	4 ×	0.18	=	36.24				(29)
Roof T	ype1	62.6	6	6.13	3	56.53	3 X	0.11	=	6.22				(30)
Roof T	ype2	158.	87	0		158.8	7 X	0.11	=	17.48				(30)
Total a	rea of e	lements	, m²			1901.8	31							(31)
				effective wi			ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2	
			= S (A x		io ana pan			(26)(30)	+ (32) =				417.19	(33)
		Cm = S(((28)	(30) + (32	2) + (32a).	(32e) =	67459.01	(34)
Therma	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) ir	ר kJ/m²K			Indica	tive Value	: Low		100	(35)
For desig	gn assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
			tailed calc											
	-		· ·			pendix I	۲						44.04	(36)
	abric he		are not kn	own (36) =	= 0.15 x (3				(33) +	(36) =			461.23	(37)
Ventila	tion hea	at loss ca	alculated	monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	337.39	333.43	329.47	309.67	305.71	285.9	285.9	281.94	293.82	30 <mark>5.71</mark>	313.63	321.55		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	798.62	794.66	790.7	770.9	766.94	747.14	747.14	743.18	755.06	766.94	774.86	782.78		
											Sum(39)1.	12 /12=	769.91	(39)
1		0.65	HLP), W/		0.63	0.61	0.61	0.61	(40)m 0.62	= (39)m ÷ 0.63	0.63	0.64	l	
(40)m=	0.65	0.65	0.65	0.63	0.63	0.61	0.61	0.61			0.63 Sum(40)1.	0.64	0.63	(40)
Numbe	er of day	vs in moi	nth (Tab	le 1a)							Ourri(40)1.	12712-	0.00	(10)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
											-			
4. Wa	ter heat	ing enei	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	ipancy, l	N								4	33		(42)
if TF.	A > 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9)2)] + 0.0	0013 x (TFA -13.	.9)			
	A £ 13.9		ator usar	no in litre	e nor de	ve hV ve	orano -	(25 x N)	+ 36		14	1.00	l	(43)
								(23 × N) to achieve		se target o		4.29		(43)
not more	that 125	litres per j	person per	r day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	-		r day for ea		1	ctor from T		· <i>,</i>	r	1			I	
(44)m=	158.72	152.95	147.17	141.4	135.63	129.86	129.86	135.63	141.4	147.17	152.95	158.72		 .
										Total = Su	m(44) ₁₁₂ =	-	1731.46	(44)

Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	m x nm x D	OTm / 360	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	235.37	205.86	212.43	185.2	177.7	153.34	142.1	163.06	165	192.3	209.91	227.95]	
lf instan	taneous v	, ater heatii	ng at point	of use (no	o hot water	^r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	2270.22	(45)
(46)m=	35.31	30.88	31.86	27.78	26.66	23	21.31	24.46	24.75	28.84	31.49	34.19		(46)
	storage								!		·		,	
-		. ,		• •			-		ame ves	sel		201		(47)
	•	•			/elling, e			• •			47)			
	storage		not wate	er (this ir	iciudes i	nstantar	ieous co	iod idmo	ers) ente	er 'O' in (47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.61	1	(48)
			m Table			,	• /					54]	(49)
			⁻ storage		ear			(48) x (49) =			87]	(50)
b) If m	nanufact	urer's de	eclared o	cylinder	loss fact								1	
		-			le 2 (kW	h/litre/da	ay)					0		(51)
		from Ta	ee secti	on 4.3								0	1	(52)
			m Table	2b								0 0		(52) (53)
			. storage		ear			(47) x (51) x (52) x (53) =		0]	(54)
		(54) in (5	-	,, j					/ (- / (.87		(55)
Water	storage	loss cal	culated	for each	month			((56)m =	(55) × (41)	m				
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)
· · ·		L s dedica <mark>te</mark>	l d solar sto	rage, <u>(</u> 57)	l m = (56)m	x [(50) – (I H11)] ÷ (5	0), else (5	7)m = (56)	l m where (L H11) is fro	m Append	J lix H	
(57)m=	2 <mark>6.95</mark>	24.34	2 6.95	26.08	26.95	26.08	26.95	26.95	26.08	2 <mark>6.95</mark>	26.08	26.95		(57)
Primar	v circuit	loss (ar	nnual) fro	om Table	33							0		(58)
					month (59)m =	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	a cylinde	r thermo	ostat)			
(59)m=	43.31	39.12	43.31	41.92	43.31	41.92	43.31	43.31	41.92	43.31	41.92	43.31		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	neat requ	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	, (59)m + (61)r	n
(62)m=	305.64	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter 'C	' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	305.64	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21		
								Out	out from w	ater heate	r (annual)₁	12	3097.53	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	134.47	119.22	126.84	115.98	115.3	105.39	103.46	110.43	109.26	120.15	124.19	132]	(65)
inclu	ıde (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(66)m- 216 58 216 58 216	(66)m= 216.58													
							210.00				()			
		· · · · ·					87.66	102 32	109.07]	(67)			
								102.02	100.07		()			
	9.2	961.55 888.78	· ·	20.39 774.7	5a), 763		848.68	3 921.45	989.84]	(68)			
								921.45	909.04		(00)			
Cooking gains (calculated	<u> </u>	· · ·	_						44.00	1	(60)			
	.66	44.66 44.66	4	4.66 44.66	44.	66 44.66	44.66	44.66	44.66		(69)			
Pumps and fans gains (Ta (70)m= 10 10 1		a) 10 10		10 10	1	0 10	10	10	10	1	(70)			
Losses e.g. evaporation (n	-			-			10		10		(
(71)m= -173.26 -173.26 -173		-173.26 -173.26		73.26 -173.26	-173	.26 -173.26	-173.2	6 -173.26 -	173.26]	(71)			
		-173.20	, ,	13.20	-170	.20 173.20	170.2	173.20	170.20		()			
Water heating gains (Table (72)m= 180.74 177.41 170).49	161.08 154.97	7 4	46.37 139.06	148	.43 151.75	161.49	9 172.49	177.42	1	(72)			
	0.49	101.00 154.97									(12)			
Total internal gains = (73)m= 1420.37 1415.92 136	4.00	4070 04 4405 4			<u> </u>	B)m + (69)m + (7	-	<u> </u>		1	(72)			
	4.32	1278.64 1185.1	1 11	101.35 1051.3	106	1.79 1109.8	1195.8	1 1294.23 1	374.31		(73)			
6. Solar gains:	solar	flux from Table 6	a and	associated equa	tions	to convert to the	annlic	able orientatio	0					
			a and				applic			Gains				
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6d m ² Flux g_ FF Gains Table 6b Table 6c														
Orientation: Access Factor Area Flux g_ FF Gains														
Northeast 0.9x 0.77		3.36	x	11.28		0.63	×	0.7	۲	34.76	(75)			
Northeast 0.9x 0.77		1.4	x	11.28	x	0.63	×	0.7	╡_	9.65	(75)			
Northeast 0.9x 0.77	ı x [1.83	x	11.28] x	0.63	×	0.7	╡_	12.62	(75)			
Northeast 0.9x 0.77] ^] x	2.4	x	11.28	l x	0.63		0.7	╡_	8.28	(75)			
Northeast 0.9x 0.77) ^] x	2.42	x	11.28	l x	0.63		0.7	╡_	16.69	(75)			
Northeast 0.9x 0.77	1 x	1.81	x	11.28	l x	0.63		0.7	╡_	6.24	(75)			
Northeast 0.9x 0.77] x	2.34	x	22.97	x	0.63		0.7	╡_	32.85	(75)			
Northeast 0.9x 0.77] x	3.36	x	22.97	x	0.63		0.7	╡_	70.75	(75)			
Northeast 0.9x 0.77	」 】 ×	1.4	x	22.97] x	0.63	۲ × ۲	0.7	╡_	19.65	(75)			
Northeast 0.9x 0.77] x	1.83	x	22.97	x	0.63		0.7	╡_	25.69	(75)			
Northeast 0.9x 0.77] x	2.4	x	22.97	x	0.63	۲ × ۲	0.7	╡_	16.85	(75)			
Northeast 0.9x 0.77] x	2.42	x	22.97	x	0.63	۲×	0.7	╡_	33.97	(75)			
Northeast 0.9x 0.77] x	1.81	x	22.97	x	0.63	۲ × ۲	0.7	╡_	12.7	(75)			
Northeast 0.9x 0.77] x	2.34	x	41.38	x	0.63	۲ × ۲	0.7	╡_	59.18	(75)			
Northeast 0.9x 0.77	」 】 x	3.36	x	41.38	x	0.63	۲×	0.7	╡_	127.47	(75)			
Northeast 0.9x 0.77	x	1.4	x	41.38	^ x	0.63	, x	0.7	╡_	35.41	(75)			
Northeast 0.9x 0.77] x	1.83	x	41.38	^ x	0.63		0.7	╡_	46.28	(75)			
Northeast 0.9x 0.77	- 1 x	2.4	x	41.38	l x	0.63	٦ ُ	0.7	$\exists $	30.35	(75)			
Northeast 0.9x 0.77	- 1 x	2.4	x	41.38	^ ×	0.63	- x	0.7	╡┋	61.21	(75)			
	」 ^] ×	1.81	x	41.38	^ x	0.63	٦^ ×	0.7		22.89	(75)			
Northeast 0.9x 0.77	」 ^	1.01	^	41.30	」 ^	0.03	_ ^	0.7		22.09				

Northeast 0.9x	0.77] x	2.34	×	67.96	×	0.63	x	0.7	=	97.2	(75)
Northeast 0.9x	0.77	x	3.36	x	67.96	x	0.63	x	0.7	=	209.34	(75)
Northeast 0.9x	0.77) x	1.4	x	67.96	x	0.63	x	0.7	=	58.15	(75)
Northeast 0.9x	0.77	x	1.83	x	67.96	x	0.63	x	0.7	=	76.01	(75)
Northeast 0.9x	0.77) x	2.4	x	67.96	x	0.63	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	2.42	x	67.96	×	0.63	x	0.7	=	100.52	(75)
Northeast 0.9x	0.77	x	1.81	x	67.96	×	0.63	x	0.7	=	37.59	(75)
Northeast 0.9x	0.77	x	2.34	x	91.35	×	0.63	x	0.7	=	130.65	(75)
Northeast 0.9x	0.77	x	3.36	x	91.35	×	0.63	x	0.7	=	281.4	(75)
Northeast 0.9x	0.77	x	1.4	x	91.35	×	0.63	x	0.7	=	78.17	(75)
Northeast 0.9x	0.77	x	1.83	x	91.35	×	0.63	x	0.7	=	102.17	(75)
Northeast 0.9x	0.77	x	2.4	x	91.35	x	0.63	x	0.7	=	67	(75)
Northeast 0.9x	0.77	x	2.42	x	91.35	x	0.63	x	0.7	=	135.12	(75)
Northeast 0.9x	0.77	x	1.81	x	91.35	×	0.63	x	0.7	=	50.53	(75)
Northeast 0.9x	0.77	x	2.34	×	97.38	×	0.63	x	0.7	=	139.29	(75)
Northeast 0.9x	0.77	x	3.36	×	97.38	×	0.63	x	0.7	=	300	(75)
Northeast 0.9x	0.77	x	1.4	x	97.38	×	0.63	x	0.7	=	83.33	(75)
Northeast 0.9x	0.77	x	1.83	×	97.38	x	0.63	x	0.7	=	108.93	(75)
Northeast 0.9x	0.77	x	2.4	x	97.38	x	0.63	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	2.42	x	97.38	×	0.63	x	0.7	=	144.05	(75)
Northeast 0.9x	0.77	x	1.81	x	97.38	x	0.63	x	0.7	=	53.87	(75)
Northeast 0.9x	0.77	x	2.34	x	91.1	х	0.63	x	0.7	=	130.3	(75)
Northeast 0.9x	0.77	x	3.36	x	91.1	×	0.63	x	0.7	=	2 <mark>80.64</mark>	(75)
Northeast 0.9x	0.77	x	1.4	x	91.1	×	0.63	x	0.7	=	77.96	(75)
Northeast 0.9x	0.77	x	1.83	x	91.1	×	0.63	x	0.7	=	101.9	(75)
Northeast 0.9x	0.77	x	2.4	x	91.1	×	0.63	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	2.42	×	91.1	×	0.63	x	0.7	=	134.75	(75)
Northeast 0.9x	0.77	x	1.81	x	91.1	x	0.63	x	0.7	=	50.39	(75)
Northeast 0.9x	0.77	x	2.34	x	72.63	×	0.63	x	0.7	=	103.88	(75)
Northeast 0.9x	0.77	x	3.36	x	72.63	×	0.63	x	0.7	=	223.73	(75)
Northeast 0.9x	0.77	x	1.4	x	72.63	×	0.63	x	0.7	=	62.15	(75)
Northeast 0.9x	0.77	x	1.83	x	72.63	×	0.63	x	0.7	=	81.24	(75)
Northeast 0.9x	0.77	×	2.4	x	72.63	×	0.63	x	0.7	=	53.27	(75)
Northeast 0.9x	0.77	x	2.42	x	72.63	×	0.63	x	0.7	=	107.43	(75)
Northeast 0.9x	0.77	×	1.81	x	72.63	×	0.63	x	0.7	=	40.17	(75)
Northeast 0.9x	0.77	x	2.34	x	50.42	×	0.63	x	0.7	=	72.12	(75)
Northeast 0.9x	0.77	×	3.36	x	50.42	X	0.63	x	0.7	=	155.32	(75)
Northeast 0.9x	0.77	×	1.4	x	50.42	×	0.63	x	0.7	=	43.15	(75)
Northeast 0.9x	0.77	×	1.83	x	50.42	×	0.63	x	0.7	=	56.4	(75)
Northeast 0.9x	0.77	×	2.4	x	50.42	×	0.63	x	0.7	=	36.98	(75)
Northeast 0.9x	0.77	×	2.42	×	50.42	×	0.63	x	0.7	=	74.58	(75)

Northeast 0.9x	0.77	1 🗸	4.04	۱.	50.40	1 🗸	0.00	v	0.7	=	07.00	(75)
Northeast 0.9x	0.77) ×]	1.81	x	50.42	×	0.63	x	0.7	1	27.89	4
Northeast 0.9x	0.77) ×]	2.34	X	28.07	X	0.63	x	0.7	=	40.14	(75)
Northeast 0.9x	0.77] ×] ×	3.36	X	28.07	X X	0.63	x	0.7	=	86.46	(75) (75)
Northeast 0.9x	0.77	X 	1.4	X	28.07	X X	0.63	x	0.7	1	24.02	
Northeast 0.9x	0.77	X	1.83	X	28.07	X	0.63	x	0.7	=	31.39	(75)
Northeast 0.9x	0.77	X	2.4	x	28.07	X	0.63	x	0.7	=	20.59	(75) (75)
Northeast 0.9x	0.77] X] V	2.42	X	28.07	×	0.63	x	0.7	=	41.52	(75)
Northeast 0.9x] ×] v	1.81	x	28.07	×		x		=	15.53	(75)
Northeast 0.9x	0.77	x x	2.34	x x	14.2	x x	0.63	x x	0.7	=	20.31	(75)
Northeast 0.9x	0.77] ^] x	3.36	x	14.2	x	0.63	x	0.7		43.73	(75)
Northeast 0.9x	0.77] ^] x	1.4	x	14.2	x	0.63	x	0.7		12.15 15.88	(75)
Northeast 0.9x		1	2.4	1		1		x				(75)
Northeast 0.9x	0.77	∫ X] v	2.4	x x	14.2	x x	0.63	x	0.7	- _	10.41 21	(75)
Northeast 0.9x	0.77	x x	1.81	x	14.2	x	0.63	x	0.7		7.85	(75)
Northeast 0.9x	0.77] ^] x	2.34	x	9.21	x	0.63	x	0.7		13.18	(75)
Northeast 0.9x] ^] x		x		x		x		-		(75)
Northeast 0.9x	0.77	」^]x	3.36		9.21 9.21	×	0.63	×	0.7	=	28.39 7.88	(75)
Northeast 0.9x	0.77] ^] x	1.4	x	9.21	×	0.63	x	0.7		10.31	(75)
Northeast 0.9x	0.77] ^] x	2.4	x	9.21		0.63	x	0.7	=	6.76	(75)
Northeast 0.9x	0.77] ^] x	2.42		9.21	x	0.63	x	0.7	-	13.63	(75)
Northeast 0.9x	0.77	」 ^] x	1.81	x	9.21	×	0.63	x	0.7	-	5.1	(75)
Southeast 0.9x	0.77] ^] x	1.28	x	36.79	×	0.63	x	0.7	-	28.79	(77)
Southeast 0.9x	0.77] ^] x	2.38	x	36.79	x x	0.63	x	0.7	=	53.52	_(<i>11)</i> _(77)
Southeast 0.9x	0.77) ^ x	1.28	x	62.67	x x	0.63	x	0.7	=	49.03](<i>11)</i>](77)
Southeast 0.9x	0.77) ^ x	2.38	x	62.67	x	0.63	x	0.7	=	91.17	(77)
Southeast 0.9x	0.77) ×	1.28	x	85.75	x	0.63	x	0.7	=	67.09	(77)
Southeast 0.9x	0.77	」 】 ×	2.38	x	85.75	 x	0.63	x	0.7	=	124.75](77)
Southeast 0.9x	0.77	x	1.28	x	106.25	x	0.63	x	0.7	=	83.13	
Southeast 0.9x	0.77) x	2.38	x	106.25	x	0.63	x	0.7	=	154.57	(77)
Southeast 0.9x	0.77) x	1.28	x	119.01	x	0.63	x	0.7	=	93.11	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	×	0.63	x	0.7	=	173.13	(77)
Southeast 0.9x	0.77	x	1.28	x	118.15	×	0.63	x	0.7	=	92.44	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	×	0.63	x	0.7	=	171.87	(77)
Southeast 0.9x	0.77	x	1.28	x	113.91	x	0.63	x	0.7	=	89.12	(77)
Southeast 0.9x	0.77	x	2.38	×	113.91	×	0.63	x	0.7	=	165.71	(77)
Southeast 0.9x	0.77	x	1.28	x	104.39	x	0.63	x	0.7	=	81.67	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	×	0.63	x	0.7	=	151.86	(77)
Southeast 0.9x	0.77	x	1.28	x	92.85	×	0.63	x	0.7	=	72.64	(77)
Southeast 0.9x	0.77	×	2.38	x	92.85	×	0.63	x	0.7	=	135.07	(77)
Southeast 0.9x	0.77	x	1.28	x	69.27	x	0.63	x	0.7	=	54.19	(77)
L		-		1								-

Southeast 0.9x	0.77] ×	2.38	×	69.27	×	0.63	x	0.7	=	100.76	(77)
Southeast 0.9x	0.77) ×	1.28	x	44.07	x	0.63	x	0.7	 =	34.48](77)
Southeast 0.9x	0.77) ×	2.38	x	44.07	x	0.63	x	0.7	=	64.11](77)
L Southeast 0.9x	0.77	」 】 ×	1.28	x	31.49	 x	0.63	x	0.7	=	24.64](77)
L Southeast 0.9x	0.77	」 】 ×	2.38	x	31.49	l X	0.63	x	0.7	=	45.81](77)
Southwest _{0.9x}	0.77) x	3.36	x	36.79]	0.63	x	0.7	=	226.42](79)
Southwest0.9x	0.77	x	3.36	x	36.79]	0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	×	3.36	x	36.79	1	0.63	x	0.7	=	226.42	(79)
Southwest _{0.9x}	0.77	x	3.36	x	36.79	İ	0.63	x	0.7	=	188.69	(79)
Southwest0.9x	0.77	×	3.36	x	62.67	İ	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67	İ	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	×	3.36	x	62.67	Ì	0.63	x	0.7	=	385.68	(79)
Southwest _{0.9x}	0.77	x	3.36	x	62.67		0.63	x	0.7	=	321.4	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75		0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75]	0.63	x	0.7	=	527.71	(79)
Southwest _{0.9x}	0.77	x	3.36	x	85.75]	0.63	x	0.7	=	439.76	(79)
Southwest0.9x	0.77	x	3.36	×	106.25		0.63	x	0.7	=	653.85	(79)
Southwest0.9x	0.77	x	3.36	x	106.25		0.63	x	0.7	=	653.85	(79)
Southwest _{0.9x}	0.77] x	3.36	x	106.25		0.63	x	0.7	=	653.85	(79)
Southwest _{0.9x}	0.7 <mark>7</mark>	×	3.36	x	106.25		0.63	×	0.7	=	5 <mark>44.88</mark>	(79)
Southwest _{0.9x}	0.77	x	3.36	x	119.01		0.63	x	0.7	=	732.37	(79)
Southwest _{0.9x}	0.77	x	3.36	x	119.01		0.63	×	0.7	=	732.37	(79)
Southwest0.9x	0.77	x	3.36	x	119.01		0.63	x	0.7	=	7 <mark>32.37</mark>	(79)
Southwest _{0.9x}	0.77	x	3.36	x	119.01		0.63	x	0.7	=	610.31	(79)
Southwest _{0.9x}	0.77	x	3.36	x	118.15		0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	x	3.36	×	118.15		0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	x	3.36	×	118.15	ļ	0.63	x	0.7	=	727.07	(79)
Southwest _{0.9x}	0.77	x	3.36	×	118.15		0.63	x	0.7	=	605.9	(79)
Southwest _{0.9x}	0.77	x	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	x	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest _{0.9x}	0.77	×	3.36	x	113.91		0.63	x	0.7	=	700.98	(79)
Southwest0.9x	0.77	×	3.36	X	113.91		0.63	x	0.7	=	584.15	(79)
Southwest _{0.9x}	0.77	×	3.36	X	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	×	3.36	×	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	x	3.36	X	104.39		0.63	x	0.7	=	642.4	(79)
Southwest _{0.9x}	0.77	×	3.36	×	104.39		0.63	x	0.7	=	535.33	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	×	3.36	×	92.85		0.63	x	0.7	=	571.39	(79)
Southwest _{0.9x}	0.77	X	3.36	x	92.85		0.63	x	0.7	=	476.16	(79)

Southwest0.9x	0.77) ×	3.36	x	69.27		0.63	x	0.7	=	426.26	(79)
Southwest _{0.9x}	0.77) ^ x	3.36	x	69.27		0.63	x	0.7	=	426.26](79)
Southwest _{0.9x}	0.77	l x	3.36	x	69.27		0.63	x	0.7	 =	426.26	(79)
Southwest _{0.9x}	0.77	l x	3.36	x	69.27		0.63	x	0.7	=	355.22	(79)
Southwest _{0.9x}	0.77	^ x	3.36	x	44.07		0.63	x	0.7	=	271.2](79)
Southwest _{0.9x}	0.77	l x	3.36	x	44.07		0.63	x	0.7	 =	271.2	(79)
Southwest0.9x	0.77	l x	3.36	x	44.07		0.63	x	0.7	 =	271.2	(79)
Southwest _{0.9x}	0.77	×	3.36	x	44.07		0.63	x	0.7	 =	226](⁷ 9)
Southwest _{0.9x}	0.77	l x	3.36	x	31.49		0.63	x	0.7	=	193.77	(79)
Southwest0.9x	0.77] x	3.36	x	31.49		0.63	x	0.7	=	193.77](79)
Southwest _{0.9x}	0.77] x	3.36	x	31.49		0.63	x	0.7	=	193.77](79)
Southwest _{0.9x}	0.77	x	3.36	x	31.49		0.63	x	0.7	=	161.48	(79)
Northwest 0.9x	0.77	x	1.37	x	11.28	x	0.63	x	0.7	=	9.45	(81)
Northwest 0.9x	0.77	×	1.37	x	22.97	x	0.63	x	0.7	=	19.23	(81)
Northwest 0.9x	0.77	x	1.37	x	41.38	x	0.63	x	0.7	=	34.65	(81)
Northwest 0.9x	0.77	×	1.37	x	67.96	x	0.63	x	0.7	=	56.9	(81)
Northwest 0.9x	0.77	×	1.37	x	91.35	x	0.63	x	0.7	i =	76.49	(81)
Northwest 0.9x	0.77	×	1.37	×	97.38	х	0.63	x	0.7	=	81.55	(81)
Northwest 0.9x	0.77	x	1.37	x	91.1	x	0.63	x	0.7	=	76.29	(81)
Northwest 0.9x	0.77	x	1.37	x	72.63	×	0.63	x	0.7	=	60.82	(81)
Northwest 0.9x	0.77	x	1.37	x	50.42	x	0.63	x	0.7	=	42.22	(81)
Northwest 0.9x	0.77	x	1.37	x	28.07	x	0.63	x	0.7	=	23.5	(81)
Northwest 0.9x	0.77	×	1.37	x	14.2	x	0.63	x	0.7	=	11.89	(81)
Northwest 0.9x	0.77	x	1.37	x	9.21	x	0.63	x	0.7	=	7.72	(81)
Rooflights 0.9x	1	x	6.13	x	26.46	x	0.63	x	0.7	=	64.39	(82)
Rooflights 0.9x	1	x	6.13	x	53.3	x	0.63	x	0.7	=	129.69	(82)
Rooflights 0.9x	1	x	6.13	x	91.66	x	0.63	x	0.7	=	223.02	(82)
Rooflights 0.9x	1	x	6.13	x	139.87	x	0.63	x	0.7	=	340.3	(82)
Rooflights 0.9x	1	x	6.13	x	176.97	x	0.63	x	0.7	=	430.56	(82)
Rooflights 0.9x	1	x	6.13	x	183.63	x	0.63	x	0.7	=	446.78	(82)
Rooflights 0.9x	1	x	6.13	x	173.81	x	0.63	x	0.7	=	422.88	(82)
Rooflights 0.9x	1	x	6.13	x	145.57	x	0.63	x	0.7	=	354.17	(82)
Rooflights 0.9x	1	×	6.13	×	108.61	x	0.63	x	0.7	=	264.25	(82)
Rooflights 0.9x	1	×	6.13	×	64.26	x	0.63	x	0.7	=	156.36	(82)
Rooflights 0.9x	1	×	6.13	×	33.27	x	0.63	x	0.7	=	80.95	(82)
Rooflights 0.9x	1	×	6.13	×	21.59	x	0.63	x	0.7	=	52.52	(82)

Solar gains in	watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m .	(82)m				
(83)m= 1128.48	1980.04	2855.17	3769.99	4425.75	4480.65	4283.84	3782.91	3170.97	2228.46	1362.37	958.71		(83)
Total gains – i	nternal a	and solar	(84)m =	= (73)m -	⊦ (83)m	, watts							
(84)m= 2548.85 3395.95 4219.48 5048.63 5610.85 5582.01 5335.14 4844.7 4280.77 3424.27 2656.6 2333.02													(84)
7. Mean internal temperature (heating season)													
Temperature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisation fac	ctor for g	ains for l	iving are	ea, h1,m	(see Ta	ble 9a)							
Stroma ESAP 20	12 VErsion	1.0.4.3r(s	AP 995)	http://www	w.stroffia.o	_{:om} Jul	Aug	Sep	Oct	Nov	Dec	Page	9 of 12

														
(86)m=	1	1	0.99	0.96	0.88	0.73	0.58	0.64	0.87	0.98	1	1		(86)
Mear	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.42	19.61	19.91	20.3	20.63	20.85	20.92	20.9	20.73	20.29	19.79	19.41		(87)
Temp	perature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.67	20.68	20.68	20.68	20.69	20.69	20.69	20.7	20.69	20.69	20.68	20.68		(88)
Utilis	ation fac	ctor for g	ains for I	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.95	0.87	0.71	0.55	, 0.61	0.86	0.98	1	1		(89)
Mear	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	os 3 to	7 in Tabl	e 9c)				
(90)m=	18.37	18.64	19.04	19.59	20.02	20.3	20.38	20.37	20.16	19.57	18.89	18.36		(90)
									f	L LA = Livin	g area ÷ (4	4) =	0.04	(91)
Maar	interne		atura (fa		ala dura	llinger) fi	Δ Τ 4	. / 4 . 41	A) TO			l		
iviear (92)m=	18.41	1 temper	19.08	19.62	20.05	20.33	20.4	+ (1 – TL 20.39	A) × 12 20.19	19.6	18.92	18.4		(92)
		nent to t									10.92	10.4		(52)
(93)m=	18.41	18.68	19.08	19.62	20.05	20.33	20.4	20.39	20.19	19.6	18.92	18.4		(93)
		ating requ												
					re obtair	ed at ste	ep 11 of	Table 9	o, so tha	t Ti.m=(76)m an	d re-calc	ulate	
		factor for							,		- /			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilis	ation fac	ctor for g	ains, hm	:										
(94)m=	1	0.99	0.98	0.94	0.85	0.68	0.51	0.58	0.83	0.97	0.99	1		(94)
		hmGm	· ·	<u> </u>	-								1	
		3369.99					2731.87	2794.23	3541.77	3312.6	2641.88	2328.79		(95)
(96)m=	niy aver	age exte	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	_	e for mea									7.1	4.2		(00)
		10947.03		· · ·		4277.81	- /	2966.8	4596.53	Ē	9160.91	11119.25		(97)
		g require												
(98)m=		5091.77	4327.28	2535.83		0	0	0	0	2668.65	4693.7	6540.1		
		I				I	I	Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	33579.27	(98)
Spac	e heatir	ng require	ement in	kWh/m²	?/vear								27.46	(99)
		• •			•	untorno i	n olu olin o	miere (מווי			l	21.40	(/
		quiremer	nts – Indi	ividual n	eating s	ystems i	nciuaing	micro-C	, HP)					
-	e heati ion of si	n g: bace hea	at from s	econdar	v/supple	mentarv	svstem					[0	(201)
		bace hea				,		(202) = 1 ·	- (201) =				1	(202)
	-	ain heat		-	. ,			``	· · ·					(203)
			•	-				(204) = (2)	02) [1	(202)1 -			0.2	
		tal heati	•	-				(204) = (2	02) × [1 –	(203)] =			0.8	(204)
	-	main spa		• •									90.9	(206)
Effici	ency of	seconda	ry/supple	ementar	y heating	g system	ז, %			-			0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	/ear
Spac		ig require	r Ì	r										
	6494.18	5091.77	4327.28	2535.83	1227.76	0	0	0	0	2668.65	4693.7	6540.1		

(211)m	= {[(98	s)m x (20)4)]}x1	100 ÷ (20	06)									(211)
, ,		4481.2	· <u>··</u>	2231.75	r Ó	0	0	0	0	2348.65	4130.87	5755.87		
-								Tota	al (kWh/yea	ar) =Sum(2	211) _{15,101}	_	29552.71	(211)
•		•		y), kWh/	month									
= {[(98) (215)m=	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	01)] } x 1	00 ÷ (20	08) 0	0	0	0	0	0	0	0	0	1	
(213)11=	0	0	0	0	0	0	0	-	al (kWh/yea	-	-	-	0	(215)
Water	heating	u c								, ,	/15,101	2	0	
			ter (calc	ulated a	bove)		-			-		-		
	305.64	269.32	282.69	253.2	247.97	221.34	212.36	233.32	233	262.56	277.91	298.21		_
	-	ater hea	i								1		80.8	(216)
(217)m=	90.27	90.2	90.05	89.66	88.67	80.8	80.8	80.8	80.8	89.67	90.12	90.29		(217)
		heating, m x 100												
(219)m=	338.57	298.58	313.93	282.41	279.67	273.94	262.82	288.77	288.37	292.8	308.36	330.28		
•								Tota	al = Sum(2	19a) ₁₁₂ =			3558.49	(219)
	l totals									k	Wh/yea		kWh/year	
Space	heating	fuel use	ed, main	system	1								29552.71	
Water	neating	fuel use	d										3558.49	
Electric	ity for p	oumps, f	ans and	electric	keep-ho	t					_			
me <mark>cha</mark>	an <mark>i</mark> cal v	entilatio	<mark>n - b</mark> alar	nced, ext	tract or p	ositive i	nput fr <mark>o</mark> r	n outside	е			3600.97		(230a)
centra	l heatir	ng pump	:									120	i 👘	(230c)
Total e	lectricit	v for the	above,	kWh/yea	ur			sum	n of (230a).	(<mark>2</mark> 30g) =			3720.97	(231)
Electric				, in the second s									1874.19	(232)
		erated b	v D\/c										-1825.18	(233)
									۲				-1625.16	
12a. (JO2 en	IISSIONS ·	– inalvia	iual neal	ing syste	ens inci	uaing mi							
							lergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space	heating) (main s	ystem 1)		(21	1) x			0.2	16	=	6383.39	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	neating					(21	9) x			0.2	16	=	768.63	(264)
Space	and wa	iter heati	ng			(26	1) + (262)	+ (263) + ((264) =				7152.02	(265)
Electric	ty for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	1931.18	(267)
Electric	ity for l	ighting				(23	2) x			0.5	19	=	972.71	(268)
Energy	saving	/generat	tion tech	nologies	5									_
Item 1										0.5	19	=	-947.27	(269)
Total C	02, kg	/year							sum c	of (265)(271) =		9108.64	(272)
Dwelli	ng CO2	2 Emissi	on Rate	•					(272)	÷ (4) =			7.45	(273)
EI ratin	g (sect	ion 14)											90	(274)

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