

NORTHSTOWE PHASE 2 PLANNING APPLICATION

Energy Strategy

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Homes & Communities Agency

Northstowe Phase 2

Energy Strategy

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1 Introduction

This Energy Statement has been prepared by Hyder Consulting Ltd, on behalf of the HCA (hereafter referred to as the 'Applicant'), in support of the planning application for the Northstowe Phase 2 development.

The proposed energy strategy for the 'main Phase 2 development area' has been guided by the following key principles:

- To meet all relevant local and national planning policy
- To be an exemplar in sustainability (whilst maintaining technical and financial viability)
- To adopt a fabric first approach to ensure that carbon emission reductions are secured for the lifetime of the development
- To mitigate adverse impacts on the surrounding environment.
- To be flexible so as to provide longevity to any proposed strategy within an evolving climate. d
- To ensure the successful integration with the rest of the Northstowe development.

The statement provides a detailed account of the relevant planning policy and Building Regulations requirements to which the development will be constructed. The statement then establishes a baseline assessment of the predicted energy demans and associated carbon emissions (based upon current Building Regulations 2013) before investigating the potential means of achieving the developments energy reduction and carbon emission targets.

2 Development Overview

The proposed Northstowe Phase 2 development is located 10km northwest of Cambridge, east of Longstanton and North Oakington within the South Cambridgeshire District.

The main Phase 2 development area is approximately 165 hectares. The area is bordered to the east by the route of the Cambridgeshire Guided Busway, and to the west by Longstanton. The area includes the former Oakington Barracks, which currently comprises of three buildings, with no current use; slabs remaining from demolished buildings; remaining facilities associated with the barracks including sports amenities and green space; and a water tower which is the tallest structure on the site and visible feature in the wider landscape. The area surrounds the existing settlement of Rampton Drift, comprised of 92 properties, originally built as part of the barracks complex, although this area is not included in the application. The wider main Phase 2 Development area includes areas of hardstanding and open space associated with the former airfield (much of this currently occupied by agricultural tenants), farmland including Brookfield Farm and Larksfield Farm. The area also includes a section of Rampton Road.

Intervening vegetation results in the site being largely screened from surrounding villages and farmsteads. There are groups of trees throughout the former Oakington Barracks including avenues of mature trees around the barracks complex and leading to the station headquarter building. There are also groups of mature trees in the western corner of the site and around Rampton Drift. These all contribute to the setting of the site and adjacent Longstanton.

To the south of the main Phase 2 development area, and through which its proposed access routes run, is land that is identified for future phases of development of Northstowe. To the north of the site is the site of Northstowe Phase 1, for which an outline planning application was submitted by Gallagher Estates to South Cambridgeshire District Council in February 2012, and was granted in April 2014. The current uses of this site include agricultural fields and Cambridge Golf Club, which closed in August 2013.

The South Cambridgeshire Core Strategy has allocated Northstowe as a site for a sustainable new town with a target of up to 10,000 dwellings and associated facilities and non-residential areas. Phase 2 of the of the Northstowe development is comprised of 3,500 dwellings, two primary schools, the secondary school, the town centre, employment adjacent to the town centre, formal and informal recreational space and landscaped areas, the eastern sports hub, the remainder of the western sports hub (to complete the provision delivered at Phase 1), two primary roads to link to the southern access and the busway, engineering and infrastructure works.

Affordable housing will be provided as part of the development. The affordable housing will be 'pepper-potted' throughout the housing areas. The proportion of affordable housing to be provided will be determined as a part of a process of negotiation with the local planning authority on planning obligations.

Phase 2 includes the delivery of the town centre (~6.96 hectares) for Northstowe. Non-residential floorspace within the town centre comprises of approximately 57,500 sq.m. GIA. The precise use and layout of this area will be determined by subsequent reserved matters applications should outline planning permission be granted.

Provision has been made for the following types of uses to be located within the town centre: retail, F&B, health centre, civic hub, community meeting space, place of worship, youth facilities, crèche and library. Within the town centre area provision has been made for a town square. The extent of the town square is shown on the Landscape Parameter Plan. It extends to 0.28 hectares and is likely to be 51.55m x 54.31m.

2.1 Development Schedule

This is an outline application and therefore the assessment of energy demand and carbon emissions calculations can only be based on notional buildings. The following tables provide a summary of how the development of the site could come forward in line with the parameters and provides the notional residential unit mix and floor space areas that have been used as the basis for the basis of the energy demand and carbon emission calculations throughout.

Table 2.1 Potential mix of Residential Units

Dwelling Type	Total Units	Unit Area (m²)	Total Unit Area (m²)	No. of Occupants "N" SAP box 42
Town Centre 1 Bed Apartment (Ground Floor)	275	56.10	15,428	1.87
Town Centre 2 Beds Apartment (Mid Floor)	417	72.60	30,274	2.64
2 Beds House (Mid Terrace)	441	90.84	40,091	2.64
3 Beds House (Semi Detached)	1447	101.89	147,391	2.76
4 Beds House (End Terrace)	832	116.37	96,844	2.85
5 Beds House (Detached)	88	128.00	11,241	2.89
Total	3500		341,269	

Table 2.2: Potential floorspace for Non-Residential Units

Dwelling Type	Total Area	GIA (m²)
Secondary School	141,200	47,067
Primary School	48,500	16,167
Convenience Retail	-	10,000
Comparison/ Service Retail	-	25,000
Food and Drink	-	3,500
Office	-	16,200
Light Industrial	-	5,000
Leisure	-	10,000
Health, Community and Fitness Centre	-	6,000
Youth Facility	-	2,000
Place of Worship	-	1,000
Total		141,933

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3 Planning Policy Requirements and Targets

3.1 Introduction

This section provides a review of the relevant national, regional and local policy relative to energy and carbon emission reduction. A summary of current and future Building Regulations and the Governments approach to delivering zero carbon homes is also summarised. This is intended as an overview of the key policy and regulatory requirements that need to be met and considered as part of the scheme.

In addition, the aspirations of the client are highlighted to provide a concise and consolidated view of the targets that the scheme seeks to meet as it develops out.

The policy landscape around Climate Change has been rapidly moving with many new policies and changes to existing policy over the last number of years which will influence the way in which the energy strategy for the scheme may come forward. It is also safe to suggest that policy will continue to evolve over the period in which the development progresses; and therefore maintaining flexibility in any strategy is crucial to facilitating continued sustainable development.

3.2 National Planning and Policy Requirements

The Climate Change Act (2008)

The Climate Change Act 2008 introduced a legally binding target to reduce the UK's greenhouse gas (GHG) emissions to at least 80 per cent below 1990 levels by 2050. It also provides for a Committee on Climate Change (CCC) which sets out carbon budgets binding on the Government for 5 year periods.

In Budget 2009 the first three carbon budgets were announced which set out a binding 34% CO₂ reduction by 2020 and the Government has now proposed that the fourth carbon budget will be a 50% CO₂ reduction by 2025. The CCC also produces annual reports to monitor progress in meeting these carbon budgets. As a result of the Climate Change Act, a raft of policy at national and local level has been developed aimed at reducing carbon emissions.

The levels of the first three carbon budgets were set in fiscal budget 2009 at the "interim" level recommended by the CCC prior to global agreement on emissions reductions. The carbon budgets require a reduction in greenhouse gas emissions of 34%, against 1990 levels, by 2020. The fourth carbon budget level was set in June 2011. The carbon budget for the 2023–2027 budgetary period is 1,950,000,000 tonnes of carbon dioxide equivalent.

UK Low Carbon Transition Plan (2009)

The Labour Government launched the UK Low Carbon Transition Plan on 15th July 2009. The Plan includes the Renewable Energy Strategy (white paper) and Low Carbon Industrial Strategy. The UK Low Carbon Transition Plan is a Government white paper that sets out policies required to ensure that the UK meets its legally binding commitment to reduce carbon emissions by 34% by 2020. Policies contained in the documents include:

- Getting 40% of our electrical energy from low and zero carbon sources by 2020
- Rolling out smart meters in every home by 2020

National Planning Policy Framework

The National Planning Policy Framework was published on 27 March 2012 and sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

The NPPF was designed to make the planning system more user friendly and transparent. The framework's primary objective is sustainable development, focussing on the 3 pillars of sustainability: planning for prosperity (Economic), planning for people (Social) and planning for places (Environmental).

At the heart of the NPPF is a presumption in favour of sustainable development. The NPPF identifies 12 principles that should be at the core of land use planning; these include:

 "support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy)".

Further guidance within the NPPF is given under the heading "Meeting the challenge of climate change, flooding and coastal change"; including:

- supporting the delivery of renewable and low carbon energy infrastructure; and
- reduce greenhouse gas emissions

3.3 Building Regulations (Part L)

As part of the British Governments commitment to cutting carbon emissions by 80%, compared to 1990 levels (by 2050) the government is escalating Building Regulations requirements to reduce carbon emissions within the built environment. The government's proposed trajectory for Building Regulations Part L1A (Conservation of fuel and power in new dwellings) was outlined within Building a Greener Future: A Policy Statement (2007). This outlines the reductions in 'regulated' carbon emissions compared to a Building Regulations (2006) baseline outline in table 3.1 below:

Building type	Part L 2010	Part L 2013	Part L 2016	Part L 2018	Part L 2019
Domestic	25%	30%	Zero Carbon	Zero Carbon	Zero Carbon
Non – domestic	25%	32%	Further improvement	Zero Carbon	Zero Carbon

Table 3.1 Carbon reduction improvement compared to Building Regulations 2006

The latest Building Regulations (2013) came into effect on the 6th April 2014. As outlined above the principle aim for Part L 2013 is to:

- Provide a meaningful step towards the UK Government commitment to zero carbon standards for homes by 2016
- Drive innovation in the right direction

• Aid learning to deliver zero carbon homes.

The methodology for demonstrating compliance combines the carbon emission measure (kgCO₂/ m²/year) calculated for the dwelling, with a 'new' requirement to consider the fabric energy efficiency (FEE) (kWh/m²/year) of the building envelope. The process of demonstrating compliance uses the calculated carbon emission rate for the building in question and compares this to a target carbon emission rate, also calculated specifically for that building. In Part L terminology, the Dwelling Emission Rate (DER) must be less than the Target Emission Rate (TER). This approach is familiar from Part L 2010.

However, all residential dwellings in Phase 2 at Northstowe will come forward beyond 2016. Likewise, most non-residential (commercial and community etc.) buildings are expected to come forward post 2019. Therefore, the vast majority of buildings will need to achieve Zero Carbon, as defined by the Zero Carbon Homes policy, which represents the exemplar standard for the energy performance of dwellings.

Given the relatively minor reduction between 2010 and 2013 (6% for domestic and 9% nondomestic) the anticipated jump to zero carbon represents a major step change and will almost certainly require additional updates to Part L and how it is implemented. The traditional approach of building regulations is to assess the performance of a building considering only the energy use of the building and only those technologies attached to it and so directly affecting its carbon performance. If this approach were taken to zero carbon buildings it would rely on, extremely expensive, small scale renewable electricity generation. Inevitably this would mean that around half would not be able to meet the target and many of those that could meet the target would be economically unviable.

3.4 Achieving Zero Carbon

Residential Buildings

It was announced in the 2011 Budget 'The Plan for Growth' document, that a 'Zero Carbon Home' requires a 100% reduction in regulated energy (heating, hot water and fixed electrical items – pumps, fans, lights) over Building Regulations 2006. Therefore, emissions from cooking or from appliances such as computers and televisions are excluded from the definition.

The Government's commitment to achieving Zero Carbon Homes is based on the following hierarchical approach to achieving zero carbon targets:

- 1. Mandatory Fabric Energy Efficiency (FEE) Level To ensure energy efficiency by energy efficient building design.
- Mandatory onsite Carbon Compliance Level To ensure energy efficiency by energy
 efficient building design and to reduce carbon emissions through on-site low carbon and
 renewable energy technologies and near-site heat networks.
- 3. Mitigate the remaining carbon emissions through use of 'Allowable Solutions'.

Figure 3.1: Showing approach to achieving Zero Carbon homes.



In February 2011 recommendations for national minimum standards of Carbon Compliance – the onsite reductions of emissions – were developed by a Zero Carbon Hub led Task Group. The Task Group found that the proposal from July 2009, to tighten the Carbon Compliance standard by 70% (equivalent to 6 kg $CO_2(eq)/m^2/year$), may not be achievable in all cases. In addition, it was felt that the previous method of calculating carbon compliance level was confusing and now suggest that an absolute limit in terms of CO_2 emissions per m² floor area per annum be the measure used. These are provided in Table 3.2 below.

Built Form	Fabric Standard (kWh/m²/yr)	Carbon Compliance (kgCO₂/m²/yr)	
Detached houses	46	10	
Semi-detached houses	46	11	
End of terrace	46	11	
Mid terrace	39	11	
Apartment block	39	14	

Table 3.2: Proposed approach to achieving Zero Carbon homes

In addition, the task group are set to review and establish the Carbon Compliance limit for higher apartment blocks but the work is still ongoing.

It is proposed that the remainder of the regulated carbon emissions associated with the dwellings may be dealt with through the use of renewable technologies and/or the use of Allowable Solutions whereby each kg CO_2 emitted per annum must be matched by a saving in CO_2 off-site. In some instances this may not be possible, and therefore a financial contribution to either the CIL fund, Community Energy Fund (CEF) or some other energy related fund may be made. The pricing range is expected to between £36 and £90 per tonne with the financial impact modelled on the mid-range value of £60 per CO_2 tonne for 30 years.

It is envisaged that when the Northstowe site is developed, most of the buildings (if not all) will have to comply with the zero carbon requirements and so construction will have to take this into consideration.

As well as complying with the future zero carbon Building Regulations, there are further Code for Sustainable Homes and BREEAM requirements arising from the South Cambridgeshire Council's policy. These requirements are discussed Sections 3.6 and 3.7.

Non-residential Buildings

The equivalent definition of 'Zero Carbon' for non-domestic buildings has not progressed to the same level as that of dwellings. However it is expected that a similar framework (energy efficiency, on-site carbon compliance and allowable solutions) will be developed to ensure 'Zero Carbon' is achieved by 2019 (2018 for public sector buildings) for non-domestic buildings.

3.4.1 Allowable Solutions

Allowable solutions have been introduced to offer flexibility and options to offset remaining emissions (beyond carbon compliance), when other on-site options are not considered technically and commercially feasible. Therefore, allowable solutions are likely to become central to the overall policy of ensuring that achieving zero carbon is affordable and can be achieved.

However, the Government has not yet defined the scope or price of allowable solutions. It is also unclear as to how allowable solutions may be delivered. The Zero Carbon Hub (Allowable Solutions for Tomorrows New Homes, June 2011)) announced its proposals for a framework for allowable solutions. This was further refined within the Zero Carbon Strategies for Tomorrow's New Homes report released in February 2013.

According to these proposals, the initial choice for developers will be either:

- To pay into a carbon fund (Type 1 Allowable Solution). Here the payments from developers would be accumulated and the fund manager will take responsibility for investing in suitable Allowable Solutions projects - a wide range of carbon-saving projects could qualify as Allowable Solutions. It is expected that Local Planning Authorities will have the option to set up carbon funds and may establish local priorities for particular Allowable Solutions.
- 2. To invest in carbon-saving projects associated directly with their own developments (Type 2 Allowable Solution).

In July 2014 the Government released a summary of responses to the '*Next steps to zero carbon homes – allowable solutions*' consultation which ran from 6th of August to the 15th of October 2013. Within the report the Government announced its intention to adopt the following 4 routes, proposed in the consultation document, as part of the delivery model for allowable solutions:

- the house builder could do more or all carbon abatement on site or through connected measures (e.g. a heat network)
- the house builder could meet the remaining carbon abatement requirements themselves through their own off-site carbon abatement action (e.g. retrofitting existing buildings)
- the house builder could contract with a third party to deliver the carbon abatement measures sufficient to meet the house builder's zero carbon obligation.
- the house builder could make a payment into a fund which then invests in carbon abatement projects sufficient to meet the house builder's zero carbon obligation.

These routes are not mutually exclusive. Energy strategies will therefore be able to make use of a variety of measures such as:

- On-site allowable options This might include measures such as smart appliances, site-based heat storage, electricity storage, waste management systems, LED street lights, flexible demand systems, etc
- 2. Near-site allowable options This might include measures such as retrofitting low/zero carbon technologies to communal buildings, creation of local sustainable energy projects/infrastructure such as district heating or wind turbines, communal waste management, local energy storage, electric vehicle charging, etc.
- 3. Off-site allowable options This might include measures such as investing in energy from waste plants, low carbon electricity generation, district heating pipe-work, low carbon cooling, energy storage, flexible demand projects to counterbalance intermittent renewable energy provision, etc.

Allowable solutions will need to deliver the residual carbon emissions equal to that emitted by any new development. It is understood that the housing developers would pay an allowable solutions provider to deliver the required reductions. Recent DCLG consultation document discusses potential price cap strategy; of which some options would encourage competition between allowable solution providers ensuring that money is invested in the most cost-effective solutions. At present, a price cap has not been defined, however the DCLG consultation document proposes costs of between £36/tCO2 to £90/tCO2; which can make considerable difference to the total cost of achieving zero carbon and the final energy strategy for the development.

Based on the available information, it can be concluded that allowable solutions may be an important part in achieving a developments zero carbon target. Again, the extent to which allowable solutions may be implemented within the development will be determined in the detail design stage of the development, since it will then be possible to establish more accurate energy demands for the buildings.

At this stage, the option to consider the future incorporation of "Allowable Solutions" in the resulting energy strategy is consistent with the overall strategy and appropriate for this stage in the design of the development.

3.5 Local Policy

The current Local Development Framework (LDF) comprises a number of Development Plan Documents (DPDs) that set out policies and proposals for the development and use of land in the district. The LDF includes a vision for the future of South Cambridgeshire and objectives and targets, which developments must meet to secure that vision. The LDF consists of the following documents (considered relevant to Northstowe):

- Core Strategy DPD adopted January 2007
- Development Control Policies DPD adopted July 2007
- Northstowe AAP adopted July 2007
- Site Specific Policies DPD adopted January 2010

The Proposed Submission Local Plan for South Cambridgeshire is intended to update and replace the South Cambridgeshire Local Development Framework which was adopted between January 2007 and January 2010 and covered the period up to 2016. The draft Local Plan's policies and proposals cover the period 2011 to 2031. Underpinning the whole of the Plan is the Government's commitment to sustainable development.

3.5.1 South Cambridgeshire District Council – Core Strategy 2006

The Core Strategy allocates Northstowe to be developed as a new town of up to 10,000 new homes, with a town centre providing additional commercial areas. This proposal is the subject of a separate Area Action Plan (outlined below).

Objective ST/g of the Core Strategy reads as follows:

'To ensure development addresses sustainability issues, including climate change mitigation and adaptation issues'

3.5.2 South Cambridgeshire District Council - Development Control Policies DPD 2007

The following policies were deemed relevant to this statement:

POLICY DP/1 Sustainable Development

- 1. Development will only be permitted where it is demonstrated that it is consistent with the principles of sustainable development, as appropriate to its location, scale and form. It should:
 - f. Where practicable, minimise use of energy and resources;
 - g. Where practicable, maximise the use of renewable energy sources;
- 2. In criteria e, f, g, j and n it will be for any applicant or developer proposing to compromise sustainability to demonstrate the impracticability of use of sustainable methods, systems, materials and energy sources and provision of sustainable infrastructure. Additional cost will not, on its own, amount to impracticability.

POLICY NE/1 Energy Efficiency

- 1. Development will be required to demonstrate that it would achieve a high degree of measures to increase the energy efficiency of new and converted buildings, for example through location, layout, orientation, aspect, and external design.
- Developers are encouraged to reduce the amount of CO₂ m³ / year emitted by 10% compared to the minimum Building Regulation requirement when calculated by the Elemental Method in the current building regulations for a notional building of the same size and shape as that proposed, particularly for new or substantially demolished buildings.

Due to the age of this policy, the following should be noted:

The standard metric for CO₂ in terms of Building Regulations compliance is kg/m²/yr rather than kg/m³/yr. The former has therefore been used throughout this statement to demonstrate compliance. 'Current' refers to building regulation in place at the time of publication of this policy. This policy therefore requires a 10% improvement over Building Regulation 2006 using the CO₂ emissions rate (kg/m²/yr).

POLICY NE/2 Renewable Energy

The District Council will grant planning permission for proposals to generate energy from renewable sources, subject to proposals according with the development principles set out in Policies DP/1 to DP/3 and complying with the following criteria:

- 1. The proposal can be connected efficiently to existing national grid infrastructure unless it can be demonstrated that energy generation would be used on-site to meet the needs of a specific end user;
- 2. The proposal makes provision for the removal of the facilities and reinstatement of the site, should the facilities cease to be operational.

POLICY NE/3 Renewable Energy Technologies in New Development

All development proposals greater than 1,000 m^2 or 10 dwellings will include technology for renewable energy to provide at least 10% of their predicted energy requirements, in accordance with Policy NE/2.

Please note:

- This policy is understood to refer to total energy (regulated AND unregulated)
- This is superseded by item D13.4 of the Northstowe Area Action Plan (see below).

POLICY NE/16: Emissions Address Air Quality Issues

- Development proposals will need to have regard to any emissions arising from the proposed use and seek to minimise those emissions to control any risks arising and prevent any detriment to the local amenity by locating such development appropriately.
- 2. Where significant increases in emissions covered by nationally prescribed air quality objectives are proposed, the applicant will need to assess the impact on local air quality by undertaking an appropriate modelling exercise to show that the national objectives will still be achieved. Development will not be permitted where it would adversely affect air quality in an Air Quality Management Area.

3.5.3 Northstowe Area Action Plan (AAP)

This document provides site specific policy for Northstowe – which has been identified as a site for a sustainable new town with a target size of 10,000 dwellings and associated development.

The following section and policies of the AAP were deemed relevant to this statement:

SECTION B (Vision and Development Principles)

Item B.13 states that the buildings will:

'need to be sustainable – planned to take advantage of natural sunlight and manage internal temperatures, incorporating a high degree of energy efficiency. Opportunities for generating some of the town's own energy needs will need to be investigated to meet the requirement that 10% of energy should be from renewable sources.

POLICY NS/1: The Vision for Northstowe

Northstowe will be a sustainable and vibrant new community that is inclusive and diverse with its own distinctive local identity which is founded on best practice urban design principles, drawing on the traditions of fen-edge market towns, which encourages the high quality traditions and innovation that are characteristic of the Cambridge Sub-Region.

POLICY NS/2: Development Principles

- 3. The town of Northstowe will be developed:
 - g. To a flexible design which will be energy efficient, and built to be an exemplar of sustainable living with low carbon and greenhouse gas emissions and able to accommodate the impacts of climate change;

SECTION D13 (An Exemplar in Sustainability)

This section outlines the following sustainability objectives for Northstowe:

- D13/a To include within Northstowe, projects which are an exemplar in terms of the use of the earth's resources, including energy, water and materials.
- D13/b To contribute to the achievement of medium and long term emissions targets that move towards the Government's ambition of zero carbon development country-wide, with proposals seeking to achieve significant improvements sought by the Code of Sustainable Homes and significantly exceeding national standards set by Building Regulations subject to wider economic, viability and social testing.
- D13/c To use energy efficiently.
- D13/d To make greater use of renewable energy sources

Item D.13.4 states that:

'A major development of the scale of Northstowe, and the fact that it will be a freestanding new settlement, enhances the potential for a comprehensive approach towards the provision of energy. It offers the opportunity for innovative measures, including the use of renewable energy. Policy NE/3 of the Development Control Policies DPD requires the provision of technology for renewable energy to provide at least 10% of predicted energy requirements, but the Northstowe proposals should seek to do better where possible, aiming towards a target of 20% of predicted energy needs from renewable energy subject to wider economic, viability and social testing'.

POLICY NS/23: An Exemplar in Sustainability

- 1. Northstowe will include within the development exemplar projects in sustainable development, including energy efficient measures. This could be achieved by:
 - a. Providing an increased level of sustainability across the development as a whole above current requirements to a material extent;
 - b. Building a proportion of the development to advanced practice which fully addresses sustainability issues and minimises any environmental impact by pushing at the boundaries of the proven technology available at the time of the development.

3.5.4 Proposed Submission Local Plan

The Proposed Submission Local Plan (prepared in accordance with the NPPF) contains policies and land allocations to 2031. The draft Local Plan and its supporting documents were submitted to the Planning Inspectorate for independent examination which is scheduled to open in Autumn 2014. As such the emerging Local Plan is an important consideration in determining the proposals for Northstowe. The proposed energy strategy is therefore considerate to the following relevant policy within the draft Local Plan:

POLICY CC/2: Renewable and Low Carbon Energy Generation

- 1. Planning permission for proposals to generate energy from renewable and low carbon sources will be permitted provided that:
 - a. The development, either individually or cumulatively with other developments, does not have unacceptable adverse impacts on heritage assets (including their settings), natural assets, the landscape, or the amenity of nearby residents (visual impact, noise, shadow flicker, odour, fumes, traffic);
 - b. The development can be connected efficiently to existing national energy infrastructure or it can be demonstrated that the energy generated would be used for onsite needs only;
 - c. Provision is made for decommissioning once the operation has ceased, including the removal of the facilities and the restoration of the site; and
 - d. Developers have engaged effectively with the local community and local authority.
- 2. For proposals of 2 or more wind turbines, a minimum distance of 2 km between a dwelling and a wind turbine is set to protect residents from disturbance and visual impact. If the applicant can prove that this is not the case, a shorter distance would be considered.

POLICY CC/3: Renewable and Low Carbon Energy in New Developments

- 1. Proposals for new dwellings and new non-residential buildings of 1,000m2 or more will be required to reduce carbon emissions (over the requirements set by Building Regulations) by a minimum of 10% through the use of on-site renewable energy technologies.
- 2. This could be provided through the installation of an integrated system or site wide solutions involving the installation of a system that is not integrated within the new building. For a site wide solution, evidence must be submitted demonstrating that the installation is technically feasible and is capable of being installed.
- 3. For growth areas and new settlements, site wide renewable and low carbon energy solutions that maximise on-site generation from these sources will be sought, such as renewable and low carbon district heating systems.

3.6 Development Framework Document

In 2012 The Development Framework Document (DFD), along with a suite of documents, refreshed the master plan for Northstowe by making it relevant to today's circumstances.

The DFD confirms that the vision for Northstowe has progressed and responded to national and local policy, independent challenge and stakeholder involvement. It confirms that the vision is based on the core characteristics (the four C's) of the Cambridgeshire Quality Charter for Growth:

"planned growth of sustainable and vibrant new communities in accordance with four themes: Community, Climate, Connectivity and Character"

And that the development should move "towards low carbon with a combination of energy efficient solutions, local food production, green travel, innovative technology and communications systems and waste recycling centre to demonstrate Northstowe as an exemplar in sustainable living".

An addendum to the DFD (An Exemplar of Sustainable living) confirms the following 'relevant' environmental qualities are identified as part of the supporting framework for the Northstowe Development:

- Building adaptation to the impacts of climate change
- Efficient use of water resources
- The provision of exemplar buildings in relation to renewable resources, energy efficiency and sustainable construction products and methods
- On and / or offsite renewable energy or very low carbon technologies (solar, biomass and wind) that exceeds the standard 10% on-site creation aiming for the target of 20%
- A reduction of carbon emissions aiming to exceed the planning policy requirement of a minimum of 10% below building regulation standards (NAAP 2007)

3.7 Code for Sustainable Homes

To strengthen the sustainability requirements of new dwellings, the Government launched the Code for Sustainable Homes (CSH or 'the Code') in 2006 to operate in parallel to the Building Regulations for energy use for new residential development (Approved Document Part L1A).

CSH sets out the national standard for sustainable design and construction of new homes. The Code includes sections under a number of different sustainability issues which includes; energy use in a home, materials used in the construction and the effect on biodiversity. The Code also addresses issues such as water use within each dwelling, surface water and flooding, health and wellbeing and pollution issues. This document only considers the energy/carbon aspect of the Code.

As discussed above, Part L of the Building Regulations (Conservation of fuel and power) will progressively become more stringent and will eventually require all new dwellings built from 2016 onwards to achieve "zero carbon" status.

The Code for Sustainable Homes (CSH) was introduced as a voluntary measure to provide a comprehensive assessment of the sustainability of a new home and replaced the Eco-Homes methodology. In terms of carbon emissions CSH Level 4 equals a 25% improvement over 2010 Building Regulations (this would equate to circa 20% improvement from 2013 Building Regulations) approximately. The original programme was for all new homes to meet 'Zero carbon' from 2016. The Code Level relates to; compliance with mandatory minimum standards for waste, material, and surface water run-off as well as energy and potable water consumption.

It should be noted however that the Government recently announced in the Housing Standards Review (March 2014) their intention to wind down the Code for Sustainable Homes in a further bid to cut regulatory red tape for house builders.

Under the proposals set out in the consultation document the government indicated that it could "wind down" the Code for Sustainable Homes (CSH) in favour of using the Building Regulations as the key vehicle to provide energy requirements for buildings.

3.8 BREEAM

BREEAM (Building Research Establishment's Environmental Assessment Method) is a standard assessment method established by the Building Research Establishment (BRE), used to assess the environmental impact of non-domestic buildings. Overall BREEAM is similar to the Code and covers a range of issues and credits which are awarded where a building achieves a benchmark performance. Like the Code, BREEAM is a voluntary standard although central government and some planning authorities require compliance.

The BRE periodically updates BREEAM and the latest version of BREEAM New Construction came into force in May 2014. The latest version imposes more demanding standards and energy/carbon requirements than the previous standard. Because BRE have applied previous best practice carbon standards before the government has fully decided how to address the future carbon performance of nondomestic buildings, it is likely that the requirements will need to be changed again in the future to align with Part L (2013 and 2016) requirements.

BREEAM (2014) has the following mandatory energy requirements:

- Excellent: Energy Performance Ratio for New Construction of 0.375
- Outstanding: Energy Performance Ratio for New Construction of 0.60

3.9 Summary of Policy Requirements

The various policy and regulations requirements are summarised in table 3.3 below:

Table 3.3: Summary of Northstowe Energy Requirements

Policy	Document	Requirement
NE/1 Energy Efficiency	LDF Development Control Policies DPD, Adopted 2007	10% CO_2 reduction from 2006 Building Regulations
NE/3 Renewable	LDF Development Control Policies DPD, Adopted 2007	10% energy provided by on-site renewable technology
NS/23 An Exemplar in Sustainability	LDF Northstowe Area Action Plan DPD, Adopted July 2007	Aspiration to achieve 20% of predicted energy needs from renewable technology
CSH Level 4 – Ene 1 Dwelling Emission Rate	CSH 2010 Technical Note	25% improvement on 2010 Building Regulations
BREEAM Very Good rating	BREEAM New Construction 2011	No minimum requirement for Very Good
Building Regulations	Building Regulations 2016 (anticipated)	Zero Carbon from regulated energy

4 Methodology

The carbon dioxide emissions have been calculated by utilising the Building Regulations standards for domestic units; for non-domestic units an estimation has been made using the available benchmarks:

- Residential units: The Government's Standard Assessment Procedure (SAP) for Energy Rating of Dwellings.
- Non-domestic units: Chartered Institute of Building Services Engineers (CIBSE) Energy Benchmark TM 46 - 2008

4.1 Residential Emissions Calculation Methodology

The Target Emissions Rates (TER) for residential units of the proposed development were taken from the SAP (The Government's Standard Assessment Procedure for Energy Rating of Dwellings) assessment performed by using the Stroma FSAP software version 2009.

A sample set of dwellings were selected with the intention of demonstrating the potential energy demands of the proposed residential units. The following dwelling types have been modelled, with the range of dwelling geometries for each type to cater for the worst case:

- Town Centre 1 Bed Apartment (Ground Floor)
- Town Centre 2 Beds Apartment (Top Floor)
- 2 Beds House (Mid Terrace)
- 3 Beds House (Semi Detached)
- 4 Beds House (End Terrace)
- 5 Beds House (Detached)

The above dwellings have been modelled by using SAP software to estimate the TER emissions and energy demands which are covered by Part L of the Building Regulations, known as regulated emissions including space heating, hot water, ventilation, lighting, pumps and fans.

The unregulated emissions i.e. appliances and cooking have been estimated by utilising the SAP methodology formula A(iii) below.

- A. Calculate the non-regulated carbon emissions (appliances & cooking) by:
 - i. For elec oven, elec hob:

```
{275 + (55 \times N) + 207.8 \times (N \times TFA)^{0.4714}} \times 0.527
```

ii. For elec oven, gas hob:

 $\{137.5 + (27.5 \times N) + 207.8 \times (N \times TFA)^{0.4714}\} \times 0.527 + \{280.5 + (48.15 \times N)\} \times 0.227$

iii. For gas oven, gas hob:

{481 + (96.3 x N)} x 0.227 + {207.8 x (N x TFA)^{0.4714}} x 0.527

Where N = number of occupants, defined in SAP2009 (Table 1b) by:

The above formula has been taken from Carbon Compliance Zero Carbon Hub's document, Modelling 2016 using SAP 2009 Technical Guide.

4.2 Non-Residential Emissions Calculation Methodology

The Chartered Institute of Building Services Engineers (CIBSE) describes the statutory building energy benchmarks prepared to complement the Operational Rating procedure developed by the Department of Communities and Local Government (CLG) for Display Energy Certificates (EPC) for use in England, Wales and Northern Ireland.

CIBSE carried out various studies and develops the benchmark proposals based upon CIBSE Guide F and Energy Consumption guide ECG19. There are currently 29 benchmark categories listed under this document, which also sets the energy consumption benchmarks of a typical building type. The benchmarks are expressed in terms of delivered energy used per unit of floor area, (i.e. kWh/m²) for both electrical and fossil fuel of energy use. This generally covers lighting, heating, cooling, appliances, standard IT and small tea rooms/spaces.

The following non-domestic units have been used to estimate the energy demands on the basis of their gross internal area,

- A1/A2 Shops Retail shops and services etc.
- A3 Food & Drink Restaurants/ Café
- B1 Business Office/ Light Industrial
- D2 Assembly & Leisure
- Schools & education establishments
- Public Buildings

The above building classification has been use to estimate the target emissions under Building Regulations 2013. At this outline stage this is the best practice approach which can be adopted to demonstrate the carbon emissions and proposed improvements. These predicted energy demands and emissions have used for estimation purposes, however, it is recognised that more detailed energy modelling will be undertaken at later design stage when building detailed designs have been formalised.

5 Baseline Energy Demand and Carbon Emission

In order to establish the approximate baseline energy demand (both thermal and electrical) for the development, an energy model has been produced. This is an outline application and therefore the assessment of the proposed design solution is based on the energy consumption of 'notional' domestic and non-domestic buildings on site which are compliant with Part L 2013 Building Regulations.

The residential energy demand was calculated using information regarding regulated energy consumption abstracted from a series of sample Standard Assessment Procedure (SAP) reports developed to provide typical residential dwelling types to develop preliminary energy benchmarks for domestic buildings. The assumptions on which the SAP calculations have been undertaken are as follows:

- Roof sizes are estimated as the exact roof dimensions are not available;
- Quantities and dimensions of openings (windows and doors) for each dwelling type are estimated;
- The differing types of openings and their dimensions are assumed to be the same for all dwelling types;
- Cooling is assumed not to be provided to any of the dwellings;
- Natural ventilation
- All internal and external lighting used throughout the dwellings is energy efficient.

A conservative approach has been adopted in the assumptions made for the purposes of the SAP calculations. This approach gives a degree of comfort since neither the worst case or best-case scenario is used and therefore incorporates an element of flexibility.

The energy consumption for space heating, hot water and electricity for lighting, pumps and fans per m² have been determined and derived from sample SAP's for each typical dwelling. The average energy consumption for space heating, hot water and electricity for lighting per m² was calculated which is used as an energy benchmark for the energy demand assessment of each dwelling type.

Given that this is an outline planning application, there is still some uncertainty about the energy needs of the future occupants of non-domestic buildings. Without knowing the occupants or precise uses of the proposed units, it is difficult to accurately predict the energy demand. As such, standard benchmarks taken from CIBSE publication TM46 2008 and Guide F have been used to estimate as far as possible non-domestic energy use but there are a couple of issues with this approach. Firstly, there are multiple benchmarks for B1-B2 uses with wide differences between chilled and standard units and, secondly, the benchmarks are intended to be representative of the UK building stock as a whole and so tend to estimate higher heat demand than would typically be required for new buildings. This approach will tend to overestimate the overall energy demand.

Therefore, the non-domestic energy benchmarks, which reflect Part L 2013 Building Regulations and have been determined by assuming that the CIBSE TM46 and GUIDE F energy benchmarks, are reflective of energy consumption of 2006 Part L compliant buildings and so have been reduced by 10% to obtain the energy demand for non-domestic buildings.

These benchmarks were used in the energy model to determine the baseline energy demand.

The following tables provide a summary of the energy demand and carbon emission relative to anticipated accommodation schedule of the Phase 2 Northstowe development. The tables provide the baseline energy demand and carbon emission values based upon meeting Building Regulations 2013.

Table 5.1	Residential -	Baseline	Energy	Demand	and Carbon	Emission	(Building
Regulations	s 2013)						

TOTAL	34,960,677 kWh	11,096,277 kgCO2
	12,601,750 KWN	5,755,967 kgCO2
Sub Total Up regulated	12 601 750 kWb	5 755 067 kaCO2
Total Un-regulated Gas	2,588,586 kWh	559,135 kgCO2
Total Un-regulated Electricity	10,013,164 kWh	5,196,832 kgCO2
Sub Total Regulated	22,358,927 kWh	5,340,310 kgCO2
Total Regulated Fossil Gas	20,673,178 kWh	4,465,407 kgCO2
Total Regulated Electricity	1,685,749 kWh	874,904 kgCO2
Residential Buildings	BR2013 Building Demand	BR2013 Building Emissions

Table 5.2Non - Residential - Baseline Energy Demand and Carbon Emission (BuildingRegulations 2013)

Non – Residential Buildings	BR2013 Building Demand	BR2013 Building Emissions
Total Regulated Electricity	8,434,942 kWh	4,377,735 kgCO2
Total Regulated Gas	14,074,026 kWh	3,039,990 kgCO2
Sub Total Regulated	22,508,968 kWh	7,417,724 kgCO2
Total Un-regulated Electricity	9,269,167 kWh	4,810,698 kgCO2
Total Un-regulated Gas	3,942,938 kWh	851,675 kgCO2
Sub Total Un-regulated	13,212,104 kWh	5,662,372 kgCO2
TOTAL	35,721,072 kWh	13,080,096 kgCO2

The below table provides a summary of the total energy demand and carbon emission for the proposed Phase 2 Northstowe development.

Table 5.3All Buildings - Baseline Energy Demand and Carbon Emission (Building
Regulations 2013)

All Buildings	BR2013 Building Demand	BR2013 Building Emissions	
Total Regulated Electricity	10,120,690 kWh	5,252,638 kgCO2	
Total Regulated Gas	34,747,204 kWh	7,505,396 kgCO2	
Sub Total Regulated	44,867,895 kWh	12,758,034 kgCO2	
Total Un-regulated Electricity	19,282,330 kWh	10,007,529 kgCO2	
Total Un-regulated Gas	6,531,524 kWh	1,410,809 kgCO2	
Sub Total Un-regulated	25,813,854 kWh	11,418,339 kgCO2	
TOTAL	70,681,748 kWh	24,176,373 kgCO2	

Strategic Approach and Carbon Reduction Targets

This report considers the strategic energy strategies that may be adopted at the site to meet policy and regulatory requirements as well as client aspirations. The following energy hierarchy has been utilised:

- 1. **Be Lean:** Use less energy. Minimise energy demand through efficient design and the incorporation of passive measures;
- 2. **Be Clean:** Supply energy efficiently. Reduce energy consumption through use of low-carbon technology; and
- 3. Be Green: Use renewable energy systems.

6



The first principle stresses the primacy of seeking to reduce energy consumption. Within the built environment this comprises adopting energy efficiency measures in both the design and construction of new buildings. The second principle addresses the 'clean' supply of energy issue. This will require 'decarbonising' and improving efficiency in the generation and distribution of energy. The third principle comprises the use of 'green' energy systems. These are renewable sources of energy with low or zero carbon emissions and include, amongst others, solar generated heat and power, wind energy and biomass.

In order to achieve the expected 2016 Zero Carbon target the 'regulated' carbon will need to meet the following levels:

Table 6.1 Regulated Carbon Emission Targets

All Buildings	BR2013 Baseline Emissions	Carbon Compliance Target	Zero Carbon Homes Target
Total Regulated Electricity	5,252,638 kgCO2	4,054,175 kgCO2	0 kgCO2
Total Regulated Gas	7,505,396 kgCO2	5,537,403 kgCO2	0 kgCO2
Total Regulated	12,758,034 kgCO2	9,591,578 kgCO2	0 kgCO2

To achieve the Carbon Compliance Target, as defined by the Zero Carbon Hub, the regulated CO_2 emissions will need to be reduced by a minimum of 3,166,457 kgCO₂ (based upon Carbon Compliance (kgCO₂/m²/yr) limits provided in table 3.2). Following the initial energy efficiency measures and the introduction of renewable technology any remaining reductions required to achieve 'Zero Carbon' will be achieved through application / integration of further Low Zero Carbon (LZC) technology and/or 'Allowable Solutions'.

The following sections identify the potential options and strategy proposed for the Northstowe Phase 2 development.

7 Energy Efficiency Measures (Be Lean)

7.1 Approach

The 'Be Lean' approach seeks to minimise energy use through demand reduction and passive measures, such as maximising insulation and use of natural ventilation, which minimise the use of energy and utilise energy more effectively (e.g. energy efficient lighting). The Northstowe development will adopt appropriate future proofed building standards to ensure energy efficiency is the first priority in achieving its carbon reduction and sustainability objectives.

A range of measures to reduce carbon emissions and increase resilience to climate change proposed for Northstowe are listed below.

Passive Design	Technology
Air tightness	"A" rated appliances
Insulation	Automatic controls and monitoring
Reduced thermal bridging	Energy management systems
Solar shading	Energy efficient lighting
Use of natural daylight	Energy efficient systems
Natural ventilation	
High performance glazing	

Table 7.1 Building Energy Efficiency Measures

Passive design is the process of best employing the conventional elements of construction to reduce energy consumption and to maximise the use of the natural elements such as daylight, sunlight and natural ventilation. The simplest and most effective method of achieving carbon reduction is often initially through the passive measures proposed above (and in section 7.2 below).

The development is proposed to be designed to utilise natural daylight in all the habitable spaces for the health and wellbeing of the building occupants. All the domestic units will incorporate suitable window sizes relative to living spaces and bedrooms. This will allow the development to achieve good daylighting standards as well as controlling solar gains. The careful choice of glazing and window U values will maintain the solar gain and also minimise the solar intensity to reduce potential overheating impact.

The development is also intended to incorporate high efficiency lighting throughout. The proposed target is to provide 100% of all light fittings as low energy lighting, and will accommodate the compact fluorescent or fluorescent luminaires only.

7.2 Fabric Energy Efficiency Standards (FEES):

The FEES of a building is a performance standard to measure the heating and cooling demands of the building and is measured in kWh/m²/year. As mentioned previously the baseline has been considered to demonstrate compliance with current 2013 Building Regulations. However, due to the anticipated build out period for this development, it is reasonable to consider how the development may be future proofed relative to the 2016 Building Regulations and zero carbon building requirements. As such appropriate FEES criteria have been adopted in accordance with the FEES targets identified in Table 3.2.

The heat loss of building elements is dependent upon their U-value. The lower the U-value the better the level of insulation which will improve the thermal performance of the building and help to reduce the CO₂ emissions due to reduced space heating demands. The proposed residential units will incorporate high levels of insulation and high efficiency glazing.

Another cause of heat loss is air infiltration / permeability. In 'leaky' buildings the heat loss can occur through wind, internal / external pressure difference, stack effect etc. However, the careful design of appropriate air tightness can significantly reduce heat loss and save energy. The table below provides the breakdown of proposed U values and air tightness to attain the FEES targets.

Property Type	Floor (W/m2.K)	Wall (W/m2.K)	Roof (W/m2.K)	Window (W/m2.K)	Door (W/m2.K)	Air tightness (m3/h.m2)
1 Bed Apartment	0.14	0.18		1.2	1.0	4
2 Beds Apartment		0.18	0.10	1.2	1.0	4
2 Beds House	0.14	0.18	0.10	1.2	1.0	4
3 Beds House	0.14	0.20	0.10	1.2	1.0	4.5
4 Beds House	0.14	0.20	0.10	1.2	1.0	4.5
5 Beds House	0.14	0.20	0.10	1.2	1.0	4.5

Table 7.2 Proposed U Value and Air Tightness

Attaining these U Values and air tightness will be a significant improvement upon existing Building Regulations, and will enable the following FEES to be achieved for each dwelling type. This will future proof this build quality of this development to enable future zero carbon targets to be achieved.

Table 7.3 Fabric Energy Efficiency Standard (FEES) results for each building type

Bronorty Typo	FEE		
Рюренту Туре	(kWh/m2/Year)		
1 Bed Apartment	37.4		
2 Beds Apartment	38.8		
2 Beds House	39.0		
3 Beds House	44.3		
4 Beds House	42.9		
5 Beds House	43.6		

Climate Change Adaptation

The balance between ensuring good insulation and air tightness to minimise heat loss in the winter months and potential overheating in the summer months need to be carefully considered.

Adopting the ZCH recommended FEE standards ensures a highly efficient fabric capable of reducing the need for heating in the winter months through the minimisation of heat loss and protects the building against future temperature increases, and potential cooling requirements, through appropriate air tightness and ventilation standards.

7.3 Reduced Energy Demand and Carbon Emissions

The standards described in this section have been incorporated within the design and result in energy demand reduction of regulated energy and carbon emissions savings. The table below gives the breakdown of energy consumption and carbon emissions for space heating, hot water, lighting, pumps and fans (regulated energy) for domestic buildings and non-domestic units.

Table 7.4 All Buildings – Enhanced FEE Energy Demand and Carbon Emission

	Enhanced FEE	Enhanced FEE	
All Buildings	Demand	Emissions	
Total Regulated Electricity	10,120,690 kWh	5,252,638 kgCO2	
Total Regulated Gas	33,022,422 kWh	7,132,843 kgCO2	
Sub Total Regulated	43,143,112 kWh	12,385,481 kgCO2	
B'Regs 2013 Baseline	44,867,895 kWh	12,758,034 kgCO2	
Carbon Compliance Target	33,447,636 kWh	9,591,578 kgCO2	
Total Un-regulated Electricity	19,282,330 kWh	10,007,529 kgCO2	
Total Un-regulated Gas	6,531,524 kWh	1,410,809 kgCO2	
Sub Total Un-regulated	25,813,854 kWh	11,418,339 kgCO2	
TOTAL	68,956,966 kWh	23,803,820 kgCO2	
B'Regs 2013 Baseline	70,681,748 kWh	24,176,373 kgCO2	
B'Regs 2010 (+6%)		25,719,545 kgCO2	
B'Regs 2006 (+25%)		34,292,726 kgCO2	

By adopting enhanced fabric efficiency standards in all residential dwellings, the total energy demand across the site is reduced by circa 2.5% (comprising a 4% improvement in residential dwelling thermal demand). This reduces the sites carbon emission by 1.5% (again from a 4% reduction in carbon emissions arising from residential thermal demand).

The 1.5% improvement in emissions over Building Regulations (2013) equates to an approximate reduction of 30% over Building Regulations (2006). The emissions reductions secured through improvements to the fabric energy efficiency are therefore substantially greater than the 10% required by Policy NE/1 of the LDF Development Control Policies DPD (2007).

8 Appraisal of Low and Zero Carbon Technology (Be Clean and Be Green)

8.1 Introduction

After the initial savings through energy efficiency measures, the next step in a Sustainable Energy Strategy is the consideration of 'onsite' low carbon (be clean) and renewable energy (be green); also referred to as low and zero carbon (LZC) technology. Section 8.6 below examines the applicability and appropriateness of each technology for Phase 2 of the Northstowe development.

Utilising energy generated locally (onsite) reduces energy lost through transmission and distribution, and can often take advantage of more advanced generating technologies that combine to provide energy more efficiently. Local generation, or decentralised generation, is produced on a smaller scale nearer to the point of consumption and can offer a number of benefits, including:

- Using generated energy more efficiently by reducing distribution losses
- Contributing to security of energy supply by increasing local energy production
- Increasing reliability of supply providing the opportunity to operate 'on or off grid'
- Reducing carbon emissions through more efficient use of fossil fuels and greater use of locally generated renewable energy
- Provides the opportunity to create stronger links between energy production and consumption.
- Can be linked to fund complementary programmes of work, such as retrofitting microgeneration equipment in existing housing stock.
- Provides a visible message of commitment to sustainable energy

Zero Carbon or renewable energy comes from harnessing natural energy flows from the sun, wind, or rain. Many such as solar wind and hydro, directly produce energy and do no emit any carbon dioxide in the process. Others such as biomass, use solar energy to grow renewable plant material that can subsequently be used for energy. Examples here are wood, straw, etc. However, biomass use still generates carbon dioxide when it is burnt. The difference being that this carbon is only that taken from the atmosphere when the plant grew. This is unlike carbon emissions from fossil fuels that are essentially new to the atmosphere, causing increases in atmospheric carbon dioxide levels and climate change. Therefore, when used to replace fossil fuels, biomass leads to a net reduction in carbon emissions; particularly where local supply chains can provide a sustainable supply of biomass.

Of the available renewable energy technologies, some are 'intermittent' in nature, such as solar and wind. Others such as biomass, ground source heat pumps and anaerobic digestion can service baseload duties.

The table below identifies the energy generation technologies and approaches considered.

Table 8.1 LZC Technologies

Macro Solutions	Micro Solutions	
(typically district scale or larger)	(typically building related)	
Anaerobic Digestion CHP	Air source heat pumps	
Biomass heat, biomass power (CHP)	Ground source heat pumps	
Gas CHP	Solar Thermal (building mounted)	
Large scale PV array	Solar Photovoltaic (building mounted)	
Large scale wind energy	Wind energy (building mounted)	

8.2 Macro Technologies to be Appraised

8.2.1 Anaerobic Digestion

Anaerobic digestion (AD) involves the breakdown of biodegradable material in the absence of oxygen by micro-organisms called methanogens. It is already widely used to treat wastewater in the UK and can also be used to treat other organic wastes, including domestic and commercial food waste, manures and biofuel crops.

There are two main types of anaerobic digestion called thermophilic and mesophilic – the primary difference between them is the temperatures reached in the process. Thermophilic processes reach temperatures of up to 600C and mesophilic normally runs at about 35-400C.

The system chosen will largely depend on the feedstock to be processed. For example, 'high solid materials', such as a garden and food waste mixture, tend to be processed at a thermophilic temperature using the batch system, while 'low solid materials', such as animal slurry mixed with industrial and municipal food wastes, are more likely to be processed at a lower temperature using a continuous flow system.

The process of anaerobic digestion provides a source of renewable energy, since the food waste is broken down to produce biogas (a mixture of methane and carbon dioxide), which is suitable for energy production. The biogas can be used to generate electricity and heat to power on-site equipment and the excess electricity can be exported to the National Grid.

AD systems require large plant and storage space for successfully running the digestion process. Due to the odour, waste storage and fuel combustion emissions issues associated with this technology, the AD plants are normally located away from residential properties. Operationally there would be a requirement to capture additional organic waste from outside the development to provide sufficient 'fuel' to generate biogas to power a reasonably sized CHP.

8.2.2 Gas-fired CHP

Traditional coal and gas fired power stations lose vast amounts of the heat produced during the generation process. Combined Heat and Power (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process. CHP generates electricity and produce usable heat at the same time. The specific technologies employed, and the efficiency they achieve will vary however the CHP system offers the capability to make more efficient and effective use of valuable primary fuel resources. The CHP system helps to avoid significant energy losses and reduces CO_2 emissions; hence CHP units can be up to 90% efficient.

Gas turbines generate power by means of the Brayton cycle and a working gas (typically ambient air) is compressed in the compressor, then fed with fuel and ignited. The high temperature high pressure combustion products are then expanded through turbines to generate shaft power for the compressor and the electrical generator. The action generates power and at the same time waste heat also leaves the gas turbine in the form of hot exhaust gases (\approx 500 °C).

Gas fired CHP systems could be sized to provide sufficient heat to meet the space heating and hot water demands of the development. This solution would also contribute to meeting the electrical needs of the development at the same time and therefore benefit the development in both ways.

Upfront investment and space is required for an energy centre to house the gas CHP, back up boiler(s) and thermal store to make the system effective; as well as the installation of a district heat network (at circa £500 to £1,100 per meter), which can add another layer of complexity in coordinating services but can remove the need to install natural gas mains throughout the development depending on the choice of cooking fuel.

8.2.3 Biomass Boiler / CHP

Biomass is any organic matter, typically plant-based, that is available on a renewable or recurring basis. Biomass resources include forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, fast growing trees and plants, and municipal and industrial waste. Biomass can be used in solid form or gasified for heating applications or electricity generation, or it can be converted into liquid or gaseous fuels. The use of biomass to produce heat and power can be environmentally beneficial because biomass is a renewable resource and its combustion does not contribute additional greenhouse gases to the atmosphere.

Biomass can be used to fuel boilers to deliver hot water to meet thermal demands and/or utilised as a fuel for CHP engines. There are two established processes for delivering biomass CHP in small to medium size applications (200KWe – 2.5MWe range): Organic Rankine Cycle (ORC) and Gasification technology. Due to the renewable nature of the fuel source it has an improved carbon factor over alternative gas fuelled boiler / CHP solutions.

Biomass CHP would be sized to meet the space heating and hot water demands of the development; and as (other CHP technologies) would also contribute to meeting the electrical needs of the development. It should be noted however, that biomass CHP has not been deployed at significant scale within the UK and so may be regarded as an unproven technology for primary application at this type of development.

Biomass boilers and CHP require significant quantities of solid biomass fuel, such as wood chips/ pellets, which should to be sourced as locally as possible to maintain its sustainability credentials and improve feasibility. As per other CHP solutions, this option would also require upfront investment and space for an energy centre to house the biomass CHP, back up boiler(s) and thermal store to make the system effective; as well as the installation of a district heat network (at circa £500 to £1,100 per meter), which can add another layer of complexity in coordinating services (however can remove the need to install natural gas mains throughout the development depending on the choice of cooking fuel).

8.2.4 Land Based Photovoltaic Array (Solar Farm)

Solar farms / land base PV arrays are large scale Solar Photovoltaic (PV) installations used to generate electricity. They often cover large areas of land, generally between 5 to 60 hectares and are usually developed in rural locations.

As with any type of large scale development, the potential impacts of solar parks must be assessed. Large scale arrays have the potential to impact the landscape setting, natural habitats, soils and geological and archaeological features. Damage may be caused during construction, when panels are being erected or decommissioned, and operation (relative to landscape setting and loss of agricultural land).

The key barriers of solar farms projects in the UK are grid generation capacity constraints, planning requirements, landscape issues and general public perception of the technology. The grid connection is an increasing constraint of this technology, the usual DNO's connection delivery quotation for medium to large scale projects connecting at 33kV is 12 to 24 months. The potential visual impact of fields of PV can sometimes be difficult to mitigate and are best suited to areas that are not significantly overlooked and/or can be adequately screened through landscape buffers.

Rapidly changing fiscal incentives can also influence the viability of large scale PV installations, such as the Renewables Obligations (ROCs) banding changes for Solar PV projects (annually) versus the typical development timeline of 12 to 24 months.

A solar farm could contribute to or meet the electricity demands of the development provided sufficient land space and appropriate grid capacity (to manage the intermittence) were available. This option would require significant investment but could developed in phases as the development build-out progressed.

8.2.5 Medium / Large Wind

Medium (circa 40 to 80m hub height averaging 500kW to 1MW) to large (circa 90 to 150m hub height averaging 1.5MW to 3MW) scale wind turbines are free standing structures that may be installed singly or in groups.

Wind turbines commonly require a buffer zone or separation zone where other land uses may be affected; for example in Wales there is a Technical Advice Note (TAN 8) that states: "500m is currently considered a typical separation distance between a wind turbine and residential property to avoid unacceptable noise impacts..." In addition, landscape visual issues are likely to require any turbine(s) to be located a suitable distance away from residential dwellings. These constraints would likely mean that any medium to large scale wind turbine would not be able to be sited within or in close proximity to the development and adjacent villages.

Wind speed is critical to wind turbines; and medium to large scale turbines require a minimum of 6 meters per second (m/s) to operate; and commonly require wind speeds over 9 to 10m/s to generate electricity efficiency. The DECC wind database only provides wind speed data up to 45m height, which in this location is estimated between 6 to 7m/s.

Medium to large scale wind turbines have the potential to generate significant quantities of electricity which could have a major contribution to the electricity demands and carbon emission reduction of this development; depending on actual wind speed.

8.3 Micro Scale Technologies to be Appraised

8.3.1 Building Integrated Photovoltaic

Solar- Photovoltaic (PV) systems convert energy from the photons within sunlight into electricity through the aid of photocells; made of semi-conductor material, usually Germanium or Silicon. PV systems are suitable for any type of building but they require significant unshaded south facing space as even a small shadow may significantly reduce output. PV systems can be incorporated on buildings in various ways: on sloped roofs and flat roofs, or in facades, atria and shading devices.

Currently, there are four types of solar cells available: mono-crystalline, poly-crystalline, thin film and hybrid. Mono-crystalline and hybrid cells are the most expensive to produce but are the most efficient (12-20%), poly-crystalline cells are cheaper but their efficiency is lower (9-15%) and thin film cells are only 5-8% efficient but can be produced as thin flexible sheets. As the electrical output is DC, they are used in conjunction with inverters to convert this to a useable AC output.

The maximum total annual solar radiation is usually at an orientation due south and at a tilt from the horizontal equal to the latitude of the site minus approximately 20 degrees. However, PV's can operate at significant efficiency within a range of deviation from this optimum; e.g. a south east roof, at optimum inclination can achieve 96% efficiency; or a south west roof at +10 degree inclination can provide between 95% and 92% efficiency.

Roof mounted solar PV would be beneficial for the development; helping to meet the electricity demands of individual dwellings and contributing to the carbon reduction target.

8.3.2 Solar Thermal

Solar thermal technology converts the solar energy into heat which can be used to mitigate hot water demands. Solar water heating systems use solar panels, called collectors, fitted to the roof. To gain better savings and most benefits from this technology, the system is integrated with a thermal store system which has the capability to store the heat for a longer period of time, i.e. during the day to be utilised at peak time, and also act as a heater (e.g. immersion heater) to further reach the hot water temperatures that may be required.

Solar thermal collectors need to be positioned to receive maximum sunlight; and therefore should face south at approximately 32 degrees to attain maximum proportion of sunlight hours. Easterly facing collectors capture more energy at the start of the day, and westerly facing collectors capture more energy in the later afternoon / early evening.

Whilst large solar thermal collector systems can also provide some contribution to space heating, this would be limited and require further heating via a boiler, and is often not considered worthwhile. Similarly, during winter months the system typically requires a heating boost from a boiler/immersion heater to achieve desired hot water temperatures

8.3.3 Heat Pumps

Heat pump technology is designed to provide heating and cooling demands. There are two principle type: Ground Source and Air Source.

Ground Source Heat Pump (GSHP) technology can meet heating /cooling demands all year round as the earth's temperature is virtually constant at depth. This technology offers energy savings on meeting heating/cooling demands relatively efficiently. A kW of energy intake will

produce up to 4 kW of output which makes this technology more efficient in comparison with traditional Gas boilers. This technology can be used for heating and cooling applications.

Air Source Heat Pump (ASHP) extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can get heat from the air even when the temperature is as low as -15° C. This heat can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water.

ASHP are typically less effective than GSHP but do not have any land requirements as GSHP do. All heat pumps need electricity to run, but the heat they extract from the ground or air is constantly being renewed naturally.

The significant barriers of GSHP technology is the land requirement for ground loop or borehole construction; which also have ground trench or borehole installation costs. ASHP can have external noise constraints (although generally minimal) and the positioning of the external unit needs careful consideration.

8.4 LZC technology Appraisal

This section provides an appraisal of the differing energy options that may be applied to the scheme. This has been used to inform the selection of the preferred options to meet the policy requirements and client driven aspirational targets. It has also been used to inform the development of the site masterplan.

8.4.1 Appraisal Methodology

This document appraises the various technical, environmental, social and economic constraints associated with each LZC technology in order to explore the options available.

Environmental Appraisal

<u>Carbon reduction potential</u>: This considers the carbon reduction potential of each technology; based upon the amount of energy a particular technology can generate and the carbon savings that can be attained from it. The main purpose of this is to identify those technologies that have the potential to generate maximum energy to meet the predicted energy demand but at the same time capable of minimising the carbon emissions

Landscape: This considered the implications of a proposed technology to the landscape character / visual impact, i.e. whether this technology will impose a negative impact towards the overall landscape character or it will enhance the landscape features of the development.

Environmental Quality: This considers the impacts of a proposed technology on the local environmental quality; i.e. disruption to local wildlife/biodiversity, noise disturbance, air quality issues etc. Due to the sensitivity of each of these issues, environmental quality can play a vital role towards to adoption or refusal of any technology.

Social Appraisal

Governance: This considers the likely governance of any proposed technology; i.e. whether local / community governance is possible.

Equity: This considers how a proposed technology can be implemented to deliver a fair and equitable outcome to all; and whether a particular technology can generate enough energy, at low cost, to reduce energy bills.

<u>Health / Wellbeing:</u> This considers how a proposed technology can be implemented to enhance the health and wellbeing of the future residents and existing local community. Issues that may be considered range from shadow flicker from wind turbine to the air pollutions from waste plants. Hence, this section considers any health and wellbeing issues linked with a proposed solution.

Economic Appraisal

<u>Costs and Payback</u>: This considers, at a high level, the typical costs (Capital and Operational expenditure) of the proposed technology, typical payback periods and incentives / grant schemes.

Phasing: Considers how the technology can be phased and therefore how costs may be spread relative to expenditure.

<u>Land Values</u>: The land value impact is varying from technology to technology however the significance of this could be higher for some technologies. We have evaluated this issue within
this appraisal as the visual impacts on the land values and also the local land restrictions due to the planning etc.

Technical Appraisal

<u>Physical Factors</u>: This considers factors which can cause constraints to the particular technology; such as wind speed; land use and area (in case of wind turbines), orientation and overshadowing (in case of solar technologies) and restrictions due to the existing infrastructure such as telecommunication masts or aviation radars etc.

Connecting Infrastructure: This relates to whether enabling or connecting infrastructure is present and /or capable of managing the proposed technology; such as the intermittent energy generation technology impacting grid supply and capacity.

Integration with other technologies: Considers whether and how the technology integrates with other potential energy solutions / different technologies.

8.4.2 Carbon Reduction Potential

The first part of the appraisal is to assess the potential reductions achieved by each individual technologies. This is summarised within the table below.

Table 8.2 Meeting Carbon Reduction Targets

Carbon Saving from Technology	Reductions required to achieve:		
MACRO - DISTRICT SCALE OPTIONS		Carbon Compliance Target	Zero Carbon Target
Energy Generation Technology	Total Carbon Savings	2,794 tonnes CO2	12,385 tonnes CO2
AD - (based upon amount of organic waste generated by the development)	704 tonnes	25%	6%
Biomass CHP (sized to meet hot water and 80 % of space heating demands)	12,791 tonnes	458%	103%
Gas CHP (sized to meet hot water and 80 % space heating demands)	12,753 tonnes	456%	103%
Large Scale PV (56.15ha - land space)	12,385 tonnes	443%	100%

		Carbon	
		Compliance	Zero Carbon
MEDIUM TO LARGE SCALE WIND OPT	IONS	Target	Target
Energy Generation Technology	Total Carbon Savings	2,794 tonnes CO2	12,385 tonnes CO2
E33 Wind Turbine Unit (330KW Capacity)	406 tonnes	15%	3%
E44 Wind Turbine Unit (900KW Capacity)	688 tonnes	25%	6%
E48 Wind Turbine Unit (800KW Capacity)	794 tonnes	28%	6%
E53 Wind Turbine Unit (800KW Capacity)	1,005 tonnes	36%	8%
E70 Wind Turbine Unit (2300KW Capacity)	1,764 tonnes	63%	14%
E82 Wind Turbine Unit (2000KW Capacity)	2,346 tonnes	84%	19%
E82 Wind Turbine Unit (3000KW Capacity)	2,346 tonnes	84%	19%
E101 Wind Turbine Unit (3000KW Capacity)	3,484 tonnes	125%	28%
E126 Wind Turbine Unit (7500KW Capacity)	5,513 tonnes	197%	45%
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		Carbon	
		Compliance	Zero Carbon
MICRO - BUILDING SCALE OPTIONS		Target	Target
Energy Generation Technology	Total Carbon Savings	2,794 tonnes CO2	12,385 tonnes CO2
Building Scale PV (26% of total roof space)	2,805 tonnes	100%	23%
Solar Thermal (sized to meet hot water and 80 % of space heating demands)	5,814 tonnes	208%	47%
Heat Pump (sized to meet hot water and 80 % of space heating demands)	1,224 tonnes	44%	10%

Note: CHP, solar thermal and heat pump technologies have been sized to meet 100% of the hot water demand and 80% of the heating demand. There is a working assumption that this represents an annual 'base load' that can be satisfied without the need for significant heat dumping during the summer months. This is illustrated within the indicative graph below:

250,000 Space 200,000 Heating: Gas Space Heat (kWh/yr) 150,000 Heating: CHP Hot Water: 100,000 Gas Hot Water: CHP 50,000 0 september November AUBUST october December January February March APril 134 11/14 June

Figure 8.1 Annual Thermal Base Load Demand

8.4.3 Technology Integration

The appraisal also discusses the limitations of each technology and how they may complement (C) or pair (P) well together; and conversely where they do not typically work well together (X). The following table provides a summary of technology integration and combination.

	AD CHP	Gas CHP	Biomass CHP	Land PV	Wind	Roof PV	Solar Thermal	Heat Pumps
AD CHP	-	X ¹	X ¹	С	С	С	Х	Х
Gas CHP	X ¹	-	X ¹	С	С	С	Х	Х
Biomass CHP	X ¹	X ¹	-	С	С	С	Х	Х
Land PV	С	С	С	-	Р	Р	С	С
Wind	С	С	С	Р	-	Р	С	С

Table 8.3: Technology Integration

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Roof PV	С	С	С	Р	Р	-	C ²	С
Solar Thermal	Х	Х	Х	С	С	C ²	-	Х
Heat Pumps	Х	Х	Х	С	С	С	Х	-

As always, exceptions exist where technologies that do not typically complement each other; such as biomass CHP and gas CHP, can work together; e.g. when there is a significant heat demand and opportunity exists to have more than one technology combining to service that demand– and these opportunities are identified in the above table as X¹. Such a situation may exist at the Northstowe site due to the size of heat demand and may provide benefit relative to resilience and security of supply.

Where one technology generates heat and another power; then these technologies would typically complement each other. There can, however, be certain situations where physical limitations can create conflict; for example roof mounted solar PV and solar thermal complement each other relative to their respective electrical and thermal generation but compete on roof space to achieve this – such aspects are identified in the above table as C².

In other circumstances; technologies may be able to be paired together to meet a specific demand; such as roof mounted PV and wind turbines. Each generate electricity but do not necessarily compete against each other.

As part of this integration of technologies; a primary issue to consider is whether to link buildings to common energy infrastructure or to maintain independent operation of each building. The primary issues are that:

- Some energy technologies (e.g. CHP, biomass boiler) may not be viable or practical at a building level.
- Some low carbon systems (e.g. biomass boiler, CHP) require operational management that benefit from a shared system where centralised management can be more readily provided or is given over to a third party.
- Shared site-wide systems can introduce complexities for design, ownership, ongoing
 operation and allocation of costs and so are likely to require more involved
 management from a third party one option would be to utilise a specialist Energy
 Service Company (ESCo), which could also take on some of the wider estate
 management.
- Shared systems can potentially provide more energy options and flexibility, as technology enhancement in the future can be swapped out in centralised locations to achieve higher carbon savings.
- Shared systems can be combined with some building level systems (e.g. CHP or biomass boiler with photovoltaics). Use of a combination of shared and building level systems can help to further improve flexibility and increase carbon savings.

8.5 Technology Appraisal

Table 8.4 LZC Technology Appraisal

	Environmental	Social	Economic	Technical
Macro Solution	S			
Anaerobic	Carbon reduction potential:	Governance:	Cost:	Physical Factors:
Digester CHP	The relatively limited organic waste generated by the development would limit the heat and power generating ability of this technology. Carbon Reduction: 704 tonnes. Carbon Compliance Target: 25% Zero Carbon target: 6% Landscape: AD plants have a larger overall building footprint than some other boiler/CHP fed systems; as the AD digestion vessel needs to be accommodated. However, they are not particularly unsightly and are in keeping with the agricultural nature of the existing /surrounding land use. As this technology will not meet the sites total thermal demand; there would likely be a requirement to have additional complementary boilers located in energy centres within the masterplan site. The energy centre; with service yard would have a land space requirement; however, it is not considered that this	This type of technology could be linked to local governance structure, if deemed appropriate, and facilitate community buy-in. In addition, this technology would require a heat distribution network which again could be linked to local governance. Equity: This technology has the potential to help reduce the heating bills, depending on the pricing strategy adopted; as low cost heat could be used to support the sites thermal demand. However, due to the relatively small amount of thermal energy generated, this would not be a significant proportion of the heating bills and so limited impact. Health / Wellbeing: There is the potential that odour issues may be present which may negatively impact the immediately local environment.	Capital cost comparatively low but operation costs can be higher than other boiler/CHP options. Incentives available for this technology also mean that payback periods are low. However this technology would need to be combined with a District Heat Network which would add significant capital cost. Typical Payback: circa 10 years Phasing: This technology would need to be implemented at the start of build out; if it were to be a main contribution to the thermal demand; necessitating installation and connection to a site wide DHN. Land Values: Residential land value immediately adjacent to an AD plant may be reduced due to the potential odour issues as discussed above.	The availability of suitable organic feedstock is one of the major issues and if sufficient organic waste is not available then this technology will not be work optimally. Connecting Infrastructure: Because this technology is not predicted to generate sufficient energy to meet the developments demand; it may be possible to integrate this technology alongside other energy generation plants that collectively contribute to a DHN. However, due to potential odour issue it is unlikely this option would be located within an urban setting and therefore connecting to a DHH would incur additional costs. This option requires a site wide heat network to distribute the hot water across the site to each building. In addition; it would require grid connection relative to electricity generated. Integration with other technologies:

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	Environmental	Social	Economic	Technical
	would represent a negative spatial or landscape impact as it would be fully integrated into the masterplan layout and design. However, it would have exhaust flues extending some 15m from the roof of the CHP plant; which would have limited local landscape impact.			This technology can integrate with other boiler / CHP technologies as part of site wide network; if all units are designed to facilitate this. It will also integrate with other power generating technologies such as wind and solar PV. It would not integrate well with micro heat
	Environmental Quality:			technologies such as solar thermal; unless specific areas of the site were not
	Special precautions would need to be taken to reduce any potential odour related issue; such as negative air pressure unloading halls. Preventing odour issues would be possible but would add to building footprint and overall cost of construction and operation. More realistically, this option should not be located within an urban setting. Potential air quality impact can occur from the boiler/CHP combustion process; however this would be controlled as part of the plant and flue arrangements and is therefore unlikely to cause any significant impact.			
	Noise will be generated by the CHP engines; however, this would be mitigated by acoustic enclosures to acceptable levels.			
Biomass boiler / CHP	Carbon reduction potential: CHP design would be optimised to meet the space heating and hot water	Governance: This is district scale technology that requires a site wide DHN to facilitate the	Cost Capital cost relatively high – reduces as the size of the engine increases	Physical Factors: The major technical constraint is the availability of biomass fuel and fuel

Environmental	Social	Economic	Technical
demands of entire development or a higher density part of it such as the town centre. Biomass boiler / CHP utilises renewable wood chips/pellets as a fuel source (or	transfer of hot water to each building. This type of technology could be linked to local governance structure, if deemed appropriate, and facilitate the community buy-in.	however. High running and maintenance costs DHN increases cost significantly and therefore struggles to be cost effective on low density residential schemes.	security for long term generation. To generate the energy demand, in aaccordaance with" section 8.4.6, approximately 13,133 tonnes of biomass fuel would be required.
potentially blotuel) to generate neat and power; and therefore reduces carbon emissions further when compared to traditional gas boiler and gas CHP technologies. However, biomass CHP has not been utilised on a large scale within the UK and may be regarded as untested technology.	Equity: This technology has the potential to help reduce the heating bills, depending on the pricing strategy adopted and biomass fuel supply; as low cost heat could be used to meet the sites thermal demand	Typical Payback: circa10 – 15 Years Phasing: This technology would need to be implemented at the start of build out; if it were to be a main contribution to the thermal demand; necessitating	Connecting Infrastructure: This option requires a site wide heat network to distribute the hot water across the site to each building. In addition; it would require grid connection relative to electricity generated.
Carbon Reduction: 12,791 tonnes Carbon Compliance Target: 458% Zero Carbon: 103% Landscape: No significant landscape issues associated with this option as the	In addition; it is likely that the Biomass fuel would be purchased locally which would benefit local economy. Health / Wellbeing: No significant health and wellbeing	installation and connection to a site wide DHN. Land Values: It is considered that this technology would not have any significant impact on land values.	Integration with other technologies: This technology can integrate with other centralised boiler / CHP technologies as part of site wide network; if all units are designed to facilitate this. It will also integrate with other power generating technologies such as wind and solar PV.
biomass plants are enclosed within a building structure; with the exception of the biomass fuel storage which may be a silo type structure; which is in keeping with the existing rural nature of the site and is not considered to represent a negative landscape impact. An energy centre would be required; with additional service yard. It is not			It would not integrate well with micro heat technologies such as solar thermal; unless specific areas of the site were not to be connected to the DHN.
considered that this would represent a negative spatial or landscape impact as it would be fully integrated into the			

	Environmental	Social	Economic	Technical
	masterplan layout and design. However, it would have exhaust flues extending some 15m from the roof of the CHP plant; which would have limited local landscape impact.			
	Environmental Quality:			
	Potential air quality impact can occur due to the burning of wood fuel, which has a higher nitrogen oxide content than traditional gas boilers; however this would be controlled as part of the plant and flue arrangements and is therefore unlikely to cause any significant impact. Noise will be generated by the CHP engines; however, this would be mitigated by acoustic enclosures to acceptable levels.			
Gas CHP	Carbon reduction potential:	Governance:	Cost:	Physical Factors:
	Gas CHP design would be optimised to meet the space heating and hot water demands of entire development or a higher density part of it such as the town centre.	This is district scale technology that requires a site wide DHN to facilitate the transfer of hot water to each building. This type of technology could be linked to local governance structure, if deemed	Capital cost relatively high (although cheaper than Biomass alternative) –cost reduces as the size of the engine increases however. High running and maintenance costs (although cheaper	There are no specific physical limitations to this option. However, this technology will be dominated by the global supply of natural gas and fossil fuel prices.
	Carbon Reduction: 12,753 tonnes Carbon Compliance: 456% Zero Carbon: 103%	appropriate, and facilitate community buy-in. Equity:	than Biomass alternative) DHN increases cost significantly and therefore struggles to be cost effective on low density residential schemes.	Connecting Infrastructure: This option requires a site wide heat network to distribute the hot water across the site to each building. In
	Landscape: No significant landscape issues associated with this option as the gas	This technology has the potential to help reduce the heating bills, depending on the pricing strategy adopted; as low cost	Typical Payback: circa 10-15 years Phasing:	addition; it would require grid connection relative to electricity generated. Integration with other technologies:

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	Environmental	Social	Economic	Technical
	CHP plants are enclosed within a building structure. An energy centre would be required; with additional service yard (although this would be smaller than for the biomass and AD options as gas is piped to the energy centre). It is not considered that these would represent a negative spatial or landscape impact as they would be fully integrated into the masterplan layout and design. The energy centre would need to incorporate exhaust flues extending some 15m from the roof of the CHP plant; which would have limited local landscape.	heat could be used to meet the sites thermal demand. Health / Wellbeing: There are no negative health and wellbeing concerns.	This technology would need to be implemented at the start of build out; if it were to be a main contribution to the thermal demand; necessitating installation and connection to a site wide DHN. Land Values: It is considered that this technology would not have any significant impact on land values.	This technology can integrate with other centralised boiler / CHP technologies as part of site wide network; if all units are designed to facilitate this. It will also integrate with other power generating technologies such as wind and solar PV. It would not integrate well with micro heat technologies such as solar thermal; unless specific areas of the site were not to be connected to the DHN.
	Environmental Quality: Noise will be generated by the CHP engines; however, this would be mitigated by acoustic enclosures to acceptable levels.			
Large scale PV	Carbon reduction potential:	Governance:	Cost:	Physical Factors:
array	A large scale land based PV array has the potential to generate significant amounts of electricity resulting in substantial carbon savings.	Local governance is possible provided a suitable arrangement is put in place that enables the upfront funding required to complete the array (in full or part). Some	Solar PV is historically one of the more expensive renewable technologies, but one which has been subject to significant downward price shifting due	The major physical constraint is availability of land; that is not overshadowed.
	Carbon Reduction: 12,385 tonnes Carbon Compliance: 443% Zero Carbon: 100%	sort of 'share' arrangement may be possible as occupiers move into the development; linked to owning properties.	to relatively rapid take up and technology improvements. As downward pricing continues the economics of this option continue to improve.	Connecting Infrastructure: Due to the intermittency of electricity generation and balancing generation with demand; there is often a significant

	Environmental	Social	Economic	Technical
	Landscape: Land based PV array would occupy a significant area of land and depending where it is located may be overlooked. However, the site and immediate surrounding area is relatively flat, with numerous hedgerows that define the existing field patterns; which would likely afford significant screening. Environmental Quality: Installation of land based PV arrays can sit comfortably alongside biodiversity enhancements. The need to secure the area around the PV array would likely also benefit biodiversity. There are no negative issues with regards to air quality, noise and water quality.	There are potential issues around private wire but the opportunity to put in place bilateral agreements with iDNOs may overcome this. Equity: This technology has the potential to reduce energy bills, as electricity produced is utilised (through agreement). Health / Wellbeing: There are no negative health and wellbeing concerns of this technology	Typical Payback: payback continues to reduce and can generally be between 8 to 10 years. Phasing: Generally solar farms are brought forward in one go, although a larger array could be brought forward in several tranches. Land Values: Solar farms take up large areas of land; and therefore directly compete with other land uses. Dependent on screening and security issues; adjoining land values may also be affected by the presence of a PV array.	grid reinforcement issue associated with solar farms that requires additional infrastructure to be put in place or the incorporation of some balancing / storage technology. Integration with other technologies: Solar PV is a standalone technology and can be complementary / integrate with most other technologies. It can contribute to meeting the electricity demands without interfering with heat generating technologies and can sit comfortably with other electrical generating options.
Medium / Large scale Wind	Carbon reduction potential: Medium scale wind turbines, with a tower height of 45-65 meters and the average wind speed of 6.1 m/s to 6.4 m/s has the potential to generate electricity; albeit at the lower end of the power scale. Total electricity Generation from a single 800kW wind turbine system at a wind speed of 7m/s and hub height of 60m = 1,529,496 kWh; saving 794 tonnes of carbon per turbine. Larger scale turbines	Governance: Local governance is possible provided a suitable arrangement is put in place that enable the upfront funding required to install the turbine(s). Some sort of share' arrangement may be possible as occupiers move into the development; linked to owning properties. There are potential issues around private wire but the opportunity to put in place bilateral agreements with iDNOs may overcome this.	Cost: ~£1,000 per KW. Smaller models are more expensive per KW. Typical Payback: circa 10-20 years Phasing: Typical to install several turbine in one go to facilitate planning, grid connection issues and funding. However, individual turbines may be installed as required.	 Physical Factors: Wind speed is the predominant factor in determining the suitability of this technology. Even at 60m hub height, the predicted wind speed is at the lower end of the power scale. Connecting Infrastructure: Due to the intermittency of electricity generation and balancing generation with demand; there is often a significant grid reinforcement issue associated with

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	Environmental	Social	Economic	Technical
	 could produce more electricity and save more carbon (see table 8.2) Landscape: Landscape visual impacts will occur as a result of the installation of wind turbines; which would necessitate detailed assessment. Residential development is typically sited at least 500m away from wind turbines. Environmental Quality: Bats and birds have the potential to be affected dependent on the scale and location of the wind turbines. Noise can be an issue associated with this technology; generally requiring turbines to be located at least 500m away from away from residential areas. 	Equity: This technology has the potential to reduce energy bills as electricity produced is utilised (through agreement). Health / Wellbeing: There may be noise issues associated with this technology that may be regarded as a nuisance.	Land Values: Adjacent and nearby land values may be negatively affected due to perceived visual impact.	wind turbines that requires additional infrastructure to be put in place or the incorporation of some balancing / storage technology. Integration with other technologies: Wind turbines are a standalone technology and can integrate with most other technologies. It can contribute to meeting the electricity demands without interfering with heat generating technologies and can sit comfortably with other electrical generating options.
Micro Solutions				
Heat Pumps	Carbon reduction potential:	Governance:	Cost:	Physical Factors:
	This low carbon technology requires electricity to leverage the generation of high efficient heat, and therefore has a reduced carbon reduction potential relative to some other renewable options. Carbon Reduction: 1,224 tonnes Carbon Compliance: 44% Zero Carbon: 10%	This technology is typically installed on a building by building basis; and therefore it can largely be owned by the home owners / occupiers of the development. Equity: This option would create an immediate and direct benefit to the home owners	Comparable cost is low, however technology achieves lower levels of CO ₂ reduction and would therefore need to incorporate other technologies to meet the target reductions which would add additional cost. Ground Source Heat pump incur additional infrastructure costs for ground works.	Ground source heat pumps require access to land where the borehole system can be installed (underneath buildings if needed). Air source heat pumps require careful siting of the external heat exchanger to prevent nuisance. This technology generally works better with under floor heating system rather

	Environmental	Social	Economic	Technical
	Landscape: Heat pumps do not generally have any visual impact within the landscape. Air Source heat pumps have the potential to influence streetscape depending on their location. Environmental Quality: Noise issues can occur with air source heat pumps and therefore careful selection of low noise machines and siting external units in locations to avoid nuisance would be essential. Open loop ground source heat pumps have the potential to impact underlying groundwater characteristics; and would need approval from the Environment Agency. Close loop systems would be more typical and would not have the same potential risk.	and occupiers of buildings; reducing energy bills. Health / Wellbeing: There are no significant health and wellbeing issues associated with heat pump technology. However, there is the potential for air source heat pumps to cause noise issues; which requires careful selection of low noise machines and siting of external units in locations to avoid nuisance.	Typical Payback circa 8 years Phasing: This technology is applied at a building scale and so progresses in-line with build out. Land Values: There are not considered to be any land value issues associated with this technology.	than traditional wet radiator heating systems. Connecting Infrastructure: There are no additional infrastructure issues directly linked with this technology. Integration with other technologies: This is a standalone hot water/space heating generation technology that can combine with electricity generating technologies. It would not integrate with other heat generating technologies.
Solar Thermal	Carbon reduction potential:	Governance:	Cost:	Physical Factors:
	Solar Thermal technology generally only contributes towards the hot water demands and therefore has small footprint with regards to energy generated and carbon savings. However it has been sized here to meet 100% hot and 80% heating demands. This would require 91% of the total available roof space – forcing a monopitch roof design Carbon Reduction: 6,153 tonnes	As this technology is installed on each building; it can largely be owned by the home owners / occupiers of the development Equity: Solar Thermal would create an immediate and direct benefit to the home owners and occupiers of buildings; reducing energy bills.	The solar thermal installation cost relatively low but additional plumbing is required in comparison with the traditional boiler which increases the overall cost. Typical Payback circa 10 years Phasing:	Requirement for sufficient south roof facings, extra plumbing, and year round hot water demands require larger than normal hot water storage with immersion heater to boost heat. This technology may be difficult to install in small unit types and flats (such as those found in the Town Centre) due to limited roof space.

	Environmental	Social	Economic	Technical
	Carbon Compliance: 220% Zero Carbon: 50% Landscape: This technology is unlikely to have any impact to landscape character or view. It may however create a distinctive streetscape and design concept relative to the development.	Health / Wellbeing: There are no significant health and safety issues linked with this technology except the risk of scalding which can if not designed appropriately. Design should be undertaken to maintain the balance between bacteria growth, scald risk, water flow rates and scale reduction.	This technology is applied at a building scale and so progresses in-line with build out. Land Values: There are not considered to be any land value issues associated with this technology.	Connecting Infrastructure: No grid connection is required and no additional infrastructure required. Integration with other technologies: This is a standalone hot water generation technology that can combine with electricity generating technologies; although may conflict with roof mounted solar PV (due to space requirements).
	Environmental Quality: There are no negative issues with regards to biodiversity, air quality, land quality, noise and water quality regarding this option			
Solar PV (26% roof space)	Carbon reduction potential: Solar PV is renewable source of energy which displaces energy from the grid. It is therefore a very effective means of achieving carbon reductions if roof space is available. The below savings may be achieved if circa 26% of roof space is fitted with PV (i.e. half of the southern facing roof). Carbon Reduction: 2,805 tonnes Carbon Compliance: 100% Zero Carbon: 23%	Governance: As this technology is installed on each building; it can largely be owned by the home owners / occupiers of the development. Equity: Solar PV creates an immediate and direct benefit to the home owners and occupiers of buildings; reducing electricity bills.	Typical Cost: Solar PV is historically one of the more expensive renewable technologies, but one which has been subject to significant downward price shifting due to relatively rapid take up and technology improvements. Typical Payback circa 10 years Additional costs are associated to grid import reinforcement costs. Phasing:	Physical Factors: The primary physical constraint is the necessity to have roof orientations facing south to attain the maximum solar harvest for the benefit of the technology. Also the overshadowing needs to be considered for each dwelling/ buildings. Connecting Infrastructure: Due to the intermittency of electricity generation and balancing generation with demand; there is often a significant
	Landscape:	Health / Wellbeing:	This technology is applied at a building scale and so progresses in-line with build out.	grid import reinforcement issue associated with solar PV that requires additional infrastructure to be put in

Environmental	Social	Economic	Technical
This technology is unlikely to have any impact to landscape character or view. It may however create a distinctive streetscape and design concept relative to the development. Environmental Quality:	There are no negative health and wellbeing concerns regarding this technology	Land Values: There are not considered to be any land value issues associated with this technology.	place or the incorporation of some balancing / on-site storage technology. Integration with other technologies: Solar PV is a standalone technology that can integrate with other most other technologies; other than those that may compete for roof space (such as solar thermal). It can contribute to mosting the
There are no negative issues with regards to biodiversity, air quality, land quality, noise and water quality as this option.			electricity demands without interfering with heat generating technologies and sit comfortably with other electrical generating options.

8.5.1 Appraisal Summary

The appraisal undertaken in the previous section is designed to identify suitable headline energy options and approaches. This has been fed into an initial screening in order to eliminate technologies from further evaluation:

Macro Soluti	ons	
Anaerobic Digester	Reject	Anaerobic Digestion (AD) CHP is unlikely to be able to generate significant heat or power, relative to the sites predicted demands, due to likely limitations on organic waste feedstock; although additional feedstocks may be identified (but not necessarily guaranteed).
		There are potential odour issues associated with this technology which would point to it being located away from residential development.
		These issues, coupled with high maintenance, space and operational restrictions suggest that this technology is not appropriate for this development.
Biomass CHP	Reject	Biomass CHP could meet the overall heating demands and a considerable proportion of the electrical demand of the development; however, consistent and availability biomass fuel would be required to facilitate this.
		This option has the potential to create significant carbon savings, however the technology is still in its infancy and is therefore burdened by significant risk.
Gas CHP	Option	Gas CHP, if correctly sized, is capable of producing enough heat to meet the thermal demands of site; and enough electricity to meet the electrical demand. The CO ₂ reductions would be significant, however as with the other centralised heating technology, this will incur extensive site wide District Heat Network (DHN) to ensure each building is connected. It would therefore be better suited to the high density, mixed use nature of the Town centre.
Large scale PV array	Option	A solar PV land based array would be able to generate significant electricity; provided that sufficient land is available.
		It is estimated that approximately 57ha of land would be required to meet 100% of the electricity demand of the Phase 2 site; and would require significant grid reinforcement (which will be necessary as part of the development). This option is able to sit comfortably alongside many other technologies and therefore could be considered as part of a suite of technologies utilised to achieve energy demand and carbon savings.
Wind Turbines	Option	Small scale wind turbines would not be viable at Northstowe due to the lack of sufficient wind speed.
		Medium scale turbines may be viable; with an estimated average speed of 6.3m/s at a hub height of 60meters. Each medium scale turbine would only contribute a small portion of the sites electricity demand; requiring approximately 16 turbines to meet the total

electrical demand.

Table 8.5: Technology ScreeningTechnologyScreeningSummary

		Large scale wind turbines may be viable; the DECC wind database does not provide wind speed data at heights appropriate for large scale turbines (80+ meters). However we have assumed that a wind speed of 7m/s may be achievable. A 3MW turbine would meet less that 20% of sites electricity demand; requiring approximately 5 turbines to meet the total electrical demand.
		However any wind option, especially large scale, can present significant adverse visual and acoustic impacts on the surrounding area. It therefore represents a significant planning risk.
		(Note: If higher wind speeds were recorded at the site it would significantly improve electricity generation).
Micro Solutio	ns	
Heat	Reject	Heat pump technology could meet the thermal demands of the site;

Heat Pumps	Reject	Heat pump technology could meet the thermal demands of the site; however it requires electricity to operate and therefore does not create the same carbon savings as some other options. Ground source heat pumps require some ground space for borehole installation or trenches and air source heat pumps require careful siting of the external heat exchanger to avoid noise nuisance.
Solar Thermal	Reject	If this technology is used to replace traditional boiler solution then it would require circa 86% of available roof space – forcing a mono pitch roof design. Potential conflicting demands on roof space between Solar Thermal and Solar PV; and per m2 solar PV achieves a higher carbon saving.
Solar PV (building mounted)	Option	Roof mounted solar PV is able to generate electricity on site which enables significant carbon reductions. It is increasingly affordable and is able to sit comfortably alongside many other technologies – it could therefore be considered as part of a suite of technologies utilised to achieve energy demand and carbon savings.

In terms of land use the site is predominantly low/medium density residential with high density residential and non-residential aspects concentrated within the town centre. A district heat network for the entire site is therefore likely to be financially unviable due the extensive pipework costs. Site wide options will therefore need to incorporate some form of building scale technology. Solar PV represents the most practical and economically viable option in this regard.

However, the density of the town centre itself could result in installation costs of a DHN serving the town centre area being feasible. The town centre is also mixed use, containing a variety of residential and non-residential buildings which would enable any CHP system to work at full capacity for longer periods and therefore more efficiently. This would reduce CO₂ emissions significantly within the town centre and reduce the dependence on allowable solutions for the remainder of the site.

This supports the work undertaken by Renewables East (*Provision of Zero Carbon Energy for the Northstowe Eco-Town Development* (dated June 2010)) which suggests that the optimum technical solution for the whole development would likely involve the use of district heating for the central high density portion of the development, with micro-generation technologies recommended for the remainder.

Section 9 discusses the preferred energy strategy options for the development. It is recognised, however, that irrespective of whichever strategic approach and energy options are

recommended, the implementation strategy must be flexible and adaptive to the development, shifting economic incentives and models, and evolving technologies.

9 Preferred Energy Strategy

Based upon the recommendations of the strategic LZC options appraisal this statement provides recommendations as to the preferred options, following the enhanced fabric enhancements outlined in section 7, to achieve the initial site wide carbon compliance reductions before providing an account of various further options to meet the future 2016 Zero Carbon Standard (as currently understood).

The sections below identify various combined technology solutions that seek to achieve the zero carbon target. As previously discussed, the applicant is focused on achieving this target through predominantly on-site and/or direct near site technology rather than any significant reliance on off-site/off-set allowable solutions. The energy strategy therefore needs to strike a balance between financial viability and the client aspiration to meet a significant proportion of the target through onsite solutions. Whilst the options below are strategic in nature, they are considered robust enough to demonstrate how the relevant carbon emissions can be achieved. Refinement of these options will be subject to detailed design, testing and optimisation which will be undertaken in tandem with the further development of the masterplan as the scheme progresses beyond the outline towards submission of reserved matter planning applications.

The options adopt a strategic approach appropriate for an outline application. Refinement and optimisation of the options will continue to progress during the detailed design stages and subsequent Reserved Matters Applications.

The preferred energy strategy is comprised of two key stages. Firstly, meeting the carbon compliance target and secondly, achieving zero carbon. The section below identifies the **preferred approach to achieve the carbon compliance** and sets a series of **options to achieve zero carbon**:

- 1. Carbon Compliance Target: Site wide building mounted Solar PV to meet 100% of the Carbon Compliance Target.
- 2. Zero Carbon Target: Options to be considered:
 - Town Centre: Gas CHP plus Allowable Solutions (Type 1) financial contribution for residual emissions
 - Allowable Solution (Type 2): Land based PV array
 - Allowable Solution (Type 2): Medium to Large Scale Wind
 - Allowable Solution (Type 1): Financial contribution

9.1 Carbon Compliance Target: Site wide Solar PV (Roof mounted)

The density of the development, outside of the town centre, makes a site wide DHN and associated LZC technologies (Biomass CHP, Gas CHP) financially unviable due to the extensive pipework costs. As a general rule a density of at least 50 dwellings per hectare is required before a DHN becomes viable. It is therefore recommended that the initial step towards Zero Carbon be achieved through roof mounted PV across the entire development.

The following general assumptions have been made:

Annual PV output per kWp: 850.00 kWh/year

•

- PV peak output: 1.25 kWp at 850 kWh
- Typical PV Area per kWp: 10.00 m²

The following assumptions have been made for the residential aspect:

- Total Available Roof Area: 137,393 m² (as per SAP calculations)
- % Roof with PV installed: 26% (space needed to achieve CC)
- Total PV area: 35,722 m²

The following assumptions have been made for the commercial aspect:

•	Total Available Roof Area:	58,239 m ²	

- % Roof with PV installed: 26% (space needed to achieve CC)
- Total PV area: 15,142 m²

Based on these assumptions the following calculations can be made:

Table 9.1: Option 1 Building Mounted Solar PV

All Buildings	Enhanced FEE Emissions
Total Regulated Electricity	5,252,638 kgCO2
Total Regulated Gas	7,132,843 kgCO2
Solar PV generation	- 2,804,841 kgCO2
Sub Total Regulated	9,580,640 kgCO2
B'Regs 2013 Baseline	12,758,034 kgCO2
Carbon Compliance Target	9,591,578 kgCO2

The above table demonstrates that the provision of solar PV to 26% of the available roof space (i.e. circa half of traditional south facing roof) would achieve an approximate reduction of 2,804,841 KgCO₂. This reduces the regulated emissions to **9,580,640 kgCO₂** which is beyond the Carbon Compliance target of 9,591,578 kgCO₂. This also represents a 25% reduction on the Building Regulations 2013 baseline emissions which exceeds the 10% reduction required by the emerging policy CC/3 of the Proposed Submission Local Plan.

9.2 Zero Carbon Target Options

Following the initial reductions achieved through fabric enhancements and roof mounted Solar PV a further reduction of 9,580,640 kgCO₂ is required in order to reach the Zero Carbon target.

Whilst preference has been given to on-site reductions in CO₂ emissions and low carbon/renewable energy generation, it is recognised by the government that it is often technically and economically unviable to achieve 100% of the Zero Carbon Target through onsite solutions. The Governments Zero Carbon framework therefore makes provision for 'Allowable Solutions', enabling the remaining CO₂ emissions to be achieved through alternative measures outside the scope of SAP and SBEM assessment procedures.

It should be noted however that technological solutions located outside of the application boundary would need to be taken forward as a standalone scheme.

Zero Carbon Hub recommendations on framework structure and how Allowable Solutions might be selected are currently under Government consideration (as discussed in Section 3.4). However it is expected that the initial choice for developers will be either:

- To pay into a carbon fund (Type 1 Allowable Solution). Here the payments from developers would be accumulated and the fund manager will take responsibility for investing in suitable Allowable Solutions projects - a wide range of carbon-saving projects could qualify as Allowable Solutions. It is expected that Local Planning Authorities will have the option to set up carbon funds and may establish local priorities for particular Allowable Solutions.
- To invest in carbon-saving projects associated directly with their own developments (Type 2 Allowable Solution). These would include on-site, near site and off-site solutions.

Evidence of Allowable Solutions will be required to be submitted as part of the Building Control Approval for Compliance with Building Regulations (2016). This Energy Statement provides a series of options, presented below, that will be further investigated in respect to meeting the future 2016 Building Regulation. It is envisaged that the selection of which, or combination of options, will either form separate planning applications or come forward as part of reserved matter applications. The options are not presented in order of preference.

Given the site constraints the options outlined below are considered to be the most practical, economical and low risk.

9.2.1 Option 1 – Town Centre Gas CHP District Heat Network + Allowable Solutions: financial contribution (Type 1)

It is the Applicant's intention that the economic and technical viability of utilising district heating, including the provision of CHP, for the town centre be explored. This will incorporate various relevant factors, with a particular focus on:

- The possible CO₂ reductions
- The capital costs
- The running costs.
- Acceptability and long term security

Below is an indicative assessment of the potential CO₂ reductions expected following provision of a Gas CHP DHN to the town centre, which assumes circa 692 dwellings (apartments) and mixed use commercial, educational and employment uses.

Within the town centre the initial carbon reductions are achieved through energy efficiency enhancements (as applied throughout the development); with the resultant carbon emissions as follows:

- BR 2013 Baseline: 7,960,792 kgCO₂
- Be Lean Enhancements: 7,875,448 kgCO₂

Installing a GAS CHP driven DHN to meet 100% hot water demands and 80% of the space heating demands will reduce the carbon emissions by approximately 5,919,435 KgCO₂ to 1,956,013 KgCO₂.

The provision of roof mounted PV to 26% of the available roof space, as outlined previously, reduces the town centre carbon emissions by a further 886,253 KgCO₂ to 1,069,760 KgCO₂.

This means that the remaining Phase 2 site wide emissions, following the implementation of this option to the town centre, would therefore be **3,661,205 KgCO₂ (3,661 tonnes)**.

The most likely means of achieving the remaining carbon reductions would be either:

1. Type 1 - Payment based on pounds (£) per tonne of CO_2 for 30 years:

The table below demonstrates the potential residual Type 1 Allowable Solutions cost following application of Town Centre Gas CHP driven DHN:

Table 9.2: Potential Residual Type 1 Allowable Solutions Cost

AS Rate	Cost (£)
@ £60/tonne for 30 yrs	£6,590,169
@ £90/tonne for 30 yrs	£9,885,254

2. 'Near-Site' option - such as land based Solar PV.

If this were to be a large scale land based Solar PV array then a total space of circa 16.6ha would be required to achieve the remaining 3,661,205 KgCO2 emissions reduction. This is based upon a provision of 6.64ha of Solar PV and spacing at a ratio of 1: 2.5.

9.2.2 Option 2 – Allowable Solution (Type 2): Land based PV array

The following general assumptions have been made with regards to a Land Based PV Array:

- Annual PV output per kWp: 850.00 kWh/year
- PV peak output: 1.25 kWp at 850 kWh
- Typical PV Area per kWp: 10.00 m²
- Total land required: spacing ratio of 1: 2.5 to enable suitable spacing and prevent overshadowing.

Following application of energy efficiency measures and installation of roof mounted PV to 26% of available roof space, the remaining regulated emissions to meet the Zero Carbon target will be 9,580,640 kgCO₂.

Based upon these assumptions the savings per hectare is estimated at **551,438 kgCO**₂. This means that approximately **43.43ha** of land would be required to achieve the Zero Carbon target $((9,580,640 \text{ kgCO}_2 / 551,438 \text{ kgCO}_2) \times 2.5))$.

9.2.3 Option 3 – Allowable Solution (Type 2): Medium to Large Scale Wind

Following application of energy efficiency measures and installation of roof mounted PV to 26% of available roof space, the remaining regulated emissions to meet the Zero Carbon target will be 9,580,640 kgCO2.

Medium Scale Wind

The following general assumptions have been made with regards to medium scale wind energy potential:

- Wind Turbine Total Capacity: 800 kWp (medium scale turbine)
- Available at wind speed of 7 m/s: 180 kWp
- Guarantee Availability 97%
- Operational hours
 8760

Based upon these assumptions the total electricity generation potential per medium scale wind turbine is 1,529,496 kWh. This equates to a saving of **793,808 kgCO**₂ which represents **8.3%** of the total reductions required to achieve the Zero Carbon Target. Over **12 medium turbines** would therefore be required.

Large Scale Wind

The following general assumptions have been made with regards to a large scale wind energy potential:

•	Wind Turbine Total Capacity:	3000 kWp

- Available at wind speed of 7 m/s: 532 kWp
- Guarantee Availability 97%
- Operational hours 8760

Based upon these assumptions the total electricity generation potential per turbine is 4,520,510 kWh. This equates to a saving of **2,346,145 kgCO**₂ which represents **24.49%** of the total reductions required to achieve the Zero Carbon Target. Over **4 large turbines** would therefore be required.

9.2.4 Option 4 – Allowable solutions: financial contribution (Type 1)

This option considers that the remainder of the regulated carbon emissions associated with the development may be dealt with through the use of Type 1 Allowable Solutions whereby each kg CO2 emitted per annum must be off-set by an appropriate financial contribution to either the CIL fund, Community Energy Fund (CEF) or some other energy related fund. This recognises that in some instances it may not be either technically or economically feasible to achieve the savings through application of technology alone and therefore a financial contribution may be made instead.

Following application of energy efficiency measures and installation of roof mounted PV to 26% of the available roof space, the remaining regulated emissions to meet the Zero Carbon target will be 9,580,640 kgCO2.

The payment required to off-set the above remaining emissions, based on two pricing scenarios, are provided in the table below:

Table 9.3: Allowable Solutions Cost

AS Rate	Cost (£)
@ £60/tonne for 30 yrs	£17,245,153
@ £90/tonne for 30 yrs	£25,867,729

10 Summary

This energy strategy has been prepared to ensure that Phase 2 of the Northstowe development meets the sustainability aspirations and key development priorities, Building Regulations requirements and planning targets. The following local and national energy requirements were deemed relevant:

Policy	Document	Requirement
NE/1 Energy Efficiency	LDF Development Control Policies DPD, Adopted 2007	10% CO_2 reduction from 2006 Building Regulations
NE/3 Renewable	LDF Development Control Policies DPD, Adopted 2007	10% energy provided by on-site renewable technology
NS/23 An Exemplar in Sustainability	LDF Northstowe Area Action Plan DPD, Adopted July 2007	Aspiration to achieve 20% of predicted energy needs from renewable technology
CC/3: Renewable and Low Carbon Energy in New Developments	Proposed Submission Local Plan, 2011-2031 (not yet adopted)	10% CO ₂ reduction from 2013 Building Regulations through onsite renewable energy technologies
CSH Level 4 – Ene 1 Dwelling Emission Rate	CSH 2010 Technical Note	25% improvement on 2010 Building Regulations
BREEAM Very Good rating	BREEAM New Construction 2011	No minimum requirement for Very Good
Building regulations	Building regulations 2016	Zero Carbon from regulated energy

A fundamental premise of the energy strategy is that the development will be post implementation of the 2016 Building Regulations; which are set to implement zero carbon buildings standards as described in section 3.

As such, this strategy has adopted the approach advocated by the ZCH relative to future energy demand reduction targets and approaches relative to achieving zero carbon emissions:

- 1. Mandatory Fabric Energy Efficiency (FEE) Level To ensure energy efficiency by energy efficient building design.
- Mandatory onsite Carbon Compliance Level To ensure energy efficiency by energy
 efficient building design and to reduce carbon emissions through on-site low carbon and
 renewable energy technologies and near-site heat networks.
- 3. Mitigate the remaining carbon emissions through use of 'Allowable Solutions'.



To enable this the carbon compliance and allowable solution targets for the development have been calculated; as follows:

All Buildings	BR2013 Baseline Emissions	Carbon Compliance Target	Zero Carbon Homes Target
Total Regulated Electricity	5,252,638 kgCO2	4,054,175 kgCO2	0 kgCO2
Total Regulated Gas	7,505,396 kgCO2	5,537,403 kgCO2	0 kgCO2
Total Regulated	12,758,034 kgCO2	9,591,578 kgCO2	0 kgCO2

These targets, when combined, achieve zero carbon (regulated energy). To meet these targets the proposed strategy follows the energy hierarchy principles below:

- 1. **Be Lean:** Use less energy. Minimise energy demand through efficient design and the incorporation of passive measures;
- 2. **Be Clean:** Supply energy efficiently. Reduce energy consumption through use of low-carbon technology; and
- 3. Be Green: Use renewable energy systems.

10.1 Fabric Energy Efficiency Standard

The standards outlined within this statement surpass the FEES set by the ZCH and result in reduced energy demand and carbon emissions. The table below gives the breakdown of energy consumption and carbon emissions for space heating, hot water, lighting, pumps and fans (regulated energy) for domestic buildings and non-domestic units.

	Enhanced FEE	Enhanced FEE
All Buildings	Demand	Emissions
Total Regulated Electricity	10,120,690 kWh	5,252,638 kgCO2
Total Regulated Gas	33,022,422 kWh	7,132,843 kgCO2
Sub Total Regulated	43,143,112 kWh	12,385,481 kgCO2
B'Regs 2013 Baseline	44,867,895 kWh	12,758,034 kgCO2
Carbon Compliance Target	33,447,636 kWh	9,591,578 kgCO2

By adopting enhanced fabric efficiency standards in all residential dwellings, the total energy demand across the site is reduced by circa 2.5% (comprising a 4% improvement in residential dwelling thermal demand). This reduces the sites carbon emission by 1.5% (again from a 4% reduction in carbon emissions arising from residential thermal demand).

The 1.5% improvement in emissions over Building Regulations (2013) equates to an approximate reduction of 30% over Building Regulations (2006). The emissions reductions secured through improvements to the fabric energy efficiency are therefore substantially greater than the 10% required by Policy NE/1 of the LDF Development Control Policies DPD (2007).

10.2 Carbon Compliance Target

Having achieved the FEES Target the statement then outlines different means of achieving the Carbon Compliance Target. Whilst the options are strategic in nature, they are considered robust enough to demonstrate how the relevant carbon emissions can be achieved. Refinement of these options will be subject to detailed design, testing and optimisation which will be undertaken in tandem with the further development of the masterplan as the scheme progresses towards submission of outline and reserved matter planning applications.

As refinement and optimisation of the options will continue to progress, we have not sought, at this stage, to provide detailed design justification for each element of each option; due to the fact that detailed design has not yet been progressed. Rather the options adopt a strategic approach relative to determination of such elements, such as engine sizing and roof area available for PV etc. It is recognised, however, that irrespective of whichever strategic approach and energy options are recommended, the implementation strategy must be flexible and adaptive to the development, shifting economic incentives and models, and evolving technologies.

The density of the development, outside of the town centre, makes a site wide DHN and associated LZC technologies (Biomass CHP, Gas CHP) financially unviable due to the extensive pipework costs. It is therefore recommended that the initial step towards Zero Carbon be achieved through roof mounted PV to the entire development.

The provision of Solar PV to 26% of the available roof space would generate 5,404,318 kWh of energy. This would meet 12.5% of the regulated energy demand of the development which surpasses the 10% requirement of Policy NE/3 (Renewable) of the LDF Development Control Policies DPD (Adopted 2007). It would also reduce the Northstowe regulated emissions by 2,804,841 KgCO₂ to **9,580,640 kgCO₂** which is beyond the Carbon Compliance Target of 9,591,578 kgCO₂. This represents a 20% reduction in CO₂ which is beyond the 10% requirement of the emerging policy CC/3 of the Proposed Submission Local Plan.

All Buildings	Enhanced FEE Emissions
Total Regulated Electricity	5,252,638 kgCO2
Total Regulated Gas	7,132,843 kgCO2
Solar PV generation	- 2,804,841 kgCO2
Sub Total Regulated	9,580,640 kgCO2
B'Regs 2013 Baseline	12,758,034 kgCO2
Carbon Compliance Target	9,591,578 kgCO2

10.3 Achieving Zero Carbon

Following the initial reductions achieved through roof mounted Solar PV a further reduction of 9,580,640 kgCO₂ is required in order to reach the Zero Carbon target. The client has the option to achieve this through further onsite technological additions, Allowable Solutions or a combination of the two; as identified below:

- a) Town Centre: Gas CHP with remaining reductions to be achieved through allowable solutions
- b) Type 2 Allowable Solution: Land based PV array
- c) Type 2 Allowable Solution: Medium to Large Scale Wind
- d) Type 1 Allowable solutions

The density of the Town Centre would reduce installation costs of a DHN significantly. The Town Centre is also mixed use, containing a variety of residential and non-residential buildings which would enable any CHP system to work at full capacity for longer periods and therefore more efficiently. This would reduce CO₂ emissions significantly within the Town Centre and reduce the dependence on allowable solutions for the remainder of the site.

Installing a GAS CHP driven DHN to meet 100% hot water demands and 80% of the space heating demands (option a) would reduce the carbon emissions by approximately 5,919,435 KgCO₂. The remaining site wide emissions to be met through allowable solutions, following the implementation of this option to the Town Centre, would be 3,661,205 KgCO₂ (3,661 tonnes).

Whilst the definition and methodology for the provision of Allowable Solutions is still in its infancy this statement provides an estimate of the land requirements for a potential Solar PV farm contribution for options a and b above. This would be 16.60ha (option a) and 43.43ha (option b) respectively. Utilising Solar PV for the Type 2 Allowable Solutions contribution would assist the development in meeting the aspirational target within policy NS/23 (An Exemplar in Sustainability) of the LDF Northstowe Area Action Plan DPD to achieve 20% of predicted energy needs from renewable technology.

Medium to large scale wind turbines (option c) would be a viable means of achieving the Zero Carbon Target however comes with significant planning risk due to the significant adverse visual and acoustic impacts on the surrounding area. Over 12 medium scale turbines or 4 large scale turbines would be the minimum requirement.

10.4 Northstowe Phase 2 Proposals

The table below provides a summary of the development requirements and the proposals to address them.

	Requirement	Northstowe Proposals				
Policy Target	10% CO ₂ reduction on 2006 B'regs through FEES	32% CO ₂ reduction from 2006 Building Regulations				
	10% energy provided by on-site renewable technology	Minimum of 12% regulated energy provided by or site renewable technology (based upon PV to 26° of available roof space)				
	10% CO ₂ reduction through on- site renewable technology	25% CO ₂ reduction provided by on-site renewable technology				
	CSH Level 4: 25% improvement on 2010 Building Regulations	100% reduction (Zero Carbon)				
	BREEAM Very Good: No minimum requirement	100% reduction (Zero Carbon)				
Policy Aspiration	Aspiration to achieve 20% of predicted energy needs from renewable technology	Potential Near Site Land Based PV farm would increase renewables provision to exceed 20% aspirational target				
Building regulations	Zero Carbon from regulated energy	FEES and Carbon Compliance targets met. Viability study to be undertaken for Town Centre DHN. Remaining reductions through Allowable Solutions.				

The Energy Statement has adopted a strategic approach appropriate for an outline application. Refinement and optimisation of the options will continue to progress during the detailed design stages and subsequent Reserved Matters Applications.

Appendices

Appendix A: Roof Mounted Solar PV Calculations

Solar PV								
Annual PV output per kWp	850.00	kWh/year						
PV peak output	1.25	kWp at 850 kWh						
Typical PV Area per kWp	10.00	m2						
Residentail Solar PV Ene	ergy Potential		Commercial Solar PV Ene	rgy Potentia				
Total Available Roof Area	137,393	m2	Total Available Roof Area	58,239	m2	137.3925317	1	
% of available Roof for PV	26%		% of available Roof for PV	26%				
Total available PV area	35,722	m2	Total available PV area	15,142	m2	50,864	m2	
Total PV Installed capacity	4,465	kWp	Total PV Installed capacity	1,893	kWp			
Total annual output from PV	3,795,469	kWh/year	Total annual output from PV	1,608,849	kWh/year	5,404,318	kWh/year	
Total Annual Solar PV Energy Generation			Total Annual Solar PV Energy Generation			Total		
Capacity For Residential Development	3,795,468.69	kWh/year	Capacity For Commercial Development	1,608,849	kWh/year	5,404,317.99	j li	
Regulated Electricity Demand	1,685,748.75	kWh/year	Regulated Electricity Demand	8,434,942	kWh/year	10,120,690.42		
Un Regulated Electricity Demand	10,013,163.59	kWh/year	Un Regulated Electricity Demand	9,269,167	kWh/year	19,282,330.25	j	
Total Energy Demand	11,698,912.34	kWh/year	Total Energy Demand	17,704,108	kWh/year	29,403,020.67	,	
% of electricity demand met by Solar PV	32%		% of electricity demand met by Solar PV	9%		18.38%		
%Total Regulated Energy Demand	225%		%Total Regulated Energy Demand	19%		53.40%		
Carbon Savings								
	1.969.848.25	kgCO2		834.993	kgCO2	2.804.841.04		
Hence Carbon Savings would be	1,970	tonnesCO2	Hence Carbon Savings would be	835	tonnesCO2	2,805	tonnesCO2	
total Regulated Emissions	4 968	tonnes	total Regulated Emissions	7417 72	tonnes	12 385	tonnesCO4	
total Emissions	10 724	tonnes	total Emissions	13080.10	tonnes	23 804	tonnesC05	
% total Regulated Emissions	40%		% total Regulated Emissions	11%		23%	,	
% total Emissions	18%		% total Emissions	6%		12%		
	0.510	1.002/11//						
Gria Supplied Electricity CO2 factor	0.519	KgCO2/KWN						

Appendix B: Town Centre CHP Calculations

CIBSE Method Calculations

Without CHP

Electricity Demand (P)	8,554,776	kWh
Electricity Emissions (P X Pf - electric emissions)	4,439,928.72	kgCO2
Thermal Demand (H)	15,905,180	kWh
Thermal Emissions (H X Hf - gas emissions)	3,435,518.95	kgCO2
	7,875,448	kgCO2
Total Emissions without CHP	7,875	tonnes

With CHP

Electricity Demand (P)	8,554,776	kWh
Thermal Demand (H)	15,905,180	kWh
Heat Generation from CHP (HCHP)	13,306,593	kWh
(H-H _{CHP}) Heat (Demand - Generation)	2,598,587	kWh
[(H-H _{CHP})/ŋ,boiler X E _{f,boiler}]	561,294.90	kgCO2
FCHP - Gas Fuel to run CHP	11,420,387	kWh
($F_{CHP} X E_{f,CHP}$) - Gas fuel X fuel factor	182,726.19	kgCO2
Electricity Generated from CHP (PCHP)	6,336,473	kWh
(P-P _{CHP}) Elect. (Demand - Generation)	2,218,303	kWh
(P-P _{CHP})X electricity fuel factor	1,151,299.34	kgCO2
Total Emissions with CHD	1,895,320	kgCO2
	1,895	tonnes

Difference between the Emissions to estimate the savings

Total CO2 emissions Savings

5,980,127 kgCO2 5,980 tonnes CO2

Total CO2 emissions Savings

Appendix C: SAP Worksheets – Building Regulations Baseline

SAP WorkSheet: New dwelling design stage

		User D	etails:								
Assessor Name: Software Name:	Assessor Name: Stroma FSAP 2012 Software Version: Version										
Property Address: 1 Bed - 2 Person - Flat											
Address :	nciona:										
T. Overall dwelling dime	IISIONS.	Aroc	(m ²)			iaht(m)		Volumo(m ³)			
Ground floor			6.1	(1a) x		2.5	(2a) =	140.25	(3a)		
Total floor area TFA = (1)	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 5	6.1	(4)].]		
Dwelling volume				(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	140 25] (5)		
							l				
2. Ventilation rate:	main seco	ondary	other		total			m ³ per hour			
	heating heat	ting		, <u> </u>		v.	10		1		
Number of chimneys	0 +	0 +	0		0	X 4	+0 =	0	(6a)		
Number of open flues	0 +	0 +	0	=	0	× 2	20 =	0	(6b)		
Number of intermittent fa	ns				2	x ^	10 =	20	(7a)		
Number of passive vents					0	× ′	10 =	0	(7b)		
Number of flueless gas fi	res				0	X 4	40 =	0	(7c)		
							Air ch	anges per hou	ır		
Infiltration due to chimner	ys, flues and fans = $(6a)+($	(6b)+(7a)+(7b)+(7	7c) =	Г	20	<u> </u>	÷ (5) =	0.14	(8)		
If a pressurisation test has b	een carried out or is intended, p	proceed to (17), o	otherwise c	ontinue fro	om (9) to ((16)]		
Number of storeys in th	ne dwelling (ns)							0	(9)		
Additional infiltration						[(9)	-1]x0.1 =	0	(10)		
Structural infiltration: 0	.25 for steel or timber fran	ne or 0.35 for	masonr	y constr	uction			0	(11)		
deducting areas of openir	ngs); if equal user 0.35	ung to the greate	er wall area	a (aller							
If suspended wooden f	loor, enter 0.2 (unsealed)	or 0.1 (seale	d), else (enter 0				0	(12)		
If no draught lobby, en	ter 0.05, else enter 0							0	(13)		
Percentage of windows	s and doors draught stripp	bed						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,	q50, expressed in cubic r	metres per ho	ur per so	uare m	etre of e	envelope	area	5.5	(17)		
If based on air permeabil	Ity value, then $(18) = [(17) \div$	- 20]+(8), otherwis	se (18) = (1	lb) maabilituu	ia haina w	and		0.42	(18)		
Number of sides sheltere	d	en done of a deg	iree ali per	meaning	is being us	seu		2] (19)		
Shelter factor	u .		(20) = 1 - [0.075 x (1	9)] =			0.85	(10)		
Infiltration rate incorporat	ing shelter factor		(21) = (18)	x (20) =				0.36	(21)		
Infiltration rate modified f	or monthly wind speed						I		7		
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec				
Monthly average wind sp	eed from Table 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 Eactor (22a)m $= (2)^{2}$	2)m $\div 4$										
(22a)m = 1.27 1.25	1.23 1.1 1.08 0	0.95 0.95	0.92	1	1.08	1.12	1.18				
	II	I				ļ	I				

SAP WorkSheet: New dwelling design stage

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se						-	
II III				ondix NL (2	(22) = (22)	\rightarrow \sim	austion (I		wine (22h) - (220)			0	(23a)
li exi	aust air n		using App		(238) = (238	() × FIIIV (6	equation (i	NO)), Other	wise (230) = (238)			0	(23b)
IT Data	anced with	neat reco	overy: effic	iency in %	allowing f	or in-use ta	actor (tron	n Table 4n) =				0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with hea	at recove	ery (MVI I	HR) (24a T	ı)m = (22	2b)m + (i	23b) × [I	1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	ed mecha	anical ve	entilation	without	heat rec	covery (N	ИV) (24b)m = (22	2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	ntilation o then (24o	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22b	outside b) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural if (22b)r	ventilation	on or wh en (24d)	ole hous m = (221	se positiv b)m othe	ve input v erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a	u) or (24b	o) or (24	c) or (24	d) in boy	(25)				1	
(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
0.11														_
3. He	at losse	s and he	eat loss	paramet	er:	Net An								X I.
ELEN	IENT	area	ss (m²)	Openin	igs 1 ²	Net Ar A ,r	ea n²	U-valu W/m2	ле К	A X U (W/I	<)	k-value	e A K k	J/K
Doors						2	x	1.1	=	2.2				(26)
Windo	WS					2.88	x1	/[1/(1.3)+	0.04] =	3.56				(27)
Floor						56.1	x	0.15		8.415				(28)
Walls		50		10.6	4	39.36	3 X	0.22] = [8.66	ה ר		¬ —	(29)
Total a	area of e	lements	, m²			106.1								(31)
Party v	wall					15	 x	0		0				(32)
Party o	ceilina					56.1			L		L		\dashv	(32b)
* for win	ndows and	roof wind	ows. use e	effective wi	indow U-va	alue calcul	 ated using	n formula 1	/ī(1/U-valu	e)+0.041 a	L Is aiven in	paragraph	 13.2	(022)
** incluc	le the area	as on both	sides of ir	nternal wal	ls and par	titions				·/ · ·] ·	5	1		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.95	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	13857.9	(34)
Therm	al mass	parame	ter (TMI	- = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pi	recisely the	indicative	values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						5.3	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			35.26	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y	·			(38)m	= 0.33 × (25)m x (5)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.88	27.7	27.52	26.67	26.51	25.77	25.77	25.64	26.06	26.51	26.83	27.17		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	63.14	62.96	62.78	61.92	61.77	61.03	61.03	60.89	61.31	61.77	62.09	62.42		
		•	•		•		•		/	Average =	Sum(39)	12 /12=	61.93	(39)

SAP WorkSheet: New dwelling design stage

Heat lo	ss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.13	1.12	1.12	1.1	1.1	1.09	1.09	1.09	1.09	1.1	1.11	1.11		
Numbe	or of day	rs in mo	nth (Tab	le 1a)		1		!	,	Average =	Sum(40)1	.12 /12=	1.1	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	.lul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
												_		
4. Wa	ter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 ×	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	.9)	87		(42)
Annual Reduce not more	averag the annua that 125	je hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	82. If	.74		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pe	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	91.01	87.7	84.39	81.08	77.77	74.46	74.46	77.77	81.08	84.39	87.7	91.01		
-									-	Total = Su	m(44) ₁₁₂ =		992.85	(44)
Energy o	content of	hot water	used - ca	culated m	onthly $= 4$.	190 x Vd,r	n x nm x L	0Tm / 3600) kWh/mor	oth (see Ta	ables 1b, 10	c, 1d)		
(45)m=	134.97	118.04	121.81	106.2	101.9	87.93	81.48	93.5	94.62	110.27	120.36	130.71		
lf instant	aneous v	vater heati	ng at point	t of use (no	o hot water	· storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1301.78	(45)
(46)m=	20.25	17.71	18.27	15.93	15.28	13.19	12.22	14.02	14.19	16.54	18.05	19.61		(46)
Water	storage	loss:	-					<u>.</u>						
Storag	e volum	ne (litres)	includir	ng any s	olar or N	/WHRS	storage	within sa	ame ves	sel	(0		(47)
If comr	nunity h	neating a	and no ta	ank in dw	velling, e	nter 110	litres in	(47)						
Otherw Water	lise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	turer's de	eclared l	oss fact	or is kno	wn (kWł	n/dav):					า		(48)
Tempe	rature f	actor fro	m Table	2b		,	, , , , , , , , , , , , , , , , , , ,					<u></u>		(49)
Eneray	lost fro	om water	storage	. kWh/v	ear			(48) x (49)) =			<u></u>		(50)
b) If m	anufact	turer's de	eclared	cylinder	loss fact	or is not	known:	(- / (-)	,		`	5		(00)
Hot wa	ter stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)				(0		(51)
If comr	nunity h	heating s	ee secti	on 4.3									I	(72)
Tempe	e lactor rature f	actor fro	bie za m Table	2h)		(52)
Enorgy	loct fro				oor			$(47) \times (51)$) v (52) v (53) -		<u> </u>		(53)
Enter	(50) or	(54) in (5	55)	, KVVII/ yv	cai			(47) X (01)	/ (() ~ ()	00) -		ן ר		(54)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m	`	.		()
(56)m-	0	0	0	0	0	0	0		0	0		0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	i0), else (5	7)m = (56)	m where (H11) is from	m Append	ix H	(00)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	om Table		•		-		•)		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		L		I	
(moc	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 x (41)	m						
----------	-------------	---------------	---------------	----------------	----------------------------	-----------------------	----------------------	-------------------------------	--------------	-------------	--------------	-------------	---------------	-------
(61)m=	23.28	20.99	23.19	22.38	23.09	22.29	23.01	23.06	22.34	23.15	22.47	23.26		(61)
Total h	heat req	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	158.25	139.04	145	128.58	124.99	110.22	104.49	116.56	116.96	133.41	142.83	153.97		(62)
Solar DI	HW input	calculated	using App	endix G or	r Appendix	H (negativ	ve quantity) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies,	, see Ap	pendix C	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=	158.25	139.04	145	128.58	124.99	110.22	104.49	116.56	116.96	133.41	142.83	153.97		
								Outp	out from w	ater heate	r (annual)₁	12	1574.29	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	50.7	44.5	46.3	40.91	39.65	34.81	32.84	36.85	37.05	42.45	45.64	49.28		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	vater is fr	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	s (Table	e 5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17		(66)
Lightin	g gains	(calcula	ted in A	pendix	L, equat	ion L9 or	^r L9a), a	lso see	Table 5					
(67)m=	37.59	33.39	27.15	20.56	15.37	12.97	14.02	18.22	24.45	31.05	36.24	38.63		(67)
Applia	nces da	ins (calc	ulated ir	Append	dix L. ea	uation L ²	13 or L1:	3a), also	see Ta	ble 5	<u> </u>			
(68)m=	243.31	245.83	239.47	225.92	208.83	192.76	182.02	179.5	185.86	199.4	216.5	232.57		(68)
Cookir	u dains	(calcula	ted in A	n Dendix	L equat	ion 15	or I 15a)	also se	e Table	5				
(69)m=	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09		(69)
Pump	and fa	ns gains	(Table !	5a)							I			
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	sea ev	n Aporatic	n (nega	i tive valu	i es) (Tab	le 5)								
(71)m=	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78		(71)
Water	heating	nains (T	I Table 5)											
(72)m=	68.14	66.22	62.23	56.81	53.3	48.35	44.14	49.53	51.45	57.06	63.39	66.23		(72)
Total	internal	aaine -				(66)	m + (67)m	+ (68)m -	- (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	437.51	433.91	417.33	391.77	365.97	342.55	328.66	335.73	350.24	375.99	404.61	425.91		(73)
6. So	lar gains	S:								[
Solar g	gains are o	alculated	using sola	r flux from	Table 6a	and associ	ated equa	tions to co	nvert to th	ne applicat	ole orientat	ion.		
Orient	ation: A	Access F	actor	Area		Flu	X		g_		FF		Gains	
	-	Table 6d		m²		Tab	ole 6a	Т	able 6b	Та	able 6c		(W)	
Solar g	gains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m				
(83)m=	56.31	110.14	181.39	264.55	324.22	331.89	315.98	271.42	210.97	130.7	70.21	46.3		(83)
Total g	gains – i	nternal a	and sola	r (84)m =	= (73)m ·	+ (83)m	, watts			-				
(84)m=	493.82	544.06	598.72	656.32	690.18	674.45	644.64	607.15	561.21	506.68	474.81	472.21		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	perature	during h	neating p	eriods ir	n the livii	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							1
01	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	. (7
Stroma	FSAP 201	2 version	: 1.0.0.28	SAP 9.91) - n ttp://w v	ww.stroma	.com						Page 4	ot /

(86)m=	0.99	0.98	0.96	0.89	0.75	0.56	0.41	0.46	0.7	0.92	0.98	0.99		(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=	20.05	20.19	20.43	20.72	20.91	20.98	21	21	, 20.95	20.7	20.33	20.02		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	19.98	19.98	19.99	20	20	20.01	20.01	20.01	20.01	20	20	19.99		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.97	0.94	0.86	0.69	0.48	0.32	0.36	0.62	0.89	0.97	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.74	18.95	19.29	19.69	19.92	20	20.01	20.01	19.97	19.68	19.16	18.71		(90)
								-	f	LA = Livin	g area ÷ (4	4) =	0.5	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	.A) × T2					
(92)m=	19.39	19.57	19.86	20.2	20.41	20.49	20.5	20.5	20.46	20.19	19.74	19.37		(92)
Apply	adjustn	nent to tl	ne mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.39	19.57	19.86	20.2	20.41	20.49	20.5	20.5	20.46	20.19	19.74	19.37		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	to the r	nean int	ernal ter	nperatur	re obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	lon	Tactor IC	Mor		Ible 9a	lup	lul	Δυα	Son	Oct	Nov	Dec		
Utilisa	ution fac	tor for a	ains hm	. Api	Iviay	Jun	Jui	Aug	Sep	Oci	INUV	Dec		
(94)m=	0.98	0.97	0.94	0.86	0.72	0.52	0.37	0.41	0.66	0.9	0.97	0.99		(94)
Usefu	l gains,	hmGm .	W = (94	4)m x (84	4)m					_				
(95)m=	485.42	528.6	564.05	567.26	496.86	353.34	237.42	248.5	370.29	454.34	460.33	465.6		(95)
Month	nly avera	age exte	rnal tem	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)
Heat I	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	953	923.62	838.8	700.03	538.15	359.61	238.23	249.86	390.06	592.4	784.99	946.66		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	347.88	265.45	204.41	95.59	30.72	0	0	0	0	102.72	233.75	357.91		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1638.43	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								29.21	(99)
9a. En	ergy rec	uiremer	its – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 – ((203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1							·	89.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %					·	0	(208)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec	kWh/v	 ear
Space	e heatin	g require	ement (c	alculate	d above)		1 / 149	000	000		200		
	347.88	265.45	204.41	95.59	30.72	0	0	0	0	102.72	233.75	357.91		
(211)m	= {[(98)m x (20	4)] + (21	u 0)m } x	100 ÷ (2	.06)	L				L			(211)
、 · · · /·	386.96	295.27	227.37	106.33	34.17	0	0	0	0	114.26	260.01	398.12		× /
			L			1		Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	1822.5	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214)	m } x 100 ÷ (208)			-			_	-		
(215)m= 0 0	0 0	0	0	0	0	0	0	0	0		_
					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water heating	/ I I / I										
158.25 139.04	(calculated a 145 128.58	bove) 124.99 1	10.22	104.49	116.56	116.96	133.41	142.83	153.97]	
Efficiency of water heater	,									87.3	(216)
(217)m= 89.07 88.99 8	38.8 88.39	87.8	87.3	87.3	87.3	87.3	88.41	88.9	89.1		(217)
Fuel for water heating, kV	Vh/month	II								1	
$(219)m = (64)m \times 100 \div$	(217)m			110.00	400.54	400.07	450.0	400.00	470.0	1	
(219)m= 177.66 156.24 16	53.28 145.47	142.35 1	26.26	119.69	133.51 Tota	133.97	150.9	160.68	172.8	1702.02	
Annual totals							••••• ₁₁₂	Wh/vear		kWh/vear	(219)
Space heating fuel used,	main system	1					K	Will year		1822.5	1
Water heating fuel used										1782.82	i
Electricity for pumps, fans	s and electric	keep-hot									4
central heating pump:									30]	(230c)
boiler with a fan-assisted	d flue								45		(230e)
Total electricity for the ab	ove, kWh/yea	ır			sum	of (230a).	(<mark>2</mark> 30g) =			75	(231)
Electricity for lighting									_	265.53	(232)
10a Euel costs - individu	ual heating sv	stems									
10a. Fuel costs - individu	u <mark>al h</mark> eating sy	stems:	Fu kW	el h/year			Fuel P (Table	rice 12)		Fuel Cost £/year	
10a. Fuel costs - individu Space heating - main sys	u <mark>al heating sy</mark> tem 1	stems:	Fue kW (211	el /h/year) x			Fuel P (Table	rice 12)	x 0.01 =	Fuel Cost £/year 63.423	(240)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys	u <mark>al heating sy</mark> tem 1 tem 2	stems:	Fue kW (211 (213	el h/year) x			Fuel P (Table	12)	x 0.01 = x 0.01 =	Fuel Cost £/year 63.423](240)](241)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar	u <mark>al heating sy</mark> tem 1 tem 2 ry	stems:	Fue kW (211 (213 (215	el h/year) x) x ;) x			Fuel P (Table 3.4	Price 12) ¹⁸	x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 63.423 0 0)(240))(241))(242)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other	ual heating sy tem 1 tem 2 ry fuel)	stems:	Fue kW (211 (213 (215 (219	el 'h/year) x ;) x ;) x			Fuel P (Table 3.4 0 13. 3.4	Price 12) ¹⁸ 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 63.423 0 0 62.04](240)](241)](242)](247)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric	tem 1 tem 2 ry fuel) keep-hot	stems:	Fue kW (211 (213 (215 (219 (231	el 'h/year) x ;) x ;) x			Fuel P (Table 3.4 0 13. 3.4 13.	Price 12) 18 19 19 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 63.423 0 0 62.04 9.89)(240))(241))(242))(247))(249)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting	tem 1 tem 2 ry fuel) keep-hot of (230a) to (230g) sepa	Fue kW (211 (213 (215 (219 (231 arately (232	el 'h/year) x ;) x ;) x ;) x	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \hline \begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Table 12a 35.02)(240))(241))(242))(247))(249))(250)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg	tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12)	230g) sepa	Fue kW (211 (213 (215 (219 (231 arately (232	el 'h/year) x ;) x ;) x ;) x	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Table 12a 35.02 120](240)](241)](242)](247)](249)](250)](250)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost	tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12) t lines (253) a	230g) sepa nd (254) as (245)(24	Fue kW (211 (213 (215 (219 (231 arately (232 s need 7) + (25	el 'h/year) x) x) x) y as app led 0)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline ding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Fable 12a 35.02 120](240)](241)](242)](247)](249)](250)](251)](255)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ	ual heating sy tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12) t lines (253) a ual heating sy	(230g) sepa nd (254) as (245)(24)	Fue kW (211 (213 (215 (219 (231 arately (232 s need 7) + (25	el 'h/year) x ;) x ;) x ;) x)) ;) as app ;) led 0)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline x \ 0.01 = \end{array}$	Fuel Cost £/year 63.423 0 0 0 62.04 9.89 Table 12a 35.02 120](240)](241)](242)](247)](249)](250)](251)](255)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tab	ual heating sy tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12) tines (253) a ual heating sy le 12)	(230g) sepa nd (254) as (245)(24 ystems	Fue kW (211 (213 (215 (219 (231 arately (232 s need 7) + (25	el 'h/year) x) x) x))))))))))))))	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline x \ 0.01 = \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Table 12a 35.02 120 290.38](240)](241)](242)](247)](249)](250)](251)](255)](255)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tab Energy cost factor (ECF)	tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12) t lines (253) a ual heating sy le 12)	(230g) sepa nd (254) as (245)(24) (255) x (25)	Fue kW (211 (213 (215 (219 (231 arately (232 s need 7) + (25	el h/year) x) x) x)) r as app led 0)(254) 4) + 45.0]	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. fuel pri 13.	Price 12) 18 19 19 18 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \begin{array}{l} x \ 0.01 = \\ 0.01 = \\ \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Table 12a 35.02 120 290.38 0.42 1.21](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)
10a. Fuel costs - individu Space heating - main sys Space heating - main sys Space heating - secondar Water heating cost (other Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tab Energy cost factor (ECF) SAP rating (Section 12)	tem 1 tem 2 ry fuel) keep-hot of (230a) to (es (Table 12) t lines (253) a ual heating sy le 12)	(230g) sepa nd (254) as (245)(24) ystems [(255) x (24)	Fue kW (211 (213 (215 (219 (231 (231) arately (232) s need 7) + (25) 56)] ÷ [(4)	el h/year) x) x) x)) r as app) led 0)(254)	licable a = =	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ \begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 63.423 0 0 62.04 9.89 Table 12a 35.02 120 290.38 0.42 1.21 83.17](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)](258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	393.66 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	385.09 (264)
Space and water heating	(261) + (262) + (263) + (264) =		778.75 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	137.81 (268)
Total CO2, kg/year	sum	of (265)(271) =	955.48 (272)
CO2 emissions per m ²	(272)) ÷ (4) =	17.03 (273)
El rating (section 14)			87 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	2223.45 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2175.04 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4398.49 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)

sum of (265)...(271) =

(272) ÷ (4) =

'Total Primary Energy

Primary energy kWh/m²/year

5443.92

97.04

(272)

(273)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 20	12	:	Stroma Softwa	a Num Ire Ver	ber: sion:		Versio	n: 1.0.0.28	
		Pro	operty A	Address:	1 Bed -	2 Perso	on - Flat			
Address :										
1. Overall dwelling dimer	hsions:		_							
One word flager			Area	a(m²)		Av. Hei	ight(m)	1	Volume(m ³)	
			5	6.1	(1a) x	2	2.5	(2a) =	140.25	(3a)
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1	e)+(1n)	5	6.1	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	140.25	(5)
2. Ventilation rate:										
	main s heating	secondary heating		other		total			m ³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x	20 =	0	(6b)
Number of intermittent far	ـــــــــــــــــــــــــــــــــــــ					2	x ′	10 =	20	(7a)
Number of passive vents						0	x [,]	10 =	0	(7b)
Number of flueless gas fir	es				L L	0	X	40 =	0	(7c)
					L			Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = (6a)+(6b)+(7a))+(7b)+(7	7c) =	ļ	20		÷ (5) =	0.14	(8)
It a pressurisation test has be Number of storeys in th	en carried out or is intend	led, proceed	to (17), o	otherwise c	ontinue fro	om (9) to (16)	1	0	
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber	frame or C).35 for	masonr	y constr	uction		-	0	(11)
if both types of wall are pre	esent, use the value corre	sponding to t	he greate	er wall area	a (after					_
deducting areas of opening	gs); if equal user 0.35	aled) or 0.1	(seale	d) else	enter ()			1	0	T (12)
If no draught lobby, enter	er 0.05. else enter 0		(00010	u), 0100					0	(12)
Percentage of windows	and doors draught s	stripped							0	(14)
Window infiltration	Ũ		(0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	לק50, expressed in cu	bic metres	per ho	ur per so	quare m	etre of e	nvelope	area	5.5	(17)
If based on air permeabilit	ty value, then (18) = [(17) ÷ 20]+(8),	, otherwis	se (18) = (16)				0.42	(18)
Air permeability value applies	if a pressurisation test ha	as been done	or a deg	iree air pei	meability i	is being us	sed	,		-
Number of sides sheltered	1			(20) = 1 - [0.075 x (1	9)] =			2	(19)
Infiltration rate incorporati	ng shelter factor			(21) = (18)	x (20) =	-/1			0.26	(20)
Infiltration rate modified for	or monthly wind spee	d		· · · · ·				l	0.30	
Jan Feb	Mar Apr Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7				1					
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
		1 1	I				1	<u> </u>		
Wind Factor (22a)m = (22)m ÷ 4		0.05	0.00	4	1.00	1.40	1 4 0		
(220)111 1.27 1.25 1	.23 1.1 1.08	0.95	0.90	0.92	I	1.08	1.12	1.10		

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m					
	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se				•	-		
IT Me	echanica			andix NL (0	26) (006) .	austion /		nuiae (22h)	(22a)			0	(23a)
li exi				indix IN, (2	3D) = (238	a) × FIIIV (e		NO)), Other) = (238)			0	(23b)
IT Data	anced witi	n neat reco	very: effic	iency in %	allowing f	or in-use ta	actor (from) =			(00)	0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a I	m = (22)	2b)m + (2	23b) × [′	1 – (23c)	÷ 100]	(24a)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	ed mecha	anical ve I	entilation	without	heat rec	covery (N	ИV) (24b I)m = (22	2b)m + (2	23b) I	1	I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h if (22b)r	ouse ex n < 0.5 >	tract ver (23b), t	ntilation o hen (240	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22b	outside b) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (221	e positiv b)m othe	ve input erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]	-			
(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
2 40	ot loooo	a and he		ooromot	or!									_
					de	Not Ar						k voluc	<u>`</u>	
		area	(m²)	m	95 1 ²	A,r	n ²	W/m2	K	(W/ł	<)	kJ/m ² ·l	, (kJ/K
Doors						2	x	1.1] = [2.2				(26)
Windo	ws					2.88	x1.	/[1/(1.3)+	0.04] =	3.56	F			(27)
Floor						56.1	₩,	0.15		8.415	Fir			(28)
Walls		50		10.6	4	39.36		0.22		8.66			5 📂	(29)
Total a	irea of e	lements	 m²	10.04	·	106.1		0.22	L	0.00	L			(31)
Party	wall		,			100.1	<u> </u>		r					(01)
Dorty							╡ ^	0	[0			\dashv	(32)
* for win	ening	Iroofwind		footivowi	ndowilly	56.1		formula 1	15/1/11	0.001		naraarank		(32b)
** includ	le the area	as on both	sides of ir	nternal wal	ls and par	titions	aleu using	i ornula 1,	/[(1/0-vaiu	e)+0.04j a	is given in	paragraph	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.95	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	13857.	9 (34)
Therm	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	: Medium		250	(35)
For desi can be ι	ign asses: Ised inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						5.3	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			35.26	(37)
Ventila	tion hea	at loss ca	alculated	monthly	/	-			(38)m	= 0.33 × (25)m x (5)	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.88	27.7	27.52	26.67	26.51	25.77	25.77	25.64	26.06	26.51	26.83	27.17		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	63.14	62.96	62.78	61.92	61.77	61.03	61.03	60.89	61.31	61.77	62.09	62.42		
		-	-				-		/	Average =	Sum(39)1	12 /12=	61.93	(39)

Heat lo	oss para	imeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.13	1.12	1.12	1.1	1.1	1.09	1.09	1.09	1.09	1.1	1.11	1.11		
Numbe	er of day	ı /s in moi	nth (Tab	le 1a)					/	Average =	Sum(40)1	.12 /12=	1.1	(40)
- turno c	Jan	Feh	Mar	Apr	May	Jun	. lul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,		20	01											(11)
4. Wa	iter heat	ting enei	rgy requ	irement:								kWh/ye	ear:	
Assum if TF	ed occu A > 13.9 A £ 13.9	upancy, l 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (1	ΓFA -13.	1./ .9)	87		(42)
Annual Reduce not more	l averag the annua e that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed : ld)	(25 x N) to achieve	+ 36 a water us	se target o	f 82	.74		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per I	r day for ea	ach month I	Vd,m = fa	ctor from	i able 1c x	(43)					I	
(44)m=	91.01	87.7	84.39	81.08	77.77	74.46	74.46	77.77	81.08	84.39	87.7	91.01		-
Energy o	content of	hot water	used - cai	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600) kWh/mon	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 10	c, 1d)	992.85	(44)
(45)m=	134.97	118.04	121.81	106.2	101.9	87.93	81.48	93.5	94.62	110.27	120.36	130.71		_
lf instant	aneous w	vater heatii	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)	Total = Su	m(45) ₁₁₂ =		1301.78	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:		<u> </u>				<u></u>		_				
Storag	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel)		(47)
If comr	nunity h	neating a	ind no ta	ank in dw	elling, e	nter 110) litres in	(47)						
Otherw	ise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	siorage	iuss. urer's de	eclared I	oss facti	or is kno	wn (k\Mł	n/dav).					<u>۲</u>		(48)
Tempe	rature f	actor fro	m Table	2h			"duy).					<u> </u>		(40)
Energy	lost fro	m water	storade	~ 20 . k\//b/\/	əər			$(48) \times (49)$	_					(43)
b) If m	anufact	urer's de	eclared (cylinder l	oss fact	or is not	known:	(40) × (49)	-			J		(50)
, Hot wa	ter stor	age loss	factor fi	om Tabl	e 2 (kW	h/litre/da	ay)				()		(51)
If comr	nunity h	neating s	ee secti	on 4.3										
Volume	e factor	from Ta	ble 2a								()		(52)
Tempe	rature f	actor fro	m Table	2b							()		(53)
Energy	lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =	()		(54)
Enter	(50) or ((54) in (5	55)								()		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3						()		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	. 4.	- (- ()			
(mod	alfied by	r tactor fi	rom lab	ie H5 if t	nere is s	solar wat	ter heati	ng and a	cylinde		stat)	0		(50)
(59)m=	U	U	U	0	U	U	U	U	U	U	U	U		(39)

Combi	loss cal	culated	for each	month ((61)m = ((60) ÷ 36	65 × (41)	m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for each	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	114.72	100.34	103.54	90.27	86.61	74.74	69.26	79.48	80.42	93.73	102.31	111.1		(62)
Solar DH	IW input o	alculated	using App	endix G or	Appendix	H (negativ	/e quantity	') (enter '0	if no sola	r contributi	on to wate	er heating)		
(add a	dditiona	lines if	FGHRS	and/or V	WWHRS	applies,	see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from wa	ater hea	ter											
(64)m=	114.72	100.34	103.54	90.27	86.61	74.74	69.26	79.48	80.42	93.73	102.31	111.1		_
								Outp	out from wa	ater heatei	(annual)	12	1106.52	(64)
Heat g	ains froi	n water	heating,	kWh/mo	onth 0.28	5´[0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	28.68	25.08	25.88	22.57	21.65	18.69	17.31	19.87	20.11	23.43	25.58	27.78		(65)
inclu	de (57)ı	n in calo	culation	of (65)m	only if c	ylinder is	s in the c	welling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	iins (see	Table 5	and 5a):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equati	on L9 or	[.] L9a), a	lso see	Table 5					
(67)m=	15.04	13.35	10.86	8.22	6.15	5.19	5.61	7.29	9.78	12.42	14.5	15.45		(67)
Appliar	nces gai	ns (calc	ulated ir	Append	dix L, equ	Jation L	13 or L1:	3a), also	see Ta	ble 5				
(68)m=	163.02	、 164.71	160.44	151.37	139.91	129.15	121.95	120.26	124.53	133.6	145.06	155.82		(68)
Cookin	a aains	(calcula	ted in A	opendix	L. equat	ion L15	or L15a)	. also se	e Table	5				
(69)m=	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35		(69)
Pumps	and far	ns gains	(Table f	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
losses		aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78		(71)
Water	heating	aains (T	able 5)			_								
(72)m=	38.55	37.33	34.79	31.34	29.1	25.95	23.27	26.71	27.93	31.49	35.52	37.33		(72)
Total i	nternal	nains –				(66)	m + (67)m	+ (68)m +	- (69)m + ((70)m + (7	1)m + (72)	m		. ,
(73)m=	267.64	266.43	257.14	241.98	226.21	211.33	201.88	205.3	213.28	228.56	246.12	259.65		(73)
6. Sol	ar gains	:			-						-			
Solar g	ains are c	alculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicab	le orientat	ion.		
Orienta	ation: A	ccess F	actor	Area		Flu	x		g_		FF		Gains	
	Т	able 6d		m²		Tab	ole 6a	Т	able 6b	Та	able 6c		(W)	
Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	56.31	110.14	181.39	264.55	324.22	331.89	315.98	271.42	210.97	130.7	70.21	46.3		(83)
Total g	ains – ir	nternal a	ind solai	(84)m =	= (73)m -	⊦ (83)m ,	watts							
(84)m=	323.95	376.58	438.53	506.53	550.42	543.22	517.85	476.72	424.24	359.25	316.32	305.95		(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	iving are	ea, h1,m	(see Ta	ble 9a)							4
0	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	- (6
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(86)m=	1	1	0.99	0.95	0.86	0.68	0.51	0.57	0.84	0.98	1	1		(86)
Moon	intorno	l tompor	i aturo in	living or	00 T1 (fc	l Mow cto	nc 2 to 7	L 7 in Tabl						
(87)m-	10 77			11VIII 20 55	20.83		20 00	20.99	20.89	20.51	20.08	19.75		(87)
(07)11-	10.77	10.00	20.2	20.00	20.00	20.00	20.00	20.00	20.00	20.01	20.00	13.75		(0.)
Temp	erature	during h	neating p	periods in	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)				I	
(88)m=	19.98	19.98	19.99	20	20	20.01	20.01	20.01	20.01	20	20	19.99		(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	0.94	0.81	0.59	0.4	0.46	0.77	0.97	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=	18.86	19.02	19.29	19.64	19.88	19.99	20.01	20.01	19.94	19.61	19.18	18.84		(90)
				•			•		f	LA = Livin	g area ÷ (4	4) =	0.5	(91)
Moon	intorna	l tompor	aturo (fo	or the wh	olo dwol	llina) – f	Ι Λ 🗸 Τ1	⊥ (1 _ fl	Λ) ∨ Τ2					
(92)m-	10 31	10 47	10 74		20 36	20.48		+(1-12)	20.42	20.06	19.63	10.3		(92)
	adiusta	nont to t	ho moor			aturo fro		20.0			10.00	10.0		(0-)
(93)m-	10 31		19 74	20.09	20.36	20.48	20.5	20.5	20 42	20.06	19.63	10.3		(93)
(00)III-	aco hoa	ting rog	uiromon	+	20.00	20.40	20.0	20.0	20.42	20.00	10.00	10.0		(00)
Sot Ti	i to tho r	ang requ		mporatu	ro obtain	od at et	on 11 of	Table 0	a co tha	t Ti m_('	76)m an	d ro, colo	vulato	
the ut	ilisation	factor fo	or gains	using Ta	able 9a	ieu al Si		Table 9	0, SO INA	t 11,m=(70)III ali	u re-caic	ulale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
ا Utilisa	ation fac	tor for a	ains. hm):								200		
(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.46	0.52	0.8	0.97	0.99	1		(94)
Usefu	l gains.	hmGm	W = (9)	1 4)m x (8-	4)m									
(95)m=	323.07	374.24	430.64	475.33	454.87	343.86	235.88	245.56	338.97	347.69	314.55	305.34		(95)
Month	nlv avera	age exte	rnal tem	n Derature	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)
Heat	loss rate	e for mea	ı an interr	al tempo	erature.	Lm.W:	I =[(39)m :	ı x [(93)m	– (96)m	1				
(97)m=	947.98	917.3	831.24	693.2	534.61	, 358.75	238.08	249.57	387.2	584.15	777.72	942.33		(97)
Space	e heatin	a reauire	ement fo	r each n	nonth. k	Nh/mon ⁻	1 = 0.02	24 x [(97])m – (95)ml x (4 [,]	1)m			
(98)m=	464.93	364.94	298.05	156.87	59.33	0	0	0	0	175.93	333.48	473.92		
. ,								Tota	l per vear	(kWh/vear) = Sum(9	8)1 59 12 =	2327.44	(98)
0					24					(,(-	- ,		
Space	e neatin	g require	ement in		year								41.49	(99)
8c. Sp	bace co	oling rec	quiremer	nt										
Calcu	lated fo	<u>r June, J</u>	July and	August.	See Tat	ple 10b			·				I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate	e Lm (ca	lculated	using 2	5°C inter	nal tem	perature	and exte	ernal ten	nperatur	e from T	able 10)	I	
(100)m=	0	0	0	0	0	573.69	451.63	462.78	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm				1		r				I	
(101)m=	0	0	0	0	0	0.91	0.96	0.94	0	0	0	0		(101)
Usefu	Il loss, h	mLm (V	Vatts) =	(100)m > T	(101)m		i		· · · · ·				I	
(102)m=	0	0	0	0	0	523.78	431.85	433.99	0	0	0	0		(102)
Gains	s (solar g	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)				I	
(103)m=	0	0	0	0	0	705.09	674.11	627.14	0	0	0	0		(103)
Space		g require	ement fo	or month,	whole d	lwelling,	continue	ous (kW	(h) = 0.0	24 x [(10)3)m – (102)m]:	x (41)m	
set (1	04)III tO		104)m <	ະວ×(98)/III 	120 54	120.04	140 7	0	0	0	0		
(104)M=	U	U	0	U	U	130.54	100.24	143.7		(104)	0	184.10	(404)
									rotal	= Sum(190 41)	-	454.49	(104)

Cooled	fraction	า							f C =	cooled	area ÷ (4	4) =	1	(105)	
Intermi	ttency f	actor (Ta	able 10b)											
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0			
-							-	Tota	= Sum(104)	=	0	(106)		
Space	nittency factor (Table 10b) $1 = 0$ 0 0 0 0.25 0.25 0.25 0 0 0 Total = Sum(104) = Total = Sum(104) Total = Sum(104) Total = Sum(107)														
(107)m=	0	0	0	0	0	32.64	45.06	35.93	0	0	0	0			
-									Total	= Sum(107)	=	113.62	(107)	
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)	÷ (4) =			2.03	(108)	
8f. Fab	ric Enei	rgy Effici	ency (ca	alculated	l only un	der spec	cial conc	litions, s	ee sectio	on 11)					
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		43.51	(109)	



		U	lser De	tails:						
Assessor Name: Software Name:	Stroma FSAP 2012	2	S S	Stroma Softwa	a Num re Ver	ber: sion:		Versio	n: 1.0.0.28	
		Prop	perty Ad	ddress:	2 Beds	- Flat				
Address :										
1. Overall dwelling dimer	isions:									
One word file on		г	Area(<u>m²)</u>		Av. Hei	ight(m)	1 /2 \	Volume(m ³)	
Ground floor		l	72	2.6	(1a) x	2	2.6	(2a) =	188.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)·	+(1n)	72	6	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	188.76	(5)
2. Ventilation rate:										
	main see	condary	0	other		total			m ³ per hou	•
Number of chimneys		0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0	i = Г	0	×	20 =	0	(6b)
Number of intermittent fan	s]	L		, r	3	x ^	10 =	30	(7a)
Number of passive vents						0	x ^	10 =	0	(7b)
Number of flueless gas fire	es					0	X	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = $(6a)$	+(6b)+(7a)+	-(7b)+(7c)	c) =	ontinuo fr	30	(16)	÷ (5) =	0.16	(8)
Number of storeys in the	en carned out of is interided e dwelling (ns)	, proceeu io	(<i>17)</i> , 00	iei wise c	onunue no	5m (9) to (10)		0	
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fr	ame or 0.3	35 for r	masonr	constr	uction			0	(11)
if both types of wall are pre	sent, use the value correspo	onding to the	e greater	[.] wall area	a (after					
deducting areas of opening	ys); if equal user 0.35	d) or 0 1 (halea	ا) مادم (ontor ()				0	
If no draught lobby enter	200, enter 0.2 (unseale	u) or 0.1 (Sealeu	i), eise (0	(12)
Percentage of windows	and doors draught stri	pped							0	(10)
Window infiltration		P	0.	.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8	3) + (10) +	- (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, c	50, expressed in cubic	c metres p	ber hou	ir per so	uare m	etre of e	nvelope	area	6	(17)
If based on air permeabilit	y value, then (18) = [(17)) ÷ 20]+(8), c	otherwise	e (18) = (1	16)				0.46	(18)
Air permeability value applies	if a pressurisation test has l	been done o	or a degre	ee air per	meability i	is being us	sed			_
Number of sides sheltered			(2	20) – 1 - [0 075 v (1	0)1 -			2	(19)
Infiltration rate incorporativ	a chaltar factor		(2	21) - (18)	x (20) -	5)] –			0.85	
Infiltration rate modified for	r monthly wind anod		(2	- (10)	x (20) -				0.39	(21)
		lun		Δυσ	Son	Oct	Nov	Dec		
	ad frame Table 7	Jun		Aug [Seb	001		Dec		
(22)m- 51 5		2.0	20	27	4	12	4.5	47		
	4.4 4.3	5.0	5.0	3.1	4	4.3	4.0	4.7		
Wind Factor (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		

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_		
	0.5	0.49	0.48	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46			
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se								7(220)
lf exh	aust air h	eat nump i	using App	endix N (2	(23a) = (23a	a) x Fmv (e	equation (I	N5)) other	rwise (23h) = (23a)			0		$\int_{(22h)}^{(23a)}$
lf hal:	anced with	n heat reco	overv: effic	viency in %	allowing f	or in-use f	actor (fron	n Table 4h) =) = (200)			0		$\int_{(200)}^{(200)}$
a) If	halance	nd mech	anical ve	ntilation	with he	at recove		HR) (24a	n^{-}	2b)m ⊥ ('	23b) v [[,]	1 _ (23c)	1001](230)
(24a)m=												$\frac{1-(230)}{0}$]		(24a)
b) If	halance		anical ve		without	heat rec		(24h	$\int_{-\infty}^{\infty}$	$\sum_{i=1}^{n}$	23h)	Ů	J		(-7
(24b)m=									0		230)	0	1		(24b)
() If			tract ver	L tilation (l °		Ventilatio	n from c			ů	Ů	J		
0) 11	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22b	b) m + 0.	5 × (23b))				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24c)
d) If	natural	ventilatio	on or wh	lole hous	se positiv	/e input	ventilatio	on from l	oft		1		1		
	if (22b)n	n = 1, th	en (24d)	m = (22	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]		•			
(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)						
(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	-0.57	0.58	0.59	0.6	0.61			(25)
3. He	at losse	s and he	eat loss	paramet	er:								_		
ELEN	IENT	Gros	ss	Openin	igs	Net Ar	rea	U-valı	Je	AXU		k-value	e	АX	k
		area	(m²)	m	1 ²	A ,r	m²	W/m2	K	(VV/I	K)	kJ/m²•l	ĸ	kJ/k	(
Doors						2	x	1.1	=	2.2					(26)
Windo	ws Type	e 1				2.88	x1	/[1/(1.3)+	0.04] =	3.56					(27)
Windo	ws Type	e 2				3.96	x1	/[1/(1.3)+	0.04] =	4.89					(27)
Walls		80)	11.7	2	68.28	3 X	0.22	=	15.02					(29)
Roof		72.	6	0		72.6	x	0.14	=	10.16					(30)
Total a	area of e	elements	, m²			152.6	6								(31)
Party f	loor					72.6					ſ				(32a)
* for win ** inclua	idows and le the area	l roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Is and par	alue calcul titions	lated using	g formula 1,	/[(1/U-valu	e)+0.04] a	as given in	paragraph	1 3.2		-
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				39.4	4	(33)
Heat c	apacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	1580	4.6	(34)
Therm	al mass	parame	eter (TMI	- = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250)	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f			_
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						7.6	3	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)									-
Total f	abric he	at loss							(33) +	(36) =			47.0	3	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y I		1	1.	(38)m	= 0.33 × (25)m x (5))	1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			(00)
(38)m=	38.85	38.55	38.26	36.88	36.62	35.42	35.42	35.2	35.89	36.62	37.14	37.69	J		(38)
Heat tr	ransfer o	coefficie	nt, W/K					,	(39)m	= (37) + (3	38)m		1		
(39)m=	85.88	85.58	85.29	83.91	83.65	82.45	82.45	82.23	82.91	83.65	84.17	84.72			٦.
										Average =	Sum(39)1	12 /12=	83.9	1	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.18	1.18	1.17	1.16	1.15	1.14	1.14	1.13	1.14	1.15	1.16	1.17		
Numbe	r of day	us in mo	nth (Tab	lo 12)					,	Average =	Sum(40) ₁ .	12 /12=	1.16	(40)
	Jan	Feh	Mar	Anr	May	Jun	Jul	Αμα	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assum if TF if TF	Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.69													
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.69 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)														(43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec														
Hot wate	r usage ii	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					4	
(44)m=	103.06	99.31	95.56	91.82	88.07	84.32	84.32	88.07	91.82	95.56	99.31	103.06		
-									-	Total = Su	m(44) ₁₁₂ =		1124.28	(44)
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x L	0Tm / 3600) kWh/mor	oth (see Ta	ables 1b, 1 I	c, 1d)		
(45)m=	152.83	133.67	137.93	120.25	115.39	99.57	92.27	105.88	107.14	124.86	136.3	148.01		
lf instanta	aneous w	ater heati	ng at point	of use (no	o hot water	· storage),	enter 0 in	boxes (46,) to (61)	Total = Su	m(45) ₁₁₂ =		1474.11	(45)
(46)m=	22.92	20.05	20.69	18. <mark>04</mark>	17.31	14.94	13.84	15.88	16.07	18.73	20.44	22.2		(46)
Water s	storage	loss:												
Storage	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comn	nunity h	eating a	and no ta	ink in dw	velling, e	nter 110) litres in	(47)		(0) : ((
Water of	ISE IT NO	o stored	not wate	er (this ir	iciudes i	nstantar	neous co	iiod iamo	ers) ente	er 'O' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/dav):					0]	(48)
Tempe	rature f	actor fro	m Table	2b		,	, , , , , , , , , , , , , , , , , , ,					0		(49)
Enerav	lost fro	m water	storage	. kWh/ve	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared of	ylinder l	loss fact	or is not	known:	. , . ,				0	l	(00)
Hot wa	ter stora	age loss	factor fr	om Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
If comn	nunity h	eating s	ee secti	on 4.3									1	
Tempe	rature f	actor fro	bie za m Table	2h								0		(52) (53)
Enorm	loot fro				oor			(47) x (51)	x (52) x (52) -		0		(53)
Energy Enter ((50) or ((54) in (5	501age	, KVVII/ye	ear			(47) X (31)	(JZ) X (55) =		0		(54)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m		0	I	()
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	J lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary	/ circuit	loss (ar	nual) fro	om Table			-					0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		L		ı	
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	i loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	23.41	21.12	23.32	22.49	23.19	22.37	23.08	23.15	22.44	23.26	22.6	23.39		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	176.24	154.79	161.25	142.75	138.57	121.94	115.35	129.03	129.58	148.13	158.9	171.4		(62)
Solar D	HW input	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	') (enter '0'	if no sola	r contributi	on to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or \	WWHRS	applies,	see Ap	pendix G	3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	176.24	154.79	161.25	142.75	138.57	121.94	115.35	129.03	129.58	148.13	158.9	171.4		_
								Outp	out from wa	ater heate	r (annual)	12	1747.93	(64)
Heat g	jains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	56.67	49.73	51.69	45.61	44.16	38.7	36.45	40.99	41.23	47.33	50.97	55.06		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal g	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46		(66)
Lightir	ig gains	(calcula	ted in Ap	opendix	L, equati	on L9 oi	r L9a), al	lso see	Table 5					
(67)m=	48.22	42.82	34.83	26.37	19.71	16.64	17.98	23.37	31.37	39.83	46.49	49.56		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L ²	13 or L1:	3a), also	see Ta	ble 5				
(68)m=	303.42	306.57	298.63	281.74	260.42	240.38	226.99	223.84	231.78	248.67	269.99	290.03		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15		(69)
Pumps	s and fa	ns gains	(Table §	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. e	/aporatic	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3		(71)
Water	heating	gains (1	able 5)											
(72)m=	76.17	74	69.48	63.34	59.36	53.75	48.99	55.1	57.27	63.62	70.79	74.01		(72)
Total	internal	gains =				(66)	m + (67)m	+ (68)m +	- (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	528.11	523.69	503.24	471.76	439.79	411.08	394.27	402.61	420.72	452.42	487.57	513.9		(73)
6. So	lar gain	s:	1	1										
Solar (gains are	calculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicat	le orientat	ion.		
Orient	ation:	Access F	actor	Area		Flu	х		g_		FF		Gains	
		Table 6d		m²		Tat	ole 6a	Т	able 6b	Та	able 6c		(VV)	
Solar (gains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	70.31	137.54	226.5	330.34	404.84	414.43	394.55	338.91	263.43	163.2	87.66	57.82		(83)
Total g	gains – i	nternal a	and solai	r (84)m = I	= (73)m -	⊦ (83)m	, watts			i				()
(84)m=	598.41	661.23	729.74	802.09	844.63	825.5	788.82	741.53	684.15	615.62	575.24	571.71		(84)
7. Me	ean inte	rnal temp	perature	(heating	season)								
Temp	perature	during h	neating p	eriods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilis	ation fac	ctor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
Stroma	Jan FSAP 20	Feb	Mar	Apr SAP 9.91	May	Jun ww.stroma	Jul .com	Aug	Sep	Oct	Nov	Dec	Page 4	of 7

(86)m=	0.99	0.99	0.97	0.91	0.8	0.61	0.46	0.5	0.75	0.94	0.99	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.92	20.07	20.32	20.64	20.87	20.97	21	20.99	20.93	20.62	20.22	19.9		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.93	19.94	19.94	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.95	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.96	0.89	0.74	0.53	0.35	0.39	0.67	0.92	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 1	7 in Tabl	e 9c)	-			
(90)m=	18.52	18.73	19.1	19.55	19.83	19.95	19.97	19.97	19.91	19.54	18.97	18.5		(90)
									f	iLA = Livin	g area ÷ (4	4) =	0.31	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA x T1	+ (1 – fL	.A) × T2			-		
(92)m=	18.96	19.15	19.48	19.89	20.16	20.27	20.29	20.29	20.23	19.88	19.36	18.94		(92)
Apply	adjustr	nent to t	he mear	internal	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.96	19.15	19.48	19.89	20.16	20.27	20.29	20.29	20.23	19.88	19.36	18.94		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	i to the i	mean int	ernal te	mperatui	re obtair	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	lisation		or gains		able 9a	l	1.1		Con	Oct	Nov	Dee		
Litilies	Jan tion fac	tor for a	ains br	Apr	iviay	Jun	Jui	Aug	Sep	Oct	INOV	Dec		
(94)m=	0.99	0.98	0.95	0.89	0.75	0.55	0.38	0.43	0.69	0.91	0.98	0.99		(94)
Usefu	Il gains.	hmGm	W = (9)	4)m x (84	4)m									
(95)m=	590.16	646.02	695.08	710.5	635.42	456.09	302.83	317.37	473.36	562.74	561.09	565.25		(95)
Month	nly aver	age exte	rnal tem	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)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1258.78	1219.58	1106.91	922	707.41	467.78	304.3	319.91	508.19	776.42	1032.16	1248.36		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4′	1)m			
(98)m=	497.46	385.44	306.4	152.28	53.56	0	0	0	0	158.98	339.18	508.23		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	2401.52	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								33.08	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	a micro-C	CHP)					
Space	e heatir	ng:			Ŭ	, 								
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	– (201) =			ĺ	1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		İ	1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1							İ	89.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g system	ז, %						0	(208)
	, Ian	Feb	Mar	Apr	May			Δυσ	Sen	Oct	Nov	Dec	k\\/b\\	
Space	e heatin	a require	ement (c	alculate	d above)	Jui	Aug	Oep	001	INOV	Dec	K V V 1/ y	Cal
	497.46	385.44	306.4	152.28	53.56	0	0	0	0	158.98	339.18	508.23		
(211)m	$h = \{ [(98)$)m x (20	$(4)] + (2^{\prime})$	L [())m } x	∟ 100 ∸ (2	206)		I						(211)
(<u>~</u> · · <i>)</i> //	553.34	428.74	340.82	169.39	59.58	0	0	0	0	176.84	377.28	565.33		(=)
		1	I	1	I	1	1	Tota	l II (kWh/yea	ar) =Sum(2	1 211) _{15,1012}	=	2671.33	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214	4) m } x 100 ÷ ((208)					-			
(215)m= 0 0	0 0	0 0	0	0	0	0	0	0		_
				Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,1012}	2	0	(215)
Water heating		h a a)								
176.24 154.79	161.25 142.75	138.57 121.94	115.35	129.03	129.58	148.13	158.9	171.4		
Efficiency of water heater	er								87.3	(216)
(217)m= 89.2 89.14	88.99 88.62	88.01 87.3	87.3	87.3	87.3	88.63	89.05	89.23		(217)
Fuel for water heating, k	Wh/month	• •								
$(219)m = (64)m \times 100 - (219)m = 197.57 173.65$. (217)111 181.21 161.07	157.45 139.68	132.13	147.8	148.43	167.14	178.43	192.09		
				Tota	I = Sum(21	19a) ₁₁₂ =			1976.65	(219)
Annual totals						k	Wh/year	•	kWh/year	-
Space heating fuel used	2671.33									
Water heating fuel used									1976.65	
Electricity for pumps, far	ns and electric	keep-hot								
central heating pump:								30		(230c)
boiler with a fan-assiste	ed flue							45		(230e)
Total electricity for the a	bove, kWh/yea	ar		sum	of (230a).	<mark>(2</mark> 30g) =			75	(231)
Electricity for lighting									340.6	(232)
10a Eugl costs - individ	dual booting o	votomo:								
	uuar neating sy	Fu	iel			Fuel P	rice		Fuel Cost	
	uuar neating sy	Fu kV	iel Vh/year			Fuel P (Table	rice 12)		Fuel Cost £/year	
Space heating - main sy	vstem 1	Fu kV (21	iel Vh/year 1) x			Fuel P (Table	rice 12)	x 0.01 =	Fuel Cost £/year 92.9621](240)
Space heating - main sy Space heating - main sy	vstem 1 vstem 2	Fu kV (21 (21	iel Vh/year 1) x 3) x			Fuel P (Table	12)	x 0.01 = x 0.01 =	Fuel Cost £/year 92.9621 0](240)](241)
Space heating - main sy Space heating - main sy Space heating - seconda	vstem 1 vstem 2 ary	Fu kV (21 (21 (21) (21)	iel Vh/year 1) x 3) x 5) x			Fuel P (Table 3.4 0 13.	12)	x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 92.9621 0](240)](241)](242)
Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (other	vstem 1 vstem 2 ary er fuel)	Fu kV (21 (21 (21) (21) (21) (21)	iel Vh/year 1) x 3) x 5) x 9)			Fuel P (Table 3.4 0 13.	Price 12) 18 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 92.9621 0 0 68.79](240)](241)](242)](247)
Space heating - main sy Space heating - main sy Space heating - second Water heating cost (other Pumps, fans and electric	vstem 1 vstem 2 ary er fuel) c keep-hot	Fu kV (21 (21 (21) (21) (21) (21) (23)	iel Vh/year 1) x 3) x 5) x 9) 1)			Fuel P (Table 3.4 0 13. 3.4 13.	Price 12) 18 19 19 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 92.9621 0 0 68.79 9.89](240)](241)](242)](247)](249)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconds Water heating cost (other Pumps, fans and electric (if off-peak tariff, list eac	vstem 1 vstem 2 ary er fuel) c keep-hot	Fu kV (21 (21 (21 (21 (23 (230g) separatel	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13.	Price 12) 18 19 19 19 19 19		Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a](240)](241)](242)](247)](249)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconds Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting	er fuel) c keep-hot	Fu kV (21 (21 (21 (23 (230g) separatel (23	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. fuel pri 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline control contr$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93](240)](241)](242)](247)](249)](250)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char	vstem 1 vstem 2 ary er fuel) c keep-hot ch of (230a) to p rges (Table 12)	Fu kV (21 (21 (21 (21 (23 (230g) separatel (23	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2)	licable a	nd apply	Fuel P (Table 3.4 0 13. 13. 13. 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ r \ 0.01 = \\ r \ 0.01 = \\ r \ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120](240)](241)](242)](247)](249)](250)](251)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repea	vstem 1 vstem 2 ary er fuel) c keep-hot th of (230a) to o rges (Table 12) at lines (253) a	Fu kV (21 (21 (21 (21 (21 (21 (21) (23) (230g) separatel (23) (230g) separatel (23)	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2) ded	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel priv 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline c \ ding \ to \ 7 \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120](240)](241)](242)](247)](249)](250)](251)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repeat Total energy cost	vstem 1 vstem 2 ary er fuel) c keep-hot th of (230a) to o rges (Table 12) at lines (253) a	(230g) separatel (230g) separatel (230g) separatel (230g) separatel (230g) separatel (230g) separatel (245)(247) + (247)	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2) ded 50)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline cling \ to \ x \\ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120 336.57](240)](241)](242)](247)](249)](250)](251)](255)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repeat Total energy cost 11a. SAP rating - indivi	vstem 1 vstem 2 ary er fuel) c keep-hot th of (230a) to p rges (Table 12) at lines (253) a idual heating s	Fu kV (21 (21 (21 (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23)	iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2) ded 50)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline \begin{array}{c} c \\ r \\ x \\ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120 336.57](240)](241)](242)](247)](249)](250)](251)](255)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repeat Total energy cost 11a. SAP rating - indivi Energy cost deflator (Ta	vstem 1 vstem 2 ary er fuel) c keep-hot th of (230a) to to rges (Table 12) at lines (253) a idual heating s	Fu kW (21 (21 (21 (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23)	lel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2) ded 50)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 13. 13. 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline c \text{ding to } \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120 336.57 0.42](240)](241)](242)](247)](249)](250)](251)](255)](255)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repeat Total energy cost 11a. SAP rating - indivi Energy cost deflator (Ta Energy cost factor (ECF)	vstem 1 vstem 2 ary er fuel) c keep-hot ch of (230a) to o rges (Table 12) at lines (253) a idual heating s ible 12)	Fu kV (21 (21 (21 (21 (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23 (230g) separatel (23) (25) x (256)] ÷ [<pre>lef Vh/year 1) x 3) x 5) x 9) 1) y as appl ded 50)(254) (4) + 45.0]</pre>	licable a	nd apply	Fuel P (Table 3.4 0 13. 13. 13. 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120 336.57 0.42 1.2](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repeat Total energy cost 11a. SAP rating - indivi Energy cost deflator (Ta Energy cost factor (ECF SAP rating (Section 12)	vstem 1 vstem 2 ary er fuel) c keep-hot th of (230a) to o rges (Table 12) at lines (253) a idual heating s uble 12)	(230g) separatel (230g) separatel (245)(247) + (250g) separatel (255) x (256)] ÷ [iel Vh/year 1) x 3) x 5) x 9) 1) y as appl 2) ded 50)(254) (4) + 45.0]	licable a	nd apply	Fuel P (Table 3.4 0 13. 13. 7 fuel priv 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 92.9621 0 0 68.79 9.89 Fable 12a 44.93 120 336.57 0.42 1.2 83.23](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)](258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	577.01 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	426.96 (264)
Space and water heating	(261) + (262) + (263) + (264) =	=	1003.96 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	176.77 (268)
Total CO2, kg/year	SU	um of (265)(271) =	1219.66 (272)
CO2 emissions per m ²	(2	72) ÷ (4) =	16.8 (273)
El rating (section 14)			86 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	3259.02 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2411.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =		5670.53 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(222)		

sum of (265)...(271) =

(272) ÷ (4) =

Primary energy kWh/m²/year

'Total Primary Energy

(272)

(273)

6946.43

95.68

User Details:		
Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version	n: 1.0.0.28	
Property Address: 2 Beds - Flat		
Address :		
1. Overall dwelling dimensions:		
Area(m ²) Av. Height(m)	Volume(m ³)	
Ground floor 72.6 (1a) x 2.6 (2a) =	188.76	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 72.6 (4)		
Dwelling volume $(3a)+(3c)+(3d)+(3e)+(3n) =$	188.76	(5)
2. Ventilation rate:		
main secondary other total	m ³ per hour	
Number of chimneys $0 + 0 = 0 \times 40 =$	0	(6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$	0	(6b)
Number of intermittent fans $3 \times 10 = 6$	30	(7a)
Number of passive vents $0 \times 10 =$	0	(7b)
Number of flueless gas fires	0	(7c)
Air cha	inges per hou	r
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 30 \div (5) = $	0.16	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)		1
Additional infiltration	0	(9) (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after	-	1. ,
deducting areas of openings); if equal user 0.35	_	lua
If no draught lobby enter 0.05, else enter 0	0	(12)
Percentage of windows and doors draught stripped	0	(13)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	0	(14)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	6	(17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$	0.46	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered	2	(19)
Shelter factor $(20) = 1 - [0.075 \times (19)] =$	0.85	(20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.39	(21)
Infiltration rate modified for monthly wind speed		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Monthly average wind speed from Table 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 Factor $(22a)m = (22)m \div 4$		
(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		

Adjust	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.5	0.49	0.48	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se				-			
II Me				ondix N (2	(26) - (22)	\rightarrow \sim $Emy(c$	austion (nuine (22h)) - (22a)			0	(23a)
lf bol	aust all th				.50) = (256	or in use f	octor (from	(3)), other	wise (230)) = (23a)			0	(23b)
) = (0)) h) inc. i (/	00h) [4 (00 a)	0	(23c)
a) II								HR) (24a	0 m = (22)	2) + m(α2	230) × [1 - (23C)	÷ 100]]	(24a)
(24a)III=)			0		(240)
D) IT	balance		anical ve					VIV) (24b	m = (22)	20)m + (α 	23D)		1	(24b)
(240)11=		0			0	0				0	0	0		(240)
C) IT	whole n if (22b)n	ouse ex n < 0.5 x	tract ver (23b), 1	then (24	or positiv c) = (23b); otherv	ventilatio wise (24	on from c c) = (22b	outside b) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft			-		
	if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		r	1	
(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)		i	i	1	
(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramet	er:									
ELEN		Gros area	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r	ea m²	U-valı W/m2	le K	A X U (W/I	K)	k-value kJ/m²·l	e K	A X k kJ/K
Doors						2	x	1.1	= [2.2				(26)
Windo	ws Type	e 1				2.88	x1	/[1/(1.3)+	0.04] =	3.56	6			(27)
Windo	ws Type	2				3.96	x1	/[1/(1.3)+	0.04] =	4.89	E			(27)
Walls		80	,	11.7	2	68.28	3 X	0.22] = [15.02	ור			(29)
Roof		72.	6	0		72.6	x	0.14	= [10.16			\neg	(30)
Total a	area of e	lements	, m²			152.6	3							(31)
Party f	loor					72.6	_				[(32a)
* for win ** includ	idows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and par	alue calcul titions	ated using	g formula 1,	/[(1/U-valu	e)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				39.4	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	15804.	.6 (34)
Therm	al mass	parame	ter (TM	- = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						7.63	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			47.03	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y 1				(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	38.85	38.55	38.26	36.88	36.62	35.42	35.42	35.2	35.89	36.62	37.14	37.69		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m	-		
(39)m=	85.88	85.58	85.29	83.91	83.65	82.45	82.45	82.23	82.91	83.65	84.17	84.72		
									/	Average =	Sum(39)1	12 /12=	83.91	(39)

Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$														
(40)m=	1.18	1.18	1.17	1.16	1.15	1.14	1.14	1.13	1.14	1.15	1.16	1.17		
						I			/	Average =	Sum(40)1.	.12 /12=	1.16	(40)
Numbe	er of day	vs in moi	nth (Tab	le 1a)						-		I		
	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)
I														
4. Wa	ter heat	ting enei	rgy requ	irement:								kWh/ye	ear:	
Assum if TF	ed occu A > 13.9	ipancy, l 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-13.9)2)] + 0.()013 x (1	ГFA -13.	2. 9)	31		(42)
Annual Reduce	averag	e hot wa al average	ater usag hot water	ge in litre usage by	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed t	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.69		(43)
normore	e inal 125	nires per j	lerson per	day (all w	aler use, r								I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	day for ea	ach month	Vd,m = fa	ctor from	able 1c x	(43)					I	
(44)m=	103.06	99.31	95.56	91.82	88.07	84.32	84.32	88.07	91.82	95.56	99.31	103.06		_
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	Fotal = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1124.28	(44)
(45)m=	152.83	133.67	137.93	120.25	115.39	99.57	92.27	105.88	107.14	124.86	136.3	148.01		
									1	Fotal = Su	m(45) ₁₁₂ =		1474.11	(45)
lf instant	aneous w	ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46)) to (61)					
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:												
Storage	e volum	e (litres)	includir	ng any so	olar or M	/WHRS	storage	within sa	ame vess	sel		0		(47)
If comr	nunity h	eating a	ind no ta	ınk in dw	velling, e	nter 110	litres in	(47)						
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (47)			
Water :	storage	IOSS:											l	(10)
a) if m _	anufact	urer's de	eclared I	oss facto	or is kno	wn (kvvr	1/day):					0		(48)
Tempe	rature fa	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			C		(50)
b) If m	anufact	urer's de	eclared (cylinder I	oss fact	or is not b/litro/da	known:						l	(54)
If comr	nunity h	eating s	ee secti	on 4.3		1/1116/08	iy))		(51)
Volume	e factor	from Ta	ble 2a									<u>ר</u>		(52)
Tempe	rature f	actor fro	m Table	2b								<u>,</u>		(53)
Enerav	lost fro	m water	storage	kWh/ve	ear			(47) x (51)	x (52) x (53) =		- -		(54)
Enter	(50) or ((54) in (5	55)	,y.	Jul			(, (,		,		<u>,</u>		(55)
Water	storage	loss cal	, culated t	for each	month			((56)m = (55) × (41)r	n		-		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)r	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Priman	v circuit	loss (ar	nual) fre	om Table	3	-)		(58)
Primar	v circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 x (41)	m				I	. /
(moc	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
		-			-	-	-				-			

Combi	loss ca	culated	for each	month ((61)m = ((60) ÷ 36	65 × (41)	m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	129.91	113.62	117.24	102.22	98.08	84.63	78.43	90	91.07	106.13	115.85	125.81		(62)
Solar DH	HW input o	alculated	using App	endix G or	Appendix	H (negativ	/e quantity) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	lines if	FGHRS	and/or \	WWHRS	applies,	see Ap	pendix C	G)	-				
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	129.91	113.62	117.24	102.22	98.08	84.63	78.43	90	91.07	106.13	115.85	125.81		,
								Outp	out from wa	ater heate	r (annual)₁	12	1252.99	(64)
Heat g	ains froi	n water	heating	kWh/m	onth 0.25	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	32.48	28.4	29.31	25.55	24.52	21.16	19.61	22.5	22.77	26.53	28.96	31.45		(65)
inclu	ide (57)i	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ins (see	e Table 5	and 5a):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equati	on L9 or	[.] L9a), al	lso see	Table 5					
(67)m=	19.29	17.13	13.93	10.55	7.88	6.66	7.19	9.35	12.55	15.93	18.59	19.82		(67)
Appliar	nces gai	ns (calc	ulated ir	Append	dix L, equ	uation L ²	13 or L1:	3a), alsc	see Ta	ble 5				
(68)m=	203.29	205.4	200.08	188.77	174.48	161.05	152.08	149.98	155.29	166.61	180.89	194.32		(68)
Cookin	ig gains	(calcula	ited in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54		(69)
Pumps	and far	ns gains	(Table \$	ōa)						-				
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)				-	-			
(71)m=	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3		(71)
Water	heating	gains (T	able 5)							-				
(72)m=	43.65	42.27	39.4	35.49	32.96	29.39	26.35	30.24	31.62	35.66	40.23	42.27		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	323.84	322.41	311.02	292.42	272.94	254.71	243.24	247.18	257.07	275.82	297.33	314.03		(73)
6. Sol	lar gains	:												
Solar g	ains are c	alculated	using sola -	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicat	le orientat	ion.		
Orienta	ation: A	ccess F able 6d	actor	Area m ²		Flu: Tab	x ble 6a	т	g_ able 6b	Т	FF able 6c		Gains (W)	
	•					- Cat		•					(11)	
Solar	noine in i	watta ar		l for ooo	h manth			(02)	um (74) m	(00)m				
$\frac{(83)m}{(83)m}$	70.31	137 54	226.5	330.34	404 84	414 43	394 55	(83)m = 5 338 91	um(74)m . 263.43	(82)m	87.66	57 82		(83)
Total d	ains – i	nternal a	nd sola	(84)m =	= (73)m -	+ (83)m	watts	000.01	200.40	100.2	07.00	01.02		()
(84)m=	394.15	459.95	537.53	622.76	677.78	669.14	637.8	586.09	520.5	439.01	384.99	371.85		(84)
7 140	on intor	nol toma	oroturo	(booting						l				
Tomp	arrinter	during b			season		rom Toh		1 (00)				04	1(85)
	tion for	tor for a	icauly for					ກ ະ ອ, 10	· (C)				21	
Juiise	lan	Feh	Mar		za, 111,111 Mavi	Un Jun	Jul	Δυα	Sen	Oct	Nov	Dec		
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(86)m=	1	1	0.99	0.96	0.89	0.72	0.55	0.62	0.87	0.98	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ns 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.66	19.82	20.09	20.46	20.77	20.94	20.99	20.98	20.85	20.43	19.98	19.64		(87)
Tomp	oroturo	l during h		L	root of	dwalling	l from To							
(88)m-	19 93	19 94			19.96	19 97	19 97		12 (C)	19.96	19.95	19.95		(88)
(00)11-	10.00	10.04	10.04	10.00	10.00	10.01	10.07	10.07	10.07	10.00	10.00	10.00		(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)	0.04	0.00				(00)
(89)m=	1	1	0.99	0.95	0.84	0.63	0.43	0.49	0.81	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=	18.71	18.87	19.15	19.52	19.8	19.95	19.97	19.97	19.88	19.5	19.05	18.71		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.31	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwel	lling) = f	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.01	19.17	19.44	19.82	20.11	20.26	20.29	20.28	, 20.18	19.79	19.34	19		(92)
Apply	adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.01	19.17	19.44	19.82	20.11	20.26	20.29	20.28	20.18	19.79	19.34	19		(93)
8. Spa	ace hea	ting requ	uiremen	t										
Set T	i to the i	mean int	ernal te	mperatu	re obtain	ed at st	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	n:										
(94)m=	1	0.99	0.99	0.95	0.85	0.66	0.47	0.53	0.82	0.97	1	1		(94)
Usefu	Il gains,	hmGm	, W = (9	4)m x (8	4)m									
(95)m=	393.24	457.6	529.52	590.69	575.23	441.03	300.27	312.62	427.49	427.29	383.22	371.22		(95)
Month	nly aver	age exte	rnal terr	nperature	e from Ta	able 8		1						
(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)
Heat	loss rate	e for mea	an interr	nal temp	erature,	Lm,VV:	=[(39)m : L	x [(93)m	– (96)m					(07)
(97)m=	1263.26	1220.92	1103.89	916.01	/03.09	466.49	304.05	319.45	504.28	768.87	1030.51	1253.73		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k\	/Vh/mon ⁻	th = 0.02	24 x [(97])m – (95)m] x (4′	1)m			
(98)m=	647.29	512.95	427.33	234.24	95.13	0	0	0	0	254.14	466.05	656.59		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3293.73	(98)
Space	e heatin	g require	ement in	h kWh/m²	²/year								45.37	(99)
8c. Sp	bace co	oling rec	quiremer	nt										
Calcu	lated fo	r June, .	July and	August.	See Tal	ole 10b	-							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate	e Lm (ca	lculated	using 2	5°C inter	nal tem	oerature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	775.05	610.14	624.93	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm		-	-	-	-						
(101)m=	0	0	0	0	0	0.88	0.93	0.91	0	0	0	0		(101)
Usefu	Il loss, h	mLm (V	Vatts) =	(100)m >	‹ (101)m		-	-						
(102)m=	0	0	0	0	0	681.19	570.06	568.56	0	0	0	0		(102)
Gains	s (solar g	gains ca	Iculated	for appli	icable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	868.11	829.8	770.89	0	0	0	0		(103)
Space	e coolin	g require	ement fo	or month,	whole c	lwelling,	continue	ous (kW	(h) = 0.0	24 x [(10)3)m – (102)m]>	x (41)m	
set (1	04)m to	zero if ((104)m < I	< 3 × (98 T)m I	.	r							
(104)m=	0	0	0	0	0	134.58	193.25	150.54	0		0	0		
									Iotal	= Sum(104)	=	478.36	(104)
													_	

Cooled	fraction	า					f C =	cooled	area ÷ (4) =	1	(105)		
Intermi	ttency fa	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
Total = Sum(104) =												=	0	(106)
Space	pace cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	33.65	48.31	37.63	0	0	0	0		
-									Total	= Sum(107)	=	119.59	(107)
Space	cooling	requirer	nent in k	wh/m²/y	/ear				(107)	÷ (4) =			1.65	(108)
8f. Fab	ric Enei	rgy Effici	ency (ca	alculated	l only un	der spec	cial conc	litions, s	ee sectio	on 11)				
Fabric	Fabric Energy Efficiency										=		47.02	(109)



			User D	Details:						
Assessor Name: Software Name:	Stroma FS	AP 2012		Strom Softwa	a Num are Vei	ber: sion:		Versio	on: 1.0.0.28	
			Property	Address	: 2 Beds	- House	•			
Address :										
1. Overall dwelling dime	nsions:		_							
Ground floor			Are	a(m²)	(10) X	Av. Hei	ight(m)	(20) -	Volume(m ³)	$\mathbf{I}_{(2n)}$
				15.42			0	(2a) =	118.09	
FIRST HOOF				15.42	(1b) X	2	2.6	(2b) =	118.09	(3b)
Total floor area TFA = (1)	a)+(1b)+(1c)+((1d)+(1e)+(<i>*</i>	ln) g	90.84	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	236.18	(5)
2. Ventilation rate:										
	main heating	seconda heating	ary	other		total			m ³ per hour	
Number of chimneys	0	+ 0	+	0] = [0	x 4	= 0	0	(6a)
Number of open flues	0	+ 0	+	0	- = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns					3	x 1	0 =	30	(7a)
Number of passive vents					Ē	0	x 1	0 =	0	(7b)
Number of flueless gas fi	res					0	x 4	0 =	0] (7c)
Ĩ					L			Air ch	anges per hou	ır
Infiltration due to chimne	ys, flues and fa	ans = (6a) + (6b) +	(7a)+(7b)+((7c) =	Г	30	-	÷ (5) =	0.13	(8)
If a pressurisation test has b	een ca <mark>rried out o</mark> i	r is intended, proce	ed to (17),	otherwise o	continue fr	om (9) to (16)			-
Additional infiltration	ne dw <mark>elling</mark> (ne	5)					[(0)	11v0 1 -	0	(9)
Structural infiltration: 0	.25 for steel or	timber frame o	or 0.35 fo	r masoni	v constr	uction	[(3)-	11x0.1 =	0	1(10)
if both types of wall are p	resent, use the va	lue corresponding	to the grea	ter wall are	a (after				Ŭ]()
deducting areas of openir	ngs); if equal user	0.35		ad) alaa	optor 0					
If no draught lobby en	ter 0.05 else ϵ	enter 0	J. 1 (Seale	eu), eise					0	(12)
Percentage of windows	s and doors dr	aught stripped							0](10)](14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cubic met	es per ho	our per s	quare m	etre of e	nvelope	area	6	(17)
If based on air permeabil	ity value, then	$(18) = [(17) \div 20]$	(8), otherw	ise (18) = ((16)				0.43	(18)
Air permeability value applie	s if a pressurisatio	on test has been d	one or a de	gree air pe	rmeability	is being us	sed			٦
Shelter factor	C			(20) = 1 -	[0.075 x (1	9)] =			2	(19)
Infiltration rate incorporat	ing shelter fac	tor		(21) = (18) x (20) =				0.00	(20)
Infiltration rate modified f	or monthly wir	nd speed							0.00	J (<u> </u>
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from 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	2a)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]	
Adjust	ed infiltra	tion rat	e (allowi	ng for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43]	
Calcul If me	ate effec echanica	<i>tive air i</i> Lventila	change i tion:	rate for t	he appli	cable ca	se	-		-		_	-	(232)
lf exh	aust air he	at pump	using Appe	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (I	N5)), othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	heat reco	overy: effic	iency in %	allowing f	ór in-use fa	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (22	2b)m + ()	23b) × [1	– (23c)	÷ 100]	(200)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	overy (I	MV) (24b)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole ho if (22b)m	ouse ex < 0.5 ×	tract ver : (23b), t	ntilation o then (24o	or positiv c) = (23b	ve input v); otherv	ventilatio vise (24	on from c c) = (22t	outside b) m + 0.	.5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural v if (22b)m	ventilation = 1, the	on or wh en (24d)	ole hous m = (221	e positiv c)m othe	ve input v erwise (2	ventilati 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)					
(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
3. He	at losses	and he	at l <mark>oss</mark> r	paramete	er: 🗹									
ELEN		Gros area	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·l	e K	A X k kJ/K
Doors						2	×	1.1	=	2.2				(26)
Windo	ws Type	1				2.88	x1	/[1/(1.3)+	0.04] =	3.56				(27)
Windo	ws Type	2				3.96	x1	/[1/(1.3)+	0.04] =	4.89				(27)
Floor						45.42	<u>x</u>	0.15	=	6.813				(28)
Walls		93.	6	14.6	;	79	x	0.22	=	17.38				(29)
Roof		45.4	2	0		45.42	<u>x</u>	0.14	=	6.36				(30)
Total a	area of el	ements	, m²			184.4	4							(31)
Party v	wall					52	X	0	=	0				(32)
* for win	idows and i le the area	roof winde s on both	ows, use e sides of ir	effective wi	ndow U-va Is and par	alue calcula titions	ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	1 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)	o ana pan			(26)(30)	+ (32) =				48.32	(33)
Heat c	apacity (Cm = S(Axk)	,					((28)	(30) + (32	2) + (32a)	(32e) =	21165.2	8 (34)
Therm	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) ir	∩ kJ/m²K			Indica	tive Value:	: Medium		250	(35)
For desi can be ι	ign assessi used instea	ments wh d of a de	ere the de tailed calci	tails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	s : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.22	(36)
if details	of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)				(·				
I otal fa	abric hea	at loss	- I	I	_				(33) +	(36) =	05)		57.54	(37)
ventila	ation hea				Max	lun	11	۸	(38)m	$= 0.33 \times ($	25)m x (5)	Dee	1	
	Jan	гер	iviai	г Арг	iviay	Jun	Jui	I Aug	l Seb			Dec		

(39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ Average = Sum(39) 112 / 12 = 102.73 Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$ (40)m = $(39)m \div (4)$ (40)m = $(39)m \div (4)$ Average = Sum(39) 112 / 12 = 102.73 Average = Sum(39) m $\div (4)$ (40)m = $(39)m \div (4)$ (40)m = $(39)m \div (4)$ Average = Sum(40) 112 / 12 = 1.13 Number of days in month (Table 1a)	(39) (40) (41)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(39) (40) (41)
Average = Sum(39) $_{112}$ /12= 102.73 Heat loss parameter (HLP), W/m ² K (40)m = (39)m \div (4) Average = Sum(40) $_{112}$ /12= 1.13 Number of days in month (Table 1a)	(39) (40) (41)
(40)m= (1.15) (1.15) (1.15) (1.13) (1.13) (1.11) (1.11) (1.11) (1.12) (1.13) (1.13) (1.14) Average = Sum(40) ₁₁₂ /12= 1.13 Number of days in month (Table 1a)	(40) (41)
Average = $Sum(40)_{112}/12 =$ 1.13 Number of days in month (Table 1a) Image = $Sum(40)_{112}/12 =$	(40)
Number of days in month (Table 1a)	(41)
	(41)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(41)
(41)m= 31 28 31 30 31 31 30 31	
4. Water heating energy requirement: kWh/year:	
Assumed occupancy, N 2.64	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)	
Annual average hot water usage in litres per day Vd.average = $(25 \times N) + 36$	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of	(-)
not more that 125 litres per person per day (all water Use, not and cold)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	
(45)m= 166.27 145.42 150.06 130.82 125.53 108.32 100.38 115.18 116.56 135.84 148.28 161.02	
$Total = Sum(45)_{112} = 1603.68$	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	
(46)m= 24.94 21.81 22.51 19.62 18.83 16.25 15.06 17.28 17.48 20.38 22.24 24.15 Water storage loss:	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)	()
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)	
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day):	(48)
Temperature factor from Table 2b 0	(49)
b) If manufacturer's declared cylinder loss factor is not known:	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	
Volume factor from Table 2a	(52)
Energy lost from water storage kWb/year $(47) \times (51) \times (52) \times (53) = 0$	(53)
Enter (50) or (54) in (55) 0	(54)
Water storage loss calculated for each month $((56)m = (55) \times (41)m$	(/
(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(56)
If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H	
(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(57)

(modified by factor from Table H5 if there is solar valuer heating and a cylinder thermostat) (99) (90) 0	Primar Primar	Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = $(58) \div 365 \times (41)m$ (modified by factor from Table H5 if there is color water beating and a cylinder thermostat)													(58)
(69)m 0 <td>(moo</td> <td>dified by</td> <td>factor fi</td> <td>rom Tab</td> <td>le H5 if t</td> <td>here is s</td> <td>olar wat</td> <td>er heatir</td> <td>ng and a</td> <td>cylinde</td> <td>r thermo</td> <td>stat)</td> <td></td> <td></td> <td></td>	(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
Combi loss calculated for each month (61)m = (60) + 365 x (41)m (61) (63)m (2.4.7) 21.1.8 23.4 22.52 23.3.4 22.62 23.45 (61) Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62) Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0 # no solar contribution to water heating) (62) Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0 # no solar contribution to water heating) (63) Colput from water heating 0<	(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
(61)m= 23.47 21.18 23.4 22.68 23.27 22.44 23.14 23.22 22.62 23.34 22.66 23.45 (61) Total hear required for water heating calculated for each month (62)m = (139.74 133.64 133.66 133.76 123.52 138.41 139.06 159.17 170.44 184.47 (62) Solar DHW input calculated using Apendix G or Appendix H (negative quantity) (terter 0' thr os olar contribution to water heating) (4d4 additional lines if FCHRS and/or WWHRS applies, see Appendix G) (63) (calgame 0<	Combi	loss ca	lculated	for each	month (61)m =	(60) ÷ 36	65 × (41)	m						
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m (63)m (64)m (67)m (66)m (73.46)m (13.40)m (13.02)m ((61)m=	23.47	21.18	23.4	22.58	23.27	22.44	23.14	23.22	22.52	23.34	22.66	23.45		(61)
(82)m= 183.74 166.6 173.46 153.4 148.8 130.76 123.52 138.41 130.08 159.17 170.94 184.47 (62) Solar DHW input calculated using Appendix G or Appendix H (regative quantity) (enter U if no salar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63) Output from water heater (64)m= 189.74 166.6 173.46 153.4 148.8 130.76 123.52 138.41 130.08 159.17 170.94 184.47 (63) Output from water heater (64)m= 189.74 166.6 173.46 153.4 148.8 130.76 123.52 138.41 130.08 159.17 170.94 184.47 (63) Uput from water heater (64)m= 189.74 163.5 148.24 147.85 148.3 141.44 43.3 15 54.37 158.24 168.27 (65)m= 61.15 53.65 55.74 49.14 47.65 158.22 158.22 158.22 158.22 158.22 158.22	Total h	eat req	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
Solar DHW input calculated using Appendix II (negative quantity) (enter 0 If no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (G3) (G3)m= 0 <td>(62)m=</td> <td>189.74</td> <td>166.6</td> <td>173.46</td> <td>153.4</td> <td>148.8</td> <td>130.76</td> <td>123.52</td> <td>138.41</td> <td>139.08</td> <td>159.17</td> <td>170.94</td> <td>184.47</td> <td></td> <td>(62)</td>	(62)m=	189.74	166.6	173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		(62)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63) (43)m= 0	Solar DH	W input	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0'	if no sola	r contribut	ion to wate	er heating)		
(83)m= 0 <td>(add a</td> <td>dditiona</td> <td>l lines if</td> <td>FGHRS</td> <td>and/or V</td> <td>VWHRS</td> <td>applies</td> <td>, see Ap</td> <td>pendix G</td> <td>3)</td> <td></td> <td></td> <td></td> <td></td> <td></td>	(add a	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix G	3)					
Output from water heater Image: Computer biology of the set	(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
(61)me 18374 166.6 173.46 153.4 148.8 130.76 123.52 138.41 139.08 159.17 170.44 184.47 Output from water heater (annual)	Output	from w	ater hea	ter											
Output from water heater (annual). 1 1878.34 (64) Heat gains from water heating, kWh/month 0.25 ° [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65) (65) 61:15 53:65 57:74 41:63 39:16 44:1 44:39 51 (65) Internal gains (calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (calculated in Appendix L, equation 1:9 or L9a), atso see Table 5 (66) (66) 66:64 53:34:6 33:4 33:4 53:46:53:46 54:45:33:48:33:44:33 (48) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66) (66)	(64)m=	189.74	166.6	173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		
Heat gains from water heating, kWh/month 0.25 $^{\circ}$ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65)m = 61.15 53.65 55.74 49.14 47.56 41.63 39.16 44.1 44.39 51 54.97 59.4 (65) include (57)m in Calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (sce Table 5 and 5a): Metabolic gains (Table 5). Watts Uan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m - (158.22 157.2 52.64 59.28 15.65 68.55 76.34 79.84 (69) Pumps and fans gains (Table 5a) (70)m 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3			1	I	I				Outp	out from wa	ater heate	r (annual)₁	12	1878.34	(64)
$ \begin{array}{c} \text{(65)} \text{m} & \begin{array}{c} 61.15 & 53.65 & 55.74 & 49.14 & 47.56 & 41.63 & 39.16 & 44.1 & 44.39 & 51 & 54.97 & 59.4 \\ \text{(65)} \text{m} & \text{(15)} \text{m} \text{ include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating \\ \hline \text{(66)} \text{m} & \begin{array}{c} 53.65 & 55.74 & 49.14 & 47.56 & 41.63 & 39.16 & 44.1 & 44.39 & 51 & 54.97 & 59.4 \\ \hline \text{(66)} \text{m} & \text{(15)} \text{m} \text{(16)} \text{m} \text{m} \text{m} \text{m} \text{m} \text{m} \text{m} m$	Heat d	ains fro	m water	heating	kWh/m	onth 0.2!	5 ´ [0 85	x (45)m	+ (61)m	1 + 0.8 x	r [(46)m	+ (57)m	+ (59)m	1	J
$\begin{array}{c} \text{(a)} \text{ bits } & \text{(bit)} & (bit)$	(65)m-	61 15	53.65	55 74	49 14	47 56	41.63	39.16	44 1	44 39	51	54.97	59.4	1	(65)
S. internal gains (see Table 5 and 5a): Metabolic gains (Table 5). Watts (66)m 158.22 (66) Copy main 56.46 50.34 40.92 30.88 23.15 128.55 21.12 27.46 36.88 46.79 54.61 58.22 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (69) 27.43 29.432 319.56 343.28 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (70) 53.46 53.46 53.46	in alu	do (57)			of (CE)m	only if o				ar hot w	otor io fr	04.07		acting	(/
3: The Hard gaths reservable controls): Metabolic gains (Table 5), Watts: (6)m 168.22 158.23 158.23 158.23 158.		ue (57)				only if c	yiinder is	s in the C	iwening	of not wa	alerisii	om com	munity n	eating	
Metabolic gains (Table 5). Wats Jun	D. IIII	emai ga	ains (see		b and ba										
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Metabo	olic gair	is (Table	e 5), Wat	ts	_							_		
$ \begin{array}{c} (66)m = 158.22 \ 158.2$		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67) = 56.64 50.31 40.92 30.98 23.15 19.55 21.12 27.46 86.85 46.79 54.61 58.22 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68) = 359.12 362.85 353.46 333.47 308.23 284.51 268.67 264.94 274.33 294.32 319.56 343.28 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) = 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 63.46 (59) Pumps and fans gains (Table 5a) (70) = 3 3 3 3 3 3 3 3 3 3	(66)m=	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22		(66)
$ \begin{array}{c} (67)^{m} = & 56.64 & 50.31 & 40.92 & 30.98 & 23.15 & 19.55 & 21.12 & 27.46 & 56.85 & 46.79 & 54.61 & 58.22 & (67) \\ \mbox{Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 \\ (68)^{m} = & 359.12 & 362.85 & 353.46 & 333.47 & 308.23 & 284.51 & 268.67 & 264.94 & 274.33 & 294.32 & 319.56 & 343.28 & (68) \\ \mbox{Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 \\ (69)^{m} = & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & 53.46 & (69) \\ \mbox{Pumps and fans gains (Table 5a) \\ (70)^{m} = & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 &$	Lightin	g gains	(calcula	ted in Ap	opendix l	L, equat	ion L9 oi	L9a), a	lso see T	Table 5					
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68) m= 359.12 362.85 353.46 333.47 308.23 284.51 268.67 264.94 274.33 294.32 319.56 343.28 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) m= 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 53.46 63.46 (69) Pumps and fans gains (Table 5a) (70) m= $\overline{3}$	(67)m=	56.64	50.31	40.92	30.98	23.15	19.55	21.12	27.46	36.85	46.79	54.61	58.22		(67)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Applia	nces ga	ins (calc	ulated ir	Append	lix L, eq	uation L	13 or L13	3a), also	see Tal	ole 5				
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 53.46 $53.$	(68)m=	359.12	362.85	353.46	333.47	308.23	284.51	268.67	264.94	274.33	294.32	319.56	343.28		(68)
$ \begin{array}{c} (69) \text{m} = & 53.46 & $	Cookin	ig gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
Pumps and fans gains (Table 5a) (70)m= 3 <td>(69)m=</td> <td>53.46</td> <td></td> <td>(69)</td>	(69)m=	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46		(69)
$\begin{array}{c} (70)^{m} = \hline 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3$	Pumps	and fa	ns gains	(Table {											
Losses e.g. evaporation (negative values) (Table 5) (71)m= $\frac{1}{105.48} \cdot \frac{1}{105.48} \cdot \frac{1}$	(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Losses	se a ev	u vaporatio	n (nega	tive valu	es) (Tab	Le 5)								
Water heating gains (Table 5) (72)m= 82.19 79.83 74.92 68.26 63.92 57.82 52.64 59.28 61.65 68.55 76.34 79.84 (72) Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m (73)m= 607.16 602.19 578.5 541.9 504.5 471.08 451.62 460.87 482.03 518.86 559.71 590.54 (73) 6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Area Flux g_ FF Gains Table 6a Table 6b Table 6c (W) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = Sum(74)m(82)m <td>(71)m=</td> <td>-105.48</td> <td></td> <td>(71)</td>	(71)m=	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48		(71)
(72)m= 82.19 79.83 74.92 68.26 63.92 57.82 52.64 59.28 61.65 68.55 76.34 79.84 (72) Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m (73)m= 607.16 602.19 578.5 541.9 504.5 471.08 451.62 460.87 482.03 518.86 559.71 590.54 (73) 6. Solar gains Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Area Flux g_ FFF Gains Table 6a FFF Gains Table 6b Table 6c (W) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (W) (W)	Water	heating	T) anico	able 5)											
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$ $(73)m = 607.16 - 602.19 - 578.5 - 541.9 - 504.5 - 471.08 - 451.62 - 460.87 - 482.03 - 518.86 - 559.71 - 590.54$ (73) 6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. FF Gains Table 6d Orientation: Access Factor Area Mark Flux g_ FF Gains Table 6b Table 6c (W) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 - 160.63 - 264.53 - 385.8 - 472.82 - 484.01 - 460.8 - 395.82 - 307.66 - 190.6 - 102.38 - 67.52 - (83) (83)m	(72)m=	82.19	79.83	74.92	68.26	63.92	57.82	52.64	59.28	61.65	68.55	76.34	79.84		(72)
$ \begin{array}{c} (73)_{m=} & (60)_{m} + (6$	Total i	ntornal	agine –				(66)	m + (67)m	+ (68)m +	(69)m + (70)m + (7	1)m + (72)	m		
6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Area Flux g_ FF Gains Table 6a Table 6a Table 6b Table 6c (W) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 160.63 264.53 385.8 472.82 484.01 460.8 395.82 307.66 190.6 102.38 67.52 (83)	(73)m-	607 16	94115 -	578 5	541 9	504 5	471.08	451.62	460.87	482.03	518.86	559 71	590 54		(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 g_ FF Gains Table 6d m ² Table 6a Table 6b Table 6c (W) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 160.63 264.53 385.8 472.82 484.01 460.8 395.82 307.66 190.6 102.38 67.52 (83)	6 Sol	ar gaing		010.0	011.0	001.0	11 1.00	1011.02	100101	102.00	010.00	000.11	000.01		(- /
Orientation:Access Factor Table 6dArea m²Flux Table 6a g_{-} FF Table 6bGains Table 6cSolar gains in watts, calculated for each month(83)m = Sum(74)m(82)m(83)m =82.11160.63264.53385.8472.82484.01460.8395.82307.66190.6102.3867.52(83)	Solar o	ains are o	calculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicab	le orientat	ion.		
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 160.63 264.53 385.8 472.82 484.01 460.8 395.82 307.66 190.6 102.38 67.52 (83)	Orienta	ation:	Access F	actor	Area		Flu	x		a		FF		Gains	
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 160.63 264.53 385.8 472.82 484.01 460.8 395.82 307.66 190.6 102.38 67.52 (83)	Chona	-	Table 6d	~~~~	m²		Tak	ole 6a	Т	able 6b	Та	able 6c		(W)	
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 82.11 160.63 264.53 385.8 472.82 484.01 460.8 395.82 307.66 190.6 102.38 67.52 (83)															
$ (83)m = 82.11 \ 160.63 \ 264.53 \ 385.8 \ 472.82 \ 484.01 \ 460.8 \ 395.82 \ 307.66 \ 190.6 \ 102.38 \ 67.52 \ (83) $	Solar	naine in	watte or	alculated	l for parl	n month			(83)m – Si	um(74)m	(82)m				
	(83)m=	82.11	160.63	264.53	385.8	472.82	484.01	460.8	395.82	307.66	190.6	102.38	67.52		(83)

Total g	jains – ii	nternal a	and solar	⁻ (84)m =	= (73)m ·	+ (83)m	, watts							
(84)m=	689.27	762.82	843.03	927.7	977.32	955.09	912.42	856.69	789.69	709.46	662.1	658.06		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livii	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.98	0.93	0.83	0.65	0.48	0.53	0.78	0.95	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	r 7 in Tabl	e 9c)					
(87)m=	19.9	20.04	20.29	20.61	20.85	20.97	20.99	20.99	, 20.91	20.6	20.19	19.88		(87)
Temn		durina h	L Deating r	eriods in	n rest of	dwelling	from Ta	1 hle 9 T	h2 (°C)					
(88)m=	19.96	19.96	19.96	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.97	19.97		(88)
l Itilisa	tion fac	tor for a	ains for	rest of du	welling	h2 m (se	e Tahle	(() ()						
(89)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.37	0.42	0.7	0.93	0.99	0.99		(89)
Mean	Interna	temper	ature in	the rest	of dwelli	ng 12 (te	ollow ste	eps 3 to	/ in Tabl	e 9c)	40.05	10.10		(00)
(90)m=	18.51	18.72	19.07	19.53	19.84	19.97	19.99	19.99	19.92	19.52	18.95	18.48		(90)
									I	LA = LIVIN	g area ÷ (4	+) =	0.22	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	18.81	19.01	19.34	19.76	20.06	20.19	20.21	20.21	20.14	19.76	19.22	18.79		(92)
Apply	adjustn	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.81	19.01	19.34	19.76	20.06	20.19	20.21	20.21	20.14	19.76	19.22	18.79		(93)
8. Spa	ac <mark>e hea</mark>	ting requ	uire <mark>men</mark> t											
Set Ti the ut	i to the r ilisation	nean int factor fo	ternal ter or gains	nperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	b, 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	ation fac	tor for g	i ains, hm	 .:										
(94)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.4	0.44	0.72	0.93	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	682.1	749.16	810.57	837.34	758.79	549.27	363.14	380.97	566.29	658.73	649.45	652.47		(95)
Month	nly avera	age exte	ernal tem	perature	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)
Heat	loss rate	e for me	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1521.97	1474.78	1338.25	1116.12	856.29	565.32	365.07	384.35	613.89	938.49	1248.94	1511.52		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	624.86	487.61	392.59	200.72	72.54	0	0	0	0	208.14	431.63	639.14		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3057.24	(98)
Space	e heating	g require	ement in	kWh/m²	/year								33.66	(99)
9a. En	ergy rec	uiremer	nts – Indi	ividual h	eating s	vstems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:			Ŭ.		- C							
Fracti	ion of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 ·	– (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)

Efficiency Efficiency J Space he	y of main s y of secon lan Fe eating requ 4.86 487.6 {[(98)m x (2.61 524.8	pace hea dary/supp Mar iirement (1 392.59	ting syste lementar Apr	em 1 ry heating May	g systen	n, %						92.9	(206)
Efficiency J Space he	y of secon lan Fe eating requ 4.86 487.6 {[(98)m x (2.61 524.8	dary/supp b Mar lirement (1 392.59	lementar Apr	y heating May	g systen	n, %						0	(208)
J Space he	lan Fe eating requ 4.86 487.6 {[(98)m x (2.61 524.8	Mar iirement (1 392.59	Apr	May									(· · · /
Space he	eating requ 4.86 487.6 {[(98)m x (2.61 524.8	irement (1 392.59	calculata	,	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
624	4.86 487.6 {[(98)m x (2.61 524.8	1 392.59		d above))	1	1	1	i	1	1		
	{[(98)m x (2.61 524.8	-	200.72	72.54	0	0	0	0	208.14	431.63	639.14		
(211)m = {	2.61 524.8	204)] + (2	10)m } x	100 ÷ (2	06)								(211)
672		8 422.6	216.06	78.09	0	0	0	0	224.05	464.62	687.99		٦
							lota	al (KWh/yea	ar) = Sum(2)	211) _{15,1012}	2	3290.9	(211)
Space he	eating fuel	(seconda	ry), kWh/	(month									
$= \{[(98)m\}$	$\frac{x(201)j}{0}$	(214) m }	<u>x 100 ÷ (</u>	208)	0	0	0	0	0	0	0		
(213)11=	0 0	0	0	0	0	0	Tota		ar) –Sum(215)		0	7(215)
Meter bee	-41						1010			- 10/ _{15,1012}	<u>-</u>	0	(213)
Output from	ating m water h	eater (cal	rulated a	hove)									
189	9.74 166.0	5 173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		
Efficiency	of water h	eater	1	1		1	1	1		1		87.3	(216)
(217)m= 89	9.28 89.2	89.09	88.75	88.14	87.3	87.3	87.3	87.3	88.75	89.15	89.3		(217)
Fuel for wa	ater heatir	g, kWh/m	ionth	•		•	•	•		•			
(219)m =	(64)m x 1	00 ÷ (217)m			I							
(219)m= 212	2.52 186.7	2 194.71	172.84	168.83	149.79	141.49	158.54	159.31	179.34	191.75	206.56	_	7
							TOLA	ii = Sum(2	19a) ₁₁₂ =			2122.38	(219)
Space hea	otais ating fuel i	sed mair	system	1					K	wn/year		3200 Q	
Maria La			System								_	3290.9	
Water hea	ating fuel u	sed										2122.38	
Electricity	for pumps	, fans and	l electric	keep-ho	t								
central he	eating pur	np:		_						_	30		(230c)
boiler wit	h a fan-as	sisted flue)								45		(230e)
Total elect	tricity for th	ne above,	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electricity	for lighting	ļ										400.14	(232)
10a. Fue	l costs - in	dividual h	eating sy	stems:									_
					E				Eucl D	rico		Eucl Coot	
					гu kW	/h/vear			(Table	12)		fuer Cost	
Space hea	atina - mai	n system	1		(21	1) x				,	x 0.01 =	11/ 5232	7(240)
Space hea	ating - mai	n system	2		(21)	3) x					x 0.01 =	0	$\Box^{(241)}$
Space her	ating - sec	ndarv	-		(21	ý 5) x				40	x 0.01 =	0	$ \begin{bmatrix} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2$
Water hea	ating cost (other fuel)		(21	9)				19	x 0.01 =	72.96	$\int_{(247)}^{(247)}$
Pumpe fa	ins and eld	etric koor	, hot		(23	1)				10	x 0.01 =	0.00	$\int_{(240)}^{(247)}$
(if off-neal	k tariff liet	each of (3	230a) to /	(230a) ea	 naratel	, as ann	licahle a	nd annly			ding to T	9.09 ahle 12a	
Energy for	r lighting			2009/ 30	(23)	2)	nouble a	ուզ զիիլ)	13.	19	x 0.01 =	52.78	(250)
Additional	standing	harges (1	Table 12)						_			120	(251)

Appendix Q items: repeat lines (253) and (254)	as needed			_
Total energy cost (245)(2	247) + (250)(254) =		371.05	(255)
11a. SAP rating - individual heating systems				
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		1.15	(257)
SAP rating (Section 12)			84	(258)
12a. CO2 emissions – Individual heating syste	ms including micro-CH	Р		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216 =	710.83	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	458.43	(264)
Space and water heating	(261) + (262) + (263) +	- (264) =	1169.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	207.67	(268)
Total CO2, kg/year		sum of (265)(271) =	1415.86	(272)
CO2 emissions per m ²		(272) ÷ (4) =	15.59	(273)
El rating (section 14)			86	(274)
13a. Primary Energy Space heating (main system 1)	Energy kWh/year (211) x	Primary factor	P. Energy kWh/year 4014.89	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	1.22 =	2589.31	(264)
Space and water heating	(261) + (262) + (263) +	- (264) =	6604.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25	(267)
Electricity for lighting	(232) x	0 =	1228.42	(268)
'Total Primary Energy		sum of (265)(271) =	8062.87	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	88.76	(273)

				User D	etails:							
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.0.28		
A dalaa aa			Pr	operty .	Address	: 2 Beds	- House					
Address : 1 Overall dwelling dime	nsions:											
	10010.			Area	a(m²)		Av. Hei	aht(m)		Volume(m ³)		
Ground floor				4	5.42	(1a) x	2	.6	(2a) =	118.09	(3a)	
First floor				4	5.42	(1b) x	2	.6	(2b) =	118.09	(3b)	
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)-	+(1n)	0.84	(4)			1		J	
Dwelling volume				L		(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	236.18	(5)	
2 Ventilation rate:											_	
	main	sec	condary	у	other		total			m ³ per hour		
Number of chimneys] + [0] + [0] = [0	x 4	= 0	0	(6a)	
Number of open flues	0	 +	0] + [0	ī - Г	0	x 2	20 =	0	(6b)	
Number of intermittent fai	ns					- F	3	x 1	0 =	30	(7a)	
Number of passive vents						Ē	0	x 1	0 =	0	(7b)	
Number of flueless gas fi	res						0	x 4	+0 =	0	(7c)	
Number of flueless gas fires 0 × 40 = 0 Air changes per												
Infiltration due to chimney	s, flues and fa	ans = (6a))+(6b)+(7	<mark>a)+</mark> (7b)+(7c) =		30	-	÷ (5) =	0.13	(8)	
If a pressurisation test has be	een ca <mark>rried out or</mark>	is intended	l, proceed	to (17), o	otherwise of	continue fro	om (9) to (16)			- 7	
Additional infiltration	ie dw <u>eiling</u> (ns	5)						 [(9)-	11x0.1 =	0	(9)	
Structural infiltration: 0.	.25 for steel or	timber fr	ame or	0.35 fo	r masoni	ry constr	uction			0	(11)	
if both types of wall are pr	resent, use the va	lue correspo	onding to	the great	er wall are	a (after						
deducting areas of openin	igs); if equal user loor. enter 0.2	0.35 (unseale	d) or 0.	1 (seale	d). else	enter 0				0	T (12)	
If no draught lobby, ent	ter 0.05, else e	enter 0	.,	(-,,					0	(13)	
Percentage of windows	s and doors dr	aught stri	pped							0	(14)	
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)	
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)	
Air permeability value,	q50, expresse	d in cubio	c metres	s per ho	our per s	quare m	etre of e	nvelope	area	6	(17)	
If based on air permeabili	ity value, then	(18) = [(17)) ÷ 20]+(8), otherwi	se (18) = ((16)				0.43	(18)	
Air permeability value applies	s if a pressurisatio	on test has l	been don	e or a deg	gree air pe	rmeability i	is being us	sed			-	
Number of sides sheltere	d				(20) = 1 -	[0 075 x (1	9)] =			2	(19)	
Infiltration rate incorporati	ing shelter fac	tor			(21) = (18)	$(20) \times (20) =$	-/1			0.85	(20)	
Infiltration rate modified for	or monthly win	d sneed			() (10	, (,) –				0.30	^(۲۷)	
Jan Feb	Mar Apr	Mav	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec]		
Monthly average wind so	eed from Tabl	• 7			1		- ••		- •••	1		
(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		
Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	•	•		-	
	0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(22.5)
lf evh	oust air b		using Ann	andix N (2	3h) - (23a	a) y Emv (e	auation (N	(15)) other	wise (23h) - (23a)			0	(238)
If bal	anced wit			iency in %	$\frac{1}{2}$	for in-use f	actor (from	n Table 4b	wise (200) – (200)			0	(23D)
)- .)	26) m i (226) [4	(020)	0	(23c)
a) II (24a)m-								Π Κ) (248	0 = (22)	20)m + (0	230) × [1	-(230)] - 100j	(24a)
b) If	halance	d mech	l	ntilation	without	heat rec	overv (N	///) (24h)m = (22	<u> </u>	23h)	ů	J	()
(24b)m=				0	0				0		0	0	1	(24b)
c) If	whole h		tract ver	L	or positiv	l /e input v	ventilatio	n from c	utside				1	
0) 11	if (22b)r	n < 0.5 >	< (23b), t	hen (24	c) = (23b	b); other	vise (24	c) = (22t	o) m + 0.	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural if (22b)r	ventilation ventilation = 1, th	on or wh en (24d)	ole hous m = (221	e positiv c)m othe	ve input v erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]	•			
(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
3 He	at l <mark>osse</mark>	s and he	eat l <mark>oss</mark> i	naramete	ər. 🖌									
ELEN		Gros	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r	ea n²	U-valı W/m2	le K	A X U (W/I	K)	k-value kJ/m²·	e K	A X k kJ/K
Doors						2	x	1.1		2.2				(26)
Windo	ws Type	e 1				2.88	x1.	/[1/(1.3)+	0.04] =	3.56				(27)
Windo	ws Type	e 2				3.96	x1.	/[1/(1.3)+	0.04] =	4.89				(27)
Floor						45.42	<u>x</u>	0.15] = [6.813	Ξr			(28)
Walls		93.	6	14.6	;	79	x	0.22		17.38	Ξī		$\exists \vdash$	(29)
Roof		45.4	12	0		45.42	<u>x</u>	0.14		6.36	Ξ Ē			(30)
Total a	area of e	elements	, m²			184.4	4							(31)
Party v	wall					52	×	0	=	0				(32)
* for win ** incluc	dows and le the are	l roof wind as on both	ows, use e sides of ir	effective wi	ndow U-va Is and par	alue calcul titions	ated using	formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	h 3.2	
Fabric	heat lo	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				48.32	(33)
Heat c	apacity	Cm = S	(A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	21165.2	28 (34)
Therm	al mass	parame	eter (TMF	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign asses Jsed inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	indicative	e values of	TMP in Te	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.22	(36)
<i>if details</i> Total f	of therma abric he	a <i>l bridging</i> at loss	are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			57.54	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	ý				(38)m	= 0.33 × ((25)m x (5)			
		1	1			i .		•	0	0.1			1	

(38)m=	47.32	47	46.68	45.18	44.9	43.6	43.6	43.37	44.11	44.9	45.47	46.06		(38)
Heat tra	ansfer o	coefficie	nt, W/K	1				1	(39)m	= (37) + (3	38)m			
(39)m=	104.86	104.54	104.22	102.73	102.45	101.14	101.14	100.91	101.65	102.45	103.01	103.61		
									(10)	Average =	Sum(39)1.	12 /12=	102.73	(39)
Heat Io	ss para		HLP), W/	/m²K	1 1 2	1 1 1	1 1 1	1 1 1	(40)m	= (39)m ÷	(4)	1 1 4		
(40)m=	1.15	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	Average =	1.13 Sum(40)	1.14	1 13	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)						nonago				
	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	ting ene	rgy requ	irement:								kWh/yea	ar:	
Assum if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . 9)	64		(42)
Annual	averag	je hot wa	ater usag	ge in litre	es per da	ay Vd,av Iwelling is	erage =	(25 x N)	+ 36 a water us	se target o	10'	1.92		(43)
not more	that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)			je turget e				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	112.12	108.04	103.96	99.89	95.81	91.73	91.73	95.81	99.89	103.96	108.04	112.12		
Energy o	content of	hot water	used - cal	lculated mo	onthly $= 4$.	190 x Vd,r	n x nm x E)))))))))))))))))))) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1223.1	(44)
(45)m=	166.27	145.42	150.06	130.82	125.53	108.32	100.38	115.18	116.56	135.84	148.28	161.02		
lf instant	aneous w	vater heati	na at point	t of use (no	hot water	storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	-	1603.68	(45)
(46)m-	0					0	0	0		0	0	0		(46)
Water	storage	loss:		Ů	Ŭ	Ŭ	Ů		Ű	Ű	Ŭ	Ů		()
Storage	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr Otherw Water	nunity h vise if no storage	eating a o stored loss:	and no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar	litres in neous co	(47) ombi boil	ers) ente	er 'O' in (47)			
a) If m	anufact	urer's d	eclared I	oss facto	or is kno	wn (kvvr	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	20				(40) (40)				0		(49)
b) If m	anufact	m water urer's d	r storage eclared (e, kvvn/ye cvlinder l	ear loss fact	or is not	known:	(48) X (49)) =			0		(50)
Hot wa	ter stor	age loss	factor fr	rom Tabl	e 2 (kW	h/litre/da	iy)					0		(51)
If comr	nunity h	eating s	see secti	on 4.3										
Volume	e factor	from 1a	ble 2a m Table	2h								0		(52)
Energy	lost fro	m water	storade	~ 20 . k\//b///	aar			(47) x (51) y (52) y (53) -		0		(53)
Enter	(50) or ((54) in (55)	,	501			(1) X (01	/	00) –		0		(54)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m	L			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contain:	s dedicate	d solar sto	nage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendix	κH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t I	here is s	solar wat	er heatii	ng and a	ı cylinde I	r thermo	stat)		I	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m		-	-	-	_	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	141.33	123.61	127.55	111.2	106.7	92.07	85.32	97.91	99.08	115.46	126.04	136.87		(62)
Solar DI	-IW input	calculated	using App	endix G or	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(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=	141.33	123.61	127.55	111.2	106.7	92.07	85.32	97.91	99.08	115.46	126.04	136.87		-
								Outp	out from wa	ater heate	r (annual)₁	12	1363.13	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	35.33	30.9	31.89	27.8	26.68	23.02	21.33	24.48	24.77	28.87	31.51	34.22		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	tern <mark>ai g</mark> a	ains (see	Table 5	5 and 5a):									
Metab	olic gair	s (Table	e 5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85		(66)
Lightin	g gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see [.]	Table 5					
(67)m=	22.66	20.12	16.37	12.39	9.26	7.82	8.45	10.98	14.74	18.72	21.84	23.29		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5				
(68)m=	240.61	243.11	236.82	223.42	206.51	190.62	180.01	177.51	183.8	197.2	214.1	230		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also se	e Table	5]	
(69)m=	36.18	36.18	36.18	36.18	36.18	36.18	36.18	36.18	36.18	36.18	36.18	36.18		(69)
Pumps	and fai	ns dains	(Table (5a)	1			1					1	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	seaev	u vaporatic	n (nega	ı tive valu	ı es) (Tab	le 5)							4	
(71)m=	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	l	(71)
Water	L heating	L nains (1	l able 5)										i	
(72)m=	47.49	45.98	42.86	38.61	35.85	31.97	28.67	32.9	34.4	38.8	43.76	45,99	1	(72)
Total i	Internal	agine -			00.00	(66)	m + (67)m	1 + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m	ł	
(73)m-	373 31	971 77	358.6	336.08	31/ 18	202.07	279.68	283.05	205.5	317.27	342.27	361.83	1	(73)
6 So	lar gains		000.0	000.00	014.10	202.01	270.00	200.00	200.0	017.27	042.21	001.00		(1-0)
Solar o	ains are o	alculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	onvert to th	e applicat	le orientat	ion.		
Orient	ation: A	Access F	actor	Area		Flu	X		q		FF		Gains	
	1	able 6d		m²		Tal	ole 6a	Т	able 6b	Т	able 6c		(W)	
Solar	ains in	watts. ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	82.11	160.63	264.53	385.8	472.82	484.01	460.8	395.82	307.66	190.6	102.38	67.52		(83)

Total g	ains – ir	nternal a	and solar	⁻ (84)m =	= (73)m -	+ (83)m	, watts							
(84)m=	455.43	532.4	623.13	722.78	787	776.98	740.48	679.77	603.16	507.86	444.65	429.35		(84)
7. Me	an inter	nal temp	berature	(heating	season)								
Temp	erature	during h	neating 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	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.9	0.75	0.58	0.65	0.89	0.99	1	1		(86)
Mean	interna	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	19.66	19.81	20.08	20.44	20.75	20.94	20.99	20.98	20.83	20.41	19.98	19.64		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	19.96	19.96	19.96	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.97	19.97		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.96	0.87	0.66	0.46	0.52	0.83	0.98	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.73	18.88	19.15	19.52	19.81	19.96	19.99	19.98	19.89	19.5	19.06	18.72		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.22	(91)
Mean	interna	temper	ature (fo	or the wh	ole dwel	lling) = fl	_A × T1	+ (1 – fL	A) × T2		_			
(92)m=	18.94	19.09	19.35	19.72	20.01	20.17	20.21	20.2	, 20.09	19.7	19.26	18.92		(92)
Apply	adjustn	nent to t	he mear	internal	tempera	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.94	19.09	19.35	19.72	20.01	20.17	20.21	20.2	20.09	19.7	19.26	18.92		(93)
8. Spa	ace hea	ting requ	uire <mark>men</mark> t											
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed 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	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.96	0.87	0.68	0.49	0.55	0.84	0.98	1	1		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	454.7	530.43	616.03	692.35	682.65	529.43	359.87	374.82	507.44	497.2	443.18	428.84		(95)
Month	nly avera	age exte	ernal tem	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)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m·	– (96)m]				()
(97)m=	1534.7	1482.98	1339.66	. 1111.47	851.66	563.79	364.77	383.79	609.31	932.27	1252.66	1525.43		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k	/Vh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m	045.00		
(98)m=	803.52	640.11	538.38	301.76	125.75	0	0	0	0	323.69	582.82	815.86		
_								lota	i per year	(kvvn/year) = Sum(9	8)15,912 =	4131.9	(90)
Space	e heatin	g require	ement in	kWh/m ²	/year								45.49	(99)
8c. Sp	bace co	oling rec	quiremer	nt										
Calcu	lated fo	r June, .	July and	August.	See Tal	ole 10b	_	í		_				
Heat	Jan	Feb		Apr	May		Jul	Aug	Sep	Oct	Nov			
neat	iuss rate	; LIII (Ca	iculated	using 25	JUINTER	nartem	Jeralure	anu exte	ennai ten	iperatur		avie 10)		

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0

0

950.75

748.47

766.92

0

0

0

0

0

0

(100)m=

0

(100)

Utilisa	tion fac	ctor for lo	ss hm	_							-	_	_	
(101)m=	0	0	0	0	0	0.86	0.92	0.89	0	0	0	0		(101)
Usefu	l loss, ł	nmLm (W	/atts) = ((100)m x	(101)m								-	
(102)m=	0	0	0	0	0	818.69	690.83	686.24	0	0	0	0		(102)
Gains	(solar	gains cal	lculated	for appli	cable we	eather re	egion, se	e Table	10)				-	
(103)m=	0	0	0	0	0	1007.96	963.25	894.14	0	0	0	0		(103)
Space set (10	Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m - (102)m] x (41)m set (104)m to zero if (104)m < 3 x (98)m													
(104)m=	0	0	0	0	0	136.27	202.68	154.68	0	0	0	0		
-		-							Total	= Sum(104)	=	493.63	(104)
Cooled	fractio	n							f C =	cooled a	area ÷ (4	4) =	1	(105)
Intermit	ttency f	actor (Ta	able 10b)									1	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
	Total = Sum(1.0.4) = 0 (106)													
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n					7	
(107)m=	0	0	0	0	0	34.07	50.67	38.67	0	0	0	0		
									Total	= Sum(107)	=	123.41	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	/ear				(107)	÷ (4) =			1.36	(108)
8f. Fabi	ric Ene	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		46.84	(109)
										. ,				
				User D	etails:									
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Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.0.28				
			P	roperty /	Address:	3 Beds	- House	•						
Address :														
1. Overall dwelling dime	ensions:			•	(2)		A 11	·) (- l				
Ground floor				Area	$a(m^2)$	(1a) x			(2a) =	Volume(m ³)	1 (3a)			
				5	0.94			0	(20) -	132.40				
FIRST HOOF				5	0.94	(1b) x	2	2.6	(2b) =	132.46	(3b)			
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)+.	(1n	10	01.89	(4)								
Dwelling volume						(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	264.91	(5)			
2. Ventilation rate:											-			
	main heating	seco hea	ondar ting	у	other		total			m ³ per hour				
Number of chimneys	0	+	0	+ [0] = [0	x 4	= 0	0	(6a)			
Number of open flues	0	+	0] + [0] = [0	x 2	20 =	0	(6b)			
Number of intermittent fa	ns					」 「	3	x 1	0 =	30] (7a)			
Number of passive vents							0	x 1	0 =	0](7b)			
Number of flueless gas fi	res						0	- x4	0 =	0	$\left \left(\frac{1}{2} \right) \right $			
							0		Air ch	anges per hou](/c) ir			
Infiltration due to chimne	ys, flues and fa	ans = (6a)+((6b)+(7	a)+(7b)+(7	7c) =		30		÷ (5) =	0.11	(8)			
If a pressurisation test has b	een carried out or	י is intended, ג א	proceed	d to (17), c	otherwise c	continue fre	om (9) to (16)		0				
Additional infiltration	le dwennig (na	>)						[(9)-	11x0.1 =	0	(3)			
Structural infiltration: 0	.25 for steel or	timber frar	ne or	0.35 for	masonr	y constr	uction	1(-7		0	(11)			
if both types of wall are p	resent, use the va	lue correspon	ding to	the greate	er wall are	a (after			I	-], ,			
deducting areas of openir	ngs); if equal user floor enter 0.2	0.35 (unsealed)	or 0	1 (seale	d) else	enter ()				0	T (12)			
If no draught lobby en	ter 0.05 else ϵ	enter 0	010.	i (Seale	iu), eise					0	(12)			
Percentage of windows	s and doors dr	aught strip	bed							0](14)			
Window infiltration		5 11			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, expresse	d in cubic ı	metre	s per ho	our per so	quare m	etre of e	nvelope	area	4.4	(17)			
If based on air permeabil	ity value, then	(18) = [(17) ÷	20]+(8	3), otherwi	se (18) = (16)				0.33	(18)			
Air permeability value applie	es if a pressurisation	on test has be	en don	e or a deg	gree air pei	rmeability	is being us	sed	ĺ					
Shelter factor	ed .				(20) = 1 -	0.075 x (1	9)] =			2	(19)			
Infiltration rate incorporat	ting shelter fac	tor			(21) = (18)) x (20) =	/-			0.00	(20)			
Infiltration rate modified f	or monthly wir	d speed								0.20	J(,			
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind sp	eed from 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 (allowi	ing for sl	nelter ar	nd wind s	speed) =	(21a) x	(22a)m				-		
	0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33			
Calcula	ate effe	ctive air	change .	rate for t	he appl	icable ca	se								
II ME				ondix N (2	(25) = (22)		oquation (N5)) otho	nuico (22h) - (220)				0	(23a)
If bala	aust all fi				.00) – (20	for in use f	actor (fror	n Toblo 4b) _) – (238)				0	(23b)
									() =	2 15)	006)	(00-)	4001	0	(23c)
a) ir	balance		anical ve					HR) (248	a = (2)	20)m + (. 1	23D) × [1	1 - (23C)) ÷ 100]]		(24a)
(24a)III=	balanaa											0	J		(240)
D) II (24b)m	balance							VIV) (240 1	D = (22)	2) + m(a2	230)	0	1		(24b)
(240)m=		0	0		0			0		0	0	0			(240)
c) If ' i	whole h f (22h)n	iouse ex	tract ver	tilation (then (24)	or positiv	ve input '	ventilatio	c) = (22)	$o_{1} m \pm 0$	5 v (23h	.)				
(24c)m =	0		0					$\frac{0}{0} = \frac{221}{0}$,, 0	0	1		(24c)
d) If	natural	l ventilativ	on or wh				Ventilati	on from		Ů	Ů	Ĵ	J		
u) n	f (22b)n	n = 1, th	en (24d)	m = (22)	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m ² x	0.5]					
(24d) <mark>m=</mark>	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56			(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24	b) or (24	c) or (24	d) in bo	(25)						
(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	1		(25)
2 40		o ond by		noromot	or										
		S and he		Ononin		Not Ar	00			ΔΧΠ		k-valu			(k
		area	(m²)	m	193 1 ²	A ,r	n²	W/m2	2K	(W/I	<)	kJ/m².	K	kJ/	K
Doors						2	×	1.1	=	2.2					(26)
Window	ws Type	e 1				2.88		/[1/(1.3)+	0.04] =	3.56					(27)
Window	ws Type	e 2				3.96		/[1/(1.3)+	0.04] =	4.89					(27)
Window	ws Type	e 3				1.26		/[1/(1.3)+	0.04] =	1.56	=				(27)
Windov	ws Type	e 4				4.41		/[1/(1.3)+	0.04] =	5.45					(27)
Floor						50.94	5 X	0.15		7.6417					(28)
Walls		12	5	18.6	5	106.3	5 X	0.2		21.27	\dashv		= ;		 (29)
Roof		50.0	24			50.9/		0.14	<u>ا</u> _ ا	7 13	╡┟				
Total a	rea of e					226.9		0.14		7.10			L		(31)
Party w	vall		,			220.0	<u> </u>			0	— r				
* for win	dows and	I roof wind	OWS USO C	offective wi	indow Ll-v	25 alue calcul			=	0 (A)+() ()/1 (A)		naragran			(32)
** includ	e the area	as on both	sides of ir	nternal wal	ls and par	titions	aleu using	g ioinnuia i	/[(1/0-vait	ie/+0.0+j a	is given in	paragrapi	1 3.2		
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				58	.82	(33)
Heat ca	apacity	Cm = S	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	185	54.9	(34)
Therma	al mass	parame	eter (TMF	- = Cm -	÷ TFA) ii	n kJ/m²K			Indica	tive Value	Medium		2	50	(35)
For desig	gn assess	sments wh	ere the de	tails of the	construc	tion are no	t known pl	recisely the	e indicative	values of	TMP in Ta	able 1f			_
can be u	sed inste	ad of a de	tailed calc	ulation.											
There	با السطار		v V/	ا- منامد			/								

if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	:1)								_
Total	fabric he	at loss							(33) +	(36) =			70.16	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)		•	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	49.41	49.19	48.97	47.95	47.76	46.88	46.88	46.71	47.22	47.76	48.15	48.55		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	119.57	119.36	119.14	118.11	117.92	117.04	117.04	116.87	117.38	117.92	118.32	118.72		
									,	Average =	Sum(39)1	12 /12=	118.12	(39)
Heat I	oss para	ameter (H	HLP), W/	/m²K		· · · · ·			(40)m	= (39)m ÷	· (4)		1	
(40)m=	1.17	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.16	1.17		
Numb	er of day	/s in mo	nth (Tab	le 1a)	-	-	-			Average =	Sum(40)1	12 /12=	1.16	(40)
	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. W	ater hea	ting ene	rgy requ	irement:								kWh/y	ear:	
													1	
Assun if TI	ned occu בא > 13 י	upancy, 9 N – 1	N + 1.76 x	[1 - exp	(-0 000?	849 x (TF	- Δ -13 Q)2)] + 0 ()013 x (⁻	TFA -13	2.	76		(42)
if TI	-A £ 13.9	9, N = 1	1 1.70 /		(0.0000	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	// 10.0) <u>_</u>)] + 0.0		1177 10.	.0)			
Annua	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		104	4.91		(43)
Reduce	e the annua	al average	hot water	usage by a	5% if the c	lwelling is	designed : Id)	to achieve	a water us	se target o	f			
not mor													1	
Hot way	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
TIOL WA					vu,ni = ia			(43)					1	
(44)m=	115.4	111.2	107.01	102.81	98.61	94.42	94.42	98.61	102.81	107.01	111.2	115.4		
Energy	content of	hot water	used - cai	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1258.89	(44)
(45)m=	171.13	149.67	154.45	134.65	129.2	111.49	103.31	118.55	119.97	139.81	152.62	165.73		
										Total = Su	m(45) ₁₁₂ =	=	1650.6	(45)
lf instar	ntaneous w	vater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46)) to (61)				1	
(46)m=	25.67	22.45	23.17	20.2	19.38	16.72	15.5	17.78	18	20.97	22.89	24.86		(46)
Storad	siorage	IUSS. De (litres)) includir	na anv si	alar or M	////HRS	storane	within sa	me ves	مما		150	1	(47)
lf com	munity k		and no to	ng any so	volling o	otor 110) litros in	(17)		501		150	J	(47)
Other	wise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	(+ <i>r)</i> mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:							,		,			
a) If r	nanufact	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	41]	(48)
Temp	erature f	actor fro	m Table	2b							0.	54	j	(49)
Energ	y lost fro	om water	r storage	, kWh/ye	ear			(48) x (49)) =		0.	76	ĺ	(50)
b) lf r	nanufact	turer's de	eclared o	cylinder l	oss fact	or is not	known:]	
Hot w	ater stor	age loss	factor fi	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
If com	munity h	heating s	see secti	on 4.3									1	(==)
volum	ie iactor oraturo f	Irom Ta	DIE 28 m Tabla	2h								0	-	(52)
Temp										50)		U]	(53)
Energ	(50) or (50)	om Water (54) in (4	storage	e, KVVN/Ye	ear			(47) X (51)) x (52) x (53) =		0	-	(54)
LING	(50) 011	(0+) 11 (5	,,,								I ^{0.}	01]	(55)

Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	23.6	21.32	23.6	22.84	23.6	22.84	23.6	23.6	22.84	23.6	22.84	23.6		(56)
If cylind	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	23.6	21.32	23.6	22.84	23.6	22.84	23.6	23.6	22.84	23.6	22.84	23.6		(57)
Prima	y circuit	loss (ar	nnual) fro	om Table	e 3		-			-	-	0		(58)
Primar	y circuit	loss cal	culated	for each	month ((59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	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	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 req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	218	192	201.32	180.01	176.07	156.85	150.18	165.42	165.32	186.68	197.97	212.6		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	(H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	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	iter										_	
(64)m=	218	192	201.32	180.01	176.07	156.85	150.18	165.42	165.32	186.68	197.97	212.6		_
								Outp	out from w	ater heate	r (annual)₁	12	2202.41	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	94.39	83.63	88.85	81.06	80.45	73.35	71.84	76.91	76.17	83.98	87.03	92.6		(65)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	leating	
5. In	tern <mark>al g</mark> a	ains (see	e Ta <mark>ble (</mark>	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38		(66)
Lightin	g gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-			_	
(67)m=	59.17	52.56	42.74	32.36	24.19	20.42	22.07	28.68	38.5	48.88	57.05	60.82		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			_	
(68)m=	387.08	391.1	380.98	359.43	332.23	306.66	289.58	285.57	295.69	317.24	344.44	370		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a)), also se	ee Table	5				
(69)m=	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29		(69)
Pumps	s and fa	ns gains	(Table !	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. e\	vaporatio	on (nega	tive valu	es) (Tab	ole 5)						-		
(71)m=	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25		(71)
Water	heating	gains (1	Table 5)											
(72)m=	126.87	124.45	119.42	112.58	108.14	101.88	96.57	103.38	105.8	112.88	120.87	124.46		(72)
Total i	internal	gains =	:			(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	685.55	680.53	655.56	616.79	576.97	541.39	520.64	530.05	552.4	591.42	634.78	667.7		(73)
6 80	lar dain	s.												

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	Factor	Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar o	ains ir	n watts, ca	alculated	l for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	108.5	212.26	349.56	509.81	624.79	639.59	608.91	523.05	406.55	251.86	135.29	89.23		(83)
Total g	jains –	internal a	and sola	r (84)m =	- (73)m -	+ (83)m	, watts							
(84)m=	794.06	892.79	1005.12	1126.6	1201.77	1180.97	1129.55	1053.09	958.95	843.28	770.08	756.93		(84)
7. Me	an inte	ernal temp	perature	(heating	season)								
Temp	eratur	e during h	neating p	periods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)	,	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.45	0.5	0.76	0.95	0.99	1		(86)
Mean	intern	al temper	rature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	19.89	20.05	20.31	20.63	20.87	20.97	21	20.99	20.92	20.61	20.19	19.86		(87)
Temp	eratur	e durina h	neating p	beriods ir	n rest of	dwellina	from Ta	ble 9. T	h2 (°C)					
(88)m=	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.95		(88)
l Itiliea	tion fa	etor for a	l Jains for	rest of d	welling	h2 m (sc	n Da Tahla	() ()						
(89)m=	0.99	0.98	0.96	0.89	0.74	0.52	0.35	0.39	0.67	0.92	0.98	0.99		(89)
Moon	intorn	al tempor		the reat	of dwalli	ng T2 (f		no 2 to	Z in Tabl					
	18 49			19 54	19.83	19 12 (10	19 96	19.96		e 90)	18.92	18 44		(90)
(00)11-	10.40	10.71	10.00	10.04	10.00	10.04	10.00	10.00	10.0	LA = Livin	g area ÷ (4	4) =	0.25	(91)
													0.20	
Mean	Intern	al temper	rature (fo	or the wh	ole dwe	ling) = fl	$A \times 11$	+ (1 – †L	A) × 12	40.70	40.04	10.0		(02)
(92)m=		19.04	19.39		20.09	20.2	20.22	20.22	20.10		19.24	10.0		(32)
Apply	18.84			10.81		20.2		4e, wrie			10.24	18.8		(93)
(33)III-	ace he	ating reg	uirement	19.01	20.03	20.2	20.22	20.22	20.10	19.79	19.24	10.0		(00)
Set T	i to the	mean int	ternal ter	mneratu	re obtain	ed at ste	on 11 of	Table 9	h so tha	t Ti m=('	76)m an	d re-calc	rulate	
the ut	ilisatio	n factor fo	or gains	using Ta	ble 9a				o, oo ina		<i>r ojin an</i>			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fa	actor for g	ains, hm	1:				•			•			
(94)m=	0.99	0.98	0.95	0.88	0.74	0.54	0.37	0.42	0.69	0.92	0.98	0.99		(94)
Usefu	Il gains	s, hmGm	, W = (94	4)m x (84	4)m								1	
(95)m=	785	874.4	959.08	995.8	893.51	640.09	421.55	442.72	661.87	774.64	753.75	749.97		(95)
Month	nly ave	rage exte	ernal tem	perature	e from Ta	able 8							I	(00)
(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)
Heat	loss ra	te for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	4 400 04	1700.00	l	(07)
(97)m=	1738.2	5 1688.13	1536.13	1289.2	989.58	655.6	423.49	446.15	/10.92	1083.59	1436.21	1732.93		(97)
Space	e neati			or each n	10ntn, K\	/vn/moni	n = 0.02	24 X [(97)m – (95)mj x (4	1)m	704.00		
(96)11=	709.22	2 546.83	429.32	211.25	/1.4/	0	0	U Tata	0	229.00	491.37	131.33	2400.05	
_								Tota	li per year	(kvvn/year) = Sum(9	8)15,912 =	3420.65	(90)
Space	e heati	ng require	ement in	kWh/m ²	/year								33.57	(99)
9a. En	ergy re	equiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heat	ing:										I		
Fracti	on of s	space hea	at from s	econdar	y/supple	mentary	system						0	(201)

Fraction of space heat from ma	ain syste	m(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from m	nain syst	em 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating	ng syster	m 1								93.5	(206)
Efficiency of secondary/supple	mentary	heating	g system	ז, %						0	(208)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requirement (ca	lculated	above))	· · · · · ·							
709.22 546.83 429.32	211.25	71.47	0	0	0	0	229.86	491.37	731.33		
$(211)m = \{[(98)m \times (204)] + (210) \}$	0)m } x 1	00 ÷ (2	06)								(211)
758.52 584.85 459.17	225.93	76.44	0	0			245.84	525.53	782.17	0050.45	
On and heating final (as an dam.					TULA		ar) =0um(2	211) _{15,10} 1	2	3658.45	(211)
$= \{[(98)m \times (201)] + (214)m \} \times $), KVVN/II 100 ÷ (2)	nontn 08)									
(215)m = 0 0 0	0	0	0	0	0	0	0	0	0		
	I				Tota	l I (kWh/yea	ar) =Sum(2	1 215) _{15,101} ;	2=	0	(215)
Water heating											_
Output from water heater (calcu	lated ab	ove)		· · · · · ·		i		i			
218 192 201.32	180.01	176.07	156.85	150.18	165.42	165.32	186.68	197.97	212.6		٦
Efficiency of water heater										79.8	(216)
(217)m= 87.73 87.45 86.79	85.24	82.62	79.8	79.8	79.8	79.8	85.37	87.14	87.85		(217)
Fuel for water heating, kWh/moi (219)m = $(64)m \times 100 \div (217)n$	nth n										
(219)m= 248.48 219.55 231.97	211.17	213.11	196.55	188.2	207.29	207.17	218.67	227.18	242.01		
					Tota	l = Sum(2	19a) ₁₁₂ =			2611.34	(219)
Annual totals							k\	Wh/yeai	r	kWh/year	-
Space heating fuel used, main s	system 1									3658.45	
Water heating fuel used		_						•		2611.34	
Electricity for pumps, fans and e	electric k	eep-ho	t								
central heating pump:									30		(230c)
boiler with a fan-assisted flue									45		(230e)
Total electricity for the above, k	Wh/year				sum	of (230a).	(230g) =			75	(231)
Electricity for lighting										418.02	(232)
10a. Fuel costs - individual hea	ating sys	tems:									_
			Fu	ما			P امر	rice		Fuel Cost	
			kW	/h/year			(Table	12)		£/year	
Space heating - main system 1			(211	1) x			3.4	.8	x 0.01 =	127.3139	(240)
Space heating - main system 2			(213	3) x			0		x 0.01 =	0	_](241)
Space heating - secondary			(215	5) x			13.	19	x 0.01 =	0	(242)
Water heating cost (other fuel)			(219	9)			3.4	.8	x 0.01 =	90.87	(247)
Pumps, fans and electric keep-h	not		(231	1)			13.	19	x 0.01 =	9.89	(249)
(if off-peak tariff. list each of (23	0a) to (2	:30a) se	eparatel	/ as app	licable a	nd apply	/ fuel prid		ا dina to ٦	able 12a	」 ` ⁻ ′
Energy for lighting	, · _	0,	(232	2)			13.	19	x 0.01 =	55.14	(250)

Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	needed) + (250)(254) =		403.22 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (256) SAP rating (Section 12)	6)] ÷ [(4) + 45.0] =		0.42 (256) 1.15 (257) 83.92 (258)
12a. CO2 emissions – Individual heating systems	including micro-CH	P	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	790.22 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	564.05 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	1354.27 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	216.95 (268)
Total CO2, kg/year		sum of (265)(271) =	1610.15 (272)
CO2 emissions per m ²		(272) ÷ (4) =	15.8 (273)
El rating (section 14)			85 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	4463.3 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	3185.84 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	7649.14 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1283.32 (268)
'Total Primary Energy		sum of (265)(271) =	9162.71 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	89.93 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Ver	ber: sion:		Versic	n: 1.0.0.28	
A daha a a			Р	roperty .	Address	: 3 Beds	- House				
Address :	ensions:										
	511510115.			Area	a(m²)		Av. Hei	iaht(m)		Volume(m ³)	
Ground floor				5	i0.94	(1a) x	2		(2a) =	132.46	(3a)
First floor				5	0.94	(1b) x	2	6	(2b) =	132.46	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)+(1r	l) 1	01.89	(4)			1		1
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	264.91	(5)
2 Ventilation rate:											1
	main	Se	econdar	у	other		total			m ³ per hour	
Number of chimneys		<u>ה ר</u>	0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0	<u> </u> + [0	- -	0	x 2	20 =	0	(6b)
Number of intermittent fa	ans					- F	4	x 1	10 =	40	(7a)
Number of passive vents	6						0	x 1	10 =	0	(7b)
Number of flueless gas fi	ires					Ē	0	x 4	40 =	0	(7c)
									Air ch	anges per hou	ır
Infiltration due to chimne	ys, flues and f	ans = (6	a)+(6b)+(7	<mark>a)+</mark> (7b)+(7c) =		40	· [÷ (5) =	0.15	(8)
If a pressurisation test has b	been carried out of	r is intende	ed, procee	d to (17), d	otherwise o	continue fro	om (9) to (16)			- 1.00
Additional infiltration	ne dw <u>eiling</u> (n:	5)						[[(9)-	-11x0.1 =	0	(9)
Structural infiltration: 0	.25 for steel o	r timber f	frame or	0.35 fo	r masoni	rv constr	uction	1(0)		0](11)
if both types of wall are p	resent, use the va	lue corres	ponding to	the great	er wall are	a (after				-], ,
deducting areas of openii	ngs); if equal user floor, enter 0,2	0.35 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0] (12)
If no draught lobby, en	iter 0.05, else	enter 0		(obuic	, a), elec					0	(12)
Percentage of window	s and doors dr	aught st	ripped							0	(14)
Window infiltration		•			0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	4.4	(17)
If based on air permeabil	lity value, then	(18) = [(1	7) ÷ 20]+(8	8), otherwi	ise (18) = ((16)				0.37	(18)
Air permeability value applie	es if a pressurisati	on test has	s been don	e or a deg	gree air pe	rmeability	is being us	sed			_
Number of sides sheltere	ed				(00)		0.1			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Intiltration rate incorporat	ting shelter fac	tor			(21) = (18) x (20) =				0.32	(21)
Intiltration rate modified f	tor monthly wir	nd speed								I	
Jan Feb	Mar Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	beed from Tabl	e 7								L	
(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	2a)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 infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m						
	0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.35	0.37			
Calcula	ate effec	tive air Lvontila	change i tion:	rate for t	he appli	cable ca	se								
lf exh	aust air he	at pump i	using Appe	endix N. (2	3b) = (23a	a) x Fmv (e	equation (N	N5)), othe	rwise (23b) = (23a)				0	$\int_{(22h)}^{(23a)}$
lf bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use fa	actor (from	n Table 4h) =) (200)				0	$\int_{(220)}^{(230)}$
a) If	balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	(2)	2b)m + (;	23b) x [1	1 – (23c)	∟ - 1001	0	(230)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (N	и V) (24b)m = (22	2b)m + (2	23b)		1		
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24b)
c) If	whole ho	ouse ex	tract ver	tilation of	or positiv	ve input v	ventilatio	n from c	outside			1	1		
i	if (22b)m	i < 0.5 ×	(23b), t	hen (240	c) = (23b	o); otherv	wise (24	c) = (22k	o) m + 0.	5 × (23b)	-	_		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) lf i	natural v if (22b)m	v = 1, th	on or wh en (24d)	ole hous m = (22t	e positiv o)m othe	ve input v erwise (2	ventilatio 4d)m = 0	on from I 0.5 + [(2	oft 2b)m² x	0.5]					
(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57			(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24k	o) or (240	c) or (24	d) in boy	(25)				_		
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57			(25)
_															
3. He	at losses	s and he	eat l <mark>oss r</mark>	paramete											
3. Hei ELEN	at l <mark>osses</mark> /IENT	s and he Gros	eat l <mark>oss p</mark> ss	oaramete Openin	er: gs	Net Ar	ea	U-valu	ue	AXU		k-value	e	A X	k
3. Hea ELEN	at losses /IENT	s and he Gros area	eat loss p ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar	ea n²	U-valu W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²-l	e K	A X kJ/ł	k K
3. He ELEN Doors	at losses	and he Gros area	eat loss r ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r	ea n² x	U-valu W/m2	ue K	A X U (W/ł 2.2	<)	k-value kJ/m²-I	e K	A X kJ/ł	k ((26)
3. He ELEN Doors Windov	at losses //ENT ws Type	s and he Gros area 1	eat loss p ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r 2 2.88	ea n ² x	U-valu W/m2 1.1 /[1/(1.3)+	ue K 0.04] =	A X U (W/ł 2.2 3.56	<)	k-value kJ/m²-l	e K	A X kJ/ł	k (26) (27)
3. Here ELEN Doors Window Window	at losses //ENT ws Type ws Type	s and he Gros area 1 2	eat loss ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r 2 2.88 3.96	ea n ² x x x ¹ / x ¹ /	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+	ue K 0.04] = 0.04] =	A X U (W/ł 2.2 3.56 4.89	<)	k-value kJ/m²-I	e K	A X kJ/ł	k (26) (27) (27)
3. Hei ELEN Doors Window Window	at losses /ENT ws Type ws Type ws Type	s and he Gros area 1 2 3	eat loss ss (m²)	Openin Openin m	er: gs 1 ²	Net An A ,r 2 2.88 3.96 1.26	ea n ² x x x ¹ / x ¹ / x ¹ /	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	ue K = 0.04] = 0.04] = 0.04] =	A X U (W/ł 2.2 3.56 4.89 1.56	<)	k-value kJ/m²-I	e K	A X kJ/ł	k (26) (27) (27) (27)
3. Her ELEM Doors Window Window Window	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	eat loss ; ss (m²)	Openin M	er: gs ,2	Net Ar A ,r 2 2.88 3.96 1.26 4.41	ea n ² x x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	ue K = 0.04] = 0.04] = 0.04] =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45		k-value kJ/m²-I	ə K	A X kJ/ł	k (26) (27) (27) (27) (27)
3. Hee ELEN Doors Window Window Window Floor	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	eat loss ; ss (m²)	Openin M	er: gs ₁ 2	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} 5 x	U-valu W/m2 [1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15	ue K = 0.04] = 0.04] = 0.04] = 0.04] = = =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175		k-value kJ/m²-I	÷ K	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28)
3. Here ELEN Doors Window Window Window Floor Walls	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	sat loss (m²)	Openin M	gs ²	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3	ea n ² x x ¹ / x ¹ / x ¹ / x ¹ / 5 x 5 x	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2	ue K = 0.04] = 0.04] = 0.04] = 0.04] = = = = =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27		k-value kJ/m²-I	ж К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28) (28) (29)
3. Here ELEN Doors Window Window Window Floor Walls Roof	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4 125 50.9	5 5 5 5 5 5 6 6 7 4	Openin m 18.63	er: gs ²	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94	ea n ² x x ¹ / x ¹ / x ¹ / 5 x 5 x 4 x	U-valı W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14	ue K • 0.04] = • 0.04] = • 0.04] = • 0.04] = = • 0.04] = = • =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13		k-value kJ/m²·I	ж К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28)](28)](29)](30)
3. Here ELEN Doors Window Window Window Floor Walls Roof Total a	at losses //ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4 125 50.9 ements	5 5 5 5 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7	Openin m 18.64	5	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.8	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} 5 x 5 x 4 x	U-valu W/m2 [1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14	ue K = 0.04] = 0.04] = 0.04] = = 0.04] = = = =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13		k-value kJ/m²-I	э К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28)](29)](29)](30) (31)
3. Here ELEN Doors Window Window Window Floor Walls Roof Total a Party w	at losses AENT ws Type ws Type ws Type ws Type area of el wall	and he Gross area 1 2 3 4 125 50.9 ements	5 5 6 14 , m ²	Openin m 18.64	gs ²	Net Arr A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3 50.94 226.89 225	ea n ² x x ^{1/} x ^{1/}	U-valu W/m2 [1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14 0	ue K 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = =	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13		k-value kJ/m²-I	ж К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (30) (31) (32)
3. Here ELEN Doors Window Window Window Window Window Floor Walls Roof Total a Party w * for win ** includ	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el wall dows and le the area	s and he Gross area 1 2 3 4 1 2 3 4 2 50.9 ements roof winders s on both	5 (m ²) 5 14 , m ² 5 5 14 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Openin m 18.63 0	5 ndow U-va	Net Arr A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.8 25 alue calculations	ea n ² x x1/ x1/ x1/ x1/ 5 x 5 x 4 x 9 x ated using	U-value W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14 0 1 formula 1	ue K 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = //((1/U-valu	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13 0 ue)+0.04] a	<)	k-value kJ/m²-l	э К — [— [— [—]	A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)
3. Here ELEN Doors Window Window Window Window Floor Walls Roof Total a Party w * for win ** includ Fabric	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area heat los	and he Gros area 1 2 3 4 <u>125</u> 50.9 ements roof winders s on both s, W/K =	at loss ss (m ²) 4 , m ² ows, use e sides of ir = S (A x	Deramete Openin m 18.64 0 effective winternal walk U)	er: gs ² 5 	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.33 50.94 226.83 25 alue calcula titions	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} 5 x 5 x 4 x 9 x 2 ated using	U-value W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ (1/(1.3)+ 0.15 0.2 0.14 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1	$\begin{array}{c} ue \\ K \\ \hline 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \hline 0.04] = \\ = \\ 0.04] = \\ 0.$	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13 0 ue)+0.04] a	<)	k-value kJ/m²-I	э К] [] [] [] [] [] [] [] [] [] [A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](29)](30) (31)](32)
3. Hei ELEN Doors Window Window Window Floor Walls Roof Total a Party v * for winiw ** includ Fabric Heat ca	at losses IENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area heat los apacity (s and he Gross area 1 2 3 4 125 50.9 rements roof window s on both s, W/K = Cm = S(sat loss ss (m ²) , m ² ows, use e sides of ir = S (A x A x k)	Deramete Openin m 18.64 0 effective winternal walk U)	er: gs ⁵ ndow U-va Is and par	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.8 25 alue calcula titions	ea n ² x x ¹ / x ¹ / x ¹ / x ¹ / 5 x 5 x 5 x 4 x 9 x 2 ated using	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14 0 formula 1 (26)(30)	$\begin{array}{c} ue \\ K \\ = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = $	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13 0 ue)+0.04] a	<) 	k-value kJ/m²-l paragraph (32e) =	ж К П [] [] [] [] [] [] [] [] [] []	A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)](32)](33)](33)
3. Here ELEN Doors Window Window Window Window Floor Walls Roof Total a Party w * for wining * for wining * for wining * for the formation of the formation * for the formation of the formation of the formation * for the formation of the formation of the formation * for the formation of the formation of the formation of the formation * for the formation of th	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and heat loss apacity C al mass	s and he Gross area 1 2 3 4 125 50.9 ements roof winder s on both s, W/K = Cm = S(parame	235 (m ²) 535 (m ²) 54 54 54 54 5 54 5 54 5 5 5 5 5 5 5 5 5 5 5 5 5	Definition of the second seco	er: gs 2 ⁵ 5 mdow U-va Is and part - TFA) ir	Net Arr A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.89 25 alue calcula titions	ea n ² x x ¹ / x ¹ / x ¹ / 5 x 5 x 4 x 9 x 2 ated using	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14 0 1 0 1 0 1 0 1 0 1 1 1 1 1 1 1 1	$\frac{ue}{2K} = \frac{1}{2}$ $\frac{1}{2} \cdot 0.04] = \frac{1}{2}$ $\frac{1}{2} \cdot 0.04] = \frac{1}{2}$ $\frac{1}{2} \cdot 0.04] = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13 0 re)+0.04] a (30) + (32 tive Value:	() ()<	k-value kJ/m²-l paragraph (32e) =	× K	A X kJ/ł	k (26) (27) (27) (27) (27) (28) (29) (30) (31) (32) (33) (33) (34) (35)
3. Here ELEN Doors Window Window Window Window Floor Walls Roof Total a Party w * for win ** includ Fabric Heat ca Therma: For designation	at losses AENT ws Type ws Type ws Type ws Type ws Type ws Type area of el vall dows and heat loss apacity (al mass ign assess used instea	and he Gross area 1 2 3 4 125 50.9 125 50.9 125 50.9 125 50.9 125 12	eat loss (m^2)	$\begin{bmatrix} 18.6!\\ 0 \end{bmatrix}$	er: gs 2 ⁵ 5 ndow U-va Is and part - TFA) ir construct	Net Arr A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 106.3 50.94 226.8 25 alue calcula titions	ea n ² x x ¹ / x	U-valu W/m2 1.1 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ 0.15 0.2 0.14 0.14 (26)(30) recisely the	$\begin{array}{c} ue \\ K \\ = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = $	A X U (W/ł 2.2 3.56 4.89 1.56 5.45 7.64175 21.27 7.13 0 1e)+0.04] a (30) + (32 tive Value: e values of	() ()<	k-value kJ/m²-l paragraph (32e) = able 1f	ж К 	A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)](32)](33)](34)](35)

<i>if detail</i> : Total f	s of therma	al bridging at loss	are not kr	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			70.16	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	v				(38)m	= 0.33 × (25)m x (5)	1	70.10	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	50.77	50.5	50.23	48.96	48.73	47.64	47.64	47.43	48.06	48.73	49.21	49.71		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	120.94	120.67	120.4	119.13	118.89	117.8	117.8	117.59	118.22	118.89	119.37	119.87		
Heat l	oss para	meter (H	HLP), W	/m²K		•	•		(40)m	Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	119.13	(39)
(40)m=	1.19	1.18	1.18	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18		
Numb	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	1.17	(40)
	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	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assun if TF	ned occu FA > 13.9	upancy, 9, N = 1	N + 1.76 ×	: [1 - exp	(-0.0003	349 x (TF	- A -13.9)2)] + 0.0)013 x (⁻	TFA -13.	2.	76		(42)
if TF	A £ 13.	9, N = 1												
Annua Reduce not mor	I average the annuate that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d ater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	104 f	4.91		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from 1	Table 1c x	(43)	000	000	1101	200		
(44)m=	115.4	111.2	107.01	102.81	98.61	94.42	94.42	98.61	102.81	107.01	111.2	115.4		
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D)Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1258.89	(44)
(45)m=	171.13	149.67	154.45	134.65	129.2	111.49	103.31	118.55	119.97	139.81	152.62	165.73		
lf instar	taneous w	ı vater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46,) to (61)	Total = Su	m(45) ₁₁₂ =	-	1650.6	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:												
Storag	je volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If com Other	munity h vise if no	neating a o stored	ind no ta	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in neous co	(47) ombi boil	ers) ente	er '0' in (47)			
vvater a) If n	storage	10SS: Turer's de	eclared I	oss facti	or is kno	wn (k\Mł	n/dav).					0	l	(48)
Temp	erature f	actor fro	m Table	2h			"duy).					0		(40)
Energ	v lost fro	om water	storage	kWh/ve	ar			(48) x (49)	-			0		(50)
b) If n	nanufact	urer's de	eclared	cylinder l	oss fact	or is not	known:	(10) x (10)				0		(30)
Hot wa	ater stor munity h	age loss neating s	factor fi ee secti	rom Tabl on 4.3	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Temp	erature f	actor fro	m Table	2b								0		(53)
Energ Enter	y lost fro (50) or (om water (54) in (5	storage 55)	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54) (55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				-	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	ı
(62)m=	145.46	127.22	131.28	114.46	109.82	94.77	87.82	100.77	101.97	118.84	129.72	140.87		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(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=	145.46	127.22	131.28	114.46	109.82	94.77	87.82	100.77	101.97	118.84	129.72	140.87		_
								Outp	out from w	ater heate	r (annual)₁	12	1403.01	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ´[0.85	× (45)m	1 + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m=	36.37	31.81	32.82	28.61	27.46	23.69	21.95	25.19	25.49	29.71	32.43	35.22		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. In	tern <mark>al g</mark> a	ains (see	e Ta <mark>ble (</mark>	5 and 5a):									
Metab	olic gair	s (Table	5), Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	23.67	21.02	17.1	12.94	9.68	8.17	8.83	11.47	15.4	19.55	22.82	24.33		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-			
(68)m=	259.35	262.04	255.25	240.82	222.59	205.46	194.02	191.33	198.11	212.55	230.77	247.9		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5			_	
(69)m=	26.70	00.70	00.70		00.70	00.70	00.70	26.70	00.70	26.70	26.70	36 78		(69)
Pumps	30.78	36.78	36.78	36.78	36.78	36.78	36.78	30.70	36.78	30.70	30.78	00.70		
· amp	s and fai	ns gains	(Table \$	36.78 5a)	36.78	36.78	36.78	30.78	36.78	30.70	30.78	00.70	1	
(70)m=	30.78 s and fai	ns gains	(Table !	36.78 5a) 0	0	0	0	0	0	0	0	0]	(70)
(70)m= Losses	s and fai	ns gains 0 vaporatic	(Table ! 0 0 (nega	36.78 5a) 0 tive valu	0 0 0 (Tab	0 0 0	0	0	0	0	0	0]	(70)
(70)m= Losse: (71)m=	s and fai	ns gains 0 vaporatic	(Table 5 0 0 0 (nega -110.25	36.78 5a) 0 tive valu -110.25	0 es) (Tab	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	0	0	0]	(70) (71)
(70)m= Losses (71)m= Water	36.78 s and fai 0 s e.g. ev -110.25 heating	36.78 ns gains o vaporatic -110.25 gains (T	(Table 5 0 0 (nega -110.25 (able 5)	36.78 5a) tive valu -110.25	0 es) (Tab -110.25	0 le 5) -110.25	0	0	0	0	0	0]	(70) (71)
(70)m= Losses (71)m= Water (72)m=	36.78 s and fai 0 s e.g. ev -110.25 heating 48.88	36.78 ns gains 0 /aporatic -110.25 gains (T 47.33	(Table 5) 0 0 (nega -110.25 able 5) 44.11	36.78 5a) 0 tive valu -110.25 39.74	0 es) (Tab -110.25 36.9	0 0 -110.25 32.91	0 -110.25 29.51	0 -110.25 33.86	0 -110.25 35.41	0 -110.25 39.93	0 -110.25 45.04	0]	(70) (71) (72)
(70)m= Losses (71)m= Water (72)m= Total i	36.78 s and fai 0 s e.g. ev -110.25 heating 48.88 internal	36.78 ns gains vaporatic -110.25 gains (1 47.33 gains =	(Table 5) 0 (Table 5) 44.11	36.78 5a) tive valu -110.25 39.74	0 es) (Tab -110.25 36.9	0 le 5) -110.25 32.91 (66)	0 -110.25 29.51 m + (67)m	0 -110.25 33.86 n + (68)m -	0 -110.25 35.41 + (69)m + (0 -110.25 39.93 (70)m + (7	0 -110.25 45.04 1)m + (72)	0 -110.25 47.34]]]	(70) (71) (72)
(70)m= Losses (71)m= Water (72)m= Total i (73)m=	38.78 s and fai 0 s e.g. ev -110.25 heating 48.88 internal 396.24	36.78 ns gains 0 aporatic -110.25 gains (1 47.33 gains = 394.73	(Table 9 0 -110.25 able 5) 44.11 380.81	36.78 5a) tive valu -110.25 39.74 357.85	0 es) (Tab -110.25 36.9	0 ole 5) -110.25 32.91 (66) 310.88	0 -110.25 29.51 m + (67)m 296.7	0 -110.25 33.86 n + (68)m - 301.01	0 -110.25 35.41 + (69)m + (313.26	0 -110.25 39.93 (70)m + (7 336.38	0 -110.25 45.04 1)m + (72) 362.98	0 -110.25 47.34 m 383.91]]]	(70) (71) (72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar g	jains ir	i watts, ca	alculated	l for eacl	n month			(83)m = S	um(74)m .	(82)m				
(83)m=	108.5	212.26	349.56	509.81	624.79	639.59	608.91	523.05	406.55	251.86	135.29	89.23		(83)
Total g	ains –	internal a	and solar	(84)m =	= (73)m ·	+ (83)m	, watts							
(84)m=	504.74	606.99	730.37	867.66	958.31	950.47	905.61	824.06	719.81	588.24	498.28	473.14		(84)
7. Me	an inte	rnal temp	berature	(heating	season)								
Temp	erature	e during h	neating p	eriods ir	n the livii	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.89	0.72	0.56	0.63	0.88	0.99	1	1		(86)
Mean	intern	al temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	19.61	19.78	20.06	20.45	20.76	20.94	20.99	20.98	20.83	20.4	19.93	19.59		(87)
Temp	erature	e durina h	neating p	eriods ir	n rest of	dwellina	from Ta	ble 9. Tl	h2 (°C)					
(88)m=	19.93	19.93	19.93	19.94	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94		(88)
l Itilisa	tion fa	ctor for a	ains for	rest of du	velling	h2 m (se	e Table	9a)						
(89)m=	1		0.99	0.95	0.84	0.63	0.43	0.5	0.82	0.98	1	1		(89)
	in to m			the need		το //			7 in Tabl					
Mean	Intern	al temper	ature in	the rest		ng 12 (f	ollow ste	2005		e 9C)	19.00	19.64		(90)
(90)11=	10.00	10.03	19.11	19.5	19.79	19.93	19.95	19.95	19.00	19.40	10.99	10.04	0.25	(30)
											g urcu . (-		0.25	(31)
Mean	intern	al temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	.A) × T2					(00)
(92)m=	18.9	19.06	19.35	19.73	20.03	20.18	20.21	20.21	20.1	19.69	19.23	18.88		(92)
Apply	adjust	ment to t	he mear	internal	temper	ature fro	m lable	4e, whe	ere appro	opriate	40.00	10.00		(02)
(93)m=	18.9	19.06	19.35	19.73	20.03	20.18	20.21	20.21	20.1	19.69	19.23	18.88		(93)
8. Spa	ace ne	ating requ	uirement		o obtoin		om 11 of			4 T: ('	70)	d *** ***	ulata	
the ut	ilisatio	n factor fo	ernal ter or gains	nperatur using Ta	e obtain Ible 9a	ied at ste	ерттог	Table 9	o, so tha	t 11,m=(76)m an	d re-cald	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fa	ctor for g	ains, hm	:				- 5						
(94)m=	1	1	0.99	0.95	0.85	0.65	0.46	0.53	0.83	0.98	1	1		(94)
Usefu	I gains	, hmGm	, W = (94	4)m x (84	4)m									
(95)m=	503.99	604.56	720.66	823.84	810.63	621.51	420.11	437.82	595.21	574.83	496.63	472.62		(95)
Month	nly ave	rage exte	ernal tem	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)
Heat	loss ra	te for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			I	
(97)m=	1765.6	1708.97	1547.3	1290.54	990.52	657.44	425.35	447.7	709.33	1080.79	1447.63	1759.46		(97)
Space	e heati	ng require	ement fo	r each m	nonth, k	Nh/mont	th = 0.02	4 x [(97))m – (95)m] x (4′	1)m		1	
(98)m=	938.64	742.16	615.02	336.02	133.83	0	0	0	0	376.44	684.72	957.41		_
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	4784.25	(98)
Space	e heati	ng require	ement in	kWh/m²	/year								46.96	(99)
8c. Sr	bace co	ooling rec	quiremer	nt										_

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and ext	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1107.32	871.72	893.68	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.87	0.93	0.9	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0	963.59	808.87	803.06	0	0	0	0		(102)
Gains	(solar	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	1216.98	1162.29	1068.88	0	0	0	0		(103)
Space set (1	Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 x (98)m 104)m 0 0 0 0 182 44 262 95 197 77 0 0 0 0 0													
(104)m=	0	0	0	0	0	182.44	262.95	197.77	0	0	0	0		
	Total = Sum(104) = $f C = cooled cros + (4) =$													(104)
Cooled	Cooled fraction $f C = cooled area \div (4) = \begin{bmatrix} c \\ c \\ c \\ c \\ c \\ c \\ c \\ c \\ c \\ c$													(105)
Intermi	ttency f	actor (Ta	able 10b)		i		i	1		i		I	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Tota	l = Sum((104)	=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	45.61	65.74	49.44	0	0	0	0		_
									Total	= Sum(107)	=	160.79	(107)
Space	cooling	requirer	nent in k	(Wh/ <mark>m²</mark> /y	/ear				(107)	÷ (4) =			1.58	(108)
8f. Fab	ric Ene	rgy Effici	ien <mark>cy (c</mark> a	alculated	l only un	de <mark>r spec</mark>	cial cond	liti <mark>on</mark> s, s	ee sectio	on 11)				
Fabric	Energ	y Effici <mark>e</mark> r	псу						(99) -	+ (108) =	=		48.53	(109)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.0.28	
			P	roperty /	Address	4 Beds	- House	•			
Address :											
1. Overall dwelling dime	ensions:			A * 0 *	n (m 2)			abt(m)		Volume(m3)	
Ground floor				Area	a(III-)	(1a) x			(2a) =	151.28	(3a)
Eirst floor					0.10	(1b) x			(2b) _	454.00](2h)
	-) - (41) - (4 -) -	(4 -1) - (4 -)		、	8.19	(10) X	2	2.6	(20) =	151.28	(30)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)	+(1r	1) 1'	16.37	(4)					_
Dwelling volume						(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	302.56	(5)
2. Ventilation rate:			_								
	main heating	se he	condar eating	у	other		total			m ³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0	+	0] + [0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins					- F	4	x 1	0 =	40	(7a)
Number of passive vents	5						0	x 1	0 =	0	(7b)
Number of flueless gas fi	0	(7c)									
	anges per hou	ır									
Infiltration due to chimne	0.13	(8)									
If a pressurisation test has b	been carried out o	is intended	d, proceed	d to (17), c	otherwise o	continue fro	om (9) to ((16)			-
Additional infiltration	ne dw <mark>eiling</mark> (ne	5)						[(0)]	11v0 1 -	0	(9)
Structural infiltration: 0	.25 for steel o	timber fr	ame or	0.35 for	r masonr	v constr	uction	[(9)-	· 1]x0. 1 =	0	(10)
if both types of wall are p	resent, use the va	lue corresp	onding to	the great	er wall are	a (after	aotion			0]()
deducting areas of openi	ngs); if equal user	0.35 (uppoole	(d) or 0	1 (222)	d) alaa	ontor O					1
If no draught lobby, en	ter 0.05 else (onter 0	u) or 0.	i (Seale	u), eise	enter 0				0	(12)
Percentage of window	s and doors dr	aught stri	ipped							0	(13)
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,	q50, expresse	d in cubi	c metre	s per ho	our per s	quare m	etre of e	nvelope	area	4.7	(17)
If based on air permeabil	lity value, then	(18) = [(17	') ÷ 20]+(8	3), otherwi	ise (18) = (16)				0.37	(18)
Air permeability value applie	es if a pressurisation	on test has	been don	e or a deg	gree air pe	rmeability	is being us	sed			
Shelter factor	u				(20) = 1 -	[0.075 x (1	9)] =			2	(19)
Infiltration rate incorporat	ting shelter fac	tor			(21) = (18)) x (20) =				0.31	(21)
Infiltration rate modified f	or monthly wir	id speed									J . ,
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from 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		

(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.92 1 1.08 1.12 1.18 Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m 0.4 0.39 0.38 0.34 0.3 0.3 0.29 0.31 0.34 0.35 0.37 Calculate effective air change rate for the applicable case If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c) a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m= 0 0 (24c) b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24c) b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 (24c)
Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m 0.4 0.39 0.38 0.34 0.3 0.3 0.29 0.31 0.34 0.35 0.37 Calculate effective air change rate for the applicable caseIf mechanical ventilation:If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23cIf balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 $(23c)$ a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] $(24c)$ b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) $(24c)$ (24b)m=
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
Calculate effective air change rate for the applicable caseIf mechanical ventilation:0If exhaust air heat pump using Appendix N, $(23b) = (23a) \times Fmv$ (equation $(N5)$), otherwise $(23b) = (23a)$ 0If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =0a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$ (24a)m =0000000000000000000000(24a)m =00 </td
If exhaust air heat pump using Appendix N, $(23b) = (23a) \times Fmv$ (equation (N5)), otherwise $(23b) = (23a)$ If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c) a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$ (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$ (24a)m = 0 0 0 0 0 0 0 0 0 0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(24b)m = 0 0 0 0 0 0 0 0 0 0
c) If whole house extract ventilation or positive input ventilation from outside
if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise $(24c) = (22b)m + 0.5 \times (23b)$
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5]
(24d)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)
(25)m = 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (25)
3. Heat losses and heat loss parameter:
ELEMENT Gross Openings Net Area U-value A X U k-value A X k area (m ²) m ² A ,m ² W/m2K (W/K) kJ/m ² ·K kJ/K
Doors Type 1 2 x 1.1 = 2.2 (26)
Doors Type 2 2 x 1.1 = 2.2 (26)
Windows Type 1 $2.88 \times 1/[1/(1.2) + 0.04] = 3.3$ (27)
Windows Type 2 $3.96 \times 1/[1/(1.2) + 0.04] = 4.53$ (27)
Windows Type 3 $1.26 \times 1/[1/(1.2) + 0.04] = 1.44$ (27)
Windows Type 4 $1.44 \times 1/[1/(1.2) + 0.04] = 1.65$ (27)
Floor $58.185 \times 0.15 = 8.727751$ (28)
Walls 120 20.56 99.44 x 0.2 = 19.89 (29)
Roof 58.19 0 58.19 x 0.11 = 6.4 (30)
Total area of elements, m ² 236.37 (31)
Party wall $30 \times 0 = 0$ (32)
* 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
$\frac{1}{26} = \frac{1}{26} $
Heat capacity $Cm = S(A \times k)$ (28) (30) + (32) + (32a) (32b) = (45700 cm - (24))
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						11.82	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								_
I otal fa	abric he	at loss		الطفير مرمط					(33) +	(36) =	()E)m v (E)		70.2	(37)
ventila			Mor		y Mov	lup	lul	Aug	(38)m	= 0.33 x ((25)III X (5)	Dee	1	
(38)m=	57.83	57.52	57 22	55.8	55.54	54.32	54.32	Aug 54.09	54 79	55.54	56.07	56.63	-	(38)
				00.0	00.01	01.02	01.02	0 1100	(20)~	(27) . (20)~	00.00	J	(/
Heat tr	128.03	127 72	1t, VV/K	126	125 74	124 51	124 51	124.28	(39)m	= (37) + (37)	126 27	126.83	1	
(55)11-	120.03	121.12	127.42	120	123.74	124.01	124.51	124.20	124.30	Average =	Sum(39)	120.00	126	(39)
Heat lo	oss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)		.20	
(40)m=	1.1	1.1	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.09	1.09		
Numbe	er of day	in moi	oth (Tab	le 12)					,	Average =	Sum(40)1	12 /12=	1.08	(40)
Numbe	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec	1	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4. Wa	ater hea	ting ener	rav requi	rement:								kWh/v	ear:	
													1	
Assum if TF	ied occu A > 13	upancy, I 9 N = 1	N + 1 76 x	[1 - exp	(-0.0003	49 x (TF	- A -13 9	(2)1 + 0)013 x (⁻	TFA -13	2.	85		(42)
if TF	A £ 13.	9, N = 1		[i onp	(0.0000			/_/] · 0.0			,			
Annua	l averag	je hot wa	ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		10	7.2		(43)
not more	the annua e that 125	litres per p	not water person per	usage by ; [.] day (all w	o% in the d ater use, l	not and co	designed (ld)	o achieve	a water us	se target o)T			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec	1	
Hot wate	er usage i	n litres per	day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from T	Table 1c x	(43)	000	000	1107	000	1	
(44)m=	117.92	113.63	109.35	105.06	100.77	96.48	96.48	100.77	105.06	109.35	113.63	117.92		
										Total = Su	r m(44) ₁₁₂ =	! =	1286.43	(44)
Energy	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x C)Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	174.88	152.95	157.83	137.6	132.03	113.93	105.57	121.15	122.59	142.87	155.96	169.36		_
lf instan	tanaous w	vətor hoatiu	na at noint	of use (no	hot water	storage)	ontor () in	hoves (16) to (61)	Total = Su	m(45) ₁₁₂ =	=	1686.71	(45)
(40)						47.00		40.47	40.20	04.40	00.00	05.4	1	(46)
Water	storage	loss:	23.67	20.64	19.8	17.09	15.84	18.17	18.39	21.43	23.39	25.4		(40)
Storag	e volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		180]	(47)
If com	munity h	neating a	ind no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water	storage	loss:			!		· (-)-						1	(12)
a) if m	nanufaci	urer's de	eclared l	oss facto	or is kno	wn (kvvr	n/day):				1.	51]	(48)
Tempe	erature t	actor fro	m Table					(40) (40)			0.	54]	(49)
b) If m	/ lost fro nanufact	om water urer's de	storage	, KVVN/ye cvlinder l	ear loss fact	or is not	known:	(48) X (49)	=		0.	82	J	(50)
Hot wa	ater stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	iy)					0]	(51)
If com	munity h	neating s	ee secti	on 4.3										
Volum	e factor	from Tal	ble 2a	01-								0		(52)
rempe	erature f	actor fro	m I able	∠D								0	J	(53)

Energy Enter	/ lost fro (50) or	om water (54) in (5	⁻ storage 55)	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	0.	0 82		(54) (55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28		(56)
If cylinde	er contain	s dedicate	l d solar sto	rage, (57)	I m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5 ⁻	1 7)m = (56)	n where (H11) is fro	m Append	ix H	
(57)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and 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	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 req	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=	223.42	196.79	206.37	184.57	180.57	160.91	154.11	169.69	169.57	191.41	202.93	217.9		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	v) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	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=	223.42	196.79	206.37	184.57	180.57	160.91	154.11	169.69	169.57	191.41	202.93	217.9		
								Outp	out from wa	ater heate	r (annual)₁	12	2258.23	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	96.98	85.93	91.31	83.33	82.73	75.46	73.94	79.11	78.34	86.34	89.43	95.14		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the c	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	65.67	58.32	47.43	35.91	26.84	22.66	24.49	31.83	42.72	54.24	63.31	67.49		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5				
(68)m=	418.52	422.86	411.92	388.62	359.21	331.57	313.1	308.76	319.7	343	372.41	400.05		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5		-		
(69)m=	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94		(69)
Pumps	s and fa	ns gains	(Table	5a)						-				
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	vaporatic	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92		(71)
Water	heating	gains (T	Table 5)								•			
(72)m=	130.35	127.87	122.73	115.74	111.2	104.81	99.38	106.34	108.81	116.04	124.21	127.88		(72)
Total i	internal	gains =	:	-	-	(66)	m + (67)m	+ (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	729.43	723.96	696.98	655.17	612.15	573.94	551.86	561.82	586.13	628.19	674.84	710.32		(73)
6. So	lar gains	s:		•	•	•	•		•					

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tal	x ble 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar o	ains ir	n watts. ca	alculated	l for eacl	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	107.92	2 211.11	347.67	507.06	621.42	636.13	605.62	520.22	404.35	250.5	134.56	88.75		(83)
Total g	jains –	internal a	and sola	r (84)m =	= (73)m -	+ (83)m	, watts							
(84)m=	837.35	935.07	1044.65	1162.22	1233.57	1210.07	1157.48	1082.04	990.49	878.69	809.4	799.07		(84)
7. Me	an inte	ernal temp	oerature	(heating	season)								
Temp	eratur	e during h	neating p	periods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for a	ains for	living are	ea. h1.m	(see Ta	ble 9a)	,	()					
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.52	0.78	0.96	0.99	1		(86)
Maan								L						
(87)m=	19.94	20.08	20.33	20.64	20.87	20.97	21 ps 3 to 7	20.99	e 9C) 20.92	20.62	20.22	19.91		(87)
Tama							from To							
			Teating p							20.02	20.01	20.01		(88)
(00)11=	20	20	20	20.01	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01		(00)
Utilisa	ation fa	ctor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)					1	
(89)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.37	0.41	0.7	0.94	0.99	1		(89)
Mean	intern	al temper	rature in	the r <mark>est</mark>	of dwelli	ing T2 (fe	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	18.6	18.8	19.16	19.6	19.89	20.01	20.02	20.02	19.97	19.58	19.02	18.56		(90)
									f	ⁱ LA = Livin	g area ÷ (4	4) =	0.25	(91)
Mean	intern	nternal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$												
(92)m=	18.93	19.12	19.45	19.86	20.14	20.25	20.27	20.27	20.21	19.84	19.32	18.9		(92)
VlgqA	adiust	tment to t	he mear	internal	tempera	ature fro	m Table	4e. whe	ere appro	opriate				
(93)m=	18.93	19.12	19.45	19.86	20.14	20.25	20.27	20.27	20.21	19.84	19.32	18.9		(93)
8. Sp	ace he	ating req	uirement	t										
Set T	i to the	mean int	ternal te	mperatur using Ta	re obtain	ned at ste	ep 11 of	Table 9I	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αιια	Sep	Oct	Nov	Dec		
Utilisa	ation fa	ictor for a	ains. hm):	may	Uun	oui	, tug	000	000	1101	200		
(94)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.39	0.44	0.72	0.93	0.98	0.99		(94)
Usefu	l gains	s, hmGm	, W = (9	4)m x (84	4)m									
(95)m=	830.32	920.67	1007.35	1050.18	, 951.57	686.59	454.54	476.96	708.69	819.64	796.29	793.72		(95)
Month	nly ave	rage exte	ernal terr	perature	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)
Heat	loss ra	te for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1873.1	8 1816.46	1650.24	1381.04	1060.91	703.52	456.55	480.5	763.05	1162.25	1542.92	1864.41		(97)
Space	e heati	ng require	ement fo	r each m	nonth, k\	Wh/mont	h = 0.02	24 x [(97)m – (95)m] x (4′	1)m			
(98)m=	775.89	601.98	478.31	238.22	81.35	0	0	0	0	254.9	537.57	796.6		
								Tota	l per year	(kWh/year	.) = Sum(9	8)15,912 =	3764.8	(98)
Space	e heati	ng require	ement in	kWh/m²	/year								32.35	(99)
9a. En	ergy re	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heat	ing:												_
Fracti	on of s	space hea	at from s	econdar	y/supple	mentary	system						0	(201)

Fraction	of space hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	of total heatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficienc	y of main spa	ace heat	ing syste	em 1								92.8	(206)
Efficienc	y of seconda	ry/suppl	ementar	y heatin	g systen	า, %						0	(208)
J	lan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space he	eating require	ement (c	alculate	d above)	(l	
77	5.89 601.98	478.31	238.22	81.35	0	0	0	0	254.9	537.57	796.6		
(211)m = -	{[(98)m x (20	4)] + (21	10)m } x	100 ÷ (2	206)							l	(211)
83	6.09 648.68	515.42	256.7	87.66	0	0			274.67	579.28	858.4	4050.0	
Space by	pating fuel (c	ocondar	v) k\//b/	month			TOLA		ar) =3um(2	211) _{15,1012}	-	4056.9	(211)
= {[(98)m	x (201)] + (21)	14) m } x	y), KVVII/ (100 ÷ ()	208)									
(215)m=	0 0	0	0	0	0	0	0	0	0	0	0		
							Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	Ē	0	(215)
Water hea	ating												
Output fro	m water heat	ter (calc	ulated a	bove)								l	
22	3.42 196.79	206.37	184.57	180.57	160.91	154.11	169.69	169.57	191.41	202.93	217.9		
			94 70	92.14	70.1	70.1	70.1	70.1	0/ 00	96.50	97.26	79.1	(216)
	ator boating	k//h/m	o4.79	02.14	79.1	/ / 9.1	19.1	79.1	04.00	00.59	07.20		(217)
(219)m <u>=</u>	<u>(64)m x 100</u>) ÷ (217)	m										
(219)m= 25	6.32 226.45	239.18	217.68	219.83	203.42	194.83	214.52	214.37	225.52	234.36	249.7		_
							Tota	I = Sum(2	19a) ₁₁₂ =			2696.17	(219)
Annual to	otals	d main	evetom	1					k\	Wh/year	•	kWh/year	ヿ
Space nea	ating fuel use	u, main	System	'								4056.9	4
Water hea	ating fuel use	d										2696.17	
Electricity	for pumps, fa	ans and	electric	keep-ho	t								
central h	eating pump:										30		(230c)
boiler wit	h a fan-assis	ted flue									45		(230e)
Total elec	tricity for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electricity	for lighting											463.88	(232)
10a. Fue	l costs - indiv	/idual he	eating sy	stems:									
					E.,				Eucl D	rico		Eucl Cost	
					k W	/h/year			(Table	12)		£/year	
Space hea	ating - main s	system 1			(21	1) x			3.4	.8	x 0.01 =	141.1801	(240)
Space hea	ating - main s	svstem 2	2		(21:	3) x					x 0.01 =	0	$\Box^{(241)}$
Snace he	ating - secon	darv			(21	5) x				10	x 0.01 =	0	$\Box_{(242)}$
Water boo	ating cost (oth				(21)	9)					x 0.01 =	00.00	$\int_{(247)}^{(247)}$
			hot		(22)	-/			3.4	<u>o</u>	x 0.01 -	93.83	
rumps, ra		по кеер-		000 ì	(23	•7				19	. 0.01 =	9.89	(249)
(It ott-peal Energy for	k tariff, list ea r lighting	ich of (2	30a) to (230g) se	eparately (23)	y as app 2)	licable a	nd apply	/ tuel prie	ce accor	ding to T x 0.01 =	able 12a	(250)
					v -				13.			01.13	

Additional standing charges (Table 12)	120 (251)		
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	needed) + (250)(254) =		426.08 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (256) SAP rating (Section 12)	6)] ÷ [(4) + 45.0] =		0.42 (256) 1.11 (257) 84.53 (258)
12a. CO2 emissions – Individual heating systems	including micro-CH	Р	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	876.29 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	582.37 (264)
Space and water heating	(261) + (262) + (263) +	· (264) =	1458.66 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	240.75 (268)
Total CO2, kg/year		sum of (265)(271) =	1738.34 (272)
CO2 emissions per m ²		(272) ÷ (4) =	14.94 (273)
El rating (section 14)			86 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	4949.42 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	3289.33 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	8238.75 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1424.11 (268)
'Total Primary Energy		sum of (265)(271) =	9893.1 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	85.01 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Ver	ber: sion:		Versic	on: 1.0.0.28	
			P	roperty <i>i</i>	Address	: 4 Beds	- House				
Address :											
	1510115.			Δro	a(m²)		Δ.ν. Ηρί	aht(m)		Volume(m ³)	
Ground floor				5	8.19	(1a) x	2	.6	(2a) =	151.28	(3a)
First floor				5	8.19	(1b) x	2	.6	(2b) =	151.28] (3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+((1d)+(1e)+(1n	I) 1	16.37	(4)	L		1		J
Dwelling volume						(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	302.56	(5)
2 Ventilation rate:]``
2. Ventilation rate:	main	Se	econdar	у	other		total			m ³ per hour	
Number of chimneys		+ [+ [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	าร					- -	4	x 1	0 =	40	(7a)
Number of passive vents						Ē	0	x 1	0 =	0	(7b)
Number of flueless gas fir	0	(7c)									
	anges per hou	ır									
Infiltration due to chimney	0.13	(8)									
If a pressurisation test has be	een carried out or	r is intende	d, proceed	d to (17), d	otherwise o	continue fro	om (9) to (16)			- 1
Additional infiltration	e aweiling (ns	5)						 [(9)-	11x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or	[.] timber f	rame or	0.35 foi	r masoni	v constr	uction	[(0)	1110.1 -	0](11)
if both types of wall are pro	esent, use the va	lue corres	oonding to	the great	er wall are	a (after], ,
deducting areas of openin	gs); if equal user oor. enter 0.2	0.35 (unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	1 (12)
If no draught lobby, ent	er 0.05, else e	enter 0		. (000.0	, e.e.e	0				0	(13)
Percentage of windows	and doors dr	aught st	ripped							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,	q50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	4.7	(17)
If based on air permeabili	ty value, then	(18) = [(17	7) ÷ 20]+(8	3), otherwi	se (18) = ((16)				0.37	(18)
Air permeability value applies	s if a pressurisatio	on test has	been don	e or a deg	gree air pe	rmeability i	is being us	sed			-
Number of sides sheltered	d				(20) = 1 -	[0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	na shaltar fac	tor			(21) = (18)	(20) = (20) =	- /]			0.85	(20)
Infiltration rate modified for	or monthly wir	nd sneed			() (10	, (=•) =				0.31	(<u>د م</u>)
Jan Feb	Mar Apr	Mav	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
Monthly average wind an	and from Tabl	, ∩ 7	2		1		23.			I	
(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		
Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter ar	nd wind s	speed) =	= (21a) x	(22a)m	•	•	•	I	
	0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	ise			<u>.</u>	<u>.</u>		· 	
IT M	echanic			andix NL (C)))))))))))))))))	а) н. Г ари (и	o question d		mulae (02k	·) (22c)			0	(23a)
lf bol	aust all fi			$\frac{1}{1000}$ in $\frac{1}{1000}$	(250) = (250)	a) x FIIIV (i	equation (fro	m Tabla 4k	: wise (23L)) = (23a)			0	(23b)
									n) —	Ob) and (00k) [1 (00-)	0	(23c)
a) II								$\frac{1}{1}$ $\frac{1}{0}$	a)m = (2)	20)m + (0	$\frac{230}{1} \times 1$	1 - (23C)	÷100j	(24a)
(24a)III=											22h)	0	İ	(244)
D) II									$\frac{1}{1}$	20)m + (1	230)	0	I	(24h)
(240)III=										0	0	0	I	(2-10)
C) II	if (22b)r	100 se ex n < 0.5 s	(23b) t	tillation (hen (24)	c) = (23)	o): other	ventilati wise (24	on from (4c) = (22	ouiside b) m + 0	5 x (23t)			
(24c)m=	0	0	0	0			0		0	0	0	0	l	(24c)
d) If	natural	ı ventilati	I on or wh	I ole hous	i se positi	L ve input	I ventilati	ion from	I loft				ł	
	if (22b)r	n = 1, th	en (24d)	m = (22	b)m othe	erwise (2	24d)m =	0.5 + [(2	22b)m² x	0.5]				
(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (2	4d) in bo	x (25)					
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. He	at l <mark>osse</mark>	s and he	eat l <mark>oss i</mark>	paramet	er: 🗹									
ELEN	/IENT	Gros	SS	Openin	igs	Net Ar	rea	U-val	ue	A X U	K)	k-value	÷ /	A X k
Doors	Type 1	area	(11-)			2				(• • /		NJ/111-•1		(26)
Doors	Type 2		I				۲Ŷ			2.2	4			(26)
Windo		<u>1</u>				2		1/[1/(1 2)]	- 0.041 -	2.2				(20)
Windo		2 1 2 2				2.00		1/[1/(1.2)]	0.041	3.3				(27)
Windo	wa Type	2				3.96		1/[1/(1.2))	0.04]	4.53				(27)
Windo	ws Type	- 1				1.26		1/[1/(1.2) ⁻	0.04] =	1.44				(27)
VVINdo	ws type	; 4				1.44	×	1/[1/(1.2)+	- 0.04] =	1.65				(27)
FIOOr						58.18	5 ×	0.15	=	8.72775			\dashv	(28)
vvalis		120	0	20.5	6	99.44	4 ×	0.2	=	19.89			\dashv	(29)
Root		58.1	19	0		58.19	9 ×	0.11	=	6.4				(30)
Total a	area of e	elements	s, m²			236.3	57							(31)
Party	wall					30	x	0	=	0				(32)
* for win	dows and	l roof wind	ows, use e	effective wi	indow U-v	alue calcu titions	lated usin	g formula :	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)	is and par			(26)(30) + (32) =				58 38	(33)
Heat o	apacitv	Cm = S((A x k)						((28).	(30) + (3	2) + (32a).	(32e) =	18703 36	(34)
Therm	al mass	parame	ter (TMF	- = Cm -	÷ TFA) iı	ר kJ/m²K	<u> </u>		Indica	ative Value	: Medium		250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Therm	al bridg	es : S (L	x Y) cal	culated (using Ap	pendix I	K						11.82	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(00)	(0.0)				-
Vontilo	abric ne	at loss		lmonthl					(33) +	(36) =	(25)m x (5)		70.2	(37)
venua	lan	Feb	Mar	Apr	y Mav	lun	6	Διια	Sen			Dec	1	
(38)m=	57.83	57.52	57.22	55.8	55.54	54.32	54.32	54.09	54.79	55.54	56.07	56.63	-	(38)
Heat tr	ansfer (L	L ht W/K						(39)m	= (37) + (38)m]	
(39)m=	128.03	127.72	127.42	126	125.74	124.51	124.51	124.28	124.98	125.74	126.27	126.83	1	
									<u>ا</u>	Average =	Sum(39)1	12 /12=	126	(39)
Heat lo	oss para	meter (H	HLP), W/	′m²K			1		(40)m	= (39)m ÷	- (4)	1		
(40)m=	1.1	1.1	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.09	1.09		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	sum(40)₁	12 /12=	1.08	(40)
	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	4. Water heating energy requirement: kWh/y													
Assum if TF	ed occu A > 13.9	ipancy, I 9. N = 1	N + 1.76 x	[1 - exp	(-0.0003	149 x (TF		(2) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2))013 x (⁻	TFA -13	2.	85]	(42)
if TF	A £ 13.	9, N = 1		[. enp	(0.0000			/_/] · 0.0						
Annua Reduce	l averag	je hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	se target o	10	7.2]	(43)
not more	e that 125	litres per p	person per	day (all w	ater use, l	hot and co	ld)		a water us	se larger o	"			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					-	
(44)m=	117.92	113.63	109.35	105.06	100.77	96.48	96.48	100.77	105.06	109.35	113.63	117.92]	
Energy	content of	bot water	used - cal	culated m	onthly - 1	100 x Vd r	т х пт х Г)Tm / 3600	kW/b/mor	Total = Su	m(44) ₁₁₂ =	= -	1286.43	(44)
	174 00	152.05	157 02	127.6	122 02	112 02	105 57	121 15	122.50	142.07	155.06	160.26	1	
(45)11=	174.00	152.95	157.65	137.0	132.03	113.93	105.57	121.15	122.09	Total – Su	m(45),	109.30	1686 71	(45)
lf instan	taneous v	vater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)			-	1000.71	
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(46)
Water	storage	loss:	includir		alar or M		storago	within ea		دما		400	1	(47)
lf com	e voluit nunity k	e (illies)	nd no ta	iy ariy su ink in dw	velling e	ntor 110	litros in	(47)		501		180		(47)
Otherv	vise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
Water	storage	loss:		,					,	,				
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	om water	storage	, kWh/ye	ear		lun av un v	(48) x (49)) =			0		(50)
Hot wa	ianutact	urer's de age loss	factor fr	om Tabl	e 2 (kW	or is not h/litre/da	known: av)					0	1	(51)
If com	nunity h	neating s	ee secti	on 4.3	- = (- J /				L	~	1	()
Volum	e factor	from Ta	ble 2a									0]	(52)
Tempe	erature f	actor fro	m Table	2b								0]	(53)

Energy Enter	y lost fro (50) or	om water (54) in ({	r storage 55)	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0	(5	i4) i5)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m	L			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	6)
If cylinde	Ler contain	L s dedicate	d solar sto	L prage, (57)	<u>I</u> m = (56)m	x [(50) – ([(H11)] ÷ (50	0), else (5	l 7)m = (56)	m where (L H11) is fro	M Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	7)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0	(5	8)
Primar (mo	y circuit	loss cal / factor f	lculated rom Tab	for each le H5 if t	month (59)m = (solar wat	(58) ÷ 36 ter heatir	5 × (41) ng and a	m i cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	9)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 30	65 x (41))m]	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(6	;1)
Total h	neat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	<u>ا</u> (46)m +	ı (57)m +	(59)m + (61)m	
(62)m=	148.64	130.01	134.15	116.96	112.22	96.84	89.74	102.98	104.21	121.44	132.56	143.95	(6	;2)
Solar DI	HW input	L calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	ion to wate	er heating)	1	
(add a	dditiona	I 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	(6	i3)
Output	t from w	ater hea	iter	•									' 	
(64)m=	148.64	130.01	134.15	116.96	112.22	96.84	89.74	102.98	104.21	121.44	132.56	143.95		
								Out	out from wa	ater heate	r (annual)₁	12	1433.71 (6	4)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	37.16	32.5	33.54	29.24	28.06	24.21	22.43	25.74	26.05	30.36	33.14	35.99	(6	5)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	ns (Table	e 5). Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	(6	6)
Lightin	g gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				I	
(67)m=	26.27	23.33	18.97	14.36	10.74	9.06	9.79	12.73	17.09	21.7	25.32	27	(6	67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			I	
(68)m=	280.41	283.32	275.99	260.38	240.67	222.15	209.78	206.87	214.2	229.81	249.52	268.04	(6	68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5			I	
(69)m=	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	(6	i9)
Pumps	s and fa	ns gains	(Table	5a)									I	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(7	0)
Losses	s e.g. ev	, aporatio	n (nega	tive valu	es) (Tab	le 5)							I	
(71)m=	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	(7	'1)
Water	heating	gains (1	Fable 5)								•		1	
(72)m=	49.95	48.37	45.08	40.61	37.71	33.63	30.15	34.6	36.18	40.81	46.03	48.37	(7	2)
Total i	internal	gains =		•	•	(66))m + (67)m	ı + (68)m ·	⊦ (69)m + ((70)m + (7	1)m + (72)	m	1	
(73)m=	422.34	420.73	405.76	381.07	354.84	330.56	315.45	319.92	333.19	358.04	386.59	409.13	(7	3)
6. So	lar gains	s:	•	•	•		•							

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Т	FF able 6c		Gains (W)	
Solar g	pains ir	watts, ca	alculated	for eac	n month	I	I	(83)m = S	um(74)m .	(82)m	I		L	
(83)m=	107.92	211.11	347.67	507.06	621.42	636.13	605.62	520.22	404.35	250.5	134.56	88.75		(83)
Total g	ains –	internal a	and solar	⁻ (84)m =	= (73)m ·	+ (83)m	, watts						1	
(84)m=	530.26	631.85	753.43	888.13	976.25	966.69	921.07	840.14	737.55	608.54	521.15	497.87		(84)
7. Me	an inte	rnal temp	berature	(heating	season)								
Temp	erature	e during h	neating p	eriods ir	n the livii	ng area t	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.91	0.75	0.58	0.65	0.9	0.99	1	1		(86)
Maan	intorro							l Zin Tahl						
wean				living are			ps 3 to 7			20.42	10.00	10.67		(87)
(07)11=	19.09	19.04	20.1	20.40	20.77	20.94	20.99	20.96	20.64	20.42	19.99	19.07		(07)
Temp	erature	e during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)				L	
(88)m=	20	20	20	20.01	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01		(88)
Utilisa	ation fa	ctor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1		0.99	0.96	0.87	0.66	0.46	0.53	0.84	0.99	1	1		(89)
Moan	intorn	al tompor	aturo in	the rest	of dwalli	ng T2 (f	ollow sto	one 3 to	Tin Tabl					
(90)m-	18.8	18 94	19.21	19 57	19.85	20	20.02	20.02	19.93	19.54	19.11	18 78		(90)
(00)		10.01	10.21	10.01	10.00	20	20.02	20.02	10.00	LA = Livin	g area ÷ (4	4) =	0.25	(91)
												,	0.20	(0.)
Mean	intern	al temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2			i		
(92)m=	19.02	19.17	19.43	19.79	20.08	20.23	20.26	20.26	20.15	19.76	19.33	19		(92)
Apply	^r adjust	ment to t	he mear I	internal	temper	ature fro I	m Table	4e, whe	ere appro	opriate		1		(22)
(93)m=	19.02	19.17	19.43	19.79	20.08	20.23	20.26	20.26	20.15	19.76	19.33	19		(93)
8. Spa	ace he	ating requ	uirement											
Set T	i to the	mean int	ernal ter	nperatur	e obtain	ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
ine ui	linsatio		Mor		Nov	lun	11	A.u.a	San	Oct	Nov	Dee		
Litilior	Jan tion fo	Feb	oine hm	Apr	way	Jun	Jui	Aug	Sep	Oci	INOV	Dec		
(94)m-				0.96	0.87	0.68	0.49	0.56	0.85	0.98	1	1		(94)
		hmGm	$\frac{0.00}{10}$	1)m x (8)	1)m	0.00	0.43	0.00	0.00	0.00				(0.)
(95)m=	529 73	630.2	746.57	854.38	850.61	661.31	450.68	469 14	628.39	598 5	520.01	497 52		(95)
Month	nlv ave		rnal tem	nerature	from T	able 8	100.00	100.111	020.00	000.0	020.01	107.02		()
(96)m=	4.3	4.9	65	8.9	11 7	14.6	16.6	16.4	14 1	10.6	71	42		(96)
Heat		te for me	an intern		ratura	[-[(39)m	v [(03)m	_ (96)m	1				
(97)m-	1884 4	2 1822 33	1648 15	1372 6	1054.08	701 48	456 19	479 78	756 54] 1151 82	1543 98	1877 21		(97)
Space			amont fo		rooq.00		h = 0.02	470.10	m = (95)	ml x (4)	1)m	1077.21		()
(98)m-	1007.8	a 801 11	670 78	373 12	151 38)iii – (93	<u>411 67</u>	737.26	1026.48		
(00)11-	1007.03	1	010.10	010.12	101.00		, v				$\frac{101.20}{100}$	2)	5170 60	(08)
_								rota	i per year	(rvvii/yeal) = Sum(9	o <i>j</i> 15,912 =	3179.09	
Space	e heati	ng require	ement in	kWh/m ²	/year								44.51	(99)
8c. S	pace co	ooling rec	quiremer	nt										

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and ext	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1170.42	921.39	944.55	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.87	0.93	0.9	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0	1013.82	854.5	847.54	0	0	0	0		(102)
Gains	(solar	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	1243.28	1187.51	1095.14	0	0	0	0		(103)
Space set (1	e <i>coolin</i> 04)m to	<i>g require</i> zero if (e <i>ment fo</i> 104)m <	r month, : 3 × (98	<i>whole c</i>)m	lwelling,	continue	ous (kW	/h) = 0.0	24 x [(10	03)m – (*	102)m]:	x (41)m	
(104)m=	0	0	0	0	0	165.22	247.76	184.21	0	0	0	0		
									Total	= Sum(104)	=	597.19	(104)
Cooled	fractio	n							f C =	cooled a	area ÷ (4	4) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b)		i		i	1		i		I	_
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Tota	l = Sum((104)	=	0	(106)
Space	cooling	requirer	ment for	month =	: (104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	41.3	61.94	46.05	0	0	0	0		_
									Total	= Sum(107)	=	149.3	(107)
Space	cooling	requirer	nent in k	(Wh/ <mark>m²</mark> /y	/ear				(107)	÷ (4) =			1.28	(108)
8f. Fab	ric Ene	rgy Effici	ien <mark>cy (c</mark> a	alculated	l only un	de <mark>r spec</mark>	cial cond	liti <mark>on</mark> s, s	ee sectio	on 11)				
Fabric	Energ	y Effici <mark>e</mark> r	псу						(99) -	+ (108) =	=		45.79	(109)
	L													-

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versio	on: 1.0.0.28	
A duba a a			P	roperty	Address	: 5 Beas	- House)			
Address :	sions:										
T. Overall dwelling dimens	510115.			Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor					a(III-)	(1a) x			(2a) =] (3a)
First floor					12.07	(10) X			(20) =	110.94](00)](3b)
Second floor					12.07	(10) X			(20) =	110.94	
Total floor area $TEA = (1a)$	ı (1b) ı (1c) ı (1d) (1o), (1r	<u></u>	100	(10) X	2	2.0	(20) =	110.92	(30)
101a11001 area TFA = (1a)	+(10)+(10)+(1u)+(1e	;)+(11	"	128	(4)					_
Dwelling volume						(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	332.8	(5)
2. Ventilation rate:	_										
	main heating	se h	econdar neating	у	other		total			m ³ per hour	
Number of chimneys	0] + [0] + [0] = [0	X ·	40 =	0	(6a)
Number of open flues	0	+	0] + [0	=	0	x	20 =	0	(6b)
Number of intermittent fans	;						4	X	10 =	40	(7a)
Number of passive vents							0	x	10 =	0	(7b)
Number of flueless gas fire	s						0	X	40 =	0	(7c)
									Air ch	anges per bo	ır
Infiltration due to chimpeuro	fluon and fo		(2) + (6b) + (7)	(a)+(7b)+(7c) –	Г					
Initiation due to chimineys	, nues and la	is intende		d to (17)	otherwise (continue fr	40	(16)	÷ (5) =	0.12	(8)
Number of storevs in the	dwelling (ns		<i>bu, procee</i>	<i>i</i> i i i i i i i i i i i i i i i i i i			0111 (0) 10 (10)		0	(9)
Additional infiltration	s	/						[(9)	-1]x0.1 =	0	(0)
Structural infiltration: 0.2	5 for steel or	timber	frame or	0.35 fo	r masoni	ry constr	ruction		1	0	(11)
if both types of wall are pres	ent, use the val	ue corres	ponding to	the great	ter wall are	a (after					_
deducting areas of openings	s); if equal user	0.35 (4 (I) - I						٦
If suspended wooden flo	or, enter U.Z	(unseal	iea) or U.	i (seale	ea), eise	enter U				0	(12)
li no draught lobby, ente	r 0.05, eise e									0	(13)
Mindow infiltration	and doors dra	aught st	прреа		0.25 - [0.2	$(14) \pm 1$	001 -			0	
					$(8) \pm (10)$		100] — 12) + (13) -	L (15) -		0	(15)
		طنه منه	io motro	o nor h		- (1) - (1	(12) + (13) +	- (IJ) -	oro 0	0	(16)
All permeability value, q	ou, expresse	(18) – [(1	$7) \div 201+(9)$	s per no	(18) = (nvelope	area	4.6	$\begin{bmatrix} (17) \\ 1(10) \end{bmatrix}$
Air permeability value applies i	f a pressurisation	n test has	s been dor	e or a de	aree air pe	rmeability	is heina us	sed		0.35	(18)
Number of sides sheltered	a proceence	11 1001 1140			gree an pe	inicasiiity	io sonig uc			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporatin	g shelter fac	tor			(21) = (18) x (20) =				0.3	(21)
Infiltration rate modified for	monthly win	d speec	ł								_
Jan Feb M	lar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind spee	ed from Table	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	2a)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 infiltra	ation rat	e (allowi	ing for sh	nelter ar	nd wind s	speed) =	(21a) x	(22a)m				-		
0.1.1	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35			
Laicuia If me	ate effec echanica	<i>tive air</i> al ventila	<i>cnange</i> . ition:	rate for t	ne appli	icable ca	ise							0	(23a)
lf exh	aust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	o) = (23a)				0	(23b)
lf bala	anced with	heat reco	overy: effic	iency in %	allowing	for in-use f	actor (fron	n Table 4h) =					0](23c)
a) If	balance	d mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [*	1 – (23c)) ÷ 100]		
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	covery (N	MV) (24b)m = (22	2b)m + (i	23b)	!	1		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from o	outside	-	2	-	-		
i	f (22b)n	ו < 0.5 א	(23b), t	then (240	c) = (23t	o); other	wise (24	c) = (22k	o) m + 0	.5 × (23b)	ī	,		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural v	ventilatio	on or wh	ole hous $m = (22)$	e positi	ve input	ventilatio	on from I	oft 2b)m² v	0.51					
(24d)m=	0.57	0.57	0.57	111 = (221)	0.55	0.54	0.54	0.5 + [(2)]	0.54	0.5	0.56	0.56	1		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	b) or (24)	c) or (24)	d in box	(25)	0.00	0.00	0.00	1		· · · · ·
(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	1		(25)
											<u> </u>		·		
3. He	at losse:	s and he	eat loss		er:							le volue		A \	(].
ELEN	IENI	area	(m²)	openin	95 1 ²	A,r	ea n²	W/m2	ile :K	A X U (W/I	K)	kJ/m ² ·	e K	kJ/l	K
Doors	Type 1					2	x	1		2					(26)
Doors	Type 2					2	x	1	=	2					(26)
Window	ws Type	1				2.88		/[1/(1.2)+	0.04] =	3.3					(27)
Windov	ws Type	2				3.96		/[1/(1.2)+	0.04] =	4.53					(27)
Windov	ws Type	3				1.26		/[1/(1.2)+	0.04] =	1.44					(27)
Windov	ws Type	4				1.44		/[1/(1.2)+	0.04] =	1.65					(27)
Floor						42.67	7 X	0.15		6.4005					(28)
Walls		210)	34.0	6	175.9	4 X	0.2		35.19	ז ד		i F		(29)
Roof		42.6	67	0		42.67	7 X	0.11		4.69	ז ד		i F		(30)
Total a	rea of e	lements	, m²			295.3	4	μ					'		(31)
* for win ** includ	dows and e the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-v Is and par	alue calcul titions	ated using	g formula 1	/[(1/U-valı	ue)+0.04] a	as given in	paragraph	h 3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				8	4.7	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	273	36.18	(34)
Therm	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) iı	n kJ/m²K			Indica	ative Value	: Medium		2	50	(35)
For desi															-
can be ι	gn assess ised instea	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	tion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f			

if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			99.47	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	62.82	62.51	62.22	60.8	60.54	59.3	59.3	59.07	59.78	60.54	61.07	61.63		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	162.29	161.98	161.68	160.27	160	158.77	158.77	158.54	159.25	160	160.54	161.1		
Heat lo	oss para	meter (H	HLP), W	/m²K		-	-		(40)m	Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	160.27	(39)
(40)m=	1.27	1.27	1.26	1.25	1.25	1.24	1.24	1.24	1.24	1.25	1.25	1.26		
Numb	er of day	vs in moi	nth (Tab	le 1a)		-	•	•	,	Average =	Sum(40) _{1.}	₁₂ /12=	1.25	(40)
	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	ater heat	ting ener	rav reau	irement:								kWh/ye	ear:	
		Ŭ											1	
Assum if TF	1ed occu A > 13 9	וpancy, l א = 1	N + 1 76 x	[1 - exp	(-0.0003	849 x (TF	FA -13 9)2)] + 0 ()013 x (⁻	TFA -13	2.	89		(42)
if TF	A £ 13.9	9, N = 1	1.107	(i ovb	(0.0000	, io x (ii	71 10.0	<i>[</i>			.0)			
Annua	l averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		108	8.24		(43)
Reduce	the annua e that 125	al average litres per l	hot water person pe	usage by : r dav (all w	5% if the c ater use. I	lwelling is hot and co	designed : ld)	to achieve	a water us	se target o	t			
	lan		Mar	()	May	lun		A	Can	Oct	Nev	Dee		
Hot wat	er usage i	n litres per	r dav for ea	Apr ach month	Vd.m = fa	ctor from	Jui Table 1c x	(43)	Sep	Oct	INOV	Dec		
(44)m-	119.06	11/ 73	110.4	106.08	101.75	07.42	07.42	101 75	106.08	110.4	11/ 73	110.06		
(44)11=	119.00	114.73	110.4	100.08	101.75	97.42	97.42	101.75	100.08		m(44)	119.00	1208.88	(44)
Energy	content of	hot water	used - cai	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1290.00	
(45)m=	176.57	154.43	159.36	138.93	133.31	115.03	106.6	122.32	123.78	144.25	157.47	171		
										Total = Su	m(45) ₁₁₂ =		1703.04	(45)
lf instan	taneous w	ater heatii	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)	1	r	r		
(46)m=	26.49	23.16	23.9	20.84	20	17.26	15.99	18.35	18.57	21.64	23.62	25.65		(46)
Storage		1055. a (litrae)	includir	na anv so	alar or M	/\//HBS	storana	within sa	me ves	مما		400	l	(47)
lf com	munity h		and no to	ng any so ank in du	velling e	ntor 110	litros in	(47)		301		180		(47)
Otherv	vise if no	stored	hot wate	er (this in	icludes i	nstantar		(47) ombi boil	ers) ente	er '0' in <i>(</i>	47)			
Water	storage	loss:		. (,		,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	51		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energ	y lost fro	m water	⁻ storage	e, kWh/ye	ear			(48) x (49)) =		0.	82		(50)
b) If m	nanufact	urer's de	eclared	cylinder l	oss fact	or is not	known:							
Hot wa	ater stora	age loss	factor fi	rom Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	nunity fi e factor	from Ta	bee secti hle 2a	011 4.3								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Enero	v lost fro	m water	storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)	, ,				. / (-)	. / (0.	82		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28	(5)	6)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28	(5	7)
Primar	ry circuit	loss (ar	nnual) fro	om Table	e 3							0	(5	8)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				'	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)		1	
(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	(5)	9)
Combi	i 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	(6	51)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54	(6)	62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (3) I	i	1		1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(6	;3)
Output	t from w	ater hea	ter		1								I	
(64)m=	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54		
							()	Outp	out from wa	ater heate	r (annual)1	12	2274.55 (6	94)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m	1 + 0.8	([(46)m	+ (57)m	+ (59)m		· F)
=m(co)	97.54	86.42	91.82	83.77	83.16	/0.83	14.27	/9.5	78.74	80.8	89.94	95.69	(0.	5)
incit	lde (57)	m in cald	culation	of (65)m	only if c	yiinder i	s in the d	dweiling	or not w	ater is fr	om com	munity n	eating	
5. Int	ternal ga	ains (see	e lable t	b and 5a):									
Metab	olic gair	is (Table	5) Wat	te										
	Law			115		L. L. L.		A	Car	Ost	New	Dee	1	
(66)m-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(6)	6)
(66)m=	Jan 173.38	Feb 173.38	Mar 173.38	Apr 173.38	May 173.38	Jun 173.38	Jul 173.38	Aug 173.38	Sep 173.38	Oct 173.38	Nov 173.38	Dec 173.38	(6)	6)
(66)m= Lightin	Jan 173.38 g gains	Feb 173.38 (calcula	Mar 173.38 ted in Ap	Apr 173.38 opendix	May 173.38 L, equat	Jun 173.38 ion L9 o	Jul 173.38 r L9a), a	Aug 173.38 Iso see	Sep 173.38 Table 5	Oct 173.38	Nov 173.38	Dec 173.38	(6	6)
(66)m= Lightin (67)m=	Jan 173.38 ng gains 65.81	Feb 173.38 (calcula 58.46	Mar 173.38 ted in Ap 47.54	Apr 173.38 opendix 35.99	May 173.38 L, equat 26.9	Jun 173.38 ion L9 o 22.71	Jul 173.38 r L9a), a 24.54	Aug 173.38 Iso see - 31.9	Sep 173.38 Table 5 42.82	Oct 173.38 54.37	Nov 173.38 63.45	Dec 173.38 67.64	(6	6) 7)
(66)m= Lightin (67)m= Applia	Jan 173.38 ag gains 65.81 nces ga	Feb 173.38 (calcula 58.46 ins (calc	Mar 173.38 ted in Ap 47.54 ulated ir	Apr 173.38 opendix 35.99 Append	May 173.38 L, equat 26.9 dix L, eq	Jun 173.38 ion L9 o 22.71 uation L	Jul 173.38 r L9a), a 24.54 13 or L1	Aug 173.38 lso see 31.9 3a), also	Sep 173.38 Table 5 42.82 see Ta 336.67	Oct 173.38 54.37 ble 5	Nov 173.38 63.45	Dec 173.38 67.64	(6	6) 7)
(66)m= Lightin (67)m= Applia (68)m=	Jan 173.38 ng gains 65.81 nces ga 440.74	Feb 173.38 (calcula 58.46 ins (calc 445.31	Mar 173.38 ted in Ap 47.54 ulated ir 433.78	Apr 173.38 opendix 35.99 Append 409.25	May 173.38 L, equat 26.9 dix L, eq 378.28	Jun 173.38 ion L9 o 22.71 uation L 349.17	Jul 173.38 r L9a), a 24.54 13 or L1 329.72	Aug 173.38 Iso see ⁻ 31.9 3a), also 325.15	Sep 173.38 Table 5 42.82 9 see Ta 336.67	Oct 173.38 54.37 ble 5 361.21	Nov 173.38 63.45 392.18	Dec 173.38 67.64 421.29	(6 (6) (6)	66) 67) 68)
(66)m= Lightin (67)m= Applia (68)m= Cookir	Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23	Mar 173.38 ted in Ap 47.54 ulated ir 433.78 tted in A	Apr 173.38 ppendix 35.99 Append 409.25 ppendix	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a)	Aug 173.38 Iso see 31.9 3a), also 325.15), also se	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table	Oct 173.38 54.37 ble 5 361.21 5	Nov 173.38 63.45 392.18	Dec 173.38 67.64 421.29	(6 (6 (6)	66) 67) 68)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23	Mar 173.38 ted in Ap 47.54 ulated in 433.78 tted in A 55.23	Apr 173.38 ppendix 35.99 Appendix 409.25 ppendix 55.23	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 • see Ta 336.67 • Table 55.23	Oct 173.38 54.37 ble 5 361.21 5 55.23	Nov 173.38 63.45 392.18 55.23	Dec 173.38 67.64 421.29 55.23	(6 (6) (6) (6)	66) 67) 68) 69)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fair 3	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3	Mar 173.38 ted in Ap 47.54 ulated ir 433.78 tted in A 55.23 (Table 9	Apr 173.38 opendix 35.99 Append 409.25 ppendix 55.23 5a)	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table 55.23	Oct 173.38 54.37 ble 5 361.21 5 55.23	Nov 173.38 63.45 392.18 55.23	Dec 173.38 67.64 421.29 55.23	(6 (6) (6) (6)	56) 57) 58) 59)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ted in A 55.23 (Table 9 3	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tivo your	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table 55.23 3	Oct 173.38 54.37 ble 5 361.21 5 55.23 3	Nov 173.38 63.45 392.18 55.23 3	Dec 173.38 67.64 421.29 55.23 3	(6 (6) (6) (6) (6)	66) 67) 68) 69) 70)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	Jan 173.38 ag gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3 s e.g. ev -115.58	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 vaporatic -115.58	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ited in A 55.23 (Table 9 3 on (nega -115.58	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3	Aug 173.38 Iso see ⁻ 31.9 3a), also 325.15), also se 55.23 3	Sep 173.38 Table 5 42.82 5 see Ta 336.67 2 e Table 55.23 3 -115.58	Oct 173.38 54.37 ble 5 361.21 5 55.23 3	Nov 173.38 63.45 392.18 55.23 3	Dec 173.38 67.64 421.29 55.23 3	(6 (6 (6 (6) (7)	56) 57) 58) 59) 70)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fan 3 s e.g. ev -115.58	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (7)	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ted in A 55.23 (Table 5 an (nega -115.58 Table 5	Apr 173.38 opendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23 3 -115.58	Sep 173.38 Table 5 42.82 9 see Ta 336.67 2e Table 55.23 3 -115.58	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58	Nov 173.38 63.45 392.18 55.23 3 -115.58	Dec 173.38 67.64 421.29 55.23 3 -115.58	(6 (6) (6) (6) (7) (7)	56) 57) 58) 59) 70) 71)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3 s e.g. ev -115.58 heating 131.1	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (T 128.6	Mar 173.38 ted in Ap 47.54 ulated in Ap 433.78 ited in A 55.23 (Table 9 3 on (nega -115.58 Table 5) 123.41	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58 105.32	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23 3 -115.58	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table 55.23 3 -115.58 109.36	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58	Nov 173.38 63.45 392.18 55.23 3 -115.58	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61	(6) (6) (6) (6) (7) (7) (7) (7)	56) 57) 58) 59) 70) 71)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fail 3 s e.g. ev -115.58 heating 131.1	Feb 173.38 (calcula 58.46 ins (calcula 445.31 (calcula 55.23 ns gains 3 vaporatic -115.58 gains (T 128.6 gains -	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ited in A 55.23 (Table 8 3 on (nega -115.58 able 5) 123.41	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58 105.32 (66)	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58 99.83 m + (67)m	Aug 173.38 Iso see - 31.9 3a), also 325.15), also se 55.23 3 -115.58 106.86) + (68)m -	Sep 173.38 Table 5 42.82 5 see Ta 336.67 2 Table 55.23 3 -115.58 109.36 (69)m + 0	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58 116.66 (70)m + (7	Nov 173.38 63.45 392.18 55.23 3 -115.58 124.91 1)m + (72)	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61 m	(6) (6) (6) (6) (7) (7) (7) (7) (7)	66) 57) 58) 59) 70) 71) 72)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i (73)m=	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fan 3 s e.g. ev -115.58 heating 131.1 internal	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (T 128.6 gains = 748.39	Mar 173.38 ted in Ap 47.54 ulated in Ap 433.78 ited in A 55.23 (Table 5) 123.41 720.75	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35 677.61	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58 111.77	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 0le 5) -115.58 105.32 (66) 593.22	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58 99.83 m + (67)m 570.12	Aug 173.38 Iso see - 31.9 3a), also 325.15), also se 55.23 3 -115.58 106.86 + (68)m + 579.93	Sep 173.38 Table 5 42.82 9 see Ta 336.67 ee Table 55.23 3 -115.58 109.36 - (69)m + 0 604.87	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58 116.66 (70)m + (7 648.26	Nov 173.38 63.45 392.18 55.23 3 -115.58 124.91 1)m + (72) 696.56	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61 m 733.57	(6) (6) (6) (7) (7) (7) (7) (7) (7) (7)	 (6) (7) (8) (9) (0) (1) (2) (3)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	tion: Access Factor Table 6d Area m ² Flux Table $0.9x$ 0.77 x 2.88 x 46 $0.9x$ 0.77 x 2.88 x 46 $0.9x$ 0.77 x 2.88 x 46 $0.9x$ 0.77 x 2.88 x 11 $0.9x$ 0.77 x 2.88 x 11 $0.9x$ 0.77 x 2.88 x 11 $0.9x$ 0.77 x 2.88 x 10 $0.9x$ 0.77 x 2.88 x 10 $0.9x$ 0.77 x 2.88 x 10 $0.9x$ 0.77 x 2.88 x 40 $0.9x$ 0.7							x ble 6a		Та	g_ able 6b		FF Table 6c			Gains (W)	
South	0.9x	0.77		x	2.8	8	x	4	6.75	x		0.63	x	0.76		=	178.71	(78)
South	0.9x	0.77		x	2.8	8	x	7	6.57	x		0.63	×	0.76		=	292.68	(78)
South	0.9x	0.77		x	2.8	8	x	9	7.53	x		0.63	×	0.76		=	372.82	(78)
South	0.9x	0.77		x	2.8	8	x	1	10.23	x		0.63	×	0.76		=	421.36	(78)
South	0.9x	0.77		x	2.8	8	x	1	14.87	x		0.63	×	0.76		=	439.09	(78)
South	0.9x	0.77		x	2.8	8	x	1	10.55	x		0.63	×	0.76		=	422.56	(78)
South	0.9x	0.77		x	2.8	8	x	10	08.01	x		0.63	×	0.76		=	412.87	(78)
South	0.9x	0.77		x	2.8	8	x	10)4.89	x		0.63	×	0.76		=	400.95	(78)
South	0.9x	0.77		x	2.8	8	x	10	01.89	x		0.63	×	0.76		=	389.45	(78)
South	0.9x	0.77		x	2.8	8	x	8	2.59	x		0.63	× ٦	0.76		=	315.68	(78)
South	0.9x	0.77		x	2.8	8	x	5	5.42	x		0.63	×	0.76		=	211.83	(78)
South	0.9x	0.77		x	2.8	8	x		10.4	x		0.63	× ٦	0.76		=	154.42	(78)
								L										
Solar g	gains ir	n watts, ca	alcula	ted	for eacl	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
(83)m=	299.53	529.03	762.0	06	989.05	1134.8	1'	134.75	1090.9	983	.37	842.15	596.1	3 362.48	253	3.78		(83)
Total g	ains –	internal a	and so	olar	(84)m =	= (73)m	+ (83)m	, watts									
(84)m=	1053.2	1277.41	1482.	81	1666.66	1767.77	7 1	727.97	1661.02	156	3.3	1447.02	1244.3	39 1059.04	987	7.34		(84)
7 . Me	an inte	rnal temp	peratu	ire ((hea <mark>ting</mark>	seaso												
Temp	eratur	e during h	neatin	g pe	eriods ir	n the liv	ing	area f	rom Tab	ole 9	, Th1	(°C)					21	(85)
Utilisa	ation fa	ctor for g	ains f	or li	ving are	88 X 114.87 X 0.63 X 0.76 = 88 X 108.01 X 0.63 X 0.76 = 88 X 108.01 X 0.63 X 0.76 = 88 X 104.89 X 0.63 X 0.76 = 88 X 104.89 X 0.63 X 0.76 = 88 X 101.89 X 0.63 X 0.76 = 88 X 82.59 X 0.63 X 0.76 = 88 X 55.42 X 0.63 X 0.76 = 88 X 40.4 X 0.63 X 0.76 = 9 83.37 842.15 596.13 362.48 253.7 = (73)m + (83)m , watts 1767.77 1727.97 1661.02 1563.3 1447.02 1244.39 1059.04 987.3 9 seascn)												
	Jan	Feb	Ма	ar 🛛	Apr	Мау		Jun	Jul	A	ug	Sep	Oc	Nov	C)ec		
(86)m=	0.99	0.98	0.95	5	0.88	0.75	Г	0.57	0.42	0.4	46	0.7	0.92	0.98	0.	99		(86)
Mean	intern	al temper	ature	in li	iving are	ea T1 (1	follo	ow ste	os 3 to 7	' in T	able	e 9c)						
(87)m=	19.8	20.03	20.3	3	20.66	20.88		20.97	21	20.	99	20.93	20.63	3 20.14	19	.76	1	(87)
Temr		- durina h	Deatin		ariods ir	n rest of	f dw	velling	from Ta		u Th	12 (°C)		!			1	
(88)m=	19.87	19.87	19.8	7	19.88	19.88		19.89	19.89	19.	89	19.88	19.88	19.88	19	.87]	(88)
		l							. Tabla	() ())							1	
Utilisa				$\frac{\text{or } r}{1}$			nz T	,m (se		9a)	35	0.61	0.80	0.98	0	00	1	(89)
(03)11-	0.33	0.90	0.3-	*	0.00	0.00		0.40	0.51	0.0	55	0.01	0.03	0.90	0.	33	J	(00)
Mean	intern	al temper	ature	in t	he rest	of dwel	ling	T2 (fo	ollow ste	eps 3	8 to 7	in Table	e 9c)				1	(00)
(90)m=	18.31	18.63	19.0	6	19.51	19.77		19.87	19.89	19.	89	19.84	19.48	3 18.81	18	.25		(90)
														ving area ÷ (+) =		0.17	(91)
Mean	intern	al temper	ature	(for	r the wh	ole dwe	ellin	g) = fl	_A × T1	+ (1	- fL/	A) × T2					1	
(92)m=	18.56	18.86	19.2	7	19.7	19.96	2	20.06	20.07	20.	07	20.02	19.67	19.03	18	3.5		(92)
Apply	adjust	ment to t	he me	an	internal	tempe	ratu	ure fro	m Table	4e,	whe	re appro	priate) 			1	
(93)m=	18.56	18.86	19.2	7	19.7	19.96		20.06	20.07	20.	07	20.02	19.67	19.03	18	3.5]	(93)
8. Sp	ace he	ating requ	uirem	ent						-			·	(70)				
Set I the ut	i to the tilisatio	mean int n factor fo	ernal or daii	ten ງຣູເ	iperatur Ising Ta	e optai ble 9a	nec	a at ste	ep 11 of	iab	ie 9b	, so that	t II,m	=(16)m an	a re	-calo	Julate	
	Jan	Feb	Ma	ar	Apr	Mav	T	Jun	Jul	A	ua	Sep	Oc	Nov)ec	1	
Utilisa	ation fa	ctor for g	ains,	hm:	1.1	,	1					1-				-	1	
(94)m=	0.99	0.97	0.93	3	0.84	0.69	Т	0.49	0.33	0.3	37	0.62	0.88	0.97	0.	99	1	(94)

0.84

0.69

0.49

0.33

0.37

0.62

0.88

0.97

0.99

0.93

(94)m= 0.99

0.97

Useful g	gains,	hmGm ,	, W = (94	4)m x (84	4)m								_	
(95)m= 1	038.25	1236.92	1377.53	1399.66	1216.58	849.47	549.13	578.58	895.41	1097.05	1028.65	976.58		(95)
Monthly	y avera	age exte	rnal tem	perature	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)
Heat lo	ss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m= 2	313.44	2261.38	2064.89	1731.16	1321.33	866.3	551.12	581.98	943.07	1451.48	1915.04	2303.36		(97)
Space I	heating	g require	ement fo	r each m	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95 I)m] x (4′	1)m		l .	
(98)m= 9	948.74	688.44	511.39	238.68	77.93	0	0	0	0	263.69	638.2	987.12		
								Tota	l per year	(kWh/year) = Sum(98	3) _{15,912} =	4354.21	(98)
Space I	heating	g require	ement in	kWh/m ²	/year								34.02	(99)
9a. Ener	gy req	uiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	heatin	g:												_
Fraction	n of sp	ace hea	at from s	econdar	/supple	mentary	system						0	(201)
Fraction	n of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction	n of tot	al heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficien	cy of r	nain spa	ace heat	ing syste	em 1								89.8	(206)
Efficien	cy of s	econda	ry/suppl	ementar	y heating	g system	n, %			_			0	(208)
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec	kWh/ve	⊐ ar
Space I	heating	g require	ement (c	alculated	d above))								
S	948.74	688.44	511.39	238.68	77.93	0	0	0	0	263.69	638.2	987.12		
ــــ = 211)m	= {[(98))m x (20	4)] + (21	0)m } x	100 ÷ (2	06)								(211)
1	056.51	766.63	569.48	265.79	86.78	0	0	0	0	293.64	710.69	1099.25		
								Tota	l (kWh/yea	ar) =Sum(2	11) _{15,1012}	=	4848.78	(211)
Space I	heating	g fuel (s	econdar	y), kWh/	month									_
= {[(98)n	n x (20	1)] + (2 ⁻	14) m } x	(100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water h	eating													
Output fi	rom wa	ater hea	ter (calc	ulated al	oove)								l	
	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54		
		ater nea		04.70	00.00	70.4	70.4	70.4	70.4	04.05	00.05	07.04	79.1	(216)
(217)m=	87.53	87.16	86.42	84.78	82.03	79.1	79.1	79.1	79.1	84.95	86.95	87.64		(217)
Fuel for ' (219)m -	water I - (64)i	neating, m x 100	kVVh/mo) ∸ (217)	onth										
(219)m= 2	257.18	227.47	240.56	219.28	221.68	204.81	196.13	216	215.87	226.96	235.13	250.49		
	I							Tota	l = Sum(2	19a) ₁₁₂ =			2711.57	(219)
Annual	totals									k\	Nh/year		kWh/year	
Space h	eating	fuel use	ed, main	system	1						-		4848.78	7
Water he	eating	fuel use	d										2711.57	Ī
Electricit	y for p	umps, fa	ans and	electric	keep-ho	t								
central	heatin	g pump:	:								[30		(230c)
		•									I		1	

boiler with a fan-assisted flue				45	1	(230e)
Total electricity for the above, kWh/year		sum of (230a).	(230g) =		75	(231)
Electricity for lighting					464.92	(232)
10a. Fuel costs - individual heating systems:]
	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		3.48	x 0.01 =	168.7377	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	94.36	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separ Energy for lighting	ately as applicab	le and apply	fuel price acc	ording to x 0.01 =	Table 12a	(250)
Additional standing charges (Table 12)					120] (251)
Appendix Q items: repeat lines (252) and (254) as	noodod], ,
Total energy cost (245)(247)	+ (250)(254) =				454.32	(255)
11a. SAP rating - individual heating systems						_
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF) [(255) x (256	5)]÷[(4)+45.0] ⊨				1.1	(257)
SAP rating (Section 12)	in al valie e valie re				84.61	(258)
12a. CO2 emissions – Individual heating systems	including micro-	JHP				
	Energy kWh/year		Emission fa	ictor	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x		0.216	=	1047.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	585.7	(264)
Space and water heating	(261) + (262) + (263	3) + (264) =			1633.04	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	241.29	(268)
Total CO2, kg/year		sum o	f (265)(271) =		1913.25	(272)
CO2 emissions per m ²		(272)	÷ (4) =		14.95	(273)
El rating (section 14)					85	(274)
13a. Primary Energy						
	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		1.22	=	5915.52	(261)

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3308.11	(264)
Space and water heating	(261) + (262) + (263) + (26	64) =		9223.63	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1427.3	(268)
'Total Primary Energy		sum of (265)(271) =		10881.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		85.01	(273)



			Us	ser D	etails:						
Assessor Name: Software Name:	Stroma FSA	P 2012	Prop	erty A	Stroma Softwa Address:	a Num are Ver 5 Beds	ber: sion: - House		Versic	on: 1.0.0.28	
Address :											
1. Overall dwelling dimen	sions:										
Cround floor			г	Area	a(m²)	(1)	Av. Hei	ght(m)		Volume(m ³)	
			Ļ	4	2.67	(1a) x	2	.6	(2a) =	110.94	(3a)
First floor			L	4	2.67	(1b) x	2	.6	(2b) =	110.94	(3b)
Second floor				4	2.66	(1c) x	2	.6	(2c) =	110.92	(3c)
Total floor area TFA = (1a))+(1b)+(1c)+(1	d)+(1e)+	(1n)		128	(4)					
Dwelling volume			-			(3a)+(3b))+(3c)+(3d))+(3e)+	.(3n) =	332.8	(5)
2. Ventilation rate:											-
	main heating	secon heatir	dary Iq		other		total			m ³ per hour	
Number of chimneys	0	+ 0	<u> </u>	+	0	=	0	X	40 =	0	(6a)
Number of open flues	0	+ 0		+	0	ī = [0	x	20 =	0	(6b)
Number of intermittent fan	s			_			4	×	10 =	40	(7a)
Number of passive vents						Ē	0	x	10 =	0	(7b)
Number of flueless gas fire	es						0	X	40 =	0	(7c)
									A :		
									Air cr	hanges per not	ur ¬
Infiltration due to chimneys	s, flues and far	1S = (6a) + (6b))+(7a)+((7b)+(7 (17) c	(C) =	pontinuo fre	40	16)	÷ (5) =	0.12	(8)
Number of storevs in the	e dwelling (ns)	s intended, pro		(<i>11)</i> , C		,onunue no	011 (9) 10 (10)		0	(9)
Additional infiltration	J J J J J J J J J J							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or t	imber frame	or 0.3	35 for	masonr	y constr	uction			0	(11)
if both types of wall are pre	sent, use the values); if equal user 0	e correspondir	g to the	greate	er wall are	a (after					-
If suspended wooden flo	or, enter 0.2 (unsealed) o	r 0.1 (s	seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else er	nter 0								0	(13)
Percentage of windows	and doors dra	ught strippe	d							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, q	50, expressed	in cubic me	etres p	er ho	our per so	quare m	etre of e	nvelope	area	4.6	(17)
If based on air permeabilit	y value, then (18) = [(17) ÷ 20)]+(8), o	therwi	se (18) = (16)				0.35	(18)
Air permeability value applies	if a pressurisation	test has been	done or	r a deg	ree air pei	rmeability i	is being us	ed			٦
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			2	(19)
Infiltration rate incorporatir	ng shelter facto	or			(21) = (18)) x (20) =				0.3	(21)
Infiltration rate modified for	r monthly wind	speed									J` ′
Jan Feb M	/ar Apr	May Ju	n .	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind spe	ed from Table	7	•						-	-	
(22)m= 5.1 5 4	.9 4.4	4.3 3.8	3	3.8	3.7	4	4.3	4.5	4.7]	
· · · · ·									-	-	

Wind F	actor (2	2a)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]		
Adjust	ed infiltra	tion rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_		
	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35]		
Calcul	ate effec	<i>tive air (</i>	change i tion:	rate for t	he appli	cable ca	se		-				-	/r	22.0)
lf exh	echanica	at pump i	lion. Ising Anne	endix N (2	3h) - (23a	a) x Emv (e	auation (N	(5)) othe	rwise (23h) – (23a)			0	(2	23a)
If hale	anced with	heat reco	werv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =) – (200)			0	(2	23D)
a) If	balance	d mech	phical ve	ntilation	with he	at recover	and (M)/F		$(2)^{-}$	2b)m + ('	23h) v [·	1 _ (23c)	0 · · 1001	(2	23C)
(24a)m=								0			0	$\frac{1}{0}$	 	(2	24a)
b) If	balance	d mech:	anical ve	ntilation	without	heat rec	overv (N	/\\/) (24b	1 = (22)	2h)m + (2	23b)		J		
(24b)m=		0		0	0	0		0	0	0	0	0]	(2	24b)
c) If	whole ho	ouse ex	tract ver	L tilation o	or positiv	L	l ventilatio	n from c	L outside				1		
i i	if (22b)m	< 0.5 ×	: (23b), t	hen (24	c) = (23b); otherw	vise (24	c) = (22b	o) m + 0.	5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2	24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from I	oft			-			
_	if (22b)m	= 1, th	en (24d)	m = (22l	o)m othe	erwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]					
(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56		(2	24d)
Effe	ctive air	change	rate - er	nter (24a) or (24k	o) or (240	c) or (24	d) in box	(25)				1		
(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	l	(2	25)
3. He	at l <mark>osses</mark>	and he	at l <mark>oss</mark> p	paramete	ər:										
ELEN	/IENT	Gros	(m2)	Openin	gs	Net Ar	ea	U-valu	ue K	A X U	0	k-value	e l	A X k	
Doors	Type 1	area	(III-)			, ,		V V/1112		(• • • •	v	KJ/111-1		NJ/ N	26)
Doors						2	X	1		2					
	Type 2					2		1	=	2				(2	26)
Windo	Type 2 ws Type	1				2		1 1 /[1/(1.2)+	0.041 =	2				(2)	26)
Windo Windo	Type 2 ws Type ws Type	1				2 2 2.88	x x x ^{1/}	1 [1/(1.2)+ /[1/(1.2)+	0.04] = [2 2 3.3			1	(2)	26) 27) 27)
Windo Windo Windo	Type 2 ws Type ws Type ws Type	1 2 3				2 2 2.88 3.96	× × × × × × × × ×	1 [1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	= 0.04] = 0.04] =	2 2 3.3 4.53			1	(2 (2 (2 (2 (2)	26) 27) 27) 27)
Windo Windo Windo Windo	Type 2 ws Type ws Type ws Type ws Type	1 2 3 4				2 2.88 3.96 1.26	x x x ^{1/} x ^{1/} x ^{1/}	1 [1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	= = = = = = = = = = = = = = = = = = =	2 2 3.3 4.53 1.44			ľ	(2 (2 (2 (2 (2 (2) (2) (2) (2) (2) (2) (26) 27) 27) 27) 27)
Windo Windo Windo Windo	Type 2 ws Type ws Type ws Type ws Type	1 2 3 4				2 2 2.88 3.96 1.26 1.44	x x x ¹ / x ¹ / x ¹ / x ¹ /	1 (1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	= = = = = = = = = = = = = = = = = = =	2 2 3.3 4.53 1.44 1.65				(2 (2 (2 (2 (2 (2 (2	26) 27) 27) 27) 27) 27) 27)
Windo Windo Windo Windo Floor	Type 2 ws Type ws Type ws Type ws Type	1 2 3 4		24.00		2 2.88 3.96 1.26 1.44 42.67	x x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	1 (1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.15	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [2 2 3.3 4.53 1.44 1.65 6.4005				(2 (2 (2 (2 (2 (2 (2 (2 (2) (2) (2) (2)	26) 27) 27) 27) 27) 27) 28)
Windo Windo Windo Windo Floor Walls Roof	Type 2 ws Type ws Type ws Type ws Type	1 2 3 4		34.00	6	2 2.88 3.96 1.26 1.44 42.67 175.9	x x x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾ x ¹	$ \begin{array}{c} 1\\ \hline \\ 1\\ \hline \\	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [= [] = [2 2 3.3 4.53 1.44 1.65 6.4005 35.19				(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2))))))))	26) 27) 27) 27) 27) 27) 28) 29)
Windo Windo Windo Windo Floor Walls Roof	Type 2 ws Type ws Type ws Type ws Type	$ \begin{array}{c} 1\\2\\3\\4\\\hline 210\\\hline 42.6\\\hline 200\\\hline 210\\\hline 210\\\hline 200\\\hline) 7 m²	34.0	6	2 2.88 3.96 1.26 1.44 42.67 175.9 42.67	x x x ¹ / x	1 (1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.15 0.2 0.11	$\begin{bmatrix} & = \\ & = \\ & 0.04 \end{bmatrix} = \begin{bmatrix} \\ & 0.04 \end{bmatrix} = \begin{bmatrix} \\ & 0.04 \end{bmatrix} = \begin{bmatrix} \\ & = \\ & = \end{bmatrix}$	2 2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69				(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (26) 27) 27) 27) 27) 28) 28) 29) 30)
Windo Windo Windo Floor Walls Roof Total a * for win	Type 2 ws Type ws Type ws Type ws Type area of el	1 2 3 4 210 42.6 ements	7 , m²	34.00	6 ndow U-va	2 2.88 3.96 1.26 1.44 42.67 175.9 42.67 295.3 alue calcula	x x x ^{1/} x ^{1/}	$ \begin{array}{c} 1\\ 1\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ 0.15\\ 0.2\\ 0.11\\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	$\begin{bmatrix} & & \\ & $	2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69	s given in	paragraph		(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (26) 27) 27) 27) 27) 27) 28) 29) 30) 31)
Windo Windo Windo Floor Walls Roof Total a * for win ** inclua	Type 2 ws Type ws Type ws Type ws Type area of el dows and be the area heat los	1 2 3 4 210 42.6 ements roof windo s on both s W/K -	7 , m² ows, use e sides of ir = S (A x	34.00 0 offective wi internal walk	5 ndow U-va Is and part	2 2.88 3.96 1.26 1.44 42.67 175.9 42.67 295.3 alue calcula titions	x x x ^{1/} x	$ \begin{array}{c} 1\\ \hline \\ 1\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ \hline 0.15\\ \hline 0.2\\ \hline 0.11\\ \hline 0.11\\ \hline 0.2\\ \hline 0.11\\ \hline (26)(30)\\ \end{array} $	$\begin{bmatrix} & & \\ & $	2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69	s given in	paragraph		(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (3 (3) (3) (3)	26) 27) 27) 27) 27) 27) 28) 29) 30) 31)
Windo Windo Windo Floor Walls Roof Total a * for win ** inclua Fabric Heat c	Type 2 ws Type ws Type ws Type ws Type ws Type area of el de the area heat los capacity (1 2 3 4 210 42.6 ements roof windown s on both s, W/K = 200	7 , m ² ows, use e sides of ir = S (A x A x k)	34.00 0 offective with ternal walk U)	5 ndow U-va Is and par	2 2.88 3.96 1.26 1.44 42.67 175.94 42.67 295.34 alue calcula titions	x x x ¹ / x	$ \begin{array}{c} 1\\ 1\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ 0.15\\ 0.2\\ 0.11\\ 0.11\\ 0.2\\ 0.11\\ 0.2 \end{array} $	$ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	2 2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69 4.69 $e)+0.04] a$ $(30) + (32)$	 	paragraph		(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (26) 27) 27) 27) 27) 227) 28) 29) 30) 331) 333)
Windo Windo Windo Floor Walls Roof Total a * for win ** inclua Fabric Heat c Therm	Type 2 ws Type ws Type ws Type ws Type ws Type area of el de the area heat los capacity (al mass	1 2 3 4 (210) (42.6) ements roof windo s on both s, W/K = Cm = S(7 , m ² ows, use e sides of ir = S (A x A x k) ter (TMF	34.00 0 effective with the the the the the the the the the t	3 Indow U-va Is and part	2 2.88 3.96 1.26 1.44 42.67 175.9 42.67 295.3 alue calcula titions	x x x ¹ / x	$ \begin{array}{c} 1\\ 1\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ (1/(1.2)+\\ 0.15\\ 0.2\\ 0.11\\ 0.11\\ 0.2\\ 0.11\\ 0.2\\ 0.11\\ 0.2\\ 0.11\\ 0.2\\ 0.11\\ 0.2\\ 0.11\\ 0.2\\ 0.2\\ 0.11\\ 0.2\\ 0.2\\ 0.2\\ 0.2\\ 0.2\\ 0.2\\ 0.2\\ 0.2$	$\begin{bmatrix} & & \\ & $	2 2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69 4.69 4.69 4.69 4.69	 	paragraph (32e) =	3.2 84. 27336	(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (26) 27) 27) 27) 28) 29) 30) 31) 33) 33) 34)
Windo Windo Windo Floor Walls Roof Total a * for win ** inclua Fabric Heat c Therm For desi can be	Type 2 ws Type ws Type ws Type ws Type ws Type area of el dows and de the area heat los capacity (al mass ign assessi used instea	1 2 3 4 (210) 42.6 ements roof windo s on both s, W/K = Cm = S(parame ments wh of a dep	7 7 ows, use e sides of ir = S (A x A x k) ter (TMF ere the de called calcu	34.00 0 iffective with the second secon	5 ndow U-va Is and part - TFA) ir construct	2 2.88 3.96 1.26 1.44 42.67 175.9 42.67 295.3 alue calcula titions	x x x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	$ \begin{array}{c} 1\\ \hline \\ 1\\ \hline \\ (1/(1.2)+\\ \hline \\ (1/(1.2)+\\ \hline \\ (1/(1.2)+\\ \hline \\ 0.15\\ \hline \\ 0.2\\ \hline \\ 0.11\\ \hline \\ 1 \\ (26)(30)\\ \hline \\ ecisely the event is a set of the eve$	$ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	2 3.3 4.53 1.44 1.65 6.4005 35.19 4.69 4.69 (30) + (32) tive Value: e values of	S given in () + (32a). Medium TMP in Tage	paragraph (32e) = able 1f	3.2 84. 27336 250	(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (26) 27) 27) 27) 28) 29) 30) 31) 33) 33) 33) 33)
if detail	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(22)	(26) -					
-----------------	---------------	-----------------------	---------------	--------------	----------------	------------	--------------	-------------	-----------------------	---------------	---	---------	---------	------	
Ventil			alaulataa	Imonthly					(33) +	(50) =	() () () () () () () () () () () () () (99.47	(37)	
venua						lun	1.1	Aug	(38)m	= 0.33 X (25)m x (5)	Dee			
(38)m=	62.82	62.51	62.22	60.8	60.54	59.3	59.3	59.07	59.78	60.54	61.07	61.63		(38)	
Heat t	ransfer (nt W/K						(39)m	= (37) + (37)	38)m				
(39)m=	162.29	161.98	161.68	160.27	160	158.77	158.77	158.54	159.25	160	160.54	161.1			
()										Average =	Sum(39)1	12 /12=	160.27	(39)	
Heat I	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)				
(40)m=	1.27	1.27	1.26	1.25	1.25	1.24	1.24	1.24	1.24	1.25	1.25	1.26		_	
Numb	er of day	vs in mo	nth (Tab	le 1a)						Average =	Sum(40) ₁ .	12 /12=	1.25	(40)	
	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. W	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:		
A		nonov	NI										I	(10)	
if TF	FA > 13.9	ipancy, i 9, N = 1	n + 1.76 x	[1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.()013 x (⁻	TFA -13.	2. .9)	89		(42)	
if TF	-A £ 13.9	9, N = 1				,			,		, 				
Annua	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	e target o	108	3.24		(43)	
not moi	re that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a water us	se larger o	1				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wa	ter usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)							
(44)m=	119.06	114.73	110.4	106.08	101.75	97.42	97.42	101.75	106.08	110.4	114.73	119.06			
			<u> </u>							Total = Su	m(44) ₁₁₂ =	:	1298.88	(44)	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)			
(45)m=	176.57	154.43	159.36	138.93	133.31	115.03	106.6	122.32	123.78	144.25	157.47	171		_	
If inotor	topoouou	otor hooti	na ot point	fund (no	hot wata	r otorogo)	ontor 0 in	havaa (16) to (61)	Total = Su	m(45) ₁₁₂ =		1703.04	(45)	
ii iiistai						siorage),							I	(10)	
(46)m= Water	0 storage	0 loss:	0	0	0	0	0	0	0	0	0	0		(46)	
Storag	ge volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)	
If com	- munity h	eating a	ind no ta	ink in dw	velling, e	nter 110) litres in	(47)							
Other	wise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)				
Water	storage	loss:											L		
a) If r	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)	
Temp	erature f	actor fro	m Table	2b								0		(49)	
Energ	y lost fro	m water	storage	e, kWh/ye	ear	or io not	known:	(48) x (49)	=			0		(50)	
Hot w	ater stor	age loss	factor fr	om Tabl	le 2 (kW	h/litre/da	av)					n		(51)	
If com	munity h	eating s	ee secti	on 4.3	,		.,							(-)	
Volum	ne factor	from Ta	ble 2a									0		(52)	
Temp	erature f	actor fro	m Table	2b								0		(53)	
Energ	y lost fro	m water	storage	e, kWh/y€	ear			(47) x (51)	x (52) x (53) =		0	,	(54)	
Enter	(50) or ((54) in (5	55)									0		(55)	

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(57)
Prima	v circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Prima	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	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	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)r	n
(62)m=	150.08	131.26	135.45	118.09	113.31	97.78	90.61	103.97	105.21	122.62	133.85	145.35]	(62)
Solar D	-IW input o	calculated	using App	endix G o	Appendix	H (negati	ve quantity	v) (enter '0	if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	S)	i	i	i	1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	150.08	131.26	135.45	118.09	113.31	97.78	90.61	103.97	105.21	122.62	133.85	145.35		_
								Outp	out from w	ater heate	r (annual)₁	12	1447.58	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	(<mark>(46)</mark> m	+ (57)m	+ (59)m]	
(65)m=	37.52	32.82	33.86	29.52	28.33	24.44	22.65	25.99	26.3	30.65	33.46	36.34		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	neating	
5. In	ternal ga	ains (s <mark>ee</mark>	e Ta <mark>ble 5</mark>	5 and 5a):									
Metab	olic gain	is (Table	5), Wat	ts						_			1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48		(66)
Lightir	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		i		1	
(67)m=	26.33	23.38	19.02	14.4	10.76	9.09	9.82	12.76	17.13	21.75	25.38	27.06		(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	ı —		1	
(68)m=	295.29	298.36	290.64	274.2	253.45	233.94	220.91	217.85	225.57	242.01	262.76	282.26		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5			1	
(69)m=	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45		(69)
Pumps	and fai	ns gains	(Table s	ōa)									1	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58		(71)
Water	heating	gains (T	able 5)	i	i		i			i	1	i	1	
(72)m=	50.43	48.83	45.51	41	38.07	33.95	30.45	34.94	36.53	41.2	46.47	48.84]	(72)
Total	ntornal	apine -				(66)	m + (67)m	+ (68)m +	-(69)m +	(70)m + (7)	(1)m + (72)	m		
		yanıs =				(00)		(00)	(00)111		· ///· · (/2)			
(73)m=	438.39	436.92	421.51	395.94	368.63	343.32	327.52	331.89	345.57	371.3	400.96	424.5		(73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orient	ation:	Access Fac Table 6d	tor	Area m²			Flu Tal	x ble 6a		g Tab	_ ole 6b		Та	FF ble 6c			Gain (W	s /)	
South	0.9x	0.77	×	2.8	8	x	4	6.75	×	0	0.63	x		0.76		=	17	'8.71	(78)
South	0.9x	0.77	x	2.8	8	x	7	6.57	×	0).63	x		0.76		=	29	2.68	(78)
South	0.9x	0.77	x	2.8	8	x	9	7.53	×	().63	x		0.76		=	37	2.82	(78)
South	0.9x	0.77	×	2.8	88	x	1	10.23	×	0).63	x		0.76		=	42	1.36	(78)
South	0.9x	0.77	x	2.8	88	x	1	14.87	×	0).63	x		0.76		=	43	9.09	(78)
South	0.9x	0.77	x	2.8	8	x	1	10.55	×	0).63	x		0.76		=	42	2.56	(78)
South	0.9x	0.77	x	2.8	8	x	10	08.01	×	0).63	x		0.76		=	41	2.87	(78)
South	0.9x	0.77	x	2.8	8	x	10	04.89	x	0).63	x		0.76		=	40	0.95	(78)
South	0.9x	0.77	x	2.8	8	x	10	01.89	×	0).63	x		0.76		=	38	9.45	(78)
South	0.9x	0.77	x	2.8	88	x	8	2.59	x	0).63	x		0.76		=	31	5.68	(78)
South	0.9x	0.77	x	2.8	88	x	5	5.42	x	().63	x		0.76		=	21	1.83	(78)
South	0.9x	0.77	x	2.8	88	x	4	40.4	x	0).63	x		0.76		=	15	64.42	(78)
Solar	aains ir	n watts. calcu	ulated	l for eacl	h mont	th			(83)m	n = Sum	ı(74)m .	(82)r	n						
(83)m=	299.53	3 529.03 70	62.06	989.05	1134.8	8 1	134.75	1090.9	983	.37 8	342.15	596.	13	362.48	253	3.78			(83)
Total (gains –	internal and	solar	(84)m =	= (73)n	1 + ((83)m	, watts											
(84)m=	737.92	965.94 11	83.57	1384.99	1503.4	.3 1	478.07	1418.42	1315	5.26 1	187.73	967.	43	763.44	678	3.28	-		(84)
7 . Me	ean <mark>inte</mark>	ernal tempera	ature	(hea <mark>ting</mark>	seaso														
Tem	peratur	e during hea	ting p	eriods ir	n the liv	ving	area	from Tab	ole 9	, Th1	(°C)							21	(85)
Utilis	ation fa	ctor for gain	s for I	iving are	ea, h1,	m (s	вее Та	ble 9a)											
	Jan	Feb	Mar	Apr	May	y	Jun	Jul	A	ug	Sep	Od	rt	Nov	D	Dec			
(86)m=	1	0.99	0.98	0.93	0.82		0.65	0.48	0.5	54	0.79	0.9	7	1		1			(86)
Mear	n intern	al temperatu	ire in	living are	ea T1 ((follo	ow ste	ps 3 to 7	7 in T	able 9	9c)						- 1		
(87)m=	19.58	19.82 2	0.15	20.53	20.82		20.96	20.99	20.	99	20.89	20.4	7	19.94	19	.54			(87)
Tem	peratur	e during hea	ting p	eriods ir	n rest o	of dv	velling	from Ta	able 9	9, Th2	(°C)		-						
(88)m=	19.87	19.87 1	9.87	19.88	19.88		19.89	19.89	19.	89	19.88	19.8	8	19.88	19	.87			(88)
Utilis	ation fa	ctor for gain	s for i	rest of d	welling	. h2	.m (se	e Table	9a)										
(89)m=	1	0.99 (0.97	0.91	0.76	<u>,,</u>	0.55	0.37	0.4	12	0.71	0.9	5	0.99		1			(89)
Moar	 intern	al temperati		the rest	of dwe		n T2 (f	l ollow ste		to 7 i	n Tahl								
(90)m=	18.58	18.81 1	9.14	19.52	19.76		19.87	19.89	19.	89	19.83	19.4	7	18.95	18	.54			(90)
		<u> </u>				_					f	LA = L	.iving	area ÷ (4	4) =		0	.17	(91)
Maar	. intorn	al tamparati	ura (fa	r tha wh	olo du	مالنه	م) fi	ΔΤ4	. /1	fI A	т о					I			
(92)m-	18 75		a 31	19 69			10) = 11 20.05	_A × 11	+ (1	$\frac{-1LA}{07}$	20	19.6	<u>а</u>	19 11	18	71			(92)
Apply	v adjust	tment to the	mean	internal	temp	erati	ure fro	m Table	4e	where	appro	onriat	<u> </u>	10.11	10	., ,			(0-)
(93)m=	18.75	18.98 1	9.31	19.69	19.94		20.05	20.07	20.	07	20	19.6	i4	19.11	18	.71			(93)
8. <u>S</u> p	bac <u>e he</u>	ating require	em <u>ent</u>																
Set 7	Ti to the	mean interr	nal ter	nperatur	re obta	ine	d at ste	ep 11 of	Tabl	le 9b,	so tha	t Ti,m	າ=(7	6)m an	d re	-calc	ulate		
the u	tilisatio	n factor for g	gains	using Ta	ble 9a	l - 1							i						
	Jan	Feb	Mar	Apr	May	y	Jun	Jul	A	ug	Sep	00	t	Nov	D	Dec			
Utilis	ation fa	ictor for gain	s, hm	:															

0.9

0.77

0.57

0.39

0.44

0.72

0.94

0.99

1

0.97

(94)m=

1

0.99

(94)

Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	735.56	955.71	1144.63	1249.4	1152.38	835.56	547.09	574.77	851.96	913.64	757.41	676.79		(95)
Month	nly aver	age exte	rnal tem	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)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2344.64	2280.87	2071.21	1728.55	1318.32	865.35	550.93	581.63	940.01	1446.28	1928.43	2337.59		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97])m – (95)m] x (4 ⁻	1)m			
(98)m=	1197.16	890.51	689.38	344.99	123.46	0	0	0	0	396.28	843.14	1235.64		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	5720.55	(98)
Space	e heatin	a require	ement in	kWh/m²	²/vear								44 69	(99)
0.0	onoutin	groquir			/ Jour							l	41.00	
8C. S	pace co	oling rec	uiremer		0 T.I	1. 4.01								
Calcu	lated to	r June, J	July and	August.	See Tat		11	A.u.a	San	Oct	Nov	Dee		
Heat					Iviay		Jui	Aug	Sep		o from T			
								1204 02						(100)
		0 to = fo = lo		0	0	1492.40	1174.95	1204.93	0	0	0	0		(100)
Utilisa			ss nm			0.0	0.05	0.00	0	0	0	0		(101)
(101)m=		0		0	0	0.9	0.95	0.93	0	0	0	0		(101)
Usefu	il loss, r	mLm (V	vatts) = ((100)m x	(101)m	10.40.07								(102)
(102)m=	0	0	0			1343.97	. 1112.42	1117.93	0	0		0		(102)
Gains	s (solar (gains ca	Iculated	for appli	cable we	eather re	egion, se		10)					(400)
(103)m=	0	0	0	0	0	1845.18	1772.81	1654.4	0	0	0	0		(103)
Space	e cooling 04)m to	g require	ement to	r month,	whole d	lwelling,	continue	bus (KW	(h) = 0.0	24 x [(10)3)m – (*	102)m] x	k (41)m	
(104)m-			0			360.87	491 33	399 13	0	0	0	0		
(101)		Ū	, , , , , , , , , , , , , , , , , , ,		Ŭ	000.01	1011.00	000.10	Tota	- Sum(0 104)	_	1251 22	
Cooled	fractio	1							f C =	cooled a	area ∸ (4	- 1) =	1	(105)
Intermi	ittency f	actor (Ta	able 10b)								.,	•	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
				1					Tota	l = Sum((104)	=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n		,	,		_	
(107)m=	0	0	0	0	0	90.22	122.83	99.78	0	0	0	0		
									Total	= Sum(107)	=	312.83	(107)
Space	coolina	requirer	nent in k	wh/m²/۱)	/ear				(107)) ÷ (4) =	,		2 44	(108)
8f Eab		rav Effici	iency (cr			der spec	rial cond	litions s	ee sectio	n 11) _				
Echri				aculateu		der spec		110115, 50		· (100)			47 4 4	
Laple	c ⊏nerg	y ⊏nicier	icy						(99) -	+(108)=	=		47.14	(109)

		Us	er Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.0.28	
		Prope	erty Address:	1 Bed -	Flat En	hanced			
Address :	nciona								
	1510115.		Area(m²)			iaht(m)		Volume(m ³)	
Ground floor			56.1	(1a) x	2	2.5	(2a) =	140.25	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	56.1	(4)					
Dwelling volume		L		(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	140.25	(5)
2. Ventilation rate:							-		_
	main se	econdary	other		total			m ³ per hour	
Number of chimneys			• 0] = [0	× 4	40 =	0	(6a)
Number of open flues	0 +	0	• 0] = [0	x	20 =	0	(6b)
Number of intermittent far	าร				2	x '	10 =	20	(7a)
Number of passive vents				Γ	0	Х ′	10 =	0	(7b)
Number of flueless gas fir	es				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimney	rs, flues and fans = (6)	a)+(6b)+(7a)+(7b)+(7c) =	Ę	20		÷ (5) =	0.14	(8)
It a pressurisation test has be Number of storeys in th	en carried out or is intende	ed, proceed to (17), otherwise c	ontinue fro	om (9) to (16)	1	0	
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or 0.3	5 for masonr	y constr	uction		-	0	(11)
if both types of wall are pro deducting areas of openin	esent, use the value corres as); if equal user 0.35	ponding to the	greater wall area	a (after					_
If suspended wooden fl	oor, enter 0.2 (unseal	ed) or 0.1 (s	ealed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter 0						İ	0	(13)
Percentage of windows	and doors draught st	ripped						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,	q50, expressed in cub	pic metres pe	er hour per so	quare mo	etre of e	nvelope	area	4	(17)
If based on air permeabili	ty value, then $(18) = [(1)$	$(7) \div 20]+(8), ot$	nerwise (18) = (16) moobilituu	ia haina w	and		0.34	(18)
Number of sides sheltered	d	s been done or	a degree all per	ineability i	is being us	seu	[2] (19)
Shelter factor	-		(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ng shelter factor		(21) = (18)	x (20) =				0.29	(21)
Infiltration rate modified for	or monthly wind speed	ł					ľ		
Jan Feb	Mar Apr May	Jun J	ul Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 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 Factor (22a)m = (22	2)m ÷ 4								
(22a)m= 1.27 1.25 1	1.23 1.1 1.08	0.95 0.	95 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_	
	0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
Calcul	ate effe	ctive air	change	rate for t	the appli	cable ca	se							(220)
lf ovh	aust air h		using Ann	endix N (2	23h) - (23a	a) × Emv (e	auation (N5)) other	nwise (23h) – (23a)			0	(234)
If bal	anced with	best reco		$\frac{1}{2}$	-00) = (200	for in-use f	actor (fror	n Table 4b) –) – (200)			0	(23D)
) = (2)	2b)m i (f	00h) v [1 (22a)	0	(23c)
a) II (24a)m-									$\frac{1}{1} = \frac{1}{2}$	$\frac{20}{10} + \frac{10}{10}$	230) x [$\frac{1 - (230)}{1 - 0}$]]	(24a)
(2-10)11-					without	boot roc		1 °	$\int_{-\infty}^{\infty}$		22h)	Ů	J	()
(24b)m-								0 (240			230)	0	1	(24b)
c) If			tract ver		or positiv		Ventilativ	on from c		Ů		Ů	J	(-)
0) 11	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	vise (24	c) = (22b	b) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilati	on from l	oft			•		
	if (22b)n	n = 1, th	en (24d)	m = (22	b)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		,	1	
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	J	(24d)
Effe	ctive air	change	rate - er	nter (24a	a) or (24b	o) or (24	c) or (24	ld) in boy	(25)				1	
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramet	er:									
ELEN	/IENT	Gros	SS	Openin	igs	Net Ar	ea	U-valı	ue	AXU		k-value	e	AXk
_		area	(m²)	rr	1 ²	A ,r	m²	W/m2	2K	(VV/I	<)	kJ/m²•l	K	kJ/K
Doors						2	×	1	= [2				(26)
Windo	WS					2.88	×1	/[1/(1.2)+	0.04] =	3.3	Ц.		_	(27)
Floor						56.1	×	0.14	_ =	7.854				(28)
Walls		50)	10.6	4	39.36	3 X	0.18	=	7.08				(29)
Total a	area of e	elements	, m²			106.1	1							(31)
Party v	wall					15	x	0	=	0				(32)
Party of	ceiling					56.1					[(32b)
* for win ** incluc	idows and le the area	l roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Ils and pari	alue calcul titions	ated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	is given in	paragraph	n 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				26.8	3 (33)
Heat c	apacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	8741	.1 (34)
Therm	al mass	parame	ter (TM	- = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	e construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						5.3	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			32.1	4 (37)
Ventila	ation hea	at loss ca	alculated	monthl	y I		<u> </u>		(38)m	= 0.33 × (25)m x (5))	1	
(0.0)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	4	(00)
(38)m=	26.33	26.21	26.08	25.52	25.41	24.91	24.91	24.82	25.1	25.41	25.63	25.85	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K		1	1		r .	(39)m	= (37) + (3	38)m		1	
(39)m=	58.47	58.34	58.22	57.65	57.55	57.05	57.05	56.96	57.24	57.55	57.76	57.99		
									,	Average =	Sum(39)1	12 /12=	57.6	5 (39)

Heat Ic	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.04	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.03		
Numbe	er of day	, vs in mo	nth (Tab	le 1a)	•		•		/	Average =	Sum(40) ₁ .	12 /12=	1.03	(40)
- turno e	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
I														
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 ×	: [1 - exp	0(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13	1. .9)	87		(42)
Annual Reduce not more	l averag the annua e that 125	je hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	78 f	3.6		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	86.46	83.32	80.17	77.03	73.88	70.74	70.74	73.88	77.03	80.17	83.32	86.46		
_			·						-	Total = Su	m(44) ₁₁₂ =		943.21	(44)
Energy o	content of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600) kWh/mor	oth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	128.22	112.14	115.72	100.89	96.8	83.53	77.41	88.83	89.89	104.75	114.35	124.17		-
lf instant	aneous w	vater heati	ng at poin	t of use (no	o hot water	r storage),	enter 0 in	boxes (46,) to (61)	Total = Su	m(45) ₁₁₂ =		1236.69	(45)
(46)m=	19.23	16.82	17.36	15.13	14.52	12.53	11.61	13.32	13.48	15.71	17.15	18.63		(46)
Water	storage	loss:	7					<u> </u>						
Storag	e volum	e (litres)	includir	ng any se	olar or N	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h	neating a	and no ta	ank in dw	velling, e	nter 110) litres in	(47)	`	(0) : ((
Water	/ISE IT NO	o stored	not wate	er (this ir	iciudes i	nstantar	neous co	niod idmo	ers) ente	er 'O' in (47)			
a) If m	anufact	urer's d	eclared I	oss fact	or is kno	wn (kWł	n/dav):					0		(48)
Tempe	rature f	actor fro	m Table	2b		,	,					0		(49)
Energy	lost fro	m water	storage	e, kWh/y	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:					-		
Hot wa	ter stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
If comr	nunity r	from Ta	ee secti	on 4.3								0		(50)
Tempe	rature f	actor fro	m Table	2b								0		(52)
Energy	lost fro	m water	storage	kWh/v	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)	,	oui			(,	,(,(,		0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	prage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	i lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	23.23	20.95	23.15	22.35	23.05	22.26	22.98	23.03	22.31	23.11	22.42	23.21		(61)
Total h	heat req	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	151.44	133.09	138.87	123.23	119.86	105.8	100.39	111.85	112.2	127.86	136.77	147.38		(62)
Solar DI	HW input	calculated	using App	endix G or	r Appendix	H (negativ	/e quantity	v) (enter '0'	if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies,	see Ap	pendix G	S)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	151.44	133.09	138.87	123.23	119.86	105.8	100.39	111.85	112.2	127.86	136.77	147.38		_
								Outp	out from w	ater heate	r (annual)	12	1508.74	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	ı] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	48.44	42.52	44.26	39.13	37.95	33.34	31.48	35.29	35.46	40.61	43.63	47.09		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17		(66)
Lightin	ig gains	(calcula	ted in Ap	opendix	L, equati	ion L9 or	[.] L9a), al	lso see	Table 5					
(67)m=	37.59	33.39	27.15	20.56	15.37	12.97	14.02	18.22	24.45	31.05	36.24	38.63		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L ²	13 or L1:	3a), also	see Ta	ble 5				
(68)m=	243.31	245.83	239.47	225.92	208.83	192.76	182.02	179.5	185.86	199.4	216.5	232.57		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09	48.09		(69)
Pumps	s and fa	ns gains	(Table s	ōa)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. ev	vaporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78		(71)
Water	heating	gains (T	able 5)											
(72)m=	65.11	63.28	59.49	54.35	51.01	46.31	42.32	47.43	49.26	54.58	60.59	63.29		(72)
Total i	internal	gains =	:			(66)	m + (67)m	+ (68)m +	- (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	434.48	430.97	414.59	389.31	363.68	340.51	326.83	333.63	348.05	373.51	401.81	422.97		(73)
6. So	lar gain	s:												
Solar (gains are (calculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	ne applicat	ole orientat	ion.		
Orient	ation: /	Access F	actor	Area		Flu	X No 6a	т	g_ able 6b	т	FF		Gains	
						ı aı		1		10			(**)	
.									(= .)	()				
Solar (jains in	watts, ca		335 QA		421 45	401.24	(83)m = S	um(74)m . 267 0	(82)m	80.15	58.8		(83)
Total c	1.5	nternal a	and solar	(84)m =	- (73)m -	+ (83)m	watts	344.00	207.9	105.90	09.15	50.0		(00)
(84)m=	505.98	570.84	644.93	725.24	775.38	761.97	728.07	678.29	615.94	539.47	490.96	481.77		(84)
			I				0.07			1				· ·
7. Me	ean inter	nal temp	perature	(heating	season)							.	
remp		auring h	ieating p	eriods ir		ig area f	rom lab	ne 9, Th	T (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	iving are	ea, n1,m		ые 9а) 	۸	S = -	0	Next	Dee		
Stroma	j Jan FSAP 201	L ⊢eb 2 Version	1 iviar 1.0.0.28	j Apr (SAP 9.91)	iviay) - http://ww	JUN ww.stroma	JUI .com	Aug	Sep	Oct	INOV	Dec	Page 4	of 7

(86)m=	0.99	0.97	0.93	0.83	0.66	0.48	0.34	0.39	0.62	0.89	0.97	0.99		(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=	20.18	20.34	20.59	20.84	20.96	20.99	21	21	20.98	20.79	20.44	20.15		(87)
Temp	erature	durina h	neating p	eriods ir	n rest of	dwellina	from Ta	able 9. Ti	h2 (°C)					
(88)m=	20.05	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.06		(88)
Utilisa	tion fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	0.98	0.97	0.92	0.79	0.6	0.41	0.27	0.31	0.54	0.85	0.96	0.99		(89)
Mean	interna	l temper	ature in	the rest	n of dwelli	ina T2 (f	n Now ste	ens 3 to 7	7 in Tahl	e 9c)				
(90)m=	18.99	19.22	19.56	19.89	20.03	20.07	20.07	20.07	20.05	19.85	19.37	18.94		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.5	(91)
Moon	intorna	ltomnor	aturo (fo	r tho wh	olo dwo	llina) – fl	I A √ T1	⊥ (1 _ fl	۸) v T2			I		
(92)m=	19.59	19.78	20.07	20.36	20.49	20.53	20.53	20.53	20.51	20.32	19.91	19.55		(92)
Apply	adjustn	nent to t	he mear	internal	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	, 19.59	19.78	20.07	20.36	20.49	20.53	20.53	20.53	20.51	20.32	19.91	19.55		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	to the r	nean int	ernal te	mperatu	re obtair	ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a									
Litilian	Jan tion foo	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.98	0.96	ains, nn	0.8	0.63	0 44	0.31	0.35	0.58	0.86	0.96	0.98		(94)
Usefu	I gains.	hmGm .	. W = (9	4)m x (84	4)m	0.11	0.01	0.00	0.00		0.00	0.00		
(95)m=	495.81	549.55	591.4	583.31	488.18	336.26	224.25	235.03	358.42	464.7	472.3	473.97		(95)
Month	ly avera	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)
Heat I	oss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	893.77	868.17	790.17	660.75	506.02	338.32	224.45	235.48	367.19	559.38	739.71	889.88		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mont	th = 0.02	24 x [(97])m – (95)m] x (4	1)m			
(98)m=	296.08	214.11	147.89	55.75	13.28	0	0	0	0	70.44	192.53	309.44		
								Tota	l per year	(kWh/year) = Sum(98	8)15,912 =	1299.53	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								23.16	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:	t from o			menter						I		
Fracti	on or sp	ace nea	it from s	econdar	y/supple	mentary	system	(202) 1	(201)				0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =	(0.0.0)]			1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 – ((203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								89.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %						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) I)		1						
	296.08	214.11	147.89	55.75	13.28	0	0	0	0	70.44	192.53	309.44		
(211)m	= {[(98)m x (20	4)] + (2′	10)m } x	100 ÷ (2	206)				_				(211)
	329.35	238.17	164.5	62.02	14.77	0	0		0	78.35	214.16	344.21		
								rota	i (kvvii/yea	$a_1 = Sum(2$	15,1012	-	1445.52	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)		-	-		-			
(215)m= 0 0	0 0	0 0	0	0	0	0	0	0		_
				Tota	ıl (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	2=	0	(215)
Water heating	<i>(</i>)) <i>(</i>) <i>() <i>(</i>) <i>() <i>() <i>() () <i>() () <i>() <i>() () <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() () <i>() <i>() <i>() <i>() () <i>() <i>() () <i>() () <i>() <i>() () <i>() <i>() () <i>() () <i>() () <i>() () () () <i>() () () () <i>() () <i>() () () <i>() () () () () () () () () () <i>() () () () () () () () () () () () () () () () () () () <i>() () () <i>() () () () () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() <i>() () <i>() <i>() () <i>() () <i>() <i>() () <i>() () <i>() <i>() () <i>() () <i>() <i>() () <i>() () <i>() <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () <i>() () () <i>() () <i>() () () <i>() () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () <i>() () () </i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i>									
151.44 133.09	r (calculated a	bove) 119.86 105.8	100.39	111.85	112.2	127.86	136.77	147.38		
Efficiency of water heate	er								87.3	(216)
(217)m= 89 88.89	88.62 88.09	87.55 87.3	87.3	87.3	87.3	88.21	88.8	89.04		(217)
Fuel for water heating, k	Wh/month	II	1	1			1			
$(219)m = (64)m \times 100 \div$	<u>+ (217)m</u>			1 400 40	100.50		454.00	405 50		
(219)m= 170.16 149.73 1	156.69 139.89	136.9 121.19	9 114.99	128.12 Tota	128.52	144.96	154.02	165.52	4740.00	
Annual totals				1012	ii – Sun(z	1 3a) ₁₁₂ –	White		1710.68	(219)
Space heating fuel used	, main system	1				N.	wii/yeai		1445.52	1
Water heating fuel used									1710.68	1
Electricity for pumps fan	s and electric	keep-hot								J
central heating nump;								30		(230c)
boiler with a fan-assiste	ad flue							45		(230e)
Total electricity for the at	hove kW/b/vea	r		sum	of (230a).	(230a) =			75	(231)
Electricity for lighting	00vc, kvvi/ycc								265.52	$\left[\begin{array}{c} 2 & 0 \\ 0 & 2 \\ 0 & $
									200.00	(202)
10a Eval agata indivia		at a maxim								
10a. Fuel costs - individ	du <mark>al he</mark> ating sy	stems:								
10a. Fuel costs - individ	du <mark>al he</mark> ating sy	stems: F	uel			Fuel P	rice		Fuel Cost	
10a. Fuel costs - individ	du <mark>al h</mark> eating sy	stems: F k	uel Wh/year			Fuel P (Table	rice 12)		Fuel Cost £/year	_
10a. Fuel costs - individ Space heating - main sys	du <mark>al heating sy</mark> stem 1	stems: F k (2	uel Wh/year			Fuel P (Table 3.4	rice 12) 8	× 0.01 =	Fuel Cost £/year](240)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys	dual heating sy stem 1 stem 2	stems: F k (2 (2	Wh/year Wh/year			Fuel P (Table 3.4	rice 12) 8	x 0.01 = x 0.01 =	Fuel Cost £/year 50.3042 0](240)](241)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda	stem 1 stem 2	stems: F k (2 (2 (2	Wh/year Wh/year (11) x (13) x (15) x			Fuel P (Table 3.4 0 13.	rice 12) 8	x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 50.3042 0 0)(240))(241))(242)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (other	stem 1 stem 2 ary er fuel)	stems: F k (2 (2 (2 (2) (2)	uel Wh/year (11) x (13) x (15) x (19)			Fuel P (Table 3.4 0 13. 3.4	rice 12) 8 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 50.3042 0 0 59.53)(240))(241))(242))(247)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric	stem 1 stem 2 ary er fuel) c keep-hot	stems: F k (2 (2 (2 (2 (2 (2) (2) (2)	uel Wh/year (11) x (13) x (15) x (19) (31)			Fuel P (Table 3.4 0 13. 3.4 13.	rice 12) ¹⁸ 19 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 50.3042 0 0 59.53 9.89)(240))(241))(242))(247))(249)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year (11) x (13) x (15) x (19) (31) ely as app	olicable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13.	rice 12) ¹⁸ 19 19 19 19		Fuel Cost £/year 50.3042 0 0 59.53 9.89 Fable 12a](240)](241)](242)](247)](249)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year (11) x (13) x (15) x (19) (31) (19) (32)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. fuel priv 13.	rice 12) 8 19 19 19 19 19 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 = rding to - x 0.01 = x	Fuel Cost £/year 50.3042 0 0 59.53 9.89 Table 12a 35.02)(240))(241))(242))(242))(247))(249))(250)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12)	stems: F k (2 (2 (2 230g) separate (2	uel Wh/year (11) x (13) x (15) x (19) (31) (31) (32)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel priv 13.	rice 12) 8 19 19 19 19 19 19	$\begin{array}{l} \times \ 0.01 = \\ \times \ 0.01 = \\ \times \ 0.01 = \\ \times \ 0.01 = \\ \times \ 0.01 = \\ \end{array}$	Fuel Cost £/year 50.3042 0 0 59.53 9.89 Fable 12a 35.02 120)(240))(241))(242))(247))(249))(250))(251)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) ely as app 32)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel prio 13.	rice 12) ¹⁸ 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline c \ 0.01 = \\ \hline c \ 0.01 = \\ \end{array}$	Fuel Cost £/year 50.3042 0 0 59.53 9.89 Table 12a 35.02 120)(240))(241))(242))(247))(249))(250)](250)](251)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 111) x 113) x 115) x 119) 131) ely as app 132) eded 250)(254)	olicable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel priv 13.	rice 12) 8 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 50.3042 0 0 0 59.53 9.89 Fable 12a 35.02 120)(240) (241) (242) (247) (249) (250) (250) (251)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charge Appendix Q items: repeat Total energy cost 11a. SAP rating - individ	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a dual heating sy	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 111) x 113) x 115) x 119) 131) ely as app 132) eded 250)(254)	olicable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	rice 12) 8 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline c \ 0.01 = \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 50.3042 0 0 59.53 9.89 Fable 12a 35.02 120](240)](241)](242)](247)](249)](250)](250)](255)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tal	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a dual heating sy ble 12)	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 111) x 113) x 115) x 119) 131) ely as app 132) eded 250)(254)	olicable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. fuel pri 13.	rice 12) 8 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline c \ 0.01 = \\ c \ 0.01 = \end{array}$	Fuel Cost £/year 50.3042 0 0 0 9.89 Table 12a 35.02 120 274.75 0.42](240)](241)](242)](247)](247)](250)](250)](255)](255)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tall Energy cost factor (ECF)	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a dual heating sy ble 12)	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year (11) x (13) x (15) x (19) (31) ely as app (32) eded (250)(254) · [(4) + 45.0]	olicable a	nd apply	Fuel P (Table 3.4 0 13. 13. 13. 13. 13.	rice 12) 8 19 19 20 19 19 20 20 20 20 20 20 20 20 20 20 20 20 20	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 50.3042 0 0 59.53 9.89 Table 12a 35.02 120 274.75 0.42 0.42 1.14](240)](241)](242)](247)](249)](250)](250)](255)](255)](256)](257)
10a. Fuel costs - individ Space heating - main sys Space heating - main sys Space heating - main sys Space heating - seconda Water heating cost (othe Pumps, fans and electric (if off-peak tariff, list each Energy for lighting Additional standing charg Appendix Q items: repeat Total energy cost 11a. SAP rating - individ Energy cost deflator (Tall Energy cost factor (ECF) SAP rating (Section 12)	stem 1 stem 2 ary er fuel) c keep-hot h of (230a) to (ges (Table 12) at lines (253) a dual heating sy ble 12))	stems: F k (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) ely as app eded 250)(254) · [(4) + 45.0])) = =	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel priv 13.	rice 12) 8 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ \hline x \ 0.01 = \\ \hline \text{rding to } \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 50.3042 0 0 0 59.53 9.89 Table 12a 35.02 120 274.75 0.42 1.14 84.08](240)](241)](242)](247)](249)](250)](250)](251)](255)](256)](257)](258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	312.23 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	369.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =		681.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	137.81 (268)
Total CO2, kg/year	sum	of (265)(271) =	858.48 (272)
CO2 emissions per m ²	(272) ÷ (4) =	15.3 (273)
EI rating (section 14)			89 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	1763.54 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2087.03 (264)
Space and water heating	(261) + (262) + (263) + (264) =		3850.57 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	815.18 (268)

sum of (265)...(271) =

(272) ÷ (4) =

Primary energy kWh/m²/year

'Total Primary Energy

4896

87.27

(272)

(273)

User Details:		
Assessor Name:Stroma Number:Software Name:Stroma FSAP 2012Software Version:Version	n: 1.0.0.28	
Property Address: 1 Bed - Flat Enhanced		
Address :		
1. Overall dwelling dimensions:		
Area(m ²) Av. Height(m)	Volume(m ³)	
$56.1 (1a) \times 2.5 (2a) = [$	140.25	(38)
$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix} = $		1
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	140.25	(5)
2. Ventilation rate:	<u> </u>	
main secondary other total heating heating	m ³ per hour	
Number of chimneys $0 + 0 + 0 = 0 \times 40 =$	0	(6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0	(6b)
Number of intermittent fans 2 x 10 =	20	(7a)
Number of passive vents 0 × 10 =	0	(7b)
Number of flueless gas fires	0	(7c)
Air cha	inges per hou	r
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20 \div (5) =$	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)		-
Number of storeys in the dwelling (ns)	0	(9)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(10)
if both types of wall are present, use the value corresponding to the greater wall area (after]` ′
deducting areas of openings); if equal user 0.35		1
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
I no draught lobby, enter 0.05, else enter 0	0	(13)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	0	(14)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$	0.34	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		1
Number of sides sheltered	2	(19)
Shelter factor $(20) = 1 - [0.075 \times (19)] =$	0.85	(20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.29	(21)
Infiltration rate modified for monthly wind speed		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Monthly average wind speed from Table 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 Factor (22a)m = (22)m \div 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		

Adjust	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se				-			(00-)
li me	echanica		using App	andix N (2	(23a) – (23a) × Emv (e	auation ((15)) other	wise (23h) - (23a)			0	(23a)
If bal	ancod with				.50) – (256	or in uso f	actor (from	T_{2}	wise (250)) – (238)			0	(230)
) =			(00 s)	0	(23c)
a) If	balance		anical ve					HR) (24a	m = (22)	2b)m + (2	23b) × ['	1 - (23c)	÷ 100] I	(245)
(24a)m=						0	0) (00			0		(240)
D) IT	balance		anical ve	entilation		neat rec		VIV) (24b)m = (22	2b)m + (2	230)		1	(246)
(240)m=		0			0				0	0	0	0		(240)
C) If	whole h if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), t	tilation d	or positiv c) = (23b); otherv	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural if (22b)n	ventilation $= 1.$ the	on or wh en (24d)	ole hous m = (22)	se positiv o)m othe	ve input [.] erwise (2	ventilatio 4d)m =	on from I 0.5 + [(2	oft 2b)m² x	0.51				
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	, 0.54	0.54	, 0.54	0.55	0.55	0.56		(24d)
Effe	ctive air	change	rate - er	ı hter (24a) or (24t) or (24	L c) or (24	d) in boy	(25)		ļ		1	
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
0.11														
		s and ne				Not Ar	00					k volu		
ELEN		area	ss (m²)	r	95 1 ²	A,r	ea n²	W/m2	K	(W/I	K)	kJ/m ² ·l	K	kJ/K
Doors						2	x	1] = [2			_	(26)
Windo	ws					2.88	x1	/[1/(1.2)+	0.04] =	3.3	F		_	(27)
Floor						56.1		0.14	Ţ_	7.854	Fir			(28)
Walls		50)	10.6	4	39.36		0.18		7.08	57		╡ ┣	(29)
Total a	area of e	lements	, m²			106.1			L		L			(31)
Party v	wall					15	×	0		0				(32)
Party of	ceiling					56.1					i			(32b)
* for win	dows and le the area	roof winde as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	lue calcul titions	ated using	formula 1,	/[(1/U-valu	e)+0.04] a	L as given in	paragraph	 1 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				26.83	3 (33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8741.	.1 (34)
Therm	al mass	parame	eter (TMI	- = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						5.3	(36)
if details	s of therma	al bridging	are not kr	10wn (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			32.14	4 (37)
Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	26.33	26.21	26.08	25.52	25.41	24.91	24.91	24.82	25.1	25.41	25.63	25.85]	(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	58.47	58.34	58.22	57.65	57.55	57.05	57.05	56.96	57.24	57.55	57.76	57.99		
									/	Average =	Sum(39)1	12 /12=	57.65	5 (39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.04	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.03		
		1			1		1	ļ	·	Average =	Sum(40)1	.12 /12=	1.03	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)						-				
	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)
L														
4. Wa	ter heat	ting enei	gy requ	irement:								kWh/ye	ear:	
Assum	ed occu	ipancy, l	N								1.8	87		(42)
if TF. if TF.	A > 13.9 A £ 13.9	9, N = 1 9, N = 1	+ 1.76 x	: [1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ΓFA -13.	.9)			
Annual	averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	3.6		(43)
Reduce a	the annua that 125	al average litres per j	hot water person per	usage by a r day (all w	5% if the d ater use, l	welling is hot and co	designed i Id)	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
L Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	86.46	83.32	80.17	77.03	73.88	70.74	70.74	73.88	77.03	80.17	83.32	86.46		
` ´ I									-	L Fotal = Su	m(44) ₁₁₂ =		943.21	(44)
Energy c	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D) 7 Tm / 3600) kWh/mon	oth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	128.22	112.14	115.72	100.89	96.8	83.53	77.41	88.83	89.89	104.75	114.35	124.17		
lf instant	aneous w	vater heatii	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Fotal = Su	m(45) ₁₁₂ =		1236.69	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:						<u> </u>						
Storage	e volum	e (litres)	includir	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel	(C		(47)
If comm	nunity h	eating a	nd no ta	ank in dw	velling, e	nter 110	litres in	(47)						
Otherw	vise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Tempe	rature f	actor fro	m Table	2b							()		(49)
Energy	lost fro	m water	storage	e, kWh/ye	ear			(48) x (49)) =		()		(50)
b) If m	anufact	urer's de	eclared of	cylinder l	oss fact	or is not	known:							
Hot wa	ter stora	age loss	factor fr	rom Tabl	e 2 (kW	h/litre/da	ay)				(0		(51)
If comn	nunity r	from To	ee secu	on 4.3								-	I	(50)
Tempe	rature f	actor fro	n Tahla	2h))		(52)
- Cinpo								(47) (54)		50)		5		(00)
Energy	(FO) or (m water	storage	e, KVVN/ye	ear			(47) X (51)) x (52) x (53) =	(2		(54)
	(50) 01 ((54) III (5) 	(((50))			()		(55)
vvater	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	n			I	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contains	s dedicate	d solar sto	orage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary	y circuit	loss (ar	inual) fro	om Table	e 3						(0		(58)
Primary	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moc	lified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	108.99	95.32	98.36	85.75	82.28	71	65.8	75.5	76.4	89.04	97.19	105.55		(62)
Solar DH	HW input of	calculated	using App	endix G or	r Appendix	H (negativ	e quantity	r) (enter '0	' if no sola	r contributi	on to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies,	see Ap	pendix C	<u>3)</u>					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	108.99	95.32	98.36	85.75	82.28	71	65.8	75.5	76.4	89.04	97.19	105.55		
								Outp	out from wa	ater heatei	r (annual)	12	1051.19	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	27.25	23.83	24.59	21.44	20.57	17.75	16.45	18.88	19.1	22.26	24.3	26.39		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	Table 5	5 and 5a):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48		(66)
Lightin	g gains	(calcula	ted in A	opendix	L, equati	ion L9 or	[.] L9a), a	lso see	Table 5					
(67)m=	15.04	13.35	10.86	8.22	6.15	5.19	5.61	7.29	9.78	12.42	14.5	15.45		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L ²	13 or L1:	3a), alsc	see Ta	ble 5				
(68)m=	163.02	164.71	160.44	151.37	139.91	129.15	121.95	120.26	124.53	133.6	145.06	155.82		(68)
Cookin	g gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35	32.35		(69)
Pumps	and fai	ns gains	(Table (5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.a. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-74.78	-74.78	-74.78	-74.78	-74.78	, -74.78	-74.78	-74.78	-74.78	-74.78	-74.78	-74.78		(71)
Water	heating	u aains (T	able 5)											
(72)m=	36.62	35.46	33.05	29.78	27.65	24.65	22.11	25.37	26.53	29.92	33.75	35.47		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	- (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	265.71	264.56	255.4	240.41	224.75	210.03	200.71	203.96	211.88	226.98	244.34	257.78		(73)
6. Sol	ar gains	6:												
Solar g	ains are o	calculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicab	le orientat	ion.		
Orienta	ation: A	Access F	actor	Area		Flu	х		g_		FF		Gains	
	٦	Table 6d		m²		Tab	ole 6a	Т	able 6b	Ta	able 6c		(W)	
Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	71.5	139.87	230.34	335.94	411.7	421.45	401.24	344.66	267.9	165.96	89.15	58.8		(83)
Total g	ains – i	nternal a	and solar	r (84)m =	= (73)m -	+ (83)m	, watts							
(84)m=	337.21	404.43	485.74	576.35	636.46	631.49	601.95	548.62	479.77	392.95	333.49	316.58		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	eating p	periods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
Stroma I	Jan -SAP 201	Feb 2 Version:	Mar	Apr (SAP 9.91)	May	Jun w.stroma	Jul .com	Aug	Sep	Oct	Nov	Dec	Page 4	of 6

(86)m=	1	0.99	0.98	0.91	0.76	0.57	0.42	0.47	0.75	0.96	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ns 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.91	20.08	20.37	20.71	20.92	20.99	21	21	20.94	20.62	20.19	19.87		(87)
Tomp	oroturo	l during h		L L	root of	dwalling	l from To							
(88)m-		20.05			20.06				20.07	20.06	20.06	20.06		(88)
(00)11-	20.00	20.00	20.00	20.00	20.00	20.01	20.07	20.07	20.07	20.00	20.00	20.00		(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						(00)
(89)m=	1	0.99	0.97	0.89	0.71	0.49	0.33	0.38	0.68	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	19.05	19.23	19.51	19.84	20.01	20.06	20.07	20.07	20.04	19.77	19.34	19.02		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.5	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.48	19.65	19.94	20.27	20.46	20.53	20.53	20.53	, 20.49	20.2	19.77	19.45		(92)
Apply	adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.48	19.65	19.94	20.27	20.46	20.53	20.53	20.53	20.49	20.2	19.77	19.45		(93)
8. Spa	ace hea	ting requ	uirement	t						-				
Set Ti	i to the i	mean int	ernal te	mperatu	re obtain	ed at st	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	n:										(0.4)
(94)m=	1	0.99	0.97	0.9	0.73	0.53	0.37	0.43	0.71	0.95	0.99	1		(94)
Usetu	il gains,	hmGm	, VV = (9)	4)m x (8	4)m	000.44		004.45	0.40 54	070.40	004.00	045.05		(05)
(95)m=	336.13	400.91	471.46	515.95	467.09	333.11	223.81	234.15	342.51	373.46	331.06	315.85		(95)
Montr	niy aver	age exte	rnai tem				16.6	16.4	14.1	10.6	74	4.2		(06)
	4.3	4.9	0.0			14.0	[(20)m	10.4	(06)m	10.0	7.1	4.2		(30)
	887.46					LIII , VV =	= [(39) m]	x [(93)m	- (90)III 365.8	552 18	731.82	884 28		(97)
Space	boatin		amont fo		1004.02	Mb/mon	$\frac{224.4}{1000}$	233.4	m = (95)	m v (A)	1)m	004.20		(01)
(98)m=	410 19	309.03	231 41	100.56	27.7		11 = 0.02		0)11] X (4	288.55	422 91		
(00)	110.10	000.00	201111	100.00		Ů	Ů	Tota		(k)//b///oar	r = Sum(9)	8)	1023 31	(98)
•								1012		(KWIII)yeai) – Oum(3	0/15,912 -	1525.51	
Space	e heatin	g require	ement in	n KVVh/m	/year								34.28	(99)
8c. Sp	bace co	oling rec	quiremer	nt										
Calcu	lated fo	<u>r June, J</u>	July and	August.	See Tal	<u>ole 10b</u>			-			_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate	e ∟m (ca I				nai tem	perature	and exte	ernal ten	nperatur		able 10)		(100)
(100)m=				0	0	536.28	422.18	432.88	0	0	0	0		(100)
(101)m				0		0.06	0.08	0.07	0	0	0	0		(101)
				$\frac{1}{(100)m}$	(101)m	0.90	0.98	0.97	0	0	0	0		(101)
(102)m-	0		Valls) = 0			516.44	415 38	421 76	0	0	0	0		(102)
Gaine	s (solar /	l <u>č</u> nains ca	l Iculated	for appli	l cable w	ather re		e Table	10)	v		Ň		()
(103)m=						808.47	772.61	711.41	0	0	0	0		(103)
Snace	e coolin	L a require	ement fo	r month	whole c	welling	continu	DUS (kM	/h) = ∩ ∩	 24 x [/1/	<u> </u>	102)m 1	(41)m	(/
set (1	04)m to	zero if ((104)m <	< 3 × (98)m	y,	Jonand		, – 0.0	[[. [(· (· · /···	
(104)m=	0	0	0	0	0	210.26	265.78	215.5	0	0	0	0		
		•	•	-	•	•		•	Total	= Sum(104)	=	691.54	(104)
												I		

Cooled	fraction	า							f C =	cooled	area ÷ (4	4) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
-								-	Tota	= Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	52.57	66.44	53.88	0	0	0	0		
-									Total	= Sum(107)	=	172.89	(107)
Space	cooling	requirer	ment in k	(Wh/m²/y	/ear				(107)	÷ (4) =			3.08	(108)
8f. Fab	ric Enei	rgy Effici	iency (ca	alculated	l only un	der spec	cial conc	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		37.37	(109)



		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.0.28	
		Property A	Address:	2 Beds	- Flat El	nhanced			
Address :	nciono:								
T. Overall dwelling dime		Aros	a(m ²)			iaht(m)		Volumo(m ³)	
Ground floor			72.6	(1a) x	2	2.6	(2a) =	188.76	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 7	72.6	(4)]]
Note: Note:		· /) (3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	188 76	(5)
2. Ventilation rate:	main seco	ondary	other		total			m ³ per hour	
Number of chimneys	heating heat	ting+		1 = [x 4	10 =		
Number of chimneys			0		0		- vi	0](6a)
Number of open flues	0 +	0 +	0		0	X	20 =	0	(6b)
Number of intermittent fai	ns			L	3	x ′	10 =	30	(7a)
Number of passive vents					0	x	10 =	0	(7b)
Number of flueless gas fi	res				0	X 4	40 =	0	(7c)
							Air ch	anges per hou	ır
Infiltration due to chimney	(s. flues and fans = $(6a)+($	(6b)+(7a)+(7b)+(7	7c) =	Г	30	<u> </u>	÷ (5) =	0.16](8)
If a pressurisation test has be	een carried out or is intended, p	proceed to (17), o	otherwise c	ontinue fro	om (9) to ((16)	. (0) –	0.10	
Number of storeys in th	ne dwelling (ns)							0	(9)
Additional infiltration						[(9)	1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber fran	me or 0.35 for	masonr	y constr	uction			0	(11)
If both types of wall are pr deducting areas of openin	esent, use the value correspon igs); if equal user 0.35	ding to the greate	er wall area	a (atter					
If suspended wooden f	loor, enter 0.2 (unsealed)) or 0.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter 0							0	(13)
Percentage of windows	and doors draught stripp	ped						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,	q50, expressed in cubic r	metres per ho	our per so	luare m	etre of e	envelope	area	4	(17)
If based on air permeabili	Ity value, then $(18) = [(17) \div$	- 20j+(8), otherwi	se (18) = (1	b)	ia haina w	and		0.36	(18)
Number of sides sheltere	d	en done of a deg	giee all per	ineability i	s being us	seu		2] (19)
Shelter factor	-		(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ing shelter factor		(21) = (18)	x (20) =				0.31	(21)
Infiltration rate modified for	or monthly wind speed								1
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 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 Factor $(22a)m = (22a)m $	2)m ÷ 4								
(22a)m = 1.27 1.25	1.23 1.1 1.08 0	0.95 0.95	0.92	1	1.08	1.12	1.18		
			I I			I	1		

Adjust	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m						
<u> </u>	0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36			
Calcula If ma	ate etter	ctive air	change	rate for t	he appli	cable ca	se								(220)
lf exh	aust air h	eat pump i	using App	endix N. (2	(23a) = (23a	a) x Fmv (e	equation (1	N5)), other	rwise (23b) = (23a)				0	(23a)
lf bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =) (200)				0	
a) If	halance	d mech:	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a) m = (22	2h)m + (23h) x [[,]	1 – (23c)	⊥ 1001	0	(230)
(24a)m=					0				0	0			- 100]		(24a)
b) If	balance	d mech:	anical ve	I	without	heat rec	covery (N	///) (24h	1 = (22)	2h)m + (;	23h)				
(24b)m=	0	0		0	0	0		0	0	0	0	0			(24b)
c) If	whole h	use ex	ract ver	ntilation of	r positiv	i ve input v	ventilatio	n from c	utside						
i	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22b	o) m + 0.	5 × (23b))				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft				-		
i	if (22b)n	n = 1, the	en (24d) I	m = (22l	o)m othe I	erwise (2 I	24d)m =	0.5 + [(2	2b)m² x I	0.5]		1	1		
(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56			(240)
Effe	ctive air	change	rate - er	nter (24a) or (24t	b) or (24)	c) or (24	d) in boy	(25)	0.55	0.50	0.50	I		(25)
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56			(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramet	er:										
ELEN		Gros	(m^2)	Openin	gs	Net Ar	rea	U-valu W/m2	ue K	A X U	K)	k-value	e K	A	Xk /K
Doors		area	(111)			2		1		2			`		(26)
Windo	ws Type	e 1				2.88		L /[1/(1.2)+	0.041 =	33	Ħ				(27)
Windo	ws Type	2				3.96		/[1/(1.2)+	0.041 =	4.53	Ħ				(27)
Walls		80		11.7	2	68.29		0.18		12 20	H,				(29)
Roof		72			<u> </u>	72.6		0.10		7.26	╡╏		\exists		(20)
Total a	irea of e	lements		0		152.6		0.1	[7.20	L				(31)
Party f	loor		,			70.6	, 				Г		-		$\Box_{(222)}$
* for win	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	 lated usinc	a formula 1	/[(1/U-valu	e)+0.041 a	L as aiven in	paragraph	 132		(52a)
** inclua	le the area	as on both	sides of ir	nternal wal	ls and par	titions		,		-,,-		p =			
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				32	2.68	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	15	804.6	(34)
Therm	al mass	parame	ter (TM	⁻ = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		2	250	(35)
For desi	gn assess	sments wh	ere the de	etails of the	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f			
Therm	al brida	es : S (L	x Y) cal	culated i	usina Ar	pendix l	ĸ						7	<u> </u>	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)							,	.00	
Total fa	abric he	at loss							(33) +	(36) =			4	0.31	(37)
Ventila	tion hea	at loss ca	alculated	d monthly	y	-	-		(38)m	= 0.33 × (25)m x (5))			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	35.86	35.67	35.49	34.65	34.5	33.76	33.76	33.62	34.04	34.5	34.81	35.15			(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m		_		
(39)m=	76.17	75.98	75.8	74.96	74.81	74.07	74.07	73.93	74.35	74.81	75.12	75.46			_
									/	Average =	Sum(39)1	12 /12=	7	4.96	(39)

Heat lo	ss para	imeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.05	1.05	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.04		
Numbe	er of day	, /s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 /12=	1.03	(40)
[Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
`´ l		I	I	I		I	I						l	
4. Wa	ter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (⁻	TFA -13.	2. .9)	31		(42)
Annual Reduce	averag the annua that 125	je hot wa al average litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.69]	(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					1	
(44)m=	103.06	99.31	95.56	91.82	88.07	84.32	84.32	88.07	91.82	95.56	99.31	103.06		
								_	-	Total = Su	m(44) ₁₁₂ =		1124.28	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	_	
(45)m=	152.83	133.67	137.93	120.25	115.39	99.57	92.27	105.88	107.14	124.86	136.3	148.01		_
lf instant	aneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46,) to (61)	Total = Su	m(45) ₁₁₂ =		1474.11	(45)
(46)m=	22.92	20.05	20.69	18.04	17.31	14.94	13.84	15.88	16.07	18.73	20.44	22.2		(46)
Water	storage	loss:												
Storage	e volum	e (litres)	includir	ng any so	olar or N	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	nunity h	neating a	ind no ta	ınk in dw	velling, e	nter 110	litres in	(47)						
Otherw	vise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	storage	iurer's di	aclared I	oss facti	or is kno	wn (k\//h	n/dav).					0	1	(48)
Tomno	raturo f	actor fro	m Tabla	2h			i/day).					0		(40)
Enorgy	loct fro	m wata			oor			$(48) \times (40)$	\ _			0]	(49)
b) If m	anufact	urer's de	eclared of	cylinder l	oss fact	or is not	known:	(40) × (49)	/ -			J		(50)
Hot wa	ter stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)				(0		(51)
If comm	nunity h	neating s	ee secti	on 4.3										
Volume	e factor	from Ta	ble 2a									0		(52)
Tempe	rature f	actor fro	m Table	2b							(0		(53)
Energy	lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	5)		_							0		(55)
Water	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primary	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moc	lified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month (61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	23.41	21.12	23.32	22.49	23.19	22.37	23.08	23.15	22.44	23.26	22.6	23.39		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	176.24	154.79	161.25	142.75	138.57	121.94	115.35	129.03	129.58	148.13	158.9	171.4		(62)
Solar DI	IW input	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	r) (enter '0'	if no sola	r contributi	ion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or V	VWHRS	applies,	see Ap	pendix G	G)	-		-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	176.24	154.79	161.25	142.75	138.57	121.94	115.35	129.03	129.58	148.13	158.9	171.4		_
								Outp	out from w	ater heate	r (annual)₁	12	1747.93	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5´[0.85	× (45)m	+ (61)m) + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	56.67	49.73	51.69	45.61	44.16	38.7	36.45	40.99	41.23	47.33	50.97	55.06		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	welling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal g	ains (see	e Table 5	and 5a):									
Metab	olic gaiı	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46	138.46		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	_, equati	on L9 or	⁻ L9a), a	lso see	Table 5					
(67)m=	48.22	42.82	34.83	26.37	19.71	16.64	17.98	23.37	31.37	3 9.83	46.49	49.56		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, equ	uation L ²	13 or L1:	3a), also	see Ta	ble 5				
(68)m=	303.42	306.57	298.63	281.74	260.42	240.38	226.99	223.84	231.78	248.67	269.99	290.03		(68)
Cookir	ng gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15	51.15		(69)
Pumps	and fa	ns gains	(Table 5	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	se.a. e	vaporatic	n (nega	tive valu	es) (Tab	le 5)				I	I			
(71)m=	-92.3	-92.3	-92.3	-92.3	-92.3	, -92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3		(71)
Water	heating	u aains (1	able 5)											
(72)m=	76.17	74	69.48	63.34	59.36	53.75	48.99	55.1	57.27	63.62	70.79	74.01		(72)
Total i	nterna	l gains =	I			(66)	m + (67)m	+ (68)m +	- (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	528.11	523.69	503.24	471.76	439.79	411.08	394.27	402.61	420.72	452.42	487.57	513.9		(73)
6. So	lar gain	s:												
Solar g	ains are	calculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicat	le orientat	ion.		
Orienta	ation:	Access F	actor	Area		Flu	х		g_		FF		Gains	
		Table 6d		m²		Tab	ole 6a	Т	able 6b	Ta	able 6c		(W)	
Solar g	gains in	watts, ca	alculated	for eac	n month			(83)m = S	um(74)m .	(82)m				
(83)m=	80.44	157.35	259.13	377.93	463.17	474.13	451.39	387.74	301.38	186.71	100.29	66.15		(83)
Total g	jains – i	internal a	and solar	⁻ (84)m =	- (73)m -	⊦ (83)m	, watts							
(84)m=	608.54	681.04	762.38	849.69	902.96	885.21	845.66	790.36	722.1	639.13	587.87	580.04		(84)
7. Me	an inte	rnal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							-
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Dogo 4	of 7

(86)m=	0.99	0.98	0.95	0.87	0.72	0.53	0.38	0.43	0.68	0.92	0.98	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ns 3 to 7	7 in Table	e 9c)					
(87)m=	20.12	20.27	20.51	20.78	20.94	20.99	21	21	20.97	20.75	20.38	20.09		(87)
Temn	erature	during h	eating r	eriods ir	n rest of	dwelling	from Ta	hle 9 Tl	և h2 (°Ը)					
(88)m=	20.04	20.04	20.05	20.06	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05		(88)
Litilioc	tion for	tor for a	oine for	root of d	L Wolling	h2 m (oc	L Do Toblo							
(89)m=	0.99	0.98	0.94	0.84		0 45		9a)	0.6	0.89	0.97	0.99		(89)
(00)	0.00	0.00					0.0	0.01		0.00	0.07	0.00		(/
Mean	interna	temper	ature in	the rest	of dwelli	ng 12 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)	40.00	40.05		(00)
(90)m=	18.89	19.11	19.45	19.82	20	20.06	20.07	20.07	20.04	19.78	19.28	18.85	0.01	
									1		y alea ÷ (4	+) =	0.31	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2		· · · · · ·			
(92)m=	19.27	19.47	19.78	20.12	20.3	20.35	20.36	20.36	20.33	20.08	19.62	19.24		(92)
Apply	adjustn	nent to t	he mear	n interna	l temper	ature fro	m Table	e 4e, whe	ere appro	opriate				
(93)m=	19.27	19.47	19.78	20.12	20.3	20.35	20.36	20.36	20.33	20.08	19.62	19.24		(93)
8. Spa	ace hea	ting requ	uirement	1		_			_	/				
Set Ti	to the r	nean int	ernal ter	mperatui using Ta	re obtair able 9a	ied at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	lan	Feb	Mar		May	lun	lul -	Aug	Sen	Oct	Nov	Dec	-	
Utilisa	ation fac	tor for a	ains, hm			Juli		<u>, ag</u>	000	001	1107	000		
(94)m=	0.98	0.97	0.94	0.84	0.68	0.48	0.33	0.37	0.62	0.89	0.97	0.99		(94)
Usefu	l gains,	hmGm .	W = (9	4)m x (84	4)m									
(95)m=	598.87	661.36	713.28	714.93	610.76	422.16	277.97	291.88	448.06	566.59	570.23	572.62		(95)
Month	nly avera	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)
Heat I	oss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1140.47	1107.01	1006.64	840.98	643.03	426.04	278.34	292.64	463.2	709.52	940.86	1134.58		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	402.95	299.48	218.26	90.76	24.01	0	0	0	0	106.34	266.85	418.1		
								Tota	l per year	(kWh/year) = Sum(98	8)15,912 =	1826.75	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								25.16	(99)
9a. En	erav rec	luiremer	nts – Ind	ividual h	eating s	vstems i	ncludina	i micro-C	CHP)					
Space	e heatir	ng:				,			/					
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	encv of r	nain spa	ace heat	ina svste	em 1								89.9	(206)
Efficie	ancy of a	seconda	rv/suppl	ementar	v heatin	n system	<u>ו</u> %					l		(208)
Linoic										Q ((200)
S = = = =	Jan	Feb	Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	ear
Space	+ neatin						0	0	0	106.24	266 95	110 1		
(0.1.1)	402.90	233.40	210.20		4.00		0	0	U	100.34	200.00	410.1		
(211)m	1 = {[(98)m x (20	4)] + (21	10)m } x	$100 \div (2)$	06)				140.00	200.00	405.07		(211)
	448.22	333.12	242.78	100.95	20./1	U	U			118.29	∠96.83	405.07		
								rola		$a_{j} = \operatorname{Sum}(2)$	····/ _{15,1012}	-	2031.98	(211)

Space heating fuel (secondary), kWh/month

$= \{[(98)m \times (201)] + (214)m \times (201)\}$	4) m } x 100 ÷	(208)				-		-	_	
(215)m= 0 0	0 0	0 0	0	0	0	0	0	0		_
				Tota	al (kWh/yea	ar) =Sum(2	215) _{15,10} 1	2	0	(215)
Water heating	or (oploylated a	abaya)								
176.24 154.79	161.25 142.75	138.57 121.94	115.35	129.03	129.58	148.13	158.9	171.4]	
Efficiency of water heat	er	II							87.3	(216)
(217)m= 89.09 89	88.78 88.29	87.67 87.3	87.3	87.3	87.3	88.37	88.91	89.13		(217)
Fuel for water heating, k (219)m = (64)m x 100	⟨Wh/month ÷ (217)m								-	
(219)m= 197.82 173.93	181.64 161.67	158.05 139.68	132.13	147.8	148.43	167.62	178.72	192.31		_
				Tota	al = Sum(2)	19a) ₁₁₂ =			1979.8	(219)
Annual totals	h main avetam	1				k	Wh/yea	r	kWh/year	7
Water heating fuel used	i, main system								1979.8	_ T
Electricity for pumps fai	ns and electric	keen-hot								
central heating pump:								30	ו	(230c)
boiler with a fan-assist	ed flue							45		(230e)
Total electricity for the a	above, kWh/ve	ar		sum	of (230a).	(230g) =			75	(231)
Electricity for lighting	, , , , , , , , , , , , , , , , ,							_	340.6	$\frac{1}{(232)}$
g.tanig										<u> </u>
10a Fuel costs - indivi	dual heating s	vstems								
10a. Fuel costs - indivi	dual heating s	ystems: Fi k\	uel Nh/year			Fuel P (Table	rice 12)		Fuel Cost £/year	
10a. Fuel costs - indivi Space heating - main sy	dual heating s	ystems: Fi k\ (2	u el Wh/year 11) x			Fuel P (Table	rice 12)	x 0.01 =	Fuel Cost £/year	(240)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy	dual heating s ystem 1 ystem 2	ystems: F(k\ (2 (2	uel Wh/year 11) x 13) x			Fuel P (Table	12)	x 0.01 = x 0.01 =	Fuel Cost £/year 70.713](240)](241)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second	dual heating s ystem 1 ystem 2 lary	ystems: F(k\ (2 (2 (2) (2)	uel Wh/year 11) x 13) x 15) x			Fuel P (Table 3.4	rice 12) ¹⁸	x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 70.713 0](240)](241)](242)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (other	dual heating s ystem 1 ystem 2 lary er fuel)	ystems: F(k\ (2 (2 (2 (2) (2)	uel Wh/year 11) x 13) x 15) x 19)			Fuel P (Table 3.4 0 13. 3.4	rice 12) ¹⁸ 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 70.713 0 0 68.9	(240) (241) (242) (247)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot	yStems: F((2) (2) (2) (2) (2) (2) (2)	uel Wh/year 11) x 13) x 15) x 19) 31)			Fuel P (Table 3.4 0 13. 3.4 13.	Price 12) 18 19 19 19	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	Fuel Cost £/year 70.713 0 0 68.9 9.89	(240) (241) (242) (247) (249)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to	ystems: Fr (2) (2) (2) (2) (2) (2) (2) (2) (2) (2)	uel Wh/year 11) x 13) x 15) x 19) 31) Iy as app	licable a	Ind apply	Fuel P (Table 3.4 0 13. 3.4 13.	rice 12) ¹⁸ 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding to \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a	(240) (241) (242) (247) (249)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to	ystems: Fr kN (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) 1y as app 32)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel prin 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93](240)](241)](242)](247)](249)](250)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing chai	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12	ystems: Fr kl (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) Iy as app 32)	licable a	Ind apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	rice 12) ¹⁸ 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120	(240) (241) (242) (247) (249) (250) (250)
Space heating - main sy Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repe	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a	(230g) separate (230g) separate (230g) separate (230g) separate (230g)	uel Wh/year 11) x 13) x 15) x 19) 31) Iy as app 32)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. (fuel pri 13.	rice 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120](240)](241)](242)](247)](249)](250)](251)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing chai Appendix Q items: repe Total energy cost	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a	(230g) separate (230g) separate (245)(247) + (2	uel Wh/year 11) x 13) x 15) x 19) 31) Iy as app 32) eded 250)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 0 68.9 9.89 Table 12a 44.93 120](240)](241)](242)](247)](249)](250)](251)](255)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repe Total energy cost 11a. SAP rating - indiv	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a idual heating s	vstems: Fi kl (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) 1y as app 32) eded 250)(254)	licable a	nd apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel pri 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120 314.43](240)](241)](242)](247)](249)](250)](251)](255)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing chai Appendix Q items: repe Total energy cost 11a. SAP rating - indiv Energy cost deflator (Ta	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a idual heating s able 12)	vstems: Fi kl (2 (2 (2 (2 (2 (2 (2 (2 (2 (2	uel Wh/year 11) x 13) x 15) x 19) 31) 1y as app 32) eded 250)(254)	licable a	Ind apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel priv 13.	Price 12) 18 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120 314.43 0.42](240)](241)](242)](247)](249)](250)](251)](255)](255)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing char Appendix Q items: repe Total energy cost 11a. SAP rating - indiv Energy cost deflator (Ta Energy cost factor (ECF	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a idual heating s able 12)	(230g) separate (230g) separate (245)(247) + (2	uel Wh/year 11) x 13) x 15) x 19) 31) 1y as app 32) eded 250)(254) [(4) + 45.0]	licable a	Ind apply	Fuel P (Table 3.4 0 13. 3.4 13. 7 fuel prin 13.	Price 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120 314.43 0.42 1.12](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)
10a. Fuel costs - indivi Space heating - main sy Space heating - main sy Space heating - second Water heating cost (othe Pumps, fans and electri (if off-peak tariff, list eac Energy for lighting Additional standing chai Appendix Q items: repe Total energy cost 11a. SAP rating - indiv Energy cost deflator (Ta Energy cost factor (ECF SAP rating (Section 12)	dual heating s ystem 1 ystem 2 lary er fuel) c keep-hot ch of (230a) to rges (Table 12 at lines (253) a idual heating s able 12) -) 2)	(230g) separate (230g) separate (230g) separate (230g) separate (245)(247) + (2 (245)(247) + (2 (255) x (256)] ÷	uel Wh/year 11) x 13) x 15) x 19) 31) 1y as app 32) eded 250)(254) [(4) + 45.0]	licable a	Ind apply	Fuel P (Table 3.4 0 13. 13. 13. 13.	rice 12) 18 19 19 19 19 19 19 19	$\begin{array}{l} x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ x \ 0.01 = \\ rding \ to \\ x \ 0.01 = \end{array}$	Fuel Cost £/year 70.713 0 0 68.9 9.89 Table 12a 44.93 120 314.43 0.42 1.12 84.33](240)](241)](242)](247)](249)](250)](251)](255)](255)](256)](257)](258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	438.91 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	427.64 (264)
Space and water heating	(261) + (262) + (263) + (264	l) =	866.55 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	176.77 (268)
Total CO2, kg/year		sum of (265)(271) =	1082.24 (272)
CO2 emissions per m ²		(272) ÷ (4) =	14.91 (273)
El rating (section 14)			88 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	2479.02 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2415.36 (264)
Space and water heating	(261) + (262) + (263) + (264	+) =	4894.38 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x		1045.65 (268)

sum of (265)...(271) =

(272) ÷ (4) =

'Total Primary Energy

Primary energy kWh/m²/year

6170.28

84.99

(272)

(273)

		Us	er Details:						
Assessor Name: Software Name:	Stroma FSAP 20	12	Stroma Softwa	a Num Ire Ver	ber: sion:		Versio	n: 1.0.0.28	
		Prope	erty Address:	2 Beds	- Flat Er	nhanced			
Address :									
1. Overall dwelling dime	ensions:								
			Area(m²)		Av. Hei	ight(m)	, ,	Volume(m ³))
Ground floor		L	72.6	(1a) x	2	2.6	(2a) =	188.76	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1	e)+(1n)	72.6	(4)					
Dwelling volume				(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	188.76	(5)
2. Ventilation rate:							L		
	main	secondary	other		total			m ³ per hou	r
Number of chimneys			• 0] = [0	x 4	40 =	0	(6a)
Number of open flues				」 <u>「</u>] = 「	0	x 2	20 =	0	
Number of intermittent fa		0	0		0	× ′	10 = [
Number of neopily yests					3			30	$\int_{(7k)}^{(7a)}$
Number of passive vents					0	^		0	(7b)
Number of flueless gas f	ires			L	0	X 4	40 = Air ch	0 anges per ho	(7c) ur
Infiltration due to chimne	ys, flues and fans = ((6a)+(6b)+(7a)+(7	7b)+(7c) =		30		÷ (5) =	0.16	(8)
If a pressurisation test has b	been carried out or is inten	ded, proceed to ((17), otherwise c	ontinue fro	om (9) to (16)	r	_	٦
Additional infiltration	ne dweiling (ns)					[(0)]	11×0.1 -	0	(9)
Structural infiltration: 0	25 for steel or timbe	r frame or 0.3	5 for masonr	v constr	uction	[(9)	· 1]XU. 1 =	0	
if both types of wall are p	resent, use the value corre	esponding to the	greater wall area	a (after			l	0	
deducting areas of openi	ngs); if equal user 0.35								_
If suspended wooden	floor, enter 0.2 (unsea	aled) or 0.1 (s	sealed), else	enter 0				0	(12)
If no draught lobby, en	iter 0.05, else enter 0						l	0	(13)
Percentage of window	s and doors draught s	stripped	0.25 - [0.2	$\mathbf{v}(14) \pm 1$	001 -			0	
			(8) + (10) -	× (14) ÷ 1	2) + (13) -	⊧ (15) –		0	(15)
	a50 expressed in cu	ihic metres ne	er hour per so		etre of e	nvelone	area	0	(10)
If based on air permeabi	lity value, then $(18) = [0]$	$(17) \div 20]+(8), ot$	herwise $(18) = (18)$	16)		nvelope		0.36	
Air permeability value applie	es if a pressurisation test h	as been done or	a degree air per	, meability i	is being us	sed	l	0.30	
Number of sides sheltere	ed			-	-			2	(19)
Shelter factor			(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.31	(21)
Infiltration rate modified f	or monthly wind spee	ed							
Jan Feb	Mar Apr May	/ Jun J	ul Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	beed from Table 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 Factor (22a)m = (2	2)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		

Adjust	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m						
	0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36			
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-							
II Me				ondix N (2	(26) - (22c)	\sim	auction (N		nuine (22h)	(<u>)</u>			()	(23a)
lf bol	aust all II				.50) = (258	a) x Filiv (e	octor (from	(3)), other	1 WISE (23D)) = (23a)			()	(23b)
) =			4 (00)	()	(23c)
a) If	balance		anical ve	entilation		at recove	ery (MVI	HR) (24a T	m = (22)	2b)m + (2	23b) × [1 – (23c)	÷100]		(24a)
(24a)m=					0	0	0			0		0			(24a)
b) If	balance	ed mecha	anical ve	entilation	without	heat rec	covery (N	VIV) (24b)m = (22	2b)m + (2	23b)		l		(0.4b)
(24b)m=		0	0	0	0	0	0	0	0	0	0	0			(240)
c) If	whole h if (22b)n	ouse ex n < 0.5 >	tract ver (23b), t	tilation of then (24)	or positiv c) = (23b); otherv	ventilatio wise (24	on from c c) = (22b	outside b) m + 0.	5 × (23b)		_		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural if (22b)n	ventilation = 1, th	on or wh en (24d)	ole hous m = (221	se positiv o)m othe	ve input erwise (2	ventilatio 4d)m =	on from I 0.5 + [(2	oft 2b)m² x	0.5]					
(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	b) or (24	c) or (24	d) in boy	(25)						
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56			(25)
2 40		a and he		noromot	or										_
		S and he				Not Ar	02	ll-vali		ΔΧΠ		k-value	<u>_</u>	ΔΧ	' k
ELEN		area	(m²)	r	93 1 ²	A,r	n²	W/m2	K	(W/I	<)	kJ/m ² ·ł	, (kJ/l	K
Doors						2	x	1] = [2			_		(26)
Windo	ws Type	e 1				2.88	x1.	/[1/(1.2)+	0.04] =	3.3	6				(27)
Windo	ws Type	e 2				3.96		/[1/(1.2)+	0.04] =	4.53					(27)
Walls		80)	11.7	2	68.28	3 X	0.18	=	12.29					(29)
Roof		72.	6	0		72.6	x	0.1	= [7.26					(30)
Total a	area of e	elements	, m²			152.6	6								(31)
Party f	loor					72.6					[(32a)
* for win ** incluc	dows and le the area	l roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	g formula 1,	/[(1/U-valu	e)+0.04] a	s given in	n paragraph	3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				32	.68	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	158	04.6	(34)
Therm	al mass	parame	ter (TM	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		25	50	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f			
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						7.	63	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)									_
Total f	abric he	at loss							(33) +	(36) =			40	.31	(37)
Ventila	ation hea	at loss ca	alculateo	d monthly	y I	1		1	(38)m	= 0.33 × (25)m x (5))	I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			10-1
(38)m=	35.86	35.67	35.49	34.65	34.5	33.76	33.76	33.62	34.04	34.5	34.81	35.15			(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m				
(39)m=	76.17	75.98	75.8	74.96	74.81	74.07	74.07	73.93	74.35	74.81	75.12	75.46			-
									/	Average =	Sum(39)1	12 /12=	74	.96	(39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.05	1.05	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.04		
Numbe	er of day	s in mor	nth (Tab	le 1a)					/	Average =	Sum(40)1	.12 /12=	1.03	(40)
[.lan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	ter heat	ting ener	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy, I 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (1	ГFA -13.	2. .9)	31		(42)
Annual Reduce a not more	averag the annua that 125	e hot wa al average litres per p	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.69		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	103.06	99.31	95.56	91.82	88.07	84.32	84.32	88.07	91.82	95.56	99.31	103.06		_
Energy c	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	Fotal = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1124.28	(44)
(45)m=	152.83	133.67	137.93	120.25	115.39	99.57	92.27	105.88	107.14	124.86	136.3	148.01		_
lf instant	aneous w	ater heatii	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46,) to (61)	Fotal = Su	m(45) ₁₁₂ =		1474.11	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water s	storage	loss:												
Storage	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	()		(47)
If comn	nunity h	eating a	ind no ta	ınk in dw	velling, e	nter 110	litres in	(47)						
Otherw	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	ieous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	storage	ioss: urer's de	eclared I	oss facti	or is kno	wn (k\//h	v(dav).					<u>,</u>	l	(48)
Tomno	ratura f	actor fro	m Tabla	2h			1/uuy).					<u> </u>		(40)
Energy	lost fro	m water	storage	20 k\//b/w	oor			(48) y (49)	_			<u>,</u>		(49)
b) If m	anufact	urer's de	eclared of	cylinder l	loss fact	or is not	known:	(40) × (40)	-			J		(50)
Hot wa	ter stora	age loss	factor fr	om Tabl	le 2 (kW	h/litre/da	ıy)				(0		(51)
If comn	nunity h	eating s	ee secti	on 4.3										
Volume	e factor	from Ta	ble 2a	0								0		(52)
Iempe	rature fa	actor fro	m I able	2b							(0		(53)
Energy	lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =	(0		(54)
Enter ((50) or ((54) in (5	5)								(0		(55)
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	n			L	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary	y circuit	loss (an	nual) fro	om Table	e 3						(0		(58)
Primary	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	lified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)		I	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for each	n month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	129.91	113.62	117.24	102.22	98.08	84.63	78.43	90	91.07	106.13	115.85	125.81		(62)
Solar DH	IW input o	calculated	using App	endix G o	r Appendix	H (negativ	e quantity	r) (enter '0	' if no sola	r contributi	on to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies,	see Ap	pendix C	<u>3)</u>					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	129.91	113.62	117.24	102.22	98.08	84.63	78.43	90	91.07	106.13	115.85	125.81		_
								Outp	out from wa	ater heatei	<mark>·(annual)</mark> ₁	12	1252.99	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5´[0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	32.48	28.4	29.31	25.55	24.52	21.16	19.61	22.5	22.77	26.53	28.96	31.45		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	welling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	Table 5	5 and 5a):									
Metabo	olic gain	s (Table	e 5), Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38	115.38		(66)
Lightin	g gains	(calcula	ted in A	opendix	L, equati	on L9 or	L9a), al	lso see	Table 5					
(67)m=	19.29	17.13	13.93	10.55	7.88	6.66	7.19	9.35	12.55	15.93	18.59	19.82		(67)
Appliar	nces ga	ins (calc	ulated ir	Append	dix L, equ	Jation L	13 or L13	3a), also	see Ta	ble 5				
(68)m=	203.29	205.4	200.08	188.77	174.48	161.05	152.08	149.98	155.29	166.61	180.89	194.32		(68)
Cookin	a dains	(calcula	ted in A	ppendix	L. equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54	34.54		(69)
Pumps	and fai	ns gains	(Table !	1										
(70)m=	0		0	0	0	0	0	0	0	0	0	0		(70)
losses		l	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3	-92.3		(71)
Water	heating	nains (T	able 5)											
(72)m=	43.65	42.27	39.4	35.49	32.96	29.39	26.35	30.24	31.62	35.66	40.23	42.27		(72)
Total i	nternal	nains –				(66)	m + (67)m	+ (68)m -	- (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	323.84	322.41	311.02	292.42	272.94	254.71	243.24	247.18	257.07	275.82	297.33	314.03		(73)
6. Sol	ar gains	S:		1										
Solar g	ains are o	alculated	using sola	r flux from	Table 6a a	and associ	ated equa	tions to co	nvert to th	e applicab	le orientat	ion.		
Orienta	ation: A	Access F	actor	Area		Flu	x		g_		FF		Gains	
	٦	Table 6d		m²		Tab	ole 6a	Т	able 6b	Та	able 6c		(W)	
Solar g	jains in	watts, ca	alculated	d for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	80.44	157.35	259.13	377.93	463.17	474.13	451.39	387.74	301.38	186.71	100.29	66.15		(83)
Total g	ains – i	nternal a	nd sola	r (84)m =	= (73)m -	⊦ (83)m ,	watts							
(84)m=	404.28	479.76	570.16	670.35	736.1	728.85	694.64	634.92	558.46	462.53	397.62	380.18		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	eating p	periods in	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					I		1
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	
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(86)m=	1	1	0.99	0.94	0.82	0.63	0.47	0.53	0.81	0.98	1	1		(86)
Mean	interna	l temper	ature in	living an	ea T1 (fo	bllow ste	os 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.86	20.02	20.29	20.64	20.88	20.98	21	20.99	20.92	20.57	20.14	19.83		(87)
Tomp	oraturo	uurina h	L Logina r	L Doriode iu	n rest of	dwelling	L from Ta		لــــــــــــــــــــــــــــــــــــ					
(88)m=	20.04	20.04	20.05	20.06	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05		(88)
(00)										20100	20100	20100		()
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se		9a)	0.74	0.00				(00)
(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.74	0.96	1	1		(69)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 3	7 in Tabl	e 9c)				
(90)m=	18.99	19.16	19.43	19.77	19.98	20.06	20.07	20.07	20.02	19.71	19.29	18.97		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.31	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.26	19.43	19.7	20.04	20.26	20.35	20.36	20.36	20.3	19.98	19.56	19.24		(92)
Apply	adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.26	19.43	19.7	20.04	20.26	20.35	20.36	20.36	20.3	19.98	19.56	19.24		(93)
8. Spa	ace hea	ting requ	uiremen	t										
Set Ti	i to the i	mean int	ernal te	mperatu	re obtain	ed at st	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	n:	0.70	0.57			0.70	0.00	0.00			(04)
(94)m=	1	0.99	0.98	0.92	0.78	0.57	0.4	0.46	0.76	0.96	0.99	1		(94)
	ains,		, VV = (9)	4)m x (8	4)m	116 22	277.22	200.25	421.01	115 11	205 52	270.52		(05)
(95)m=	403.31	470.79	rpol tor		$\frac{575.54}{100}$	410.32	211.23	290.33	421.91	443.41	395.52	379.55		(33)
(96)m-							16.6	16.4	14.1	10.6	71	4.2		(96)
Heat		for me	o.o 2n interr			m W/-	-[(30)m	v [(93)m	_ (96)m	1	7.1	7.2		(00)
(97)m=	1139 79	1103 74	1000 59	835.06	640 46	425.56	278 27	292 49	461.05	701.68	935 92	1134 95		(97)
Space	heatin	a require	ement fo	r each n	nonth k	Nh/mon	h = 0.02	24 x [(97)m – (95)ml x (4	1)m			()
(98)m=	547.94	421.31	329.07	156.19	48.45	0	0	0		190.66	389.09	562.03		
								I Tota	l per vear	(kWh/vear) = Sum(9	8)1 59 12 =	2644.74	(98)
Snoo	- hootin	a roquir	omont in	k\//b/m	2 hoor					(.,	, (-	.,	20.42	
Space	eneaun	grequite	ementin		year							l	36.43	(99)
8c. Sp	bace co	oling rec	luiremer	nt										
Calcu	lated fo	<u>r June, .</u>	July and	August.	See Tak	ple 10b		A	0.00	0-4	Nau	Dec		
Heat	Jan		Iviar	Apr	IVIAY				Sep		NOV			
(100)m-						606 27								(100)
	tion fac	tor for lo		0	0	030.27	540.15	501.9	0	0	0	Ū		(100)
(101)m-				0	0	0 94	0.97	0.96	0	0	0	0		(101)
Usefu	l loss t		/atts) =	<u>ا</u> (100) m ک	(101)m	0.04	0.07	0.00	Ŭ		•	ů		()
(102)m=	0					656.1	533.55	539.04	0	0	0	0		(102)
Gains	(solar)	l nains ca	l Iculated	for appli	icable we	eather re	aion se	e Table	10)	-				()
(103)m=	0		0			937.89	896.23	827.96	0	0	0	0		(103)
Space	e coolin	ı a reauire	ement fo	r month	whole a	lwelling.	continu	ous (kN	(h) = 0.0	24 x [(1()3) <i>m – (</i> *	102)m 1 x	(41)m	
set (1	04)m to	zero if ((104)m <	< <u>3 × (</u> 98)m				., 0.0		-, (/]/		
(104)m=	0	0	0	0	0	202.89	269.84	214.96	0	0	0	0		
I									Total	= Sum(104)	=	687.69	(104)
												I		

Cooled	fraction	า							f C =	cooled	area ÷ (4) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b)									L	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
•								-	Tota	l = Sum((104)	=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	50.72	67.46	53.74	0	0	0	0		
-									Total	= Sum(107)	=	171.92	(107)
Space	cooling	requirer	ment in k	(Wh/m²/y	/ear				(107)) ÷ (4) =			2.37	(108)
8f. Fab	ric Enei	rgy Effici	iency (ca	alculated	l only un	der spec	cial conc	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		38.8	(109)



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.0.28	
			Ρ	roperty /	Address	2 Beds	- House	Enhanc	ced		
Address :											
1. Overall dwelling dime	nsions:			Area	- (m ²)			abt(m)			
Ground floor					5 42	(1a) x			(2a) =	118.09	(3a)
First floor					5.40	(1b) x			(2b) _	110.00](2b)
	-) . (4 -) . (4 -)	(4 -1) - (4 -) -	(4	4	5.42	(10) x	2	0	(20) -	116.09	(55)
10tal floor area IFA = (1a)	a)+(1b)+(1c)+	(1d)+(1e)+	(1n) 9	0.84	(4)					-
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	236.18	(5)
2. Ventilation rate:											
	main heating	secor heati	ndar ing	у	other		total			m ³ per hour	
Number of chimneys	0	+ ()	+	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0	+ ()] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns			_		- F	3	x 1	0 =	30	(7a)
Number of passive vents							0	x 1	0 =	0	(7b)
Number of flueless gas fi	res						0	x 4	40 =	0	(7c)
									Air ch	anges per hou	r
Infiltration due to chimney	s, flues and f	ans = (6a)+(6	ib)+(7	a)+(7b)+([*]	7c) =		30	-	÷ (5) =	0.13	(8)
If a pressurisation test has b	een ca <mark>rried out o</mark> i	r is intended, pr	ocee	d to (17), c	otherwise o	continue fr	om (9) to (16)			1
Additional infiltration	ie aw <mark>eiling</mark> (ns	5)						[(9)-	11x0 1 –	0	(9)
Structural infiltration: 0.	.25 for steel or	timber fram	ne or	0.35 for	r masonr	v constr	uction	[(3)	1,0.1 -	0	(11)
if both types of wall are pr	resent, use the va	lue correspond	ling to	the great	er wall are	a (after					1
deducting areas of openin	ngs); if equal user	0.35 (unseeled)	or 0	1 (soale	d) else	ontor 0					1(10)
If no draught lobby ent	ter 0.05 else ϵ	enter 0	01 0.	i (Seale	u), eise					0	(12)
Percentage of windows	s and doors dr	aught stripp	ed							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,	q50, expresse	ed in cubic m	netre	s per ho	our per so	quare m	etre of e	nvelope	area	4	(17)
If based on air permeabil	ity value, then	$(18) = [(17) \div 2]$	20]+(8	3), otherwi	se (18) = (16)				0.33	(18)
Air permeability value applie	s if a pressurisatio	on test has bee	n don	e or a deg	gree air pe	rmeability	is being us	sed			1
Shelter factor	a				(20) = 1 -	[0.075 x (1	9)] =			2	(19)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.00	(21)
Infiltration rate modified for	or monthly wir	nd speed								0.20	1, ,
Jan Feb	Mar Apr	May J	un	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from 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	2a)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]	
Adjust	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	id wind s	peed) =	(21a) x	(22a)m					
<u> </u>	0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33		
Calcul If me	<i>ate ettec</i> echanica	ctive air	change : ition:	rate for t	he appli	cable ca	se						0	(232)
lf exh	aust air he	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	√5)) , othe	rwise (23b) = (23a)			0	(23b)
lf bala	anced with	heat reco	overy: effic	iency in %	allowing	for in-use fa	actor (from	n Table 4h) =	, , ,			0	(23c)
a) If	balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (2	23b) × [1	l – (23c)	÷ 100]	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (N	/IV) (24b)m = (22	2b)m + (2	23b)	-	_	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h if (22b)n	ouse ex า < 0.5 x	tract ver (23b), t	ntilation o then (240	or positiv	ve input v o): otherv	ventilatio vise (24	on from c c) = (22b	outside b) m + 0.	5 x (23b))			
(24c)m=	= 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural	ventilatio	n or wh	ole hous	e positi	ve input ve input ve input ve input ve input ve input ve input ve input ve input ve input ve input ve input ve	ventilatio	$r_{0.5 + 1/2}$	0ft 2h\m² x	0.51		<u> </u>	1	
(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	a) or (24)	c) or (24	d) in hoy	(25)					
(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
3. He	at l <mark>osse</mark>	s and he	eat l <mark>oss</mark> i	paramete	ər: 🗹									
ELEN		Gros area	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·	e K	A X k kJ/K
Doors						2	×	1	=	2				(26)
Windo	ws Type	e 1				2.88	x1,	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				3.96	x1.	/[1/(1.2)+	0.04] =	4.53				(27)
Floor						45.42	<u>x</u>	0.14	=	6.3588				(28)
Walls		93.	6	14.6	;	79	x	0.18	=	14.22				(29)
Roof		45.4	12	0		45.42	2 x	0.1	=	4.54	Ē		$\neg \square$	(30)
Total a	area of e	lements	, m²			184.4	4							(31)
Party v	wall					52	x	0	=	0				(32)
* for win ** inclua	ndows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and par	alue calcul titions	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	n 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				41.55	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	22465.2	8 (34)
Therm	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For desi can be เ	ign assess used instea	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	tion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.22	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	81)								
Total fa	abric he	at loss		_					(33) +	(36) =			50.77	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y		_	-	(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(38)m=	43.86	43.68	43.49	42.62	42.45	41.69	41.69	41.55	41.98	42.45	42.78	43.13		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	94.64	94.45	94.26	93.39	93.22	92.46	92.46	92.32	92.75	93.22	93.55	93.9		_
Heat In	iss nara	meter (l		/m²K					(40)m	Average = - (39)m ÷	Sum(39)1.	12 /12=	93.38	(39)
(40)m=	1.04	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.03		
		I	I	I						Average =	Sum(40)1.	₁₂ /12=	1.03	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)								- 		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4 10/														
4. Wa	ter hea	ting ene	rgy requ	irement:								kWh/ye	ar:	
Assum	ed occu	upancy,	N	F.4	(2.	64		(42)
if TF.	A > 13. A £ 13.	9, $N = 1$ 9, $N = 1$	+ 1.76 X	(1 - exp	(-0.0003	349 X (1F	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	9)			
Annual	averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	1.92		(43)
Reduce not more	the annua e that 125	al average litres per	hot water person pe	usage by . r day (all w	5% if the a rater use, l	lwelling is hot and co	designed t ld)	o achieve	a water us	se target o	t			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	112.12	108.04	103.96	99.89	95.81	91.73	91.73	95.81	99.89	103.96	108.04	112.12		
_						100				Total = Su	m(44) ₁₁₂ =	- 1.0	1223.1	(44)
Energy of	content of	not water	used - cal		bntniy = 4.	190 x Va,n		1 / 3600	kvvn/mor		DIES 1D, 1	<i>c, 1a)</i>		
(45)m=	166.27	145.42	150.06	130.82	125.53	108.32	100.38	115.18	116.56	135.84	148.28	161.02	1603.68	(45)
lf instant	aneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)		11(40) 112 -	- L	1000.00	
(46)m=	24.94	21.81	22.51	19.62	18.83	16.25	15.06	17.28	17.48	20.38	22.24	24.15		(46)
Water	storage	loss:	Vinaludia				otorogo	within or						
If com	e volum	ie (illies)	and no to	ig any so ank in du		ntor 110	litros in	(47)	ame ves	sei		0		(47)
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	intes in ieous co	(47) mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m _	anufact	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy b) If m	lost fro	om water turer's de	storage	e, kWh/ye cylinder l	ear loss fact	or is not	known:	(48) x (49)) =			0		(50)
Hot wa	ter stor	age loss	factor fi	rom Tabl	e 2 (kW	h/litre/da	iy)					0		(51)
If comr	nunity h	neating s	ee secti	on 4.3										
Volume	e factor	from Ta	ble 2a m Table	2h								0		(52)
Energy	lost fro	m water	storage	× k\//b///	aar			$(47) \times (51)$	v (52) v (53) -		0		(53)
Enter	(50) or ((54) in (5	55)	, r. v v i i/ y t	Jai			(1) ^ (01)	~ (02) ^ (0		(54)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m	L			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Prima	ry circuit	loss (ar	nual) fro	om Table	e 3	50)	(50) 00					0		(58)
Primai (mo	ry circuit	: loss cal	culated from Tab	for each	month (59)m = ((58) ÷ 36 or boati	5 × (41)	m cylinder	r thormo	etat)			
(IIIU (59)m-												0		(59)
(55)11-	0	0	0	0	0	0	0	0	0	0	0	0		(00)
Combi	i loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	23.47	21.18	23.4	22.58	23.27	22.44	23.14	23.22	22.52	23.34	22.66	23.45		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	189.74	166.6	173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		(62)
Solar D	HW input	calculated	using App	endix G oı	Appendix	H (negati	ve quantity	/) (enter '0'	' if no sola	r contributi	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix G	3)	-	-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	189.74	166.6	173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		
								Outp	out from wa	ater heate	r (annual)₁	12	1878.34	(64)
Heat c	ains fro	m water	heating.	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	-
(65)m=	61.15	53.65	55.74	49.14	47.56	41.63	39.16	44.1	44.39	51	54.97	59.4		(65)
inclu	Ide (57)	I m in calc		l of (65)m	only if c	l Vlinder i	l s in the (welling	or hot w	l ater is fr	om com	munity h	eating	
- Lo					only in c	yiinder is	5 111 110 0	Iwening			om com	internity in	cating	
э. III	ternal ga	ains (see		b and ba).									
Metab	olic gair	is (Table	e 5), Wat	ts								_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(66)m=	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22	158.22		(66)
Lightir	ig gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5			-		
(67)m=	56.64	50.31	40.92	30.98	23.15	19.55	21.12	27.46	36.85	46.79	54.61	58.22		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-			
(68)m=	359.12	362.85	353.46	333.47	308.23	284.51	268.67	264.94	274.33	294.32	319.56	343.28		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46	53.46		(69)
Pumps	s and fa	ns aains	(Table {	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
		l vanoratio	l n (nega	l tivo valu	l os) (Tab	1 Ja 5)								
(71)m-	-105 48	-105 48	-105 48	-105 48	-105 48	-105 48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48		(71)
(/ I)III-	h o otin a		-100.40	100.40	100.40	-100.40	-100.40	100.40	100.40	-100.40	100.40	100.40		()
vvater	neating	gains (1		00.00	00.00	57.00	50.04	50.00	04.05	00.55	70.04	70.04		(72)
(72)m=	82.19	79.83	74.92	68.26	63.92	57.82	52.64	59.28	61.65	68.55	76.34	79.84		(72)
Total	internal	gains =	: 			(66)	m + (67)m	1 + (68)m +	- (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	607.16	602.19	578.5	541.9	504.5	471.08	451.62	460.87	482.03	518.86	559.71	590.54		(73)
6. So	lar gains	S:												
Solar (gains are o	calculated	using sola	r flux from	Table 6a a	and assoc	iated equa	tions to co	nvert to th	e applicat	le orientat	ion.		
Orient	ation: A	Access F Fable 6d	actor	Area m²		Flu Tal	x ole 6a	т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar (gains in	watts, ca	alculated	for eac	h month	i	i	(83)m = S	um(74)m .	(82)m	i	i		
(83)m=	104.27	203.97	335.91	489.91	600.4	614.62	585.14	502.63	390.68	242.03	130.01	85.75		(83)

Total g	ains – ir	nternal a	and solar	⁻ (84)m =	= (73)m ·	+ (83)m	, watts							
(84)m=	711.43	806.16	914.41	1031.81	1104.9	1085.69	1036.77	963.5	872.71	760.89	689.72	676.28		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livii	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.88	0.73	0.54	0.39	0.44	0.69	0.93	0.99	0.99		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	bllow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	20.08	20.23	20.48	20.77	20.93	20.99	21	21	20.96	20.72	20.34	20.04		(87)
Tomp		durina k	L Deating r		rest of	dwelling	from Ta	ا م م الم	ا h2 (°C)					
(88)m=	20.05	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.06		(88)
Litilies	tion fac	tor for a	l ains for	rest of d	welling	h2 m (sc	L Do Tablo	ـــــــــــــــــــــــــــــــــــــ						
(89)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.31	0.35	0.61	0.9	0.98	0.99		(89)
(00)	0.00										0.00	0.00		
Mean	interna	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)				(00)
(90)m=	18.84	19.06	19.42	19.8	20	20.06	20.07	20.07	20.04	19.76	19.23	18.79		(90)
									T	LA = Livin	g area ÷ (4	4) =	0.22	(91)
Mean	internal	l temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	19.11	19.32	19.65	20.02	20.21	20.27	20.27	20.27	20.24	19.97	19.47	19.07		(92)
Apply	adjustn	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.11	19.32	19.65	20.02	20.21	20.27	20.27	20.27	20.24	19.97	19.47	19.07		(93)
8. Spa	ace hea	ting requ	uire <mark>men</mark> t											
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	b, 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	ation fac	tor for g	ains, hm		<u>·</u>				· · · ·					
(94)m=	0.99	0.98	0.94	0.85	0.68	0.48	0.33	0.37	0.63	0.9	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	702.61	786.65	861.47	875.8	752.44	519.18	339.13	356.69	549.81	683.58	672.96	669.65		(95)
Month	nly avera	age exte	rnal tem	perature	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)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1401.43	1361.84	1239.77	1038.17	793.15	523.94	339.6	357.58	569.72	873.46	1157.6	1396.01		(97)
Space	e heatin	g require	ement fo	r each m	honth, k	Nh/mont	h = 0.02	24 x [(97)m – (95)m] x (4 ⁻	1)m			
(98)m=	519.92	386.53	281.46	116.91	30.29	0	0	0	0	141.27	348.94	540.41		
I								Tota	l per year	(kWh/year	·) = Sum(9	8)15,912 =	2365.73	(98)
Space	e heatin	a require	ement in	kWh/m²	/vear								26.04	(99)
9a. En	erav rea	uiremer	nts – Indi	ividual h	eating s	vstems i	ncludina	micro-C	CHP)					
Space	e heatir	ng:) 0101110 1			····)					
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	, main svs	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
			5						-			I		`
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								92.9	(206)
---------------------	--------------	------------------------------------	----------------------	-------------------------	---------------	----------	----------------	-----------	------------	-----------------------	------------------------------	----------	-----------	--------
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heating	g require	ement (c	alculate	d above))	1	1			1		1	
	519.92	386.53	281.46	116.91	30.29	0	0	0	0	141.27	348.94	540.41		
(211)m	1 = {[(98])m x (20	94)] + (2´	10)m } x	100 ÷ (2	206)							1	(211)
	559.66	416.07	302.97	125.84	32.61	0	0			152.06	375.61	581.71		
0								TUla			211) _{15,1012}	-	2546.53	(211)
	e neating	g tuel (s 1)1 + (2 [,]	econdar 14) m) y	'У), кvvn/ < 100 ± (montn 208)									
- ([(30) (215)m=	0	0	0		0	0	0	0	0	0	0	0		
. ,								Tota	l (kWh/yea	ar) =Sum(2	1 215) _{15,1012}	↓	0	(215)
Water	heating	I												_
Output	from wa	ater hea	ter (calc	ulated a	bove)									
	189.74	166.6	173.46	153.4	148.8	130.76	123.52	138.41	139.08	159.17	170.94	184.47		_
Efficier	ncy of w	ater hea	iter										87.3	(216)
(217)m=	89.19	89.1	88.89	88.41	87.73	87.3	87.3	87.3	87.3	88.5	89.03	89.22		(217)
Fuel fo	r water	heating,	kWh/m	onth						_		_		_
(219)m=	212.73	186.97	195.14	173.52	169.61	149.79	141.49	158.54	159.31	179.85	192	206.75		
								Tota	l = Sum(2'	19a) ₁₁₂ =			2125.7	(219)
Annua	I totals									k	Wh/year	•	kWh/year	
Space	heating	fuel use	ed, main	system	1								2546.53	7
Water	heating	fuel use	d										2125.7	Ī
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								_
centra	al heatin	g pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricity	/ for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =		L	75	(231)
Electric	city for li	ghting											400.14	(232)
10a. F	- uel cos	ts - indiv	vidual he	eating sy	stems:									
						C					rico		Eucl Cost	
						ru kV	Vh/year			(Table	12)		£/year	
Space	heating	- main s	system 1	1		(21	1) x			3.4	8	x 0.01 =	88.6192	(240)
Space	heating	- main s	system 2	2		(21	3) x			0)	x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			13.	19	x 0.01 =	0	(242)
Water	heating	cost (otl	her fuel)			(21	9)			3.4	8	x 0.01 =	73.97	(247)
Pumps	, fans a	nd elect	ric keep	-hot		(23	1)			13.	19	x 0.01 =	9.89	(249)
(if off-p	eak tari	ff, list ea	ach of (2	30a) to (230g) se	eparatel	y as app	licable a	nd apply	/ fuel pri	ce accor	ding to	Table 12a	
		uny		able 40		(23,	~)			13.	19	× 0.01 =	52.78	
Adaltio	nai stan	aing cha	arges (1	able 12)									120	(251)

Appendix Q items: repeat lines (253) and (254)	as needed		
Total energy cost(245)(245	247) + (250)(254) =		345.26 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		1.07 (257)
SAP rating (Section 12)			85.11 (258)
12a. CO2 emissions – Individual heating syste	ems including micro-CH	Р	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	550.05 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	459.15 (264)
Space and water heating	(261) + (262) + (263) +	- (264) =	1009.2 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	207.67 (268)
Total CO2, kg/year		sum of (265)(271) =	1255.8 (272)
CO2 emissions per m ²		(272) ÷ (4) =	13.82 (273)
El rating (section 14)			88 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	3106.77 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2593.36 (264)
Space and water heating	(261) + (262) + (263) +	- (264) =	5700.12 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1228.42 (268)
'Total Primary Energy		sum of (265)(271) =	7158.79 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	78.81 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.0.28	
			P	roperty <i>i</i>	Address	: 2 Beds	- House	Enhand	ed		
Address : 1 Overall dwelling dime	ensions:										
				Area	a(m²)		Av. Hei	aht(m)		Volume(m ³)	
Ground floor				4	5.42	(1a) x	2	.6	(2a) =	118.09	(3a)
First floor				4	5.42	(1b) x	2	.6	(2b) =	118.09	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)+(1n	i) 9	0.84	(4)			1		J
Dwelling volume				L		(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	236.18	(5)
2 Ventilation rate:],,
	main	se	econdar	у	other		total			m ³ per hour	
Number of chimneys	neating 0	n + [] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns						3	x 1	0 =	30	(7a)
Number of passive vents							0	x 1	0 =	0	(7b)
Number of flueless gas fi	res						0	x 4	40 =	0	(7c)
									Air ch	anges per hou	ı r
Infiltration due to chimne	ys, flues and f	ans = (6	a)+(6b)+(7	a)+(7b)+(7c) =		30	· ·	÷ (5) =	0.13	(8)
If a pressurisation test has b	een carried out o	r is intende	ed, proceed	d to (17), d	otherwise o	continue fro	om (9) to (16)			
Additional infiltration	ie uw <u>eiling</u> (ii	>)						ا [(9)-	11x0.1 =	0	(9)
Structural infiltration: 0	.25 for steel o	r timber f	frame or	0.35 foi	r masoni	ry constr	uction	1(0)	.1.0	0	(11)
if both types of wall are p	resent, use the va	lue corres	ponding to	the great	er wall are	a (after				-], ,
deducting areas of openin If suspended wooden f	ngs); if equal user loor. enter 0.2	0.35 (unseal)	ed) or 0.	1 (seale	ed). else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0		. (, e.e.e	0				0	(13)
Percentage of windows	s and doors d	aught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	4	(17)
If based on air permeabil	ity value, then	(18) = [(1	7) ÷ 20]+(8	3), otherwi	ise (18) = ((16)	. , .			0.33	(18)
Air permeability value applie	s if a pressurisati d	on test has	s been don	e or a deg	gree air pe	rmeability	is being us	sed		2	1(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(10)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18) x (20) =				0.28	(21)
Infiltration rate modified f	or monthly wir	nd speed									-
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab	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]	
Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-			-	
	0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33]	
Calcul If ma	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat pump	using App	endix N. (2	3b) = (23a	a) x Fmv (e	equation (N	N5)), other	rwise (23b) = (23a)			0	(23a)
If bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =) (200)			0	(230)
a) If	halance	nech:	anical ve	ntilation	with he	at recove	≏rv (M\/⊦	HR) (24a) m = (22	2h)m + (23h) x [1	– (23c)	1001	(230)
(24a)m=	0			0	0	0		0	0	0	0	0]	(24a)
b) If	balance	i ed mecha	ı anical ve	ntilation	without	heat rec	ı coverv (N	и ЛV) (24b)m = (22	1 2b)m + (2	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	tilation o	or positiv	ve input v	ventilatic	n from c	outside				1	
	if (22b)r	n < 0.5 ×	(23b), t	hen (24a	c) = (23b); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b)		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22t	e positiv b)m othe	ve input erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effe	ctive air	change	rate - er	nter (<mark>24a</mark>) or (24b	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
3. He	at l <mark>osse</mark>	s and he	eat l <mark>oss</mark> i	paramete	er: 🗹									
ELEN		Gros area	ss (m²)	Openin m	gs 2	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²∙l	e K	A X k kJ/K
Doors						2	X	1	=	2				(26)
Windo	ws Type	e 1				2.88	x1,	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	e 2				3.96	x1,	/[1/(1.2)+	0.04] =	4.53				(27)
Floor						45.42	<u>x</u>	0.14	=	6.3588				(28)
Walls		93.	6	14.6		79	x	0.18	=	14.22				(29)
Roof		45.4	2	0		45.42	<u>x</u>	0.1	=	4.54				(30)
Total a	area of e	elements	, m²			184.4	4							(31)
Party v	wall					52	x	0	=	0				(32)
* for win	ndows and	l roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	he the area	as on both	sides of ir	iternal wali	is and pari	titions		(26)(30)	+ (32) =				44.55	(22)
Heat c	anacity	Cm = Sl	- 0 (A A	0)				(_0)(00)	((28)	(30) + (3)	(32a)	(32e) =	41.55	(33)
Therm	al mass	parame	ter (TMF	P = Cm -	- TFA) ir	n k.I/m²K			Indica	tive Value	: Medium	(020) -	22403.2	(35)
For desi	ign asses	sments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f	250	(00)
can be u	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.22	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(33)	(36) -				(97)
Ventils	ation he	at loss c	alculater	monthly	/				(38)m	$= 0.33 \times 0$	25)m x (5)		50.77	(37)
• On the	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec]	
	L	L	1	<u>г</u> .	,	I	I		1				1	

Let Let <thl< th=""><th>(38)m=</th><th>43.86</th><th>43.68</th><th>43.49</th><th>42.62</th><th>42.45</th><th>41.69</th><th>41.69</th><th>41.55</th><th>41.98</th><th>42.45</th><th>42.78</th><th>43.13</th><th></th><th>(38)</th></thl<>	(38)m=	43.86	43.68	43.49	42.62	42.45	41.69	41.69	41.55	41.98	42.45	42.78	43.13		(38)
		anofor c		nt W/K						(20)m	_ (27) _ (⁴	28)m			
Charter and the state and	(39)m=	94.64	94.45	94.26	93.39	93.22	92.46	92.46	92.32	92.75	93.22	93.55	93.9		
Heat loss parameter (HLP), W/m ² K (40)m = (39)m + (4) (40)m = 1.04 1.04 1.03 1.02 1.02 1.02 1.03 1.03 1.03 Number of days in month (Table 1a) Average = Sum(40)::::::::::::::::::::::::::::::::::::	(00)	0	0.1.10	0.120		00.22	02.10	0200	02:02	00	Average =	Sum(39)1		93.38	(39)
(40)me 1.04 1.04 1.03 1.03 1.02 1.02 1.02 1.03	Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
Average = Sum(40): // 21.03(40)Number of days in month (Table 1a)(41)meJanFebMarAprMayJunJunJun(41)meJanFebMarAprMayJunJun(41) 4.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	(40)m=	1.04	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.03	1.03		
Number of days in month (1 able 1a) $\begin{array}{r} \begin{array}{r} \begin{array}{r} \begin{array}{r} \begin{array}{r} \begin{array}{r} \begin{array}{r} \begin{array}{r} $	NI	(.] .		. (h. / T . h	1- 4-)					,	Average =	Sum(40)1.	12 /12=	1.03	(40)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	edmuni]	r of day	/s in mo			May	lun	11	A.u.a	San	Oct	Nov			
Image: Intersection of the start start of the start of the start of the start	(41)m-	Jan 31	28	1VIAI 31	Арі 30	1VIAY	Jun 30	31	Aug 31	30	31	30	21 21		(41)
4. Water heating energy requirement: KWh/year: Assumed occupancy, N 2.64 (42) if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2] + 0.0013 x (TFA -13.9) (14) Annual average hot water usage in litres per day Vd, average = $(25 \times N) + 36$ 101.92 (43) Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of (44) not more that 125 litres per person per day (all water use, hot and cold) (44) Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44) (44) (44) (12.12) 108.04 103.96 99.89 96.81 91.73 91.73 95.81 99.89 103.96 108.04 112.12 123.1 (44) (44) (44) 112.12 108.04 103.96 99.89 96.81 91.73 91.73 95.81 99.89 103.96 108.04 112.12 123.1 (44) (45) (46) Total = Sum(41) = 1223.1 (44) (45) (46) (46) (47) (48) (49) (49) (49) (41) (42) (42) (43) (44)	(41)11=	51	20	51	- 50	51	- 50	51	51	- 50	51	- 50	51		(41)
4. Water heating energy requirement. kWhyear: Assumed occupancy, N 2.64 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA ≥ 13.9 , N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 101.92 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per day for each month Vd, m = factor from Table 1c x (43) (43) Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) Total = Sum(4), = 1223.1 (44)m= 112.12 108.04 103.96 99.89 95.81 91.73 91.73 95.81 98.89 103.96 108.04 112.12 (44)m= 112.12 108.04 103.92 125.33 108.32 100.38 115.18 116.56 135.84 148.28 161.02 (44) (45)m= 0 0 0 0 0 0 0 0 0 (45) (46)m= 0 0 0 0 0 0 0 (46) (46)m= 0 0 0 0 0 0 0 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>															
Assumed occupancy, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA \pm 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA \pm 13.9, N = 1 Annual average hot water usage in litres per day Vd.average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) (44)m = 112.12 108.04 103.96 99.89 96.81 91.73 91.73 95.81 99.89 103.96 108.04 112.12 Total = Sum(44)z = 1223.1 (44 Energy content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m = 166.27 145.42 150.06 130.82 125.53 108.32 100.38 115.18 116.86 136.84 148.28 161.02 Total = Sum(45)t = 1603.68 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4. Wat	ter heat	ling ene	rgy requ	irement:								kWh/yea	ar:	
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)2] + 0.0013 x (TFA - 13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = $(25 \times N) + 36$ Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m = 112.12 108.04 103.96 99.89 96.81 61.73 91.73 95.81 99.89 103.96 108.04 112.12 Total = Sum(44)z = 1223.1 (44 Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m = 166.27 145.42 150.06 130.82 125.53 108.32 100.38 116.18 116.86 136.84 148.28 161.02 Total = Sum(45)t = 1603.68 (45) If instantaneous water heating at point of use (nc hot water storage), enter 0 in boxes (46) to (61) (46)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Assume	ed occu	ipancy,	N								2.	64		(42)
IN TALE 103, N = 1Annual average hot water usage in litres per day Vd, average = $(25 \times N) + 36$ 101.92(43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov DecHot water usage in litres per person per day (all water use, hot and cold)Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2">Volspan="2"Volspan="2">Volspan="2">Volspan="2"Volspan="2">Volspan="2"Volspan="	if TF/	A > 13.9	9, N = 1	+ 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.	9)			
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)	Annual	averad	e, $n = 1$	ater usad	ae in litre	es per da	av Vd.av	erade =	(25 x N)	+ 36		10'	1 92		(43)
not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) Image: the transmission of transmission of the transmission of transmiss	Reduce t	he annua	al average	hot water	usage by	5% if the a	lwelling is	designed t	to achieve	a water us	se target o	f IO	1.02		(1-)
JanFebMarAprMayJunJulAugSepOctNovDecHot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)(44)m =112.12108.04103.9699.8995.8191.7391.7395.8199.89103.96108.04112.12Total = Sum(44):::::::::::::::::::::::::::::::::::	not more	that 125	litres per	person per	r day (all w	ater use, l	hot and co	ld)							
Pot water usage in litres per day for each month $Va,m = ractor from Table 1c x (43)$ (44)m1=112.12108.04103.9699.8995.8191.7395.8199.89103.96108.04112.12Total = Sum(44)e =1223.1(44)Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)(45)m1=166.27145.42150.06130.82125.53108.32100.38115.18116.56135.84148.28161.02Total = Sum(45)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	Hot wate	r usage II	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	l able 1c x	(43)						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(44)m=	112.12	108.04	103.96	99.89	95.81	91.73	91.73	95.81	99.89	103.96	108.04	112.12		-
$(45)_{m} = 166.27 \ 145.42 \ 150.06 \ 130.82 \ 125.53 \ 108.32 \ 100.38 \ 115.18 \ 116.56 \ 135.84 \ 148.28 \ 161.02 \ Total = Sum(45)_{12} = 1603.68 \ (45)_{12} = 1603.68 \ (45)_{12} = 1603.68 \ (46)_{12} = 1603.68 \ (46)_{12} = 1603.68 \ (45)_{12} = 1603.68 \ (46)_{12} =$	Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd.r	n x nm x D))Tm / 3600) kWh/mor	Fotal = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c. 1d)	1223.1	(44)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(45)m=	166.27	145 42	150.06	130 82	125.53	108.32	100.38	115 18	116.56	135.84	148.28	161.02		
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 0		100.21	110.12	100.00	100.02	120.00	100.02	100.00	110.10		Total = Su	m(45) ₁₁₂ =	101.02	1603.68	(45)
(46)m= 0 <td>lf instanta</td> <td>aneous w</td> <td>ater heati</td> <td>ng at point</td> <td>t of use (no</td> <td>hot water</td> <td>r storage),</td> <td>enter 0 in</td> <td>boxes (46</td> <td>) to (61)</td> <td></td> <td></td> <td>L</td> <td></td> <td></td>	lf instanta	aneous w	ater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)			L		
Water storage loss: 0 (47 Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47 If community heating and no tank in dwelling, enter 110 litres in (47) 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: 0 (48 a) If manufacturer's declared loss factor is known (kWh/day): 0 (48 (49) (49) Temperature factor from Table 2b 0 (49) (49) (50) (50) b) If manufacturer's declared cylinder loss factor is not known: 0 (51) (51) (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) (51) (51)	(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47 If community heating and no tank in dwelling, enter 110 litres in (47) 0 (47 Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: 0 (47 a) If manufacturer's declared loss factor is known (kWh/day): 0 (48 (48 (49) (49) (49) Temperature factor from Table 2b 0 (49) (48) x (49) (49) (50) b) If manufacturer's declared cylinder loss factor is not known: 0 (51) (51) (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) (51) (51)	Water s	storage	loss:		•										
If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) (48) x (49) = 0 (51) (51) (51) (51) (51) (51) (52) (53) (54) (54) (54) (54) (54) (54) (54) (55) (56) (56) (57) (57) (57) (58) (Storage	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: 0 (51) (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)	If comn	nunity h iso if no	eating a	and no ta	ank in dw ar (this in	/elling, e	nter 110) litres in	(47) mbi boil	ore) onto	or 'O' in (47)			
a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: 0 (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)	Water s	storage	loss:	not wate	51 (1113 11	iciuues i	nstantai					<i>-1)</i>			
Temperature factor from Table 2b 0 (49 Energy lost from water storage, kWh/year (48) x (49) = 0 (50 b) If manufacturer's declared cylinder loss factor is not known: 0 (51 Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51	a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: 0 (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)	Tempe	rature fa	actor fro	m Table	2b								0		(49)
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating and postion 4.2	Energy	lost fro	m water	r storage	e, kWh/ye	ear			(48) x (49)) =			0		(50)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51	b) If m	anufact	urer's d	eclared of	cylinder l	oss fact	or is not	known:							
	Hot wat	ter stora	age loss	factor fr	rom Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volume factor from Table 2a	Volume	factor	from Ta	ble 2a	011 4.3								0		(52)
Temperature factor from Table 2b 0 (53	Tempe	rature fa	actor fro	m Table	2b								0		(53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ (54)	Energy	lost fro	m watei	r storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (54) in (55) 0 (55	Enter ((50) or ((54) in (5	55)	, ,								0		(55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m$	Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	L If cylinde	r contains	s dedicate	d solar sto	nage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendix	Н	
(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (57	(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	a cylinde	r thermo	stat)		I	()
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m	-	-	-	-		
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	141.33	123.61	127.55	111.2	106.7	92.07	85.32	97.91	99.08	115.46	126.04	136.87		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	KH (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (<u>G)</u>					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter				-			-	-	-	_	
(64)m=	141.33	123.61	127.55	111.2	106.7	92.07	85.32	97.91	99.08	115.46	126.04	136.87		_
								Outp	out from wa	ater heate	r (annual)₁	12	1363.13	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5´[0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	35.33	30.9	31.89	27.8	26.68	23.02	21.33	24.48	24.77	28.87	31.51	34.22		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	leating	
5. In	ternal ga	ains (see	Table 8	5 and 5a):									
Metab	olic gair	s (Table	5) Wat	tts										
Wietab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85		(66)
Lightin		i (calcula	ted in Ai	opendix	L L equat	ion I 9 o	r (9a) a	lso see '	Table 5					
(67)m=	22.66	20.12	16.37	12.39	9.26	7.82	8.45	10.98	14.74	18.72	21.84	23.29	i i i	(67)
Annlia		ins (calc	L ulated ir			uation L	13 or I 1	l 3a) also	L See Tal	L			i	
(68)m=	240.61	243.11	236.82	223.42	206.51	190.62	180.01	177.51	183.8	197.2	214.1	230	1	(68)
Cookir				ppopdiv		tion 15	or 150			5	2	200	i	()
(60)m-	19 yans	(Calcula 26.19			L, Equa		26.19), also se		26.19	26.19	26.19	I	(69)
(03)III=		30.10	(Table /		50.10	30.10	50.10	30.10	30.10	50.10	50.10	30.10	l	(00)
Pumps	s and fa	ns gains					0						I	(70)
(70)m=	0	0	Ú Ú				0	0	0	0	0	0	l l	(70)
Losse	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	ole 5)							I	(74)
(71)m=	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48		(71)
Water	heating	gains (T	able 5)		r				1				I	
(72)m=	47.49	45.98	42.86	38.61	35.85	31.97	28.67	32.9	34.4	38.8	43.76	45.99		(72)
Total i	internal	gains =			-	(66)	m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	373.31	371.77	358.6	336.98	314.18	292.97	279.68	283.95	295.5	317.27	342.27	361.83		(73)
6. So	lar gains	S:												
Solar (gains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to co	onvert to th	e applicat	le orientat	ion.		
Orient	ation: /	Access F	actor	Area		Flu Tai	X Ne 6a	т	g_ able 6b	т	FF able 6c		Gains	
				1112		idi		I		1			(**)	
_	_				_									
Solar (gains in	watts, ca	alculated	for eac	h month	044.00	FOF 4.4	(83)m = S	um(74)m .	<mark>(82)m</mark>	400.01	05.75	I	(82)
(83)m=	104.27	203.97	335.91	489.91	600.4	614.62	585.14	502.63	390.68	242.03	130.01	85.75	1	(03)

Total g	ains – ir	nternal a	and solar	⁻ (84)m =	= (73)m -	+ (83)m	, watts							
(84)m=	477.58	575.74	694.51	826.89	914.59	907.59	864.82	786.57	686.18	559.3	472.28	447.57		(84)
7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)			[21	(85)
Utilisa	ation fac	tor for a	ains for	living are	a. h1.m	see Ta	ble 9a)		. ,			I		
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.94	0.82	0.63	0.47	0.53	0.82	0.98	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	r in Table	e 9c)					
(87)m=	19.84	20	20.28	20.63	20.88	20.98	21	20.99	, 20.92	20.55	20.12	19.81		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Ti	h2 (°C)					
(88)m=	20.05	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.06		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.98	0.93	0.77	0.55	0.37	0.43	0.74	0.97	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.98	19.15	19.42	19.77	19.98	20.06	20.07	20.07	20.02	19.7	19.27	18.95		(90)
_									f	LA = Livin	g area ÷ (4	4) =	0.22	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwel	lling) = fl	_A × T1	+ (1 – fL	A) × T2		_			
(92)m=	19.17	19.33	19.61	19.96	20.18	20.26	20.27	20.27	, 20.22	19.89	19.46	19.14		(92)
Apply	adjustn	nent to t	he mear	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	19.17	19.33	19.61	19.96	20.18	20.26	20.27	20.27	20.22	19.89	19.46	19.14		(93)
8. Spa	ac <mark>e hea</mark>	ting requ	uire <mark>men</mark> t											
Set Ti	i to the r	mean int	ernal ter	mperatui	e obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	I	
Utilisa	ation fac	tor for g	ains, hm I	:				a (=						(0.4)
(94)m=	1	0.99	0.98	0.92	0.78	0.56	0.39	0.45	0.76	0.97	1	1	I	(94)
Usefu	Il gains,	hmGm	, VV = (94)	4)m x (84	4)m	540 7	000 (054.00	540.40	5 40,00	470.05		l	(05)
(95)m=	4/6./2	572.69	681.11	763.38	712.19	512.7	338.4	354.98	519.16	540.39	470.25	446.99	I	(95)
	niy avera		ernal tem				16.6	16.4	1.4.1	10.6	7 1	4.2		(96)
(90)11=	4.3	4.9		0.9	11.7	14.0	10.0	10.4	(00)	10.0	7.1	4.2	I	(30)
	1407 07	4 101 mea				Lm , vv =	=[(39)m2	x [(93)m	- (96)m	965.02	1156 14	1402.12		(07)
(97)m=	1407.07	1303.27	1230.07	1032.00	790.55	023.47	339.53	357.44	507.37	$\frac{000.93}{100}$	1150.44	1403.13	ļ.	(37)
		521 27		102.97	59.2		n = 0.02	4 X [(97])m – (95)[[] X (4	1)[[]	711 27		
(90)11=	092.10	551.27	412.09	193.07	50.5	0	0	Tota	o Der vear	kWh/vear	() = Sum(9)	8), 50.12 =	3336 13	 (98)
Snace	a hoatin	a requir	omont in	$kM/h/m^2$	woor				. poi you	(,)) can(c	· /1	26.72	
Opace	- neauil	y require	Sincint III	iX V V I / I I /	, year								30.13	
8c. Sp	bace co	oling rec	uiremer	nt		_								
Calcu	lated fo	r June, .	July and	August.	See Tal	ole 10b				-				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Heat	ioss rate	e ∟m (ca	iculated	using 2	o inter	nai temp	perature	and exte	ernal ten	peratur	e from I	adie 10)		

0

0

869.13

684.21

701.64

0

0

0

0

0

(100)m=

0

0

(100)

Utilisa	tion fac	ctor for lo	ss hm										_	
(101)m=	0	0	0	0	0	0.94	0.97	0.96	0	0	0	0		(101)
Usefu	loss, h	nmLm (W	/atts) =	(100)m x	(101)m								-	
(102)m=	0	0	0	0	0	817.51	665.39	671.54	0	0	0	0]	(102)
Gains	(solar	gains cal	lculated	for appli	cable we	eather re	egion, se	e Table	10)			•	-	
(103)m=	0	0	0	0	0	1160.61	1108.59	1018.98	0	0	0	0]	(103)
Space set (10	<i>coolin</i> 04)m to	<i>g require</i> zero if (e <i>ment fo</i> 104)m <	r month, < 3 × (98	<i>whole c</i>)m	lwelling,	continue	ous (kW	/h) = 0.0	24 x [(10)3)m – (102)m]	x (41)m	
(104)m=	0	0	0	0	0	247.04	329.74	258.5	0	0	0	0]	
-		-							Total	= Sum(104)	=	835.27	(104)
Cooled	fractio	1	(105)											
Intermit	tency f	actor (Ta	able 10b)										
(106)m=	(106)m= 0 0 0 0.25 0.25 0 0 0													
									Tota	l = Sum((104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	61.76	82.43	64.62	0	0	0	0		
									Total	= Sum(107)	=	208.82	(107)
Space	cooling	requirer	ment in l	kWh/m²/y	/ear				(107)) ÷ (4) =			2.3	(108)
8f. Fabi	ric Ene	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		39.02	(109)
													_	

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.0.28	
			Pr	operty /	Address	: 3 Beds	- House	Enhand	ced		
Address :											
1. Overall dwelling dime	ensions:										
One word file on				Area	a(m²)		Av. Hei	ight(m)	1	Volume(m ³)	٦
Ground floor				5	0.94	(1a) x	2	2.6	(2a) =	132.46	(3a)
First floor				5	0.94	(1b) x	2	2.6	(2b) =	132.46	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+((1d)+(1e)+.	(1n) 10	01.89	(4)					
Dwelling volume				L		(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	264.91	(5)
2. Ventilation rate:											-
	main	Seco	ondary	у	other		total			m ³ per hour	
Number of chimneys		+	0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0] + [0	i + F	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ins						3	x 1	10 =	30	(7a)
Number of passive vents	;						0	x 1	10 =	0	(7b)
Number of flueless gas f	res						0	x 4	40 =	0	(7c)
									Air ch	anges per hou	ur
Infiltration due to chimne	ys, flues and fa	ans = (6a)+(6b)+(7	a)+(7b)+(7	7c) =		30	· ·	÷ (5) =	0.11	(8)
If a pressurisation test has b	been carried out or	is intended, p	proceed	to (17), c	otherwise o	continue fro	om (9) to ((16)			-
Number of storeys in the	he dw <mark>elling</mark> (ns	5)								0	(9)
Additional infiltration	OE for staal or	timbertron		0 2E for		n / oo potr	uction	[(9)-	1]x0.1 =	0](10)](14)
if both types of wall are p	resent, use the va	lue correspon	ne or dina to	the areat	er wall are	y constr a (after	uction			0	(11)
deducting areas of openi	ngs); if equal user	0.35	J	J							_
If suspended wooden	floor, enter 0.2	(unsealed)	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 window	s and doors dr	aught stripp	bed							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,	q50, expresse	d in cubic r	netre	s per ho	our per so	quare m	etre of e	nvelope	area	4.5	(17)
If based on air permeabil	lity value, then	$(18) = [(17) \div$	20]+(8), otnerwi	se (18) = ((16) 	:			0.34	(18)
Air permeability value applie	ad pressurisation	on test has dee	en aon	e or a deg	gree air pei	rmeability	is being us	sea	1	2	
Shelter factor	^{ju}				(20) = 1 -	[0.075 x (1	9)] =			∠ 0.85	(19)
Infiltration rate incorporate	ting shelter fac	tor			(21) = (18)) x (20) =				0.00	(21)
Infiltration rate modified f	or monthly win	d speed								0.20	J,,
Jan Feb	Mar Apr	May 、	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sr	eed from 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 (allowi	ing for st	nelter ar	nd wind s	speed) =	= (21a) x	(22a)m				_		
	0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34			
Calcula	ate effe	ctive air	change	rate for t	he appli	icable ca	ise	-	-		-		-		
II ME				ondix N (2	(26) = (22)		oquation (NE)) otho	nuico (22h	(220)				0	(23a)
If bala	aust all fi					for in use f	Sector (from	n Tabla 4b	1 WISE (200) – (23a)				0	(23D)
									i) = 	0h)	001-)	(00-)	. 1001	0	(23c)
a) ir	balance		anical ve					HR) (248	a)m = (2.)	2b)m + (. L	23D) × [*	1 - (23C)) ÷ 100]]		(24a)
(24a)III=	balanaa											0	J		(244)
D) II (24b)m	balance				without			VIV) (240 1	D = (2)	2) + m(a 	230)	0	1		(24b)
(240)m=		0	0		0					0	0	0			(240)
c) If '	whole h f (22b)r		tract ver	tilation (or positiv	ve input v	ventilatio	on from (b) $m \pm 0$	5 v (23h					
(24c)m-	0				0			$\frac{1}{1}$			') 0	0	1		(24c)
(240)II-	notural	vontilati					Vontilati	on from		Ů	Ŭ	Ů	J		()
u) n	f (22b)r	n = 1, th	en (24d)	m = (22)	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m ² x	0.5]					
(24d) <mark>m=</mark>	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56			(24d)
Effeo	ctive air	change	rate - er	nter (24a) or (24l	b) or (24	c) or (2	ld) in bo	x (25)				·		
(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	1		(25)
		s and ne			er:	Not Ar						k volu	<u>_</u>	A V	· k
ELEIV	IENI	area	(m²)	r	95 1 ²	A,r	ea n²	W/m2	2K	A X U (W/I	<)	kJ/m².	F K	kJ/l	κ <
Doors						2	×	1		2					(26)
Window	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3					(27)
Window	ws Type	92				3.96	x1	/[1/(1.2)+	0.04] =	4.53	=				(27)
Window	ws Type	e 3				1.26	x1	/[1/(1.2)+	0.04] =	1.44	=				(27)
Windov	ws Type	e 4				4.41		/[1/(1.2)+	0.04] =	5.05					(27)
Floor						50.94	5 X	0.14		7.1323	Ξ r				(28)
Walls		12!	5	18.6	5	106.3	5 X	0.2		21 27	= 1](29)
Roof		50.0	24			50.9/	1 x		-	5.09	╡┟				(30)
Total a	rea of e					226.0		0.1		0.00			L		(31)
Porty w			,			220.0	9			0	—				
* for win	dows and	roof wind	ows use a	offective wi	ndow I I-v	25 alue calcui	×		= /[(1/]-valu	0 2 0 (مراجر)	L	naragranl			(32)
** includ	e the area	as on both	sides of ir	nternal wal	ls and par	titions	alou using	g lonnaia i	/(// O - Vait	ic)+0.0+j c	is given in	paragrapi	10.2		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30) + (32) =				54	.56	(33)
Heat ca	apacity	Cm = S	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	185	54.9	(34)
Therma	al mass	parame	eter (TMF	- = Cm -	- TFA) iı	n kJ/m²K			Indica	tive Value	Medium		2	50	(35)
For desig	gn asses	sments wh	ere the de	tails of the	construct	tion are no	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f	-		_
can be u	ised inste	ad of a de	tailed calc	ulation.											-
Theres	بالمشار		V/V	ا- منامانيم	ining A										100

if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								_
Total fa	abric he	at loss							(33) +	(36) =			65.91	(37)
Ventila	tion hea	at loss ca	alculated	monthly	/	-			(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	49.59	49.36	49.13	48.08	47.89	46.97	46.97	46.81	47.32	47.89	48.28	48.7		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	115.49	115.26	115.04	113.99	113.8	112.88	112.88	112.71	113.23	113.8	114.19	114.61		
Heat lo	oss para	meter (H	HLP), W/	/m²K					(40)m	Average = = (39)m ÷	Sum(39)₁ (4)	₁₂ /12=	113.99	(39)
(40)m=	1.13	1.13	1.13	1.12	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.12		
Numbe	er of day	vs in moi	nth (Tab	le 1a)					,	Average =	Sum(40)₁	₁₂ /12=	1.12	(40)
	Jan	Feb	Mar	Apr	Мау	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	ting ener	rav reau	irement:								kWh/ve	ear:	
Accum		inonov I	N										I	(40)
if TF.	A > 13.9	ipancy, i 9, N = 1	n + 1.76 x	[1 - exp	(-0.0003	349 x (TF	- A -13.9)2)] + 0.0)013 x (⁻	TFA -13.	2. .9)	.76		(42)
if TF.	A £ 13.9	9, N = 1		. ,		,			,		,			
Annual	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	a targat a	104	4.91		(43)
not more	e that 125	litres per j	person pe	r day (all w	ater use, l	hot and co	ld)	o acriieve	a waler us	se largel o	1			
	lan	Feb	Mar	Apr	May	lun	lul	Αμα	Sen	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from 1	Table 1c x	(43)	Ocp	001				
(44)m=	115.4	111.2	107.01	102.81	98.61	94.42	94.42	98.61	102.81	107.01	111.2	115.4		
			<u> </u>							L Total = Su	l m(44) ₁₁₂ =	=	1258.89	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	171.13	149.67	154.45	134.65	129.2	111.49	103.31	118.55	119.97	139.81	152.62	165.73		
								•		Total = Su	m(45) ₁₁₂ =	=	1650.6	(45)
lf instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46,) to (61)					
(46)m=	25.67	22.45	23.17	20.2	19.38	16.72	15.5	17.78	18	20.97	22.89	24.86		(46)
vvater :	storage	IOSS:	includir		alar ar M		storago	within or		col		450		(47)
If comr				ng any so		ntor 110	Sillaye	(47)		501		150		(47)
Otherw	nunity n vise if no	stored	hot wate	r (this in	ielling, e Indes i	nstantar		(47) mbi boili	ers) ente	r '0' in <i>(</i>	47)			
Water	storage	loss:	not wate			notantai					,			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	41		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			(48) x (49)	=		0.	.76		(50)
b) If m	anufact	urer's de	eclared of	cylinder I	oss fact	or is not	known:							
Hot wa	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
IT COMP	nunity h e factor	from To	ee secti ble 22	on 4.3								0	l	(50)
Tempe	erature f	actor fro	m Table	2b								0		(ə∠) (53)
Eneroy	/ lost fro	m water	storage	k\//h/v/	ar			(47) x (51)	x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)	, .				、 , (- 1)	(/ ~ ()	- /	0.	.76		(55)

Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	23.6	21.32	23.6	22.84	23.6	22.84	23.6	23.6	22.84	23.6	22.84	23.6		(56)
If cylind	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	23.6	21.32	23.6	22.84	23.6	22.84	23.6	23.6	22.84	23.6	22.84	23.6		(57)
Prima	y circuit	loss (ar	nnual) fro	om Table	e 3		-			-	-	0		(58)
Primar	y circuit	loss cal	culated	for each	month ((59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	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	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 req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	218	192	201.32	180.01	176.07	156.85	150.18	165.42	165.32	186.68	197.97	212.6		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	(H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	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	iter										_	
(64)m=	218	192	201.32	180.01	176.07	156.85	150.18	165.42	165.32	186.68	197.97	212.6		_
								Outp	out from w	ater heate	r (annual)₁	12	2202.41	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	94.39	83.63	88.85	81.06	80.45	73.35	71.84	76.91	76.17	83.98	87.03	92.6		(65)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	leating	
5. In	tern <mark>al g</mark> a	ains (see	e Ta <mark>ble (</mark>	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38	165.38		(66)
Lightin	g gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-			_	
(67)m=	59.17	52.56	42.74	32.36	24.19	20.42	22.07	28.68	38.5	48.88	57.05	60.82		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			_	
(68)m=	387.08	391.1	380.98	359.43	332.23	306.66	289.58	285.57	295.69	317.24	344.44	370		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a)), also se	ee Table	5				
(69)m=	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29	54.29		(69)
Pumps	s and fa	ns gains	(Table !	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. e\	vaporatio	on (nega	tive valu	es) (Tab	ole 5)						-		
(71)m=	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25	-110.25		(71)
Water	heating	gains (1	Table 5)											
(72)m=	126.87	124.45	119.42	112.58	108.14	101.88	96.57	103.38	105.8	112.88	120.87	124.46		(72)
Total i	internal	gains =	:			(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	685.55	680.53	655.56	616.79	576.97	541.39	520.64	530.05	552.4	591.42	634.78	667.7		(73)
6 80	lar dain	s.												

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	tion:	Access F Table 6d	actor	Area m²		Flu Tal	x ble 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar o	ains in	watts c	alculated	l for eacl	n month			(83)m = S	um(74)m .	(82)m				
(83)m=	137.78	269.53	443.88	647.38	793.39	812.17	773.22	664.19	516.26	319.83	171.8	113.31		(83)
Total ga	ains –	internal a	and solar		- (73)m -	+ (83)m	, watts							
(84)m=	823.34	950.06	1099.44	1264.17	1370.36	1353.56	1293.86	1194.23	1068.66	911.24	806.58	781.01		(84)
7. Mea	an inte	rnal temp	oerature	(heating	season)								
Tempe	erature	e durina h	neating p	eriods ir	n the livir	ng area f	from Tab	ole 9. Th	1 (°C)				21	(85)
Utilisa	tion fa	ctor for a	ains for	living are	a h1 m	(see Ta	ble 9a)	,	(-)					
]	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.87	0.71	0.52	0.38	0.43	0.69	0.92	0.98	0.99		(86)
Mean	intern						ns 3 to 7			0.02	0.000	0.00		
(87)m=	19.97	20.15	20.43	20.74	20.93	20.99	21	21	20.95	20.68	20.26	19.94		(87)
L Tomp						ducelling	from To							
		auring r	l 10.00						n2 (°C)	10.00	10.09	10.09		(88)
(00)11=	19.97	19.90	19.90	19.99	19.99	19.99	19.99	20	19.99	19.99	19.90	19.90		(00)
Utilisa	tion fa	ctor for g	ains for	rest of d	velling, l	h2,m (se	e Table	9a)					l	
(89)m=	0.99	0.98	0.94	0.84	0.65	0.45	0.3	0.34	0.6	0.9	0.98	0.99		(89)
Mean	interna	al temper	ature in	the r <mark>est</mark>	of dwelli	ng T2 (fe	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	18.63	18.88	19.28	19.71	19.92	19.99	19.99	19.99	19.96	19.65	19.06	18.58		(90)
									f	LA = Livin	g area ÷ (4	1) =	0.25	(91)
Mean	interna	al temper	ature (fo	or the wh	ole dwel	ling) = fl	$A \times T1$	+ (1 – fL	A) × T2					
(92)m=	18.96	19.2	19.57	19. <mark>97</mark>	20.17	20.24	20.24	20.24	20.21	19.9	19.36	18.92		(92)
Apply	adjust	ment to t	he mear	internal	tempera	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.96	19.2	19.57	19.97	20.17	20.24	20.24	20.24	20.21	19.9	19.36	18.92		(93)
8. Spa	ice hea	ating requ	uirement											
Set Ti the uti	to the lisatio	mean int	ternal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fa	ctor for g	ains, hm						· · · ·					
(94)m=	0.99	0.97	0.94	0.84	0.66	0.47	0.32	0.36	0.62	0.89	0.97	0.99		(94)
Useful	gains	, hmGm	, W = (94	4)m x (84	4)m									
(95)m=	812.39	924.79	1029.08	1056.97	911.29	629.54	410.67	431.95	663.96	813.83	785.69	772.81		(95)
Month	ly ave	rage exte	ernal tem	perature	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)
Heat le	oss rat	te for me	an intern	al tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1693.42	2 1648	1503.27	1261.32	964.2	636.33	411.43	433.37	691.67	1058.87	1399.99	1686.81		(97)
Space	heati	ng require	ement fo	r each m	nonth, kV	Nh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m		L	
(98)m=	655.49	486	352.8	147.14	39.37	0	0	0	0	182.31	442.3	680.02		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	2985.42	(98)
Space	heatii	ng require	ement in	kWh/m²	/year								29.3	(99)
9a. Ene	ergy re	quiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space Fractic	heati	ng: pace hea	at from s	econdary	/supple	mentarv	system						0	(201)
	-	•	-			- · · J							-	` (

(204) (206) (208) 211)
(206) (208) 211)
(208)
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(215)
(216)
217)
(219)
(220-)
(230C)
(230C) (230e)
(230C) (230e) (231)
(230c) (230e) (231) (232)
(230c) (230e) (231) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (230) (230) (230) (230) (230) (230) (230) (230) (230) (230) (230) (230) (230) (231) (232) (230) (230) (231) (232) (231) (232
(230c) (230e) (231) (232) (232) (232) (240) (241) (242)
(230c) (230e) (231) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (232) (230) (230) (230) (230) (230) (230) (230) (230) (230) (231) (232
(230c) (230e) (231) (232
(230c) (230e) (231) (232

Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	needed) + (250)(254) =		387.38 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (256) SAP rating (Section 12)	6)] ÷ [(4) + 45.0] =		0.42 (256) 1.11 (257) 84.55 (258)
12a. CO2 emissions – Individual heating systems	including micro-CHI	5	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	689.68 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	566.27 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	1255.95 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	216.95 (268)
Total CO2, kg/year		sum of (265)(271) =	1511.82 (272)
CO2 emissions per m ²		(272) ÷ (4) =	14.84 (273)
El rating (section 14)			86 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	3895.41 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	3198.36 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	7093.77 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1283.32 (268)
'Total Primary Energy		sum of (265)(271) =	8607.34 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	84.48 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Ver	ber: sion:		Versic	on: 1.0.0.28	
			Р	roperty <i>i</i>	Address	: 3 Beds	- House	Enhand	ced		
Address :											
1. Overall dwelling dimensi	ons:			A	. (A 11	·) (- 1 (2)	
Ground floor				Area	a(m²)	(1a) x	AV. He		(22) =		1(32)
				⁵	0.94	(1a) X		0	(2a) =	132.46](3a) 1
First floor				5	0.94	(1b) x	2	2.6	(2b) =	132.46	(3b)
Total floor area TFA = (1a)+	(1b)+(1c)+((1d)+(1e)+(1r	1) 10	01.89	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	264.91	(5)
2. Ventilation rate:											
	main	Se	econdar	у	other		total			m ³ per hour	
Number of chimneys		"ז + ר	0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fans	L					」 「	4	x 1	0 =	40	(7a)
Number of passive vents							0	x 1	0 =	0	(7b)
Number of flueless gas fires							0	x 4	40 =	0	(7c)
									Air ch	anges per hou	ı r
Infiltration due to chimneys,	flues and fa	ans = (6	a)+(6b)+(7	a)+(7b)+(7c) =		40	- -	÷ (5) =	0.15	(8)
If a pressurisation test has been	carried out or	is intende	ed, proceed	d to (17), d	otherwise o	continue fro	om (9) to (16)			-
Additional infiltration	awelling (ne	5)						[(0)	11/0 1	0	(9)
Structural infiltration: 0.25	for steel or	timber f	frame or	0 35 for	masonr	v constr	uction	[(9)-	•1]XU.1 =	0	(10)
if both types of wall are prese	nt, use the va	lue corres	ponding to	the great	er wall are	a (after	dottori			0	1()
deducting areas of openings)	if equal user	0.35									-
If suspended wooden floo	r, enter 0.2	(unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, enter	0.05, else e	enter 0								0	(13)
Percentage of windows al	na aoors ar	augnt st	rippea		0.25 [0.2	$(14) \cdot 1$	001 -			0	(14)
					(8) + (10)	. X (14) ÷ 1	(12) = (12)	(15) -		0	(15)
Air permechility volue an		طنه منام	io motro	o nor ha	(0) + (10)		2) + (13) +	r (15) =	o.ro.o	0	(16)
All permeability value, qo	, expresse	(18) – (18)	$7) \div 201+(8)$	s per no	se (18) – (elle ol e	nvelope	area	4.5	$\begin{bmatrix} (17) \\ (40) \end{bmatrix}$
Air permeability value applies if	a pressurisatio	on test has	been don	e or a dec	oree air pe	rmeability	is beina us	sed		0.38](18)
Number of sides sheltered				0 0/ 0 00	,		io sonig ac			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporating	shelter fac	tor			(21) = (18)) x (20) =				0.32	(21)
Infiltration rate modified for r	nonthly win	d speed	1							_	•
Jan Feb Ma	ır Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed	d from 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	2a)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 infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m						
_	0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38			
Calcula	ate effec	tive air (change i tion:	rate for t	he appli	cable ca	se	-		-			- 		
lf exh	aust air he	at pump i	using Appe	endix N (2	3b) = (23a	a) x Fmv (e	equation (N	N5)) othe	rwise (23h) = (23a)				0	(238)
lf bala	anced with	heat reco	overv: effic	iencv in %	allowing f	for in-use f	actor (from	n Table 4h) =) = (200)				0	$\left \begin{pmatrix} 230 \\ 220 \end{pmatrix} \right $
a) If	balance	d mech:	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a) a)m = (2)	2b)m + (;	23h) x [′	1 – (23c)	⊥	0	(230)
(24a)m=	0	0	0	0	0	0			0	0	0	0]		(24a)
b) If	balance	d mecha	anical ve	ntilation	without	heat rec	L Coverv (N	u MV) (24b	m = (22)	2b)m + (2	23b)	I	1		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24b)
c) If	whole ho	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilatio	n from o	outside			1	J		
, i	if (22b)m	< 0.5 ×	: (23b), t	hen (24a	c) = (23b); otherv	wise (24	c) = (22k	o) m + 0.	5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) lf i	natural v if (22b)m	v = 1, th	on or wh en (24d)	ole hous m = (22t	e positiv b)m othe	ve input erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]			-		
(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	d) in bo	(25)				_		
(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57			(25)
													· .		
3 He	at losses	and he	at loss r	haramete											
3. He	at losses	and he Gros	eat l <mark>oss p</mark> ss	oaramete Openin	er:	Net Ar	ea	U-valu	ue	AXU		k-value)	A X	k
3. He ELEN	at losses /IE <mark>NT</mark>	and he Gros area	eat l <mark>oss</mark> p ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/ł	<)	k-value kJ/m²•	e K	A X kJ/ł	k K
3. He ELEN Doors	at losses	and he Gros area	eat loss r ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r	ea n² X	U-valu W/m2	ue K =	A X U (W/ł	<)	k-value kJ/m²∙	e K	A X kJ/ł	k ((26)
3. He ELEN Doors Windo	at losses //ENT ws Type	and he Gros area	eat loss r ss (m²)	oaramete Openin m	ər: gs 1 ²	Net Ar A ,r 2 2.88	ea m² x x1	U-valu W/m2 1 /[1/(1.2)+	ue 2K 0.04] =	A X U (W/ł 2 3.3	<)	k-value kJ/m²-l	e K	A X kJ/ł	k (26) (27)
3. He ELEN Doors Windov Windov	at losses //ENT ws Type ws Type	and he Gros area 1 2	eat loss ss (m²)	oaramete Openin m	er: gs 1 ²	Net Ar A ,r 2 2.88 3.96	ea n ² x x x1. x1.	U-valu W/m2 1 /[1/(1.2)+ /[1/(1.2)+	ue K 0.04] = [0.04] =	A X U (W/ł 2 3.3 4.53	<)	k-value kJ/m²-l	e K	A X kJ/ł	k (26) (27) (27)
3. He ELEN Doors Windov Windov	at losses /ENT ws Type ws Type ws Type	and he Gros area 1 2 3	eat loss ; ss (m²)	Openin Openin m	er: gs 1 ²	Net Ar A ,r 2 2.88 3.96 1.26	ea n ² x x ¹ x ¹ x ¹	U-valı W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	ue K 0.04] = [0.04] = [0.04] = [A X U (W/ł 2 3.3 4.53 1.44	<)	k-value kJ/m²⊷	e K	A X kJ/ł	k (26) (27) (27) (27)
3. He ELEN Doors Windov Windov Windov	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	eat loss ; ss (m²)	Openin M	er: gs ²	Net Ar A ,r 2 2.88 3.96 1.26 4.41	ea n ² x x1. x1. x1. x1. x1.	U-valu W/m2 [1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	ue K 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/ł 2 3.3 4.53 1.44 5.05		k-value kJ/m²-	ə K	A X kJ/ł	k (26) (27) (27) (27) (27)
3. He ELEN Doors Windov Windov Windov Floor	at losses AENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	eat loss ; ss (m²)	Openin M	er: gs ₁ 2	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94	ea n ² x x ^{1,} x ^{1,} x ^{1,} x ^{1,} 5 x	U-valu W/m2 [1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ [0.14]	ue K 0.04] = [0.04] = [0.04] = [0.04] = [=]	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323		k-value kJ/m²-	÷ K	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28)
3. He ELEN Doors Windov Windov Windov Floor Walls	at losses /ENT ws Type ws Type ws Type ws Type	and he Gros area 1 2 3 4	eat loss ; ss (m ²)	Openin M	er: gs ^{j2}	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3	ea n ² x x ¹ x ¹ x ¹ x ¹ x ¹ 5 x 5 x	U-valı W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2	ue :K = = [:0.04] = [:0.04] = [:0.04] = [:0.04] = [:0.04] = [:0.04] = [A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27		k-value kJ/m²-	а К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28) (29)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof	at losses /ENT ws Type ws Type ws Type ws Type	and he Gross area 1 2 3 4 1 2 50.9	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Openin m 18.68	er: gs ²	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3	ea n ² x x ^{1,} x	U-valu W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [= = [A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09		k-value kJ/m²-	ж К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28) (29) (29) (30)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof Total a	at losses AENT ws Type ws Type ws Type ws Type	and he Gross area 1 2 3 4 125 50.9 ements	5 5 5 5 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7	Openin m 18.63	5	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3 50.94 226.8	ea n ² x x1. x1. x1. x1. 5 x 5 x 5 x 4 x	U-valu W/m2 [1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ [0.14 0.2 0.1	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [= = [A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09		k-value kJ/m²-	эк К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof Total a Party v	at losses AENT ws Type ws Type ws Type ws Type area of el wall	and he Gros area 1 2 3 4 1 2 3 4	5 5 6 14 , m ²	Openin m 18.64	gs ²	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3 50.94 226.8	ea n ² x x ¹ . x	U-valı W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1	ue	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0		k-value kJ/m²-	ж К	A X kJ/ł	k (26) (27) (27) (27) (27) (27) (28)](29)](30) (31) (32)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof Total a Party v * for win ** includ	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area	and he Gros area 1 2 3 4 <u>125</u> 50.9 ements	is (m²) (m²)	Openin m 18.63 0	5 ndow U-va	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.8 25 alue calculations	ea n ² x x1. x1. x1. 5 x 5 x 4 x 9 x ated using	U-value W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1	$\begin{array}{c} ue \\ 2K \\ \hline 0.04] = \\ 0.04] =$	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0 ve)+0.04] a	<)	k-value kJ/m²-	⇒ K □ [□ [□	A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof Total a Party v * for win ** includ Fabric	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area heat los	and he Gros area 1 2 3 4 <u>125</u> 50.9 ements roof winders s on both s, W/K =	st loss (m ²) , m ² , m ² , m ² sides of ir = S (A x	Deramete Openin m 18.64 0 effective winternal walk U)	5 ndow U-va	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 226.8 25 alue calculations	ea n ² x x1. x1. x1. x1. 5 x 5 x 4 x 9 x 2ated using	U-value W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1 0.1 0.2 0.1	$\begin{array}{c} ue \\ K \\ \hline 0.04] = \\ 0.04] = $	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0 0 re)+0.04] a	<)	k-value kJ/m²-	× Κ Π Π Π Π Π Π Π Π Π Π Π Γ Γ Γ Γ Γ Γ	A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)](33)
3. He ELEN Doors Windou Windou Windou Floor Walls Roof Total a Party v * for win ** includ Fabric Heat c	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area heat loss apacity (and he Gross area 1 2 3 4 125 50.9 ements roof winde s on both s, W/K = Cm = S(st loss (m ²) , m ² , m ² , m ² sides of ir = S (A x A x k)	18.64 0 18.64 0 effective winternal walk U)	5 ndow U-va	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 50.94 106.3 50.94 226.8 25 alue calculations	ea n ² x x 1. x 1. x 1. x 1. x 1. 5 x 5 x 5 x 4 x 9 x x ated using	U-valu W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1 0.1 (26)(30)	$\begin{array}{c} ue \\ 2K \\ \hline 0.04] = \begin{bmatrix} \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{bmatrix}$ $\begin{array}{c} 0.04] = \\ $	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0 re)+0.04] a	<)	k-value kJ/m²-	e K] [] [] [] [] [] [] [] [] [] [A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)](33)](33)](34)
3. He ELEN Doors Windov Windov Windov Floor Walls Roof Total a Party v * for win ** includ Fabric Heat c Therm	at losses AENT ws Type ws Type ws Type ws Type ws Type area of el vall dows and le the area heat loss apacity C al mass	and he Gross area 1 2 3 4 125 50.9 ements roof windows s on both s, W/K = Cm = S(parame	eat loss ss (m ²) , m ² ows, use e sides of ir = S (A x A x k) ter (TMF	Definition of the second seco	er: gs 2 ⁵ 5 ndow U-va Is and par - TFA) ir	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3 50.94 226.8 25 alue calculations	ea n ² x x1. x1. x1. 5 x 5 x 4 x 9 x 2 ated using	U-value W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1 0.1 (26)(30)	$\begin{array}{c} ue \\ K \\ \hline 0.04] = \\ 0.04] = $	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0 e)+0.04] a .(30) + (32 tive Value:	<)	k-value kJ/m²-	× K	A X kJ/ł	k (26) (27) (27) (27) (27) (28) (29) (30) (31) (32) (33) (33) (34) (35)
3. He ELEN Doors Windov Windov Windov Windov Floor Walls Roof Total a Party v * for win ** includ Fabric Heat c Therm For desi can be u	at losses AENT ws Type ws Type ws Type ws Type ws Type ws Type area of el vall dows and a heat loss apacity (al mass ign assess used instea	and he Gross area 1 2 3 4 125 50.9 ements roof winde s on both s, W/K = Cm = S(parame ments wh of of a dec	eat loss (m ²) (m ²) , m ² , m ² , m ² sides of ir = S (A x A x k) ter (TMF ere the de tailed calcu	Definition of the set	er: gs 2 ⁵ 5 mdow U-va Is and par - TFA) ir construct	Net Ar A ,r 2 2.88 3.96 1.26 4.41 50.94 106.3 50.94 226.8 225 alue calculations	ea n ² x x 1. x 1. x 1. 5 x 5 x 5 x 4 x 9 x ated using	U-valu W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.14 0.2 0.1 0.1 (26)(30) recisely the	$\begin{array}{c} ue \\ K \\ = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = \\ 0.04$	A X U (W/ł 2 3.3 4.53 1.44 5.05 7.1323 21.27 5.09 0 21.27 5.09 0 ue)+0.04] a .(30) + (32 tive Values of	() ()<	k-value kJ/m²- paragraph (32e) = able 1f	e K] [] [] [] [] [] [] [] [] [] [A X kJ/ł	k (26) (27) (27) (27) (27) (28)](29)](30) (31)](32)](33)](34)](35)

if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)			(22) .	(26) -			05.04	
Vontil	abine her	at loss of	alculator	monthly					(38)m	(30) =	'25)m v (5)		65.91	(37)
ventia	.lan	Feb	Mar	Apr	Mav	Jun	.lul	Αυσ	Sen		Nov	Dec		
(38)m=	50.97	50.69	50.41	49.11	48.87	47.74	47.74	47.53	48.18	48.87	49.37	49.87		(38)
Heat t	ransfer o	coefficie	nt. W/K	I		1	1	Į	(39)m	= (37) + (3	1 38)m	1	1	
(39)m=	116.87	116.59	116.31	115.02	114.77	113.65	113.65	113.44	114.08	114.77	115.27	115.78		
	L	Į	!	I		I	!	!	·	Average =	Sum(39)1	12 /12=	115.02	(39)
Heat I	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)		1	
(40)m=	1.15	1.14	1.14	1.13	1.13	1.12	1.12	1.11	1.12	1.13	1.13	1.14		
Numb	er of day	/s in mo	nth (Tab	le 1a)		-				Average =	Sum(40)1	12 /12=	1.13	(40)
	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. W	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Δοςιια	ned occi	inancy	N									76	1	(42)
if TF	FA > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF)2)] + 0.0)013 x (TFA -13.	.9)	/0		(42)
if TF	FA £ 13.9	9, N = 1											1	
Annua Reduce	al averag the annua	je hot wa al average	ater usag hot water	ge in litre usage by :	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed i	(25 x N) to achieve	+ 36 a water us	se target o	10- f	4.91		(43)
not moi	re that 125	litres per	person pe	r day (all w	rater use, l	hot and co	ld)			Ū				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wa	ter usage i	n litres pei	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	115.4	111.2	107.01	102.81	98.61	94.42	94.42	98.61	102.81	107.01	111.2	115.4		
Enerav	content of	hot water	used - cai	culated mo	onthly = 4	190 x Vd.r	m x nm x D) Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b. 1	= c. 1d)	1258.89	(44)
(45)m-	171 13	1/0 67	154.45	134.65	120.2	111 /0	103 31	118 55	110.07	130.81	152.62	165 73	1	
(40)11-	17 1.10	143.07	104.40	104.00	120.2	111.45	100.01	110.00	110.07	Total = Su	m(45)1 12 =	100.70	1650.6	(45)
lf instar	ntaneous w	vater heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)				1000.0	
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:											, 1	
Storag	ge volum	ie (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If com	munity h	eating a	ind no ta	ink in dw	velling, e	nter 110) litres in	(47) mbi boil	oro) ont	or (0) in (47)			
Water	storage	loss:	not wate		iciuues i	nstantai	ieous co		ers) erne		47)			
a) If r	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temp	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If r	nanufact	urer's de	eclared	cylinder l	oss fact	or is not	known:						1	
Hot w	ater stor	age loss	factor fi	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	ne factor	from Ta	ble 2a	011 4.3								0	1	(52)
Temp	erature f	actor fro	m Table	2b								0		(53)
Energ	y lost fro	m water	storage	, kWh/ve	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	55)	-								0		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				-	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	ı
(62)m=	145.46	127.22	131.28	114.46	109.82	94.77	87.82	100.77	101.97	118.84	129.72	140.87		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(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=	145.46	127.22	131.28	114.46	109.82	94.77	87.82	100.77	101.97	118.84	129.72	140.87		_
								Outp	out from w	ater heate	r (annual)₁	12	1403.01	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ´[0.85	× (45)m	1 + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m=	36.37	31.81	32.82	28.61	27.46	23.69	21.95	25.19	25.49	29.71	32.43	35.22		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. In	tern <mark>al g</mark> a	ains (see	e Ta <mark>ble (</mark>	5 and 5a):									
Metab	olic gair	s (Table	5), Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82	137.82		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	23.67	21.02	17.1	12.94	9.68	8.17	8.83	11.47	15.4	19.55	22.82	24.33		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-			
(68)m=	259.35	262.04	255.25	240.82	222.59	205.46	194.02	191.33	198.11	212.55	230.77	247.9		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5			_	
(69)m=	26.70	00.70	00.70		00.70	00.70	00.70	26.70	00.70	26.70	26.70	36 78		(69)
Pumps	30.78	36.78	36.78	36.78	36.78	36.78	36.78	30.70	36.78	30.70	30.78	00.70		
· amp	s and fai	ns gains	(Table \$	36.78 5a)	36.78	36.78	36.78	30.78	36.78	30.70	30.78	00.70	1	
(70)m=	30.78 s and fai	ns gains	(Table !	36.78 5a) 0	0	0	0	0	0	0	0	0]	(70)
(70)m= Losses	s and fai	ns gains 0 vaporatic	(Table ! 0 0 (nega	36.78 5a) 0 tive valu	0 0 0 (Tab	0 0 0	0	0	0	0	0	0]	(70)
(70)m= Losse: (71)m=	s and fai	ns gains 0 vaporatic	(Table 5 0 0 (nega -110.25	36.78 5a) 0 tive valu -110.25	0 es) (Tab	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	0	0	0]	(70) (71)
(70)m= Losses (71)m= Water	36.78 s and fai 0 s e.g. ev -110.25 heating	36.78 ns gains o vaporatic -110.25 gains (T	(Table (0 0 (nega -110.25 Table 5)	36.78 5a) tive valu -110.25	0 es) (Tab -110.25	0 le 5) -110.25	0	0	0	0	0	0]	(70) (71)
(70)m= Losses (71)m= Water (72)m=	36.78 s and fai 0 s e.g. ev -110.25 heating 48.88	36.78 ns gains 0 /aporatic -110.25 gains (T 47.33	(Table 5) 0 0 (nega -110.25 able 5) 44.11	36.78 5a) 0 tive valu -110.25 39.74	0 es) (Tab -110.25 36.9	0 0 -110.25 32.91	0 -110.25 29.51	0 -110.25 33.86	0 -110.25 35.41	0 -110.25 39.93	0 -110.25 45.04	0]	(70) (71) (72)
(70)m= Losses (71)m= Water (72)m= Total i	36.78 s and fai 0 s e.g. ev -110.25 heating 48.88 internal	36.78 ns gains vaporatic -110.25 gains (1 47.33 gains =	(Table 5) 0 -110.25 (able 5) 44.11	36.78 5a) tive valu -110.25 39.74	0 es) (Tab -110.25 36.9	0 le 5) -110.25 32.91 (66)	0 -110.25 29.51 m + (67)m	0 -110.25 33.86 n + (68)m -	0 -110.25 35.41 + (69)m + (0 -110.25 39.93 (70)m + (7	0 -110.25 45.04 1)m + (72)	0 -110.25 47.34]]]	(70) (71) (72)
(70)m= Losses (71)m= Water (72)m= Total i (73)m=	38.78 s and fai 0 s e.g. ev -110.25 heating 48.88 internal 396.24	36.78 ns gains 0 aporatic -110.25 gains (1 47.33 gains = 394.73	(Table 9 0 -110.25 able 5) 44.11 380.81	36.78 5a) tive valu -110.25 39.74 357.85	0 es) (Tab -110.25 36.9 333.52	0 ole 5) -110.25 32.91 (66) 310.88	0 -110.25 29.51 m + (67)m 296.7	0 -110.25 33.86 n + (68)m - 301.01	0 -110.25 35.41 + (69)m + (313.26	0 -110.25 39.93 (70)m + (7 336.38	0 -110.25 45.04 1)m + (72) 362.98	0 -110.25 47.34 m 383.91]]]	(70) (71) (72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Т	FF able 6c		Gains (W)	
Solar g	gains ir	n watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m .	(82)m				
(83)m=	137.78	3 269.53	443.88	647.38	793.39	812.17	773.22	664.19	516.26	319.83	171.8	113.31		(83)
Total g	gains –	internal a	nd solar	(84)m =	: (73)m ·	+ (83)m	, watts				-			
(84)m=	534.02	2 664.27	824.7	1005.23	1126.9	1123.06	1069.92	965.2	829.52	656.2	534.78	497.22		(84)
7. Me	an inte	ernal temp	oerature	(heating	season)								
Temp	peratur	e during h	neating p	eriods ir	n the livi	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	actor for g	ains for I	iving are	a, h1,m	(see Ta	ble 9a)					ľ		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.94	0.81	0.62	0.46	0.53	0.81	0.98	1	1		(86)
Mean	n intern	al temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.69	19.88	20.19	20.59	20.86	20.97	21	20.99	20.9	20.49	20.01	19.66		(87)
Temp	beratur	e during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, Tl	h2 (°C)					
(88)m=	19.96	19.96	19.97	19.98	19.98	19.99	19.99	19.99	19.98	19.98	19.98	19.97		(88)
Utilisa	ation fa	nctor for a	ains for	rest of d	vellina.	h2.m (se	e Table	9a)						
(89)m=	1	1	0.98	0.92	0.76	0.53	0.36	0.42	0.74	0.97	1	1		(89)
Mean	intern	al temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	18.77	18.95	19.27	19.65	19.89	19.98	19.99	19.99	19.93	19.57	19.1	18.74		(90)
	L	1							f	LA = Livin	g area ÷ (4	4) =	0.25	(91)
Mean	intern	al temper	ature (fo	r the wh	ole dwe	llina) – fl	$\Delta \times T1$	+ (1 _ fl	$(\Delta) \sim T_2$					
(92)m=	19	19.19	19.5	19.89	20.13	20.23	20.24	20.24	20.17	19.8	19.32	18.97		(92)
Apply	/ adjus	tment to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19	19.19	19.5	19.89	20.13	20.23	20.24	20.24	20.17	19.8	19.32	18.97		(93)
8. Sp	ace he	ating requ	uirement											
Set T the ut	i to the tilisatio	e mean int n factor fo	ernal ter or gains	nperatur using Ta	e obtair ble 9a	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	ation fa	ctor for g	ains, hm	:		r					r			
(94)m=	1	0.99	0.98	0.92	0.77	0.56	0.38	0.45	0.75	0.96	1	1		(94)
Usefu	ul gains	s, hmGm	, W = (94	4)m x (84	4)m	r								()
(95)m=	533.01	660.42	806.72	920.18	864.11	623.75	411.71	431.44	624.96	633.11	532.38	496.57		(95)
Mont	hly ave	rage exte	rnal tem	perature	e from 1a	able 8	10.0	40.4		10.0	74			(06)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1 (0C)m	10.6	7.1	4.2		(90)
Heat	1055 ra	100 mea	an intern	ai tempe	967.85	LM , VV =	=[(39)m) 413.57	x [(93)m 435.4	- (90)m	1055.93	1409 17	1710 30		(97)
Space	e heati		ement fo	r each m	anth k	Nh/mont	h = 0.02	400.4 24 x [/97])m – (95)ml x (4)	1)m	1110.00		()
(98)m=	881.45	675.47	524.73	247.21	77.18	0	0.02	0	0	314.58	631.29	903.08		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	4255	(98)
Space	e heati	ng require	ement in	kWh/m²	/year								41.76	(99)
•		- •			•							l		

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

_													-	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1068.28	840.99	862.12	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.93	0.97	0.95	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0	994.14	812.06	816.17	0	0	0	0		(102)
Gains	(solar g	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)					
(103)m=	0	0	0	0	0	1418.7	1354.35	1233.85	0	0	0	0		(103)
Space set (1	e <i>coolin</i> 04)m to	g require zero if (e <i>ment fo</i> 104)m <	r month, : 3 × (98	<i>whole c</i>)m	lwelling,	continue	ous (kW	/h) = 0.0	24 x [(10)3)m – (1	102)m]>	x (41)m	
(104)m=	0	0	0	0	0	305.68	403.46	310.75	0	0	0	0		
_									Total	= Sum(104)	=	1019.9	(104)
Cooled	fraction	n							f C =	cooled a	area ÷ (4	+) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b)		i			i				I	_
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Total	' = Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n					I	
(107)m=	0	0	0	0	0	76.42	100.87	77.69	0	0	0	0		_
									Total	= Sum(107)	=	254.97	(107)
Space	cooling	requirer	nent in k	(Wh/ <mark>m²</mark> /y	/ear				(107)	÷ (4) =			2.5	(108)
<mark>8f. F</mark> ab	ric Ene	rgy Effici	ien <mark>cy (c</mark> a	alculated	l only un	der spec	cial cond	liti <mark>on</mark> s, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		44.26	(109)
														-

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	SAP 2012	2	roporty	Strom Softwa	a Num are Ver	ber: sion:	Enhanc	Versio	on: 1.0.0.28	
Address :					Address.		- 110036				
1. Overall dwelling dim	ensions:										
				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Ground floor				5	8.19	(1a) x	2	2.6	(2a) =	151.28	(3a)
First floor				5	8.19	(1b) x	2	2.6	(2b) =	151.28	(3b)
Total floor area TFA = (*	1a)+(1b)+(1c)+	-(1d)+(1e)	+(1n	I) 1	16.37	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	302.56	(5)
2 Ventilation rate:											1
2. Ventilation rate.	main	se	condar	у	other		total			m ³ per hour	
Number of chimneys		+ [] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0	⊣ + ⊢	0		0	」] = 「	0	x 2	20 =	0	(6b)
Number of intermittent fa	ans		-		-		4	x 1	10 =	40] (7a)
Number of passive vent	s						0	x 1	10 =	-0	$\left(\frac{7}{7} \right)$
Number of flueless gas	fires						0	x 4	40 =	0	$\left(\frac{7}{2} \right)$
Number of fideless gas						L	0		Air ch	anges per hou	(/C) Ir
Infiltration due to chimne	eys, flues and	fans = (6a)+(6b)+(7	a)+(7b)+(7c) =		40		÷ (5) =	0.13	(8)
Number of storeys in	been carried out o the dwelling (r	or is intended is)	a, proceed	d to (17), c	otherwise (continue fre	om (9) to (16)		0] (9)
Additional infiltration	ine an <mark>ennig</mark> (n							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel c	or timber fr	rame or	0.35 foi	r masonr	y constr	uction			0	(11)
if both types of wall are p	present, use the v	alue corresp	onding to	the great	er wall are	a (after					•
If suspended wooden	floor, enter 0.	2 (unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er	nter 0.05, else	enter 0	,	,						0	(13)
Percentage of window	vs and doors d	raught stri	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	, q50, express	ed in cubi	c metre	s per ho	our per s	quare m	etre of e	nvelope	area	4.5	(17)
If based on air permeab	ility value, the	ך (18) = [(17	') ÷ 20]+(8	3), otherwi	se (18) = (16)		(0.36	(18)
Air permeability value appli	es it a pressurisat ed	ion test has	been aon	e or a deg	gree air pei	rmeability	is being us	sea		2	1(19)
Shelter factor	00				(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ating shelter fa	ctor			(21) = (18)) x (20) =				0.3	(21)
Infiltration rate modified	for monthly wi	nd speed									•
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed from Tat	ole 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 (allowi	ing for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
	0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36		
Calcula	ate effe	ctive air	change	rate for t	he appli	cable ca	ise			•				
IT ME	ecnanica			ondiv NL (2	(26) - (22)) v Emv (oquation (nuico (22h	(220)		l	0	(23a)
If bold	aust all II		wory: offic		(200) = (200)	a) x Fillv (e	equation (n Tabla 4b) = (23a)		l	0	(23b)
									i) = 	0h)		[1 (00-)	0	(23c)
a) If	balance		anical ve			at recove		HR) (24a T	a)m = (22	2b)m + (1	23b) × ['	1 - (23c)	÷ 100]	(245)
(24a)m=	0											0		(24a)
b) If	balance	ed mecha	anical ve	entilation	without	heat red	covery (VIV) (240 T	o)m = (22	2b)m + (2 1	23b)			(246)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(240)
c) If i	whole h f (22h)r	ouse exinct $0.5 \times$	tract ver	ntilation of the the the the the the the the the the	or positiv c) = (23k	ve input v	ventilati wise (24	on from (b) $m + 0$	5 x (23h	.)			
(24c)m=	0				$\frac{0}{0} = \frac{1}{200}$						0	0		(24c)
d) If	natural	ventilativ	n or wh		<u> </u>		<u>ventilati</u>	on from						
u) ii	f (22b)r	n = 1, the	en (24d)	m = (22b)	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m ² x	0.5]				
(24d) <mark>m=</mark>	0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	ld) in bo	x (25)		•			
(25)m=	0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(25)
3 He	at l <mark>osse</mark>	s and he	eat l <mark>oss</mark>	naramete	er.									
ELEN		Gros	SS	Openin	gs	Net Ar	rea	U-val	ue	AXU		k-value	,	AXk
		area	(m²)	m	1 ²	A ,r	m²	W/m2	2K	(W/I	<)	kJ/m²∙ŀ	(kJ/K
Doo <mark>rs</mark>	Type 1					2	x	1	=	2				(26)
Doors	Type 2					2	x	1	=	2				(26)
Window	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Window	ws Type	2				3.96	x1	/[1/(1.2)+	0.04] =	4.53				(27)
Window	ws Type	e 3				1.26	x1	/[1/(1.2)+	0.04] =	1.44				(27)
Window	ws Type	e 4				1.44	. x1	/[1/(1.2)+	0.04] =	1.65				(27)
Floor						58.18	5 X	0.14		8.1459	= 1			(28)
Walls		120)	20.5	6	99.44	4 X	0.2		19.89	i F		i —	(29)
Roof		58.1	9	0		58.19	e x	0.1		5.82	ז ר		i –	(30)
Total a	rea of e	elements	, m²			236.3	7	L						(31)
Party v	vall					30	×	0	=	0			-	(32)
* for win	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	lated using	g formula 1	l/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	 3.2	
** includ	e the area	as on both	sides of ir	nternal wal	ls and par	titions		(22)						
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30) + (32) =			ļ	56.81	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18703.36	(34)
Therma	al mass	parame	ter (TM	⊃ = Cm ÷	÷ TFA) ir	אkJ/m²K			Indica	tive Value	Medium		250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	11.82 (36)	
if details of thermal bridging are not known (36) = $0.15 \times (31)$		
Ventilation heat loss calculated monthly $(33) \neq (30) =$	68.63 (37)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov	Dec	
(38)m= 57.4 57.11 56.83 55.49 55.24 54.08 54.08 53.86 54.53 55.24 55.74	6.27 (38)	
Heat transfer coefficient, W/K (39)m = (37) + (38)m		
(39)m= 126.03 125.74 125.46 124.13 123.88 122.71 122.71 122.49 123.16 123.88 124.38 1	24.91	
Average = Sum(39) ₁₁₂	12= 124.12 (39)	
Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$	1.07	
$(40) \text{III} = 1.08 1.08 1.08 1.07 1.06 1.05 1.05 1.05 1.06 1.06 1.07$ $Average = Sum(40), c_2$	12 = 1.07 (40)	
Number of days in month (Table 1a)	1.01	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov	Dec	
(41)m= 31 28 31 30 31 30 31 30 31 30	31 (41)	
4. Water heating energy requirement:	Wh/year:	
Assumed occupancy, N	(42)	
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)		
If TFA £ 13.9, N = 1 Applual average hot water usage in litres per day Vd average = $(25 \times N) + 36$	(43)	
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of		
not more that 125 litres per person per day (all water use, not and cold)		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Dec	
(14)m = 117 92 113 63 109 35 105 06 100 77 96 48 96 48 100 77 105 06 109 35 113 63 1	17.92	
$\frac{(44)}{10} = 117.32 + 13.03 + 103.03 + 100.04$	1286.43 (44)	
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c,	(d)	
(45)m= 174.88 152.95 157.83 137.6 132.03 113.93 105.57 121.15 122.59 142.87 155.96 1	69.36	
Total = Sum(45) ₁₁₂ = If instantaneous water heating at point of use (no hot water storage) enter 0 in hoxes (46) to (61)		
	1686.71 (45)	
(46)m- 26.23 22.04 23.67 20.64 10.8 17.00 15.84 18.17 18.20 21.43 23.20	1686.71 (45)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss:	<u>1686.71</u> (45) 25.4 (46)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 18	<u>1686.71</u> (45) 25.4 (46) (47)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 18 18 If community heating and no tank in dwelling, enter 110 litres in (47)	1686.71 (45) 25.4 (46)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 18 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss:	1686.71 (45) 25.4 (46)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 18 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 1.51	1686.71 (45) 25.4 (46) (47)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 18 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 1.51 Temperature factor from Table 2b 0.54	1686.71 (45) 25.4 (46) (47) (47) (48) (49)	
(46)m=26.2322.9423.6720.6419.817.0915.8418.1718.3921.4323.39Water storage loss:Storage volume (litres) including any solar or WWHRS storage within same vessel18If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):1.51Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspan="2	1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50)	
(46)m=26.2322.9423.6720.6419.817.0915.8418.1718.3921.4323.39Water storage loss:Storage volume (litres) including any solar or WWHRS storage within same vessel18If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):Temperature factor from Table 2bDifference (48) x (49) =0.82b) If manufacturer's declared cylinder loss factor is not known:	1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50)	
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss:Storage volume (litres) including any solar or WWHRS storage within same vessel18If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):1.51Colspan="4">Colspan="4">Colspan=48(48) x (49) =0.820.82If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):1.51Colspan="4">Colspan="4">Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48Colspan=48 <td c<="" td=""><td>1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50) (51)</td></td>	<td>1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50) (51)</td>	1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50) (51)
(46)m= 26.23 22.94 23.67 20.64 19.8 17.09 15.84 18.17 18.39 21.43 23.39 Water storage loss:Storage volume (litres) including any solar or WWHRS storage within same vessel1818If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):1.51Colspan="4">Colspan="4"Colspan="4">Colspan="4"Colsp	1686.71 (45) 25.4 (46) (47) (47) (48) (49) (50) (51) (52) (52)	

Energy Enter	/ lost fro (50) or	om water (54) in (5	⁻ storage 55)	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	0.	0 82		(54) (55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28		(56)
If cylinde	er contain	s dedicate	l d solar sto	rage, (57)	I m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5 ⁻	1 7)m = (56)	n where (H11) is fro	m Append	ix H	
(57)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and 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	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 req	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=	223.42	196.79	206.37	184.57	180.57	160.91	154.11	169.69	169.57	191.41	202.93	217.9		(62)
Solar DI	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	v) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	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=	223.42	196.79	206.37	184.57	180.57	160.91	154.11	169.69	169.57	191.41	202.93	217.9		
								Outp	out from wa	ater heate	r (annual)₁	12	2258.23	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	96.98	85.93	91.31	83.33	82.73	75.46	73.94	79.11	78.34	86.34	89.43	95.14		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the c	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89	170.89		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	65.67	58.32	47.43	35.91	26.84	22.66	24.49	31.83	42.72	54.24	63.31	67.49		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5				
(68)m=	418.52	422.86	411.92	388.62	359.21	331.57	313.1	308.76	319.7	343	372.41	400.05		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5		-		
(69)m=	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94	54.94		(69)
Pumps	s and fa	ns gains	(Table	5a)						-				
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	vaporatic	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92		(71)
Water	heating	gains (T	Table 5)								•			
(72)m=	130.35	127.87	122.73	115.74	111.2	104.81	99.38	106.34	108.81	116.04	124.21	127.88		(72)
Total i	internal	gains =	:	-	-	(66)	m + (67)m	+ (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	729.43	723.96	696.98	655.17	612.15	573.94	551.86	561.82	586.13	628.19	674.84	710.32		(73)
6. So	lar gains	s:		•	•	•	•		•					

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tat	x ble 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar	naine in	watte c	alculator	l for each	h month			(83)m – S	um(74)m	(82)m				
(83)m=	137.04	268.08	441.49	643.88	789.1	807.78	769.04	660.6	513.47	318.1	170.87	112.69		(83)
Total g	L gains –	internal a	and solar	r (84)m =	- (73)m -	L + (83)m	, watts							
(84)m=	866.47	992.03	1138.46	1299.05	1401.25	1381.72	1320.91	1222.42	1099.6	946.29	845.71	823.02		(84)
7 Me	an inte	rnal temr	berature	(heating	season)								
Temr	perature	e durina h	neating r	eriods ir	the livir	, ng area f	rom Tab	ole 9 Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for a	ains for	living are	ea. h1.m	(see Ta	ble 9a)		. (0)				21	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.97	0.9	0.75	0.56	0.41	0.46	0.72	0.94	0.99	1		(86)
Mean		al temper	ature in	living are	ea T1 (fo	ullow ste	ns 3 to 7	r in Tabl	e 9c)					
(87)m=	19.98	20.15	20.41	20.72	20.92	20.99	21	21	20.95	20.67	20.27	19.95		(87)
Temp	erature	e durina h	neating p	eriods ir	rest of	dwellina	from Ta	ble 9. T	h2 (°C)				I	
(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02		(88)
l Itilie/	L	tor for a	i ains for	rest of du	velling	h2 m (sc		(
(89)m=	0.99	0.98	0.96	0.87	0.69	0.48	0.32	9a)	0.64	0.92	0.98	0.99		(89)
Moon	intorn			the reat	of dwalli	ng T2 (f						0100		
	18.67			19 72		$\frac{12}{20.03}$		20.04	20	e 9C)	10.1	18.63		(90)
(50)11-	10.07	10.51	10.20	10.72	10.00	20.00	20.04	20.04	20	LA = Livin	g area ÷ (4	4) =	0.25	(00) (91)
											5	<i>'</i>	0.20	
Mean		al temper	ature (fo	or the wh	ole dwe	l(ing) = fl	_A × 11	+ (1 – †L	.A) × 12	40.00	40.00	40.00		(02)
(92)m=		19.22	19.57	19.97	20.2	20.27	20.20	20.20	20.24		19.39	16.90		(32)
(93)m=	19	19.22	19.57	19.97	20.2	20.27	20.28	20.28	20 24	19.92	19.39	18.96		(93)
8. Sp	ace he	ating reg	uirement				20120					10100		· · ·
Set T	i to the	mean int	ternal ter	mperatur	e obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	tilisatio	n factor fo	or gains	using Ta	ble 9a		•		,	, (,			
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fa	ctor for g	ains, hm	1:									l	
(94)m=	0.99	0.98	0.95	0.86	0.7	0.5	0.34	0.39	0.66	0.91	0.98	0.99		(94)
Usefu	Il gains	hmGm	, W = (94	4)m x (84	4)m	000.00	450.0	470.0	704.40	004.45	000.00	040.00		(05)
(95)m=	858.07	972.49	1082.45	1123.67	984.8	686.99	450.3	473.2	721.12	864.15	829.22	816.68		(95)
(96)m-			65				16.6	16.4	14.1	10.6	71	42		(96)
Heat	loss rat	te for me	an interr	al tempe	erature	lm W=	=[(39)m	x [(93)m	(96)m	1				()
(97)m=	1852.9	1 1800.56	1640.05	1374.36	1052.47	695.65	451.26	474.98	755.86	1154.52	1528.5	1844.15		(97)
Space	e heatii	ng require	ement fo	r each m	nonth, k\	Nh/mont	h = 0.02	24 x [(97)m – (95)m] x (4′	1)m			
(98)m=	740.17	556.46	414.85	180.49	50.35	0	0	0	0	216.04	, 503.48	764.43		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3426.28	(98)
Space	e heatii	ng require	ement in	kWh/m²	/year								29.44	(99)
9a. <u>En</u>	er <u>gy re</u>	quiremer	nts – In <u>d</u>	ividu <u>al h</u>	eating sv	yste <u>ms i</u> i	nclu <u>dina</u>	micro-C	CHP)					
Spac	e heati	ing:					0							
Fract	ion of s	pace hea	at from s	econdary	y/supple	mentary	system						0	(201)

Fraction of space heat from main system	n(s)		(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main system	m 1		(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system	1						·	92.8	(206)
Efficiency of secondary/supplementary h	eating system	า, %					·	0	(208)
Jan Feb Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requirement (calculated a	bove)								
740.17 556.46 414.85 180.49 5	0.35 0	0	0	0	216.04	503.48	764.43		
$(211)m = \{[(98)m \times (204)] + (210)m \} \times 100$	0 ÷ (206)				-				(211)
797.59 599.64 447.04 194.5 5	4.26 0	0	0	0	232.8	542.55	823.74		-
	_		lota	I (KWh/yea	ar) = Sum(2)	211) _{15,101}	2	3692.12	(211)
Space heating fuel (secondary), kWh/mo $= ((08)m \times (201)) + (214)m \times (200)$	onth								
$= \{ [(98) \text{ if } x (201)] + (214) \text{ if } \} x 100 \div (206) $	$\frac{5}{0}$	0	0	0	0	0	0		
	<u> </u>	Ů	Tota	l (kWh/yea	ar) =Sum(2	215) _{1 510 1}		0	(215)
Water heating							-	-	
Output from water heater (calculated abov	/e)								
223.42 196.79 206.37 184.57 18	80.57 160.91	154.11	169.69	169.57	191.41	202.93	217.9		_
Efficiency of water heater								79.1	(216)
(217)m= 87.07 86.73 85.94 84.05 8	1.21 79.1	79.1	79.1	79.1	84.43	86.44	87.18		(217)
Fuel for water heating, kWh/month									
(219) m = (04) m x 100 \div (217) m (219)m = 256.6 226.89 240.14 219.59 22	22.35 203.42	194.83	214.52	214.37	226.7	234.76	249.93		
			Tota	I = Sum(2	19a) ₁₁₂ =			2704.1	(219)
Annual totals					k\	Nh/yea	r	kWh/year], ,
Space heating fuel used, main system 1								3692.12	
Water heating fuel used								2704.1	Ī
Electricity for pumps, fans and electric kee	ep-hot								_
central heating pump:							30		(230c)
boiler with a fan-assisted flue							45		(230e)
Total electricity for the above kW/b/year			sum	of (230a)	(230a) -			76	() T(221)
			Sum	01 (2000).	(2009) –			75	
Electricity for lighting								463.88	(232)
10a. Fuel costs - individual heating syste	ems:								
	Fu	el			Fuel P	rice		Fuel Cost	
	kΜ	/h/year			(Table	12)		£/year	
Space heating - main system 1	(21	1) x			3.4	8	x 0.01 =	128.4857	(240)
Space heating - main system 2	(213	3) x			0		x 0.01 =	0	(241)
Space heating - secondary	(21	5) x			13.	19	x 0.01 =	0	_ (242)
Water heating cost (other fuel)	(219	9)			24	8	x 0.01 =	Q <u>/</u> 1](247)
Pumps fans and electric keen-hot	(23)	1)				<u> </u>	x 0.01 =	0.00	$\frac{1}{240}$
	(20	· /			i 13.'	19		9.89	(249)
μ μ μ μ μ μ μ μ μ μ			line b l				ا ≂ ؛ د مثلم	able 40-	
Energy for lighting	0g) separately (232	y as appl 2)	licable a	nd apply	/ fuel pric		ding to T × 0.01 =	able 12a](250)

Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	needed) + (250)(254) =		413.67 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (256) SAP rating (Section 12)	6)] ÷ [(4) + 45.0] =		0.42 (256) 1.08 (257) 84.98 (258)
12a. CO2 emissions – Individual heating systems	including micro-CHI		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	797.5 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	584.09 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	1381.58 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	240.75 (268)
Total CO2, kg/year		sum of (265)(271) =	1661.26 (272)
CO2 emissions per m ²		(272) ÷ (4) =	14.28 (273)
El rating (section 14)			86 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	4504.38 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	3299 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	7803.38 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1424.11 (268)
'Total Primary Energy		sum of (265)(271) =	9457.74 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	81.27 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa	a Num are Vei	ber: sion:		Versio	n: 1.0.0.28	
			P	roperty <i>i</i>	Address	: 4 Beds	- House	Enhano	ced		
Address :											
1. Overall dwelling dimer	1510115.			Aroc	(m ²)			iaht(m)		Volumo(m ³)	
Ground floor				Alea	a(III-)	(1a) x			(2a) =	VOIUIIIe(III°)] ₍₃₂₎
				5	0.19	(10) X			(20) -	151.20](<i>J</i> a)
First floor				5	8.19	(1b) x	2	2.6	(2b) =	151.28	(3b)
Total floor area TFA = (1a	ı)+(1b)+(1c)+((1d)+(1e)+(1r	I) 1'	16.37	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	302.56	(5)
2. Ventilation rate:											
	main	Se	econdar	у	other		total			m ³ per hour	
Number of chimneys		+ [] + [0] = [0	x	40 =	0	(6a)
Number of open flues		L + [_	0	」 」 + 厂	0	」 L ヿ = Г	0	x:	20 =	0] [(6b)
Number of intermittent far			0		0			× ·	10 =	10	$\int_{(72)}^{(02)}$
Number of passive vents							4		10 -	40	$\left \begin{pmatrix} 7a \\ 7b \end{pmatrix} \right $
Number of flueless are fi							0		10 -	0	
Number of flueless gas fir	es					L	0		Air ch	٥ anges per hou](7c) I r
Infiltration due to chimney	s, flues and fa	ans = (6	a)+(6b)+(7	a)+(7b)+(7c) =		40		÷ (5) =	0.13	(8)
If a pressurisation test has be	en carried out or	is intende	d, procee	d to (17), c	otherwise of	continue fr	om (9) to ((16)			-
Number of storeys in th	e dw <mark>elling</mark> (ns	5)						(0)	11-0.4	0	(9)
Additional Initiation	25 for steel or	timborf	romo or	0.25 for		a constr	uction	[(9)	-1]XU.1 =	0	$\begin{bmatrix} (10) \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ $
if both types of wall are pre	esent, use the va	lue corres	bonding to	the great	er wall are	a (after	uction			0](11)
deducting areas of opening	gs); if equal user	0.35									-
If suspended wooden fl	oor, enter 0.2	(unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else e	enter 0							-	0	(13)
Percentage of windows	and doors dr	aught st	ripped		0.25 [0.2	···· (1.4) ·· 1	001 -		-	0	(14)
					$(8) \pm (10)$. ⊼ (14) ÷ 1 ⊥ (11) ⊥ (1	(13) = (13) =	⊾ (15) –		0](15)](10)
	750 expresse	d in cub	ic motro	e nor ho			etre of o		area	0	$\left \begin{pmatrix} 10 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 $
If based on air permeabilit	tv value then	(18) = [(1	$7) \div 20]+(8)$	3 per no 3). otherwi	se (18) = ((16)		invelope	alea	4.5	$\left \begin{pmatrix} 17 \\ 18 \end{pmatrix} \right $
Air permeability value applies	if a pressurisation	on test has	been don	e or a deo	ree air pe	rmeability	is being us	sed		0.30](10)
Number of sides sheltered	, d				, ,	,	0			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ng shelter fac	tor			(21) = (18)) x (20) =				0.3	(21)
Infiltration rate modified for	or monthly win	d speed							-		
Jan Feb I	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from 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		
Adjust	ed infiltr	ation rat	e (allowi	ng for sl	nelter ar	nd wind s	speed) =	= (21a) x	(22a)m	•	•	<u> </u>		
-	0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36		
Calcul	ate effe	ctive air	change	rate for t	he appl	icable ca	ise			<u>.</u>		ـــــــــــــــــــــــــــــــــــــ		
IT Me	ecnanica			andix NL (C	(22) = (22)	a) v Emv (/	oquation (nuico (22h			l	0	(23a)
If bal	aust all th		work: offic	$\frac{1}{100000}$ in $\frac{1}{1000000}$	(20) = (20)	a) × Fillv (e	equation (n Tabla 4b		i) = (23a)		l	0	(23b)
		d moob			with ho				$a_{n} = (2)$	0h) m i (226) [1 (22a)	0	(23c)
a) II (24a)m-									$\frac{a}{1} = \frac{2}{2}$	$\frac{2}{1}$		$\frac{1-(230)}{1-(230)}$	÷ 100]	(24a)
(2-10)11-	balance				without				$\int_{-\infty}^{\infty} - (2^{\prime})$	 2b)m ⊥ (23b)	Ů		(2.03)
(24b)m=												0		(24b)
(2 13)11-	whole h				l		Ventilati	on from (Ů	Ů	Ů		(
0) 11	if (22b)n	n < 0.5 >	< (23b), t	hen (24	c) = (23l	o); other	wise (24	c) = (22	b) m + 0	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilati	on or wh	ole hous	se positi	ve input	ventilati	on from	loft	!				
	if (22b)n	n = 1, th	en (24d)	m = (22	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(24d)
Effe	ctive air	change	rate - er	nter (24a	a) or (24	b) or (24	c) or (24	ld) in bo	x (25)	_		,		
(25)m=	0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	1	(25)
3. He	at l <mark>osse</mark>	s and he	eat l <mark>oss</mark>	paramet	er:									
ELEN		Gros	ss (m²)	Openin	igs 1 ²	Net Ar	rea m²	U-val W/m2	ue PK	A X U	K)	k-value k.l/m²·k) < 1	ΑXk ĸJ/K
Doors	Type 1		,			2	×	1		2				(26)
Doors	Type 2					2	×	1		2	=			(26)
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	- 0.04] =	3.3	=			(27)
Windo	ws Type	2				3.96	x1	/[1/(1.2)+	- 0.04] =	4.53	=			(27)
Windo	ws Type	e 3				1.26	x1	/[1/(1.2)+	- 0.04] =	1.44	=			(27)
Windo	ws Type	e 4				1.44	x1	/[1/(1.2)+	- 0.04] =	1.65	=			(27)
Floor						58.18	5 ×	0.14		8.1459				(28)
Walls		120	D C	20.5	6	99.44	4 ×	0.2		19.89	=		╡ ├──	(29)
Roof		58.1	19	0		58.19	э х	0.1		5.82	=		-	(30)
Total a	rea of e	lements	s, m²	L		236.3	57				L			(31)
Party v	vall					30	×	0		0				(32)
• * for win	dows and	roof wind	ows, use e	effective w	indow U-v	alue calcul	lated using	g formula 1	 1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	 3.2	` ′
** inclua	le the area	as on both	sides of ir	nternal wal	lls and par	titions		(0.0) (7) (P=)					
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30) + (32) =				56.81	(33)
Heat c	apacity	Cm = S((A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	18703.36	(34)
Therm	al mass	parame	eter (TMF	⁻ = Cm -	÷ TFA) ii	n kJ/m²K			Indica	tive Value	: Medium		250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						11.82	(36)
<i>if details</i> Total fa	of therma abric he	a <i>l bridging</i> at loss	are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			68.63	(37)
Ventila	tion hea	at loss ca	alculated	I monthly	y				(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(38)m=	57.4	57.11	56.83	55.49	55.24	54.08	54.08	53.86	54.53	55.24	55.74	56.27		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	126.03	125.74	125.46	124.13	123.88	122.71	122.71	122.49	123.16	123.88	124.38	124.91		
Heat lo	oss para	meter (F	HLP), W/	′m²K					(40)m	Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	124.12	(39)
(40)m=	1.08	1.08	1.08	1.07	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.07]	
			<u> </u>					1	,	Average =	Sum(40)1	12 /12=	1.07	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)	May	lun	lul	Δυσ	Son	Oct	Nov	Dec	1	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	-	(41)
(,]	
4. Wa	iter hea	tina ener	rav reau	rement:								kWh/v	ear:	
			37										-	
Assum if TF	ed occu A > 13.9	upancy, I 9. N = 1	N + 1.76 x	[1 - exp	(-0.0003	149 x (TF		(2)1 + 0.0)013 x (⁻	TFA -13.	2.	85		(42)
if TF	A £ 13.	9, N = 1		[. enp	(0.0000			/_/] · 0.0						
Annua	l averag	je hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	se target o	10	7.2		(43)
not more	e that 125	litres per _l	person pe	day (all w	vater use, l	hot and co	ld)			io targot o	,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	117.92	113.63	109.35	105.06	100.77	96.48	96.48	100.77	105.06	109.35	113.63	117.92		
Enerav (content of	hot water	used - cal	culated mo	onthly = 4	190 x Vd.r	m x nm x D)) Tm / 3600	- kWh/mor	Total = Su hth (see Ta	- m(44) ₁₁₂ = ables 1b. 1	= c. 1d)	1286.43	(44)
(45)m=	174 88	152.95	157.83	137.6	132.03	113.93	105 57	121 15	122 59	142 87	155.96	169.36	1	
(10)	11 1.00	102.00	101.00	107.0	102.00	110.00	100.01	121110		Total = Su	m(45)1_12 =		1686.71	(45)
lf instant	taneous w	vater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46)) to (61)		. ,			
(46)m=	0 storage	0	0	0	0	0	0	0	0	0	0	0]	(46)
Storag	e volum	ioss. ie (litres)	includir	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		180	1	(47)
If comr	nunity h	neating a	ind no ta	nk in dw	velling, e	nter 110) litres in	(47)				100]	()
Otherw	vise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:				<i></i>	<i>.</i>						•	
a) If m 	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m lable	20				(10) (10)				0]	(49)
b) If m	/ lost fro	om water urer's de	storage	, KVVh/ye cvlinder l	ear loss fact	or is not	known:	(48) x (49)	=			0		(50)
Hot wa	iter stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0]	(51)
If com	munity h	eating s	ee secti	on 4.3									-	
Volum	e tactor	trom Tal	ble 2a m Tabla	2h								0	4	(52)
rempe	aiuiel	aci0i 110	III Table	20								U	J	(53)

Energy Enter	y lost fro (50) or	om water (54) in ({	r storage 55)	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0	(5	i4) i5)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m	L			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	6)
If cylinde	Ler contain	L s dedicate	d solar sto	l orage, (57)	<u>I</u> m = (56)m	x [(50) – ([(H11)] ÷ (50	0), else (5	l 7)m = (56)	m where (L H11) is fro	M Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	7)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0	(5	8)
Primar (mo	y circuit	loss cal / factor f	lculated rom Tab	for each le H5 if t	month (59)m = (solar wat	(58) ÷ 36 ter heatir	5 × (41) ng and a	m i cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(5	9)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 30	65 x (41))m]	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(6	;1)
Total h	neat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	<u>ا</u> (46)m +	ı (57)m +	(59)m + (61)m	
(62)m=	148.64	130.01	134.15	116.96	112.22	96.84	89.74	102.98	104.21	121.44	132.56	143.95	(6	;2)
Solar DI	HW input	L calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	ion to wate	er heating)	1	
(add a	dditiona	I 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	(6	i3)
Output	t from w	ater hea	iter	•									' 	
(64)m=	148.64	130.01	134.15	116.96	112.22	96.84	89.74	102.98	104.21	121.44	132.56	143.95		
								Out	out from wa	ater heate	r (annual)₁	12	1433.71 (6	4)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	37.16	32.5	33.54	29.24	28.06	24.21	22.43	25.74	26.05	30.36	33.14	35.99	(6	5)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	ns (Table	e 5). Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	142.4	(6	6)
Lightin	g gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				I	
(67)m=	26.27	23.33	18.97	14.36	10.74	9.06	9.79	12.73	17.09	21.7	25.32	27	(6	67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			I	
(68)m=	280.41	283.32	275.99	260.38	240.67	222.15	209.78	206.87	214.2	229.81	249.52	268.04	(6	68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5			I	
(69)m=	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	37.24	(6	i9)
Pumps	s and fa	ns gains	(Table	5a)									I	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(7	0)
Losses	s e.g. e\	, aporatio	n (nega	tive valu	es) (Tab	le 5)							I	
(71)m=	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	-113.92	(7	'1)
Water	heating	gains (1	Fable 5)								•		1	
(72)m=	49.95	48.37	45.08	40.61	37.71	33.63	30.15	34.6	36.18	40.81	46.03	48.37	(7	2)
Total i	internal	gains =		•	•	(66))m + (67)m	ı + (68)m ·	⊦ (69)m + ((70)m + (7	1)m + (72)	m	1	
(73)m=	422.34	420.73	405.76	381.07	354.84	330.56	315.45	319.92	333.19	358.04	386.59	409.13	(7	3)
6. So	lar gains	s:	•	•	•		•							

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Solar g	pains ir	watts, ca	alculated	for eac	n month			(83)m = S	um(74)m .	(82)m			I	
(83)m=	137.04	268.08	441.49	643.88	789.1	807.78	769.04	660.6	513.47	318.1	170.87	112.69		(83)
Total g	ains –	internal a	and solar	⁻ (84)m =	= (73)m -	+ (83)m	, watts						I	
(84)m=	559.38	688.81	847.24	1024.95	1143.94	1138.35	1084.49	980.52	846.66	676.13	557.46	521.82		(84)
7. Me	an inte	rnal temp	perature	(heating	season)								
Temp	erature	e during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fa	ctor for g	ains for l	living are	a, h1,m	(see Ta	ble 9a)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.95	0.85	0.66	0.49	0.56	0.84	0.98	1	1		(86)
Maan	intern							in Tabl						
				living are			ps 3 to 7			20.40	20.04	10.71		(87)
(07)11=	19.74	19.91	20.2	20.57	20.65	20.97	20.99	20.99	20.69	20.49	20.04	19.71		(07)
Temp	erature	e during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)				I	
(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02		(88)
Utilisa	ation fa	ctor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.94	0.8	0.57	0.39	0.45	0.78	0.98	1	1		(89)
Moan	intern	al temper	ature in	the rest	of dwelli	ng T2 (f	allow ste	ine 3 to	7 in Tahl					
(90)m=	18.85	19.02	19.32	19 68	19.93	20.02	20.04	20.04	19.97	19.61	19 16	18 83		(90)
(00)			10102	10100					f	LA = Livin	g area ÷ (4	4) =	0.25	(91)
												<i>`</i>	0.20	
Mean	intern	al temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	.A) × T2					
(92)m=	19.07	19.24	19.54	19.91	20.16	20.26	20.28	20.27	20.2	19.83	19.38	19.05		(92)
Apply	adjust	ment to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				(00)
(93)m=	19.07	19.24	19.54	19.91	20.16	20.26	20.28	20.27	20.2	19.83	19.38	19.05		(93)
8. Spa	ace he	ating requ	uirement											
Set T	i to the	mean int	ernal ter	nperatur	e obtain	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
แก่ย นเ	lon		Mor		Mov	lun	lul.	Δυσ	Son	Oct	Nov	Dec		
Litilier	tion fo	ctor for a	aine hm		iviay	Jun	Jui	Aug	Sep	001	INUV	Dec		
(94)m=	1		0.98	0.94	0.8	0.59	0.41	0.48	0 79	0.97	1	1		(94)
l leefu	l aging	hmGm	W = (9)	1)m x (8/	1)m	0.00	0	0.10	0.110	0.01				
(95)m=	558.71	686.19	834.45	959.15	919.04	674.93	448.76	469.77	667.93	658.89	555.85	521.35		(95)
Month	lv ave	rade exte	rnal tem	perature	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)
Heat	loss ra	te for me	an intern	al tempe	rature	lm W-	-[(39)m y	v [(93)m	_ (96)m	1				()
(97)m=	1862.0	5 1803.8	1635.61	1366 13	1048	694 69	451 13	474 65	751.6	J 1143 71	1527 8	1855 02		(97)
Snace	- hoati		ament fo	r each m	re re	//h/mont	h = 0.02	/ v [(97)	m = (95)	ml x (A)	1)m	1000.02		
(98)m=	969.68	751.03	596.06	293.02	95.95		0.02	0	0	360.7	699.81	992 25		
(00)		1.01.00			00.00	Ľ		Tota) = Sum(0)	8)	4758 52	(98)
c								TUId	, por year	(www.yed)	, – Sun(9	⊂ <i>j</i> 15,912 =	+100.02	
Space	e heati	ng require	ement in	κVVh/m ²	/year								40.89	(99)
8c. S	pace c	ooling rec	luiremen	nt										

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1153.47	908.05	930.92	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.92	0.96	0.94	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0	1062.69	873	875.34	0	0	0	0		(102)
Gains	(solar	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)					
(103)m=	0	0	0	0	0	1443.92	1378.52	1259.21	0	0	0	0		(103)
Space set (1	e <i>coolin</i> 04)m to	<i>g require</i> zero if (<i>ement fo</i> 104)m <	r month, : 3 × (98	<i>whole c</i>)m	lwelling,	continue	ous (kW	/h) = 0.0	24 x [(10	03)m – (1	102)m]:	x (41)m	
(104)m=	0	0	0	0	0	274.49	376.11	285.6	0	0	0	0		
-									Total	= Sum(104)	=	936.2	(104)
Cooled	fractio	n							f C =	cooled a	area ÷ (4	l) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Total	' = Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	68.62	94.03	71.4	0	0	0	0		_
									Total	= Sum(107)	=	234.05	(107)
Space	cooling	requirer	nent in k	(Wh/ <mark>m²/</mark> y	/ear				(107)	÷ (4) =			2.01	(108)
8f. Fab	ric Ene	rgy Effici	ien <mark>cy (c</mark> a	alculated	l only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		42.9	(109)

					User E	Details:						
Assessor Name: Software Name:	Stror	ma FS/	AP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versic	on: 1.0.0.28	
				Р	roperty	Address	: 5 Beds	- House	e Enhano	ced		
Address :												
1. Overall dwelling dim	ensions:				Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor					Are	a(III-) 12.67	(1a) x			(2a) =] (3a)
Eiret floor						+2.07	(14) X				110.94	
						42.67	(df) x	2	2.6	(2D) =	110.94	
Second floor						42.66	(1c) x	2	2.6	(2c) =	110.92	(3c)
Total floor area TFA = (1a)+(1b) [,]	+(1c)+([·]	1d)+(1e	e)+(1r	n)	128	(4)					
Dwelling volume							(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	332.8	(5)
2. Ventilation rate:						_						
	m ³ per hour											
Number of chimneys		0	+	0] + [0	=	0	X 4	40 =	0	(6a)
Number of open flues		0	+	0	+	0] = [0	x :	20 =	0	(6b)
Number of intermittent f	ans	_					- Ē	4	×	10 =	40	(7a)
Number of passive vent	s						Ē	0	x	10 =	0	(7b)
Number of flueless gas	fires						Ī	0	X	40 =	0	(7c)
										Air ch	anges per hou	
Infiltration due to chimne	eys, flues	s and fa	ns = (6	a)+(6b)+(7	a)+(7b)+	(7c) =		40		÷ (5) =	0.12	(8)
If a pressurisation test has	been carrie	ed out or	is intende	ed, procee	d to (17),	otherwise of	continue fr	om (9) to (16)			
Additional infiltration	the awei	ling (ns)						[(0)]	_11v0 1 –	0	(9)
Structural infiltration: (0.25 for s	steel or	timber	frame or	0.35 fo	r masoni	rv constr	ruction	[(0)	1]x0.1 =	0	(10)
if both types of wall are	present, us	se the val	ue corres	ponding to	the grea	ter wall are	a (after					
lf suspended wooden	ings); it eq floor, en	iual user (nter 0.2).35 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	7(12)
If no draught lobby, er	nter 0.05	i, else e	nter 0		. (,					0	(12)
Percentage of window	vs and de	oors dra	aught st	ripped							0	(14)
Window infiltration			-			0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate						(8) + (10)	+ <mark>(11)</mark> + (1	12) + (13) +	+ (15) =		0	(16)
Air permeability value	, q50, ex	presse	d in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	4.5	(17)
If based on air permeab	ility valu	e, then	(18) = [(1	7) ÷ 20]+(8	3), otherw	rise (18) = ((16)				0.35	(18)
Air permeability value appli	ies if a pres	ssurisatio	n test has	s been dor	e or a de	gree air pe	rmeability	is being us	sed			-
Number of sides shelter	ed					(20) = 1 -	[0.075 x (1	19)] =			2	(19)
Infiltration rate incorpora	atina she	lter fact	or			(21) = (18)	(x (20) =	. • /]			0.00	(20)
Infiltration rate modified	for mont	thly wind	d sneer	4		() (,/				0.29	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s	peed fro	m Table	97		L					1		
(22)m= 5.1 5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
	I	I								1	1	

Wind F	actor (2	2a)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			
Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m						
0.1.1	0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.34			
Calcula If me	ate etter	ctive air al ventila	change . ition:	rate for t	ne appli	cable ca	ISE								(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a))	(23h)
lf bala	anced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,				, 	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1	1 – (23c)	÷ 100]		
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat red	covery (N	MV) (24b)m = (22	2b)m + (i	23b)	1	1		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24b)
c) If	whole h	ouse ex	tract ver	ntilation o	or positiv	/e input v	ventilatio	on from c	outside	•			•		
i	f (22b)n	า < 0.5 ×	(23b), t	hen (240	c) = (23k	o); other	wise (24	c) = (22k	o) m + 0.	.5 × (23b)	i	,		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	on or wh	ole hous $m = (22)$	e positiv	ve input	ventilatio	on from I	oft 2b)m² v	0.51					
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.5 + [(2	0.54	0.5	0.55	0.56			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24)	(24)	$r_{\rm c}$ or (24	ld) in hoy	(25)			0100]		· · · ·
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	1		(25)
											<u></u>				
3. He		s and he	eat loss		er:	Not Ar						k volu			(]e
ELEN	IENI	area	(m²)	openin	gs 1 ²	Net Ar	ea n²	W/m2	ue 2K	A X U (W/I	K)	kJ/m²-l	κ	kJ/	К
Doors	Type 1					2	×	1	=	2					(26)
Doors	Type 2					2	x	1	=	2					(26)
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3					(27)
Windo	ws Type	2				3.96	x1	/[1/(1.2)+	0.04] =	4.53					(27)
Windo	ws Type	93				1.26	x1	/[1/(1.2)+	0.04] =	1.44					(27)
Windo	ws Type	e 4				1.44	x1	/[1/(1.2)+	0.04] =	1.65					(27)
Floor						42.67	7 X	0.14	=	5.9738					(28)
Walls		210)	34.0	6	175.9	4 x	0.2		35.19	T T		Ξ Ē		(29)
Roof		42.6	67	0		42.67	7 X	0.1		4.27	i F		Ξ Γ		(30)
Total a	rea of e	lements	, m²			295.3	4	L							 (31)
* for win ** inclua	dows and le the area	roof winde as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and par	alue calcul titions	ated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	n 3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				83	.85	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	2733	36.18	(34)
Therm	al mass	parame	ter (TMF		- TFA) ir	ו kJ/m²K			Indica	tive Value	: Medium		2	50	(35)
For desi	gn assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f			-
can be ι Therm	ised inste	a a of a de a de a de a de a de a de a de a d	alled calc x Y) cal	ulation. culated i	isina Ar	nendiv I	ĸ							77	
	u nuy		~ 1) Uai	Julated	aoniy Ap	POLIDIA	•						1 14	.11	(30)
if detail	s of therma	al bridging	are not kr	10wn (36) =	= 0.15 x (3	1)								_	
-----------------	------------------	--------------	----------------------	-------------------------	--------------------------	-------------------------	-----------------------	-------------	--------------------	-------------	------------------------	---------	---------	------	
Total	fabric he	at loss							(33) +	(36) =			98.62	(37)	
Ventil	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)		•		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	62.6	62.3	62.01	60.63	60.37	59.17	59.17	58.95	59.63	60.37	60.9	61.44]	(38)	
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m				
(39)m=	161.22	160.92	160.62	159.25	158.99	157.79	157.79	157.57	158.25	158.99	159.51	160.05			
							•			Average =	Sum(39)1	12 /12=	159.24	(39)	
Heat I	oss para	meter (H	HLP), W/	/m²K					(40)m	= (39)m ÷	· (4)		1		
(40)m=	1.26	1.26	1.25	1.24	1.24	1.23	1.23	1.23	1.24	1.24	1.25	1.25	1.04		
Numb	er of day	/s in mo	nth (Tab	le 1a)						Average =	Sum(40)1.	12 /12=	1.24	(40)	
	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. W	ater hea	ting ene	rgy requ	irement:								kWh/y	ear:		
Δεειια	ned occi	inancy	N									00	1	(42)	
if TI	FA > 13.9	9, N = 1	+ 1.76 x	: [1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.0)013 x (TFA -13.	.9)	09	J	(42)	
if TI	FA £ 13.	9, N = 1											1		
Annua	al averag	e hot wa	ater usag	ge in litre	es per da 5% if the o	ay Vd,av Iwelling is	erage = designed i	(25 x N)	+ 36 a water us	se target o	108	3.24		(43)	
not mol	re that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a water at	o larger e	1				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wa	ter usage i	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from	Table 1c x	(43)					1		
(44)m=	119.06	114.73	110.4	106.08	101.75	97.42	97.42	101.75	106.08	110.4	114.73	119.06			
			<u> </u>							Total = Su	m(44) ₁₁₂ =	-	1298.88	(44)	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)			
(45)m=	176.57	154.43	159.36	138.93	133.31	115.03	106.6	122.32	123.78	144.25	157.47	171		_	
If inoto		inter booti	na of noint	hof waa /m	botwata	c otorogia l	ontor 0 in	haven (16	·	Total = Su	m(45) ₁₁₂ =	-	1703.04	(45)	
ii iiistai			ng at point			siorage),				1	1		1	(10)	
(46)m= Water	26.49 storage	23.16	23.9	20.84	20	17.26	15.99	18.35	18.57	21.64	23.62	25.65		(46)	
Storad	ae volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		180	1	(47)	
If com	, Imunity h	eating a	and no ta	ank in dw	vellina, e	nter 110) litres in	(47)					1		
Other	wise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)				
Water	storage	loss:											_		
a) If r	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	51		(48)	
Temp	erature f	actor fro	m Table	2b							0.	54		(49)	
Energ	y lost fro	m water	storage	e, kWh/ye	ear			(48) x (49)) =		0.	82]	(50)	
b) If r	nanufact	urer's de	eclared (cylinder l rom Tabl	oss fact	or is not h/litro/da	known:						1	(51)	
If com	imunitv h	leating s	ee secti	on 4.3		.,	•y)					U	J	(51)	
Volum	ne factor	from Ta	ble 2a									0]	(52)	
Temp	erature f	actor fro	m Table	2b								0	1	(53)	
Energ	y lost fro	m water	⁻ storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0	j	(54)	
Enter	(50) or	(54) in (5	55)								0.	82]	(55)	

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28	(5)	6)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	25.28	22.83	25.28	24.46	25.28	24.46	25.28	25.28	24.46	25.28	24.46	25.28	(5	7)
Primar	ry circuit	loss (ar	nnual) fro	om Table	e 3							0	(5	8)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				'	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)		1	
(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	(5)	9)
Combi	i 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	(6	51)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54	(6)	62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (3) I	i	1		1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(6	;3)
Output	t from w	ater hea	ter		1								I	
(64)m=	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54		
							()	Outp	out from wa	ater heate	r (annual)1	12	2274.55 (6	94)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m	1 + 0.8	([(46)m	+ (57)m	+ (59)m		· F)
=m(co)	97.54	86.42	91.82	83.77	83.16	/0.83	14.27	/9.5	78.74	80.8	89.94	95.69	(0.	5)
incit	lde (57)	m in cald	culation	of (65)m	only if c	yiinder i	s in the d	dweiling	or not w	ater is fr	om com	munity n	eating	
5. Int	ternal ga	ains (see	e lable t	b and 5a):									
Metab	olic gair	is (Table	5) Wat	te										
	Law			115		L. L. L.		A	Car	Ost	New	Dee	1	
(66)m-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(6)	6)
(66)m=	Jan 173.38	Feb 173.38	Mar 173.38	Apr 173.38	May 173.38	Jun 173.38	Jul 173.38	Aug 173.38	Sep 173.38	Oct 173.38	Nov 173.38	Dec 173.38	(6)	6)
(66)m= Lightin	Jan 173.38 g gains	Feb 173.38 (calcula	Mar 173.38 ted in Ap	Apr 173.38 opendix	May 173.38 L, equat	Jun 173.38 ion L9 o	Jul 173.38 r L9a), a	Aug 173.38 Iso see	Sep 173.38 Table 5	Oct 173.38	Nov 173.38	Dec 173.38	(6	6)
(66)m= Lightin (67)m=	Jan 173.38 ng gains 65.81	Feb 173.38 (calcula 58.46	Mar 173.38 ted in Ap 47.54	Apr 173.38 opendix 35.99	May 173.38 L, equat 26.9	Jun 173.38 ion L9 o 22.71	Jul 173.38 r L9a), a 24.54	Aug 173.38 Iso see - 31.9	Sep 173.38 Table 5 42.82	Oct 173.38 54.37	Nov 173.38 63.45	Dec 173.38 67.64	(6	6) 7)
(66)m= Lightin (67)m= Applia	Jan 173.38 ag gains 65.81 nces ga	Feb 173.38 (calcula 58.46 ins (calc	Mar 173.38 ted in Ap 47.54 ulated ir	Apr 173.38 opendix 35.99 Append	May 173.38 L, equat 26.9 dix L, eq	Jun 173.38 ion L9 o 22.71 uation L	Jul 173.38 r L9a), a 24.54 13 or L1	Aug 173.38 lso see 31.9 3a), also	Sep 173.38 Table 5 42.82 see Ta 336.67	Oct 173.38 54.37 ble 5	Nov 173.38 63.45	Dec 173.38 67.64	(6	6) 7)
(66)m= Lightin (67)m= Applia (68)m=	Jan 173.38 ng gains 65.81 nces ga 440.74	Feb 173.38 (calcula 58.46 ins (calc 445.31	Mar 173.38 ted in Ap 47.54 ulated in 433.78	Apr 173.38 opendix 35.99 Append 409.25	May 173.38 L, equat 26.9 dix L, eq 378.28	Jun 173.38 ion L9 o 22.71 uation L 349.17	Jul 173.38 r L9a), a 24.54 13 or L1 329.72	Aug 173.38 Iso see ⁻ 31.9 3a), also 325.15	Sep 173.38 Table 5 42.82 9 see Ta 336.67	Oct 173.38 54.37 ble 5 361.21	Nov 173.38 63.45 392.18	Dec 173.38 67.64 421.29	(6 (6) (6)	66) 67) 68)
(66)m= Lightin (67)m= Applia (68)m= Cookir	Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23	Mar 173.38 ted in Ap 47.54 ulated ir 433.78 tted in A	Apr 173.38 ppendix 35.99 Append 409.25 ppendix	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a)	Aug 173.38 Iso see 31.9 3a), also 325.15), also se	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table	Oct 173.38 54.37 ble 5 361.21 5	Nov 173.38 63.45 392.18	Dec 173.38 67.64 421.29	(6 (6 (6)	66) 67) 68)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23	Mar 173.38 ted in Ap 47.54 ulated in 433.78 tted in A 55.23	Apr 173.38 ppendix 35.99 Appendix 409.25 ppendix 55.23	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 • see Ta 336.67 • Table 55.23	Oct 173.38 54.37 ble 5 361.21 5 55.23	Nov 173.38 63.45 392.18 55.23	Dec 173.38 67.64 421.29 55.23	(6 (6) (6) (6)	66) 67) 68) 69)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fair 3	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3	Mar 173.38 ted in Ap 47.54 ulated ir 433.78 tted in A 55.23 (Table 9	Apr 173.38 opendix 35.99 Append 409.25 ppendix 55.23 5a)	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 See Ta 336.67 ee Table 55.23	Oct 173.38 54.37 ble 5 361.21 5 55.23	Nov 173.38 63.45 392.18 55.23	Dec 173.38 67.64 421.29 55.23	(6 (6) (6) (6)	56) 57) 58) 59)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ted in A 55.23 (Table 9 3	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tivo your	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23	Sep 173.38 Table 5 42.82 5 see Ta 336.67 55.23 3	Oct 173.38 54.37 ble 5 361.21 5 55.23 3	Nov 173.38 63.45 392.18 55.23 3	Dec 173.38 67.64 421.29 55.23 3	(6 (6) (6) (6) (6)	66) 67) 68) 69) 70)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	Jan 173.38 ag gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3 s e.g. ev -115.58	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 vaporatic -115.58	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ited in A 55.23 (Table 9 3 on (nega -115.58	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3	Aug 173.38 Iso see ⁻ 31.9 3a), also 325.15), also se 55.23 3	Sep 173.38 Table 5 42.82 5 see Ta 336.67 2 e Table 55.23 3 -115.58	Oct 173.38 54.37 ble 5 361.21 5 55.23 3	Nov 173.38 63.45 392.18 55.23 3	Dec 173.38 67.64 421.29 55.23 3	(6 (6 (6 (6) (7)	56) 57) 58) 59) 70)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fan 3 s e.g. ev -115.58	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (7)	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ted in A 55.23 (Table 5 an (nega -115.58 Table 5	Apr 173.38 opendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23 3 -115.58	Sep 173.38 Table 5 42.82 9 see Ta 336.67 2e Table 55.23 3 -115.58	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58	Nov 173.38 63.45 392.18 55.23 3 -115.58	Dec 173.38 67.64 421.29 55.23 3 -115.58	(6 (6) (6) (6) (7) (7)	56) 57) 58) 59) 70) 71)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fai 3 s e.g. ev -115.58 heating 131.1	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (T 128.6	Mar 173.38 ted in Ap 47.54 ulated in Ap 433.78 ited in A 55.23 (Table 9 3 on (nega -115.58 Table 5) 123.41	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58 105.32	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58	Aug 173.38 Iso see 31.9 3a), also 325.15), also se 55.23 3 -115.58	Sep 173.38 Table 5 42.82 9 see Ta 336.67 9 Table 55.23 3 -115.58 109.36	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58	Nov 173.38 63.45 392.18 55.23 3 -115.58	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61	(6) (6) (6) (6) (7) (7) (7) (7)	56) 57) 58) 59) 70) 71)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total	Jan Jan 173.38 ng gains 65.81 nces ga 440.74 ng gains 55.23 s and fail 3 s e.g. ev -115.58 heating 131.1	Feb 173.38 (calcula 58.46 ins (calcula 445.31 (calcula 55.23 ns gains 3 vaporatic -115.58 gains (T 128.6 gains -	Mar 173.38 ted in Ap 47.54 ulated in 433.78 ited in A 55.23 (Table 8 3 on (nega -115.58 able 5) 123.41	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 ole 5) -115.58 105.32 (66)	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58 99.83 m + (67)m	Aug 173.38 Iso see - 31.9 3a), also 325.15), also se 55.23 3 -115.58 106.86) + (68)m -	Sep 173.38 Table 5 42.82 5 see Ta 336.67 2 Table 55.23 3 -115.58 109.36 (69)m + 0	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58 116.66 (70)m + (7	Nov 173.38 63.45 392.18 55.23 3 -115.58 124.91 1)m + (72)	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61 m	(6) (6) (6) (6) (7) (7) (7) (7) (7)	66) 57) 58) 59) 70) 71) 72)
(66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i (73)m=	Jan Jan 173.38 og gains 65.81 nces ga 440.74 ng gains 55.23 s and fan 3 s e.g. ev -115.58 heating 131.1 internal	Feb 173.38 (calcula 58.46 ins (calc 445.31 (calcula 55.23 ns gains 3 raporatic -115.58 gains (T 128.6 gains = 748.39	Mar 173.38 ted in Ap 47.54 ulated in Ap 433.78 ited in A 55.23 (Table 5) 123.41 720.75	Apr 173.38 ppendix 35.99 Append 409.25 ppendix 55.23 5a) 3 tive valu -115.58 116.35 677.61	May 173.38 L, equat 26.9 dix L, eq 378.28 L, equat 55.23 3 es) (Tab -115.58 111.77	Jun 173.38 ion L9 o 22.71 uation L 349.17 tion L15 55.23 3 0le 5) -115.58 105.32 (66) 593.22	Jul 173.38 r L9a), a 24.54 13 or L1 329.72 or L15a) 55.23 3 -115.58 99.83 m + (67)m 570.12	Aug 173.38 Iso see - 31.9 3a), also 325.15), also se 55.23 3 -115.58 106.86 + (68)m + 579.93	Sep 173.38 Table 5 42.82 9 see Ta 336.67 ee Table 55.23 3 -115.58 109.36 + (69)m + 1 604.87	Oct 173.38 54.37 ble 5 361.21 5 55.23 3 -115.58 116.66 (70)m + (7 648.26	Nov 173.38 63.45 392.18 55.23 3 -115.58 124.91 1)m + (72) 696.56	Dec 173.38 67.64 421.29 55.23 3 -115.58 128.61 m 733.57	(6) (6) (6) (7) (7) (7) (7) (7) (7) (7)	 (6) (7) (8) (9) (0) (1) (2) (3)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor		Area m²			Flu Tat	x ole 6a		Та	g_ able 6b		FF Table 6c			Gains (W)	
South	0.9x	0.77		x	2.8	8	x	4	6.75	×		0.8	x	0.76		=	226.93	(78)
South	0.9x	0.77		x	2.8	8	x	7	6.57	x		0.8	× ٦	0.76		=	371.65	(78)
South	0.9x	0.77		x	2.8	8	x	9	7.53	x		0.8	× ٦	0.76		=	473.42	(78)
South	0.9x	0.77		x	2.8	8	x	1	10.23	x		0.8	× ٦	0.76		=	535.07	(78)
South	0.9x	0.77		x	2.8	8	x	1	14.87	x		0.8	× ٦	0.76	=	=	557.57	(78)
South	0.9x	0.77		x	2.8	8	x	1	10.55	x		0.8	× ٦	0.76		=	536.59	(78)
South	0.9x	0.77		x	2.8	8	x	10	08.01	x		0.8	× ٦	0.76		=	524.28	(78)
South	0.9x	0.77		x	2.8	8	x	10	04.89	x		0.8	× ٦	0.76		=	509.15	(78)
South	0.9x	0.77		x	2.8	8	x	10	01.89	x		0.8	۲ × ۲	0.76		=	494.54	(78)
South	0.9x	0.77		x	2.8	8	x	8	2.59	x		0.8	۲ ×	0.76		=	400.86	(78)
South	0.9x	0.77		x	2.8	8	x	5	5.42	x		0.8	۲ × ۲	0.76		=	268.99	(78)
South	0.9x	0.77		x	2.8	8	x		40.4	x		0.8	۲×	0.76		=	196.09	(78)
								L		1								
Solar o	gains ir	n watts, ca	alculat	ed	for each	n mont	h			(83)m	1 = Su	um(74)m .	(82)m					
(83)m=	380.35	671.78	967.6	9	1255.93	1441.0	2 1	440.95	1385.27	1248	3.73	1069.4	756.9	9 460.29	322	2.26		(83)
Total g	jains –	internal a	nd so	lar	(84)m =	: (73)m	ı + (83)m	, watts						-			
(84)m=	1134.0	3 1420.17	1688.4	14	1933.54	2073.9	9 2	034.17	1955.39	1828	8.65	1674.27	1405.2	25 1156.85	105	5.82		(84)
7 . Me	an inte	ernal temp	eratu	е (hea <mark>ting</mark>	seaso												
Temp	eratur	e during h	eating	j pe	eriods in	the liv	/ing	area f	from Tab	ole 9	, Th1	1 (°C)					21	(85)
Utilisa	ation fa	actor for ga	ains fo	or li	ving are	a, h1,	m (s	ее Та	ble 9a)									
	Jan	Feb	Ма	r	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		
(86)m=	0.99	0.97	0.93	Τ	0.82	0.66	Т	0.49	0.35	0.3	39	0.62	0.89	0.98	0.9	99		(86)
Mean	intern	al tempera	ature	n li	ving are	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	19.87	20.13	20.45	;	20.76	20.93		20.99	21	2	1	20.96	20.7	20.22	19	.82]	(87)
Temr		e durina h	eating		riods in	resto	 f dv	velling	from Ta		<u> </u>)2 (°C)		!			1	
(88)m=	19.87	19.87	19.88		19.88	19.89		19.89	19.89	19	.9	19.89	19.89	19.88	19	.88]	(88)
										()							1	
Utilisa				or re		veiling	, n∠ 	.,m (se		9a)	3	0.53	0.85	0.97		00	1	(89)
(03)11-	0.33	0.90	0.91		0.70	0.0		0.41	0.27	0.	5	0.00	0.00	0.97	0.	55	J	(00)
Mean	intern	al tempera	ature	n t	he rest o	of dwe	lling) T2 (fo	ollow ste	eps 3	to 7	' in Tabl	e 9c)				1	(00)
(90)m=	18.41	18.78	19.23	3	19.63	19.83		19.89	19.89	19.	89	19.87	19.58	18.91	18	.33		(90)
												I	LA = LI	/ing area ÷ (•	+) =	ľ	0.17	(91)
Mean	intern	al tempera	ature	(for	the who	ole dw	ellir	ng) = fl	_A × T1	+ (1	– fL	A) × T2					1	
(92)m=	18.65	19	19.43	3	19.82	20.01		20.07	20.08	20.	08	20.05	19.77	19.13	18	.58		(92)
Apply	v adjust	tment to th	ne me	an	internal	tempe	eratu	ure fro	m Table	4e,	whe	re appro	opriate	: I			1	
(93)m=	18.65	19	19.43	3	19.82	20.01		20.07	20.08	20.	08	20.05	19.77	19.13	18	.58		(93)
8. Sp	ace he	ating requ	lireme	nt		! -!		1 -4 -4		Tabl			4 T ! -	(70)	-		lata	
Set I the ut	i to the tilisatio	n factor fo	ernal i or gain	err s u	iperatur Ising Ta	e opta ble 9a	ineo	a at ste	ep 11 of	iab	ie 9b	, so tha	t II,m:	=(76)m an	a re-	·calc	Julate	
	Jan	Feb	Ma	r	Apr	May	,	Jun	Jul	A	ua l	Sep	Oct	Nov		ec		
Utilisa	ation fa	actor for ga	ains, h	im:		,				L		1-				-	I	
(94)m=	0.98	0.96	0.9		0.78	0.61	Τ	0.42	0.28	0.3	32	0.55	0.84	0.96	0.	99		(94)

0.78

0.61

0.42

0.28

0.32 0.55

0.84

0.96

0.99

0.9

(94)m= 0.98

0.96

Usefu	l gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	1113.05	1356.54	1515.72	1505.84	1259.53	854.55	547.7	577.85	913.48	1180.69	1112.08	1041.04		(95)
Month	nly avera	age exte	rnal tem	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)
Heat	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2313.49	2269.34	2076.88	1739.15	1321.08	863.06	548.66	579.49	941.22	1457.66	1919.04	2301.84		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m		1	
(98)m=	893.13	613.4	417.5	167.98	45.79	0	0	0	0	206.07	581.01	938.03		-
								Tota	l per year	(kWh/year) = Sum(98	B) _{15,912} =	3862.91	(98)
Space	e heating	g require	ement in	kWh/m ²	/year								30.18	(99)
9a. En	ergy req	luiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =		İ	1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								89.8	(206)
Efficie	ency of s	econda	rv/suppl	ementar	v heating	a svsterr	ı. %						0	(208)
	lon	Eab	Mor	Apr	Mov	lup			Son	Oct	Nov		k\//b/vo	
Space	heatin	n require	ement (c	alculate	d above	Jun	Jui	Aug	Sep	Oci	1100	Dec	KVVII/ye	ai
Opuot	893.13	613.4	417.5	167.98	45.79	0	0	0	0	206.07	581.01	938.03		
ا (211)m	(08))m x (20	ل (21 بر (21		100 - (2	06)								(211)
(211)	994.58	683.07	464.93	187.06	50.99	00)	0	0	0	229.47	647	1044.58		(211)
						-		Tota	l (kWh/yea	ar) =Sum(2	211), 510, 12	=	4301.68	(211)
Space	heatin	n fuel (s	econdar	v)_k\//h/	month							l		
= {[(98])m x (20	91001 (0))1)] + (2′	14) m } x	(100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating											I		
Output	from wa	ater hea	ter (calc	ulated al	oove)									
	225.11	198.27	207.9	185.9	181.85	162.01	155.14	170.86	170.75	192.79	204.44	219.54		_
Efficier	ncy of w	ater hea	ter										79.1	(216)
(217)m=	87.42	86.93	85.94	83.84	81.04	79.1	79.1	79.1	79.1	84.29	86.75	87.55		(217)
Fuel fo	r water	heating,	kWh/mo	onth										
(219)m-	1 = (64)	228.09) ÷ (217) 241 92	m 221 73	224 38	204 81	196 13	216	215 87	228 73	235.68	250 75		
(210)11-	201.0	220.00	241.02	221.70	224.00	204.01	100.10	Tota	I = Sum(2)	19a) =	200.00	200.10	2721.6	(210)
Annua	l totale									د در ۱۱۷ ۲۱	Nh/voar	l	kWb/year	(219)
Space	heating	fuel use	ed, main	system	1					N	will year		4301.68	٦
Water	heating	fueluee	d									l	2721 6	
			ч									l	2121.0	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatin	g pump:										30		(230c)

boiler with a fan-assisted flue]	45	1	(230e)
Total electricity for the above, kWh/year	sum of (2	30a)(230g) =		75	(231)
Electricity for lighting				464.92	(232)
10a. Fuel costs - individual heating systems:					7
	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	0.01 =	149.6985	(240)
Space heating - main system 2	(213) x	0	0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	0.01 =	94.71	(247)
Pumps, fans and electric keep-hot	(231)	13.19	0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) sepa Energy for lighting	arately as applicable and a (232)	pply fuel price accord	ding to	Table 12a 61.32	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as Total energy cost (245)(247)	s needed 7) + (250)(254) =	_		435.63	(255)
11a. SAP rating - individual heating systems					_
Energy cost deflator (Table 12)	56)] ÷ [(4) + 45,0] =			0.42	(256)
SAP rating (Section 12)				85.25](258)
12a. CO2 emissions – Individual heating systems	s including micro-CHP], ,
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	=	929.16	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	587.86	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		1517.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	241.29	(268)
Total CO2, kg/year	S	um of (265)(271) =		1797.24	(272)
CO2 emissions per m ²	(:	272) ÷ (4) =		14.04	(273)
EI rating (section 14)				86	(274)
13a. Primary Energy					
	Energy kWh/year	Primary factor		P. Energy kWh/year	_
Space heating (main system 1)	(211) x	1.22	=	5248.05	(261)

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3320.35	(264)
Space and water heating	(261) + (262) + (263) + (264	4) =		8568.4	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1427.3	(268)
'Total Primary Energy		sum of (265)(271) =		10225.94	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		79.89	(273)



			User D	etails:										
Assessor Name: Software Name:	Sessor Name: ware Name:Stroma FSAP 2012Stroma Number: Software Version:VersionProperty Address: 5 Beds - House Enhancedess :verall dwelling dimensions:Area(m²)Av. Height(m)d floordord floord floord floord floord floord floord floord floord floord floord floord floord floord floord floord floorfloor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)128(4)													
Addross :		P	roperty	Address	. o beus	- House	Ennand	cea						
1. Overall dwelling dimens	ions:													
			Area	a(m²)		Av. Heig	ght(m)		Volume(m ³)					
Ground floor			4	2.67	(1a) x	2.	6	(2a) =	110.94	(3a)				
First floor			4	2.67	(1b) x	2.	6	(2b) =	110.94	(3b)				
Second floor			4	2.66	(1c) x	2.	6	(2c) =	110.92	(3c)				
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+	·(1e)+(1r	n)	128	(4)			1		_				
Dwelling volume					(3a)+(3b))+(3c)+(3d)	+(3e)+	.(3n) =	332.8	(5)				
2. Ventilation rate:										_				
	main beating	secondar beating	у	other		total			m ³ per hour					
Number of chimneys		0] + [0] = [0	X 4	40 =	0	(6a)				
Number of open flues	0 +	0	<u> </u> + [0	- -	0	×	20 =	0	(6b)				
Number of intermittent fans					Γ	4	× ′	10 =	40	(7a)				
Number of passive vents					Ē	0	x ′	10 =	0	(7b)				
Number of flueless gas fire	5				Ē	0	X 4	40 =	0	(7c)				
								Air ch	anges per hou	ır				
Infiltration due to chimneys	flues and fans =	- (6a)+(6b)+(7	(a)+(7b)+(7c) =	Г	40	<u> </u>	÷ (5) =] (8)				
If a pressurisation test has bee	n carried out or is int	ended, procee	d to (17), (otherwise d	continue fr	om (9) to (1	(6)	. (0) –	0.12					
Number of storeys in the	dwelling (ns)								0	(9)				
Additional infiltration							[(9)	-1]x0.1 =	0	(10)				
Structural infiltration: 0.2	5 for steel or time	per frame or	0.35 fo	r masoni	ry constr	uction			0	(11)				
if both types of wall are pres deducting areas of openings	ent, use the value co); if equal user 0.35	prresponding to	the great	ter wall are	a (after									
If suspended wooden floo	or, enter 0.2 (uns	sealed) or 0	.1 (seale	ed), else	enter 0				0	(12)				
If no draught lobby, enter	0.05, else enter	0							0	(13)				
Percentage of windows a	nd doors draugh	nt stripped							0	(14)				
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)				
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	(15) =		0	(16)				
Air permeability value, q	i0, expressed in	cubic metre	s per ho	our per s	quare m	etre of er	nvelope	area	4.5	(17)				
If based on air permeability	value, then (18)	= [(17) ÷ 20]+(B), otherw	ise (18) = ((16)				0.35	(18)				
Air permeability value applies in	a pressurisation tes	t has been dor	ne or a deg	gree air pe	rmeability	is being use	ed			_				
Number of sides sheltered				(20) 1	[0.075 v (4	0)]			2	(19)				
Shelter factor				(20) = 1 -	[U.U75 X (1	9)] =			0.85	(20)				
Inflitration rate incorporating	g shelter factor	1		(21) = (18) x (20) =				0.29	(21)				
Infiltration rate modified for	monthly wind sp	eed							1					
	ar Apr M	ay Jun	Jul	Aug	Sep	Uct	INOV	Dec	J					
ivionthly average wind spee	a from Table 7		2.0	27	4	4.2	A E	4 7	1					
(22) 1 = 0.1 5 4.1		ο 3.8	3.8	3./	4	4.3	4.5	4./	J					

Wind F	actor (2	2a)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 infiltra	ation rat	e (allowi	ing for sh	nelter an	nd wind s	peed) =	(21a) x	(22a)m						
	0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.34			
Calcula	ate effec	ctive air	change tion:	rate for t	he appli	cable ca	se						-		
lf exh	aust air h		uion. Ising App	endix N (2	3h) - (23a	a) x Fmv (e	equation (1	(15)) othe	rwise (23h) - (23a)				0	
If hala	anced with	heat reco	werv: effic	iency in %	allowing f	for in-use f	actor (fron	n Table 4h) –	(20u)				0	
a) If	halance	d moch	anical ve	ntilation	with he	at recove	any (M)/I		$(2)^{-}$	2h)m ⊥ ('	23h) v [*	1 _ (23c)	· 1001	0	(230)
(24a)m=	0				0			0	0		0	1 - (200)	 		(24a)
(, h) lf	balance	d mech:	anical ve	I	without	heat rec	coverv (N	///) (24h	1 = (2)	2b)m + (;	23b)		l		
(24b)m=	0	0	0	0	0	0				0	0	0			(24b)
` () f	whole h	ouse ex	tract ver	L	or positiv	L /e input v	l ventilatio	n from c	L outside				l		
i i	f (22b)n	ו < 0.5 ×	: (23b), t	then (240	c) = (23b	o); otherv	wise (24	c) = (22k	o) m + 0	.5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilatio	on from l	loft			•	•		
i	f (22b)n	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		_			_
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		_	(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	d) in boy	k (25)	-					
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56			(25)
3. Hea	at l <mark>osse</mark>	s and he	at l <mark>oss</mark>	paramete	ər: 🚽						_				
ELEN	IENT	Gros	ss (m2)	Openin	gs	Net Ar	ea	U-valu	ue	AXU	0	k-value	e	AX	(k
Doore '		area	(m²)	m	2	A ,r	n²	vv/m2		(\\/)		KJ/M²∙I	ĸ	KJ/	K (06)
Dooro '						2			=	2	4		- 1		(20)
Minda		. 1				2	^	1	=	2	4				(26)
	ws Type	: I				2.88		/[1/(1.2)+	0.04] =	3.3					(27)
	ws туре т	2				3.96		/[1/(1.2)+	0.04] =	4.53					(27)
vvindo	ws Type -	: 3				1.26	x1	/[1/(1.2)+	0.04] =	1.44					(27)
Windo	ws Type	- 4				1.44	x1	/[1/(1.2)+	0.04] =	1.65	_ ,				(27)
Floor						42.67	× ×	0.14	=	5.9738			_		(28)
Walls		210)	34.0	6	175.9	4 ×	0.2	=	35.19					(29)
Roof		42.6	7	0		42.67	x	0.1	=	4.27					(30)
Total a	rea of e	lements	, m²			295.3	4								(31)
* for wind	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	is given in	paragraph	1 3.2		
Fabric	heat los	s W/K :			s anu par	uuons		(26)(30)) + (32) =				00	05	(33)
Heat c	anacity	Cm = S(- 0 (/ (/ (/ (/ (0)				. , . ,	((28).	(30) + (32	2) + (32a).	(32e) =	273	36.18](00)](34)
Therma	al mass	parame	ter (TMF	- = Cm -	- TFA) ir	ר kJ/m²K			Indica	tive Value:	Medium	(/	213	50	(35)
For desig	gn assess	ments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f	L		
	000 11010			alation.											

if detail	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(22) .	(26) -				
Vontil	abilit he	at 1055	alculator	Imonthly					(38)m	(30) =	'25)m v (5)		98.62	(37)
ventil	Jan	Feb	Mar	Apr	y Mav	Jun	Jul	Αμα	Sen		Nov	Dec		
(38)m=	62.6	62.3	62.01	60.63	60.37	59.17	59.17	58.95	59.63	60.37	60.9	61.44		(38)
Heat t	ransfer o	coefficier	nt. W/K						(39)m	= (37) + (3	38)m			
(39)m=	161.22	160.92	160.62	159.25	158.99	157.79	157.79	157.57	158.25	158.99	159.51	160.05		
									,	Average =	Sum(39)1	12 /12=	159.24	(39)
Heat I	oss para	meter (H	HLP), ₩/	/m²K	1.24	1.00	1.00	1.00	(40)m	= (39)m ÷	· (4)	1.05		
(40)m=	1.20	1.20	1.20	1.24	1.24	1.23	1.23	1.23	1.24	1.24 Average -	Sum(40),	1.20	1 24	(40)
Numb	er of day	/s in moi	nth (Tab	le 1a)						woruge –	Cum(40)		1.24	
	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. W	ater heat	ting enei	rgy requi	irement:								kWh/ye	ear:	
Assun	ned occu	ipancy, l	N								2.	89		(42)
if TF	FA > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	A -13.9)2)] + 0.0)013 x (TFA -13.	.9)			. ,
	-A £ 13.9 al averao	9, N = 1	ter usar	ne in litre	es per da	w Vd av	erage =	(25 x N)	+ 36		1.05	2.24	1	(43)
Reduce	e the annua	al average	hot water	usage by	5% if the a	lwelling is	designed i	to achieve	a water us	se target o	100	5.24		(40)
not moi	re 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 wa	ter usage li	n litres per	r day for ea	acn month	va,m = ra	ctor from	able 1c x	(43)						
(44)m=	119.06	114.73	110.4	106.08	101.75	97.42	97.42	101.75	106.08	110.4	114.73	119.06	4000.00	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D) Tm / 3600	kWh/mor	total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1298.88	(44)
(45)m=	176.57	154.43	159.36	138.93	133.31	115.03	106.6	122.32	123.78	144.25	157.47	171		
				·		·	·			Total = Su	m(45) ₁₁₂ =	=	1703.04	(45)
lf instar	ntaneous w	ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46,) to (61)	1	1		1	
(46)m= Water	0 storage	0	0	0	0	0	0	0	0	0	0	0		(46)
Storag	ge volum	le (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	me ves	sel		180		(47)
If com	, munity h	eating a	ind no ta	ink in dw	velling, e	nter 110	litres in	(47)						
Other	wise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:		,			<i></i>						1	
a) If r 	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kvvr	n/day):					0		(48)
Temp	erature f	actor fro	m l able	20				(40) (40)				0		(49)
Energ b) If r	y lost fro nanufact	om water urer's de	storage	, KVVN/ye cvlinder l	ear loss fact	or is not	known:	(48) x (49)	=			0		(50)
Hot w	ater stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ıy)					0		(51)
If com	munity h	eating s	ee secti	on 4.3										
Volum	ne factor	from Ta	ble 2a	2h								0		(52)
Temp				ZU 1/1/1- /-				(17) (54)	v (EQ) = (50)		0		(53)
⊏nerg Enter	y 10st tro (50) or 1	(54) in (5	storage	, κνν η /γθ	ar			(47) X (51)	x (52) X (ə3) =		0		(54) (55)
	,00,01	(- ·) ··· (c	,									v	l	(00)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(57)
Prima	v circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Prima	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	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	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)r	n
(62)m=	150.08	131.26	135.45	118.09	113.31	97.78	90.61	103.97	105.21	122.62	133.85	145.35		(62)
Solar D	-IW input o	calculated	using App	endix G o	Appendix	H (negati	ve quantity	v) (enter '0	if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	S)	i	i	i	1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	150.08	131.26	135.45	118.09	113.31	97.78	90.61	103.97	105.21	122.62	133.85	145.35		_
								Outp	out from w	ater heate	r (annual)₁	12	1447.58	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	(<mark>(46)</mark> m	+ (57)m	+ (59)m]	
(65)m=	37.52	32.82	33.86	29.52	28.33	24.44	22.65	25.99	26.3	30.65	33.46	36.34		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	neating	
5. In	ternal ga	ains (s <mark>ee</mark>	e Ta <mark>ble 5</mark>	5 and 5a):									
Metab	olic gain	is (Table	5), Wat	ts						_			1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48		(66)
Lightir	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		i		1	
(67)m=	26.33	23.38	19.02	14.4	10.76	9.09	9.82	12.76	17.13	21.75	25.38	27.06		(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	ı —		1	
(68)m=	295.29	298.36	290.64	274.2	253.45	233.94	220.91	217.85	225.57	242.01	262.76	282.26		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5			1	
(69)m=	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45		(69)
Pumps	and fai	ns gains	(Table s	ōa)									1	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58		(71)
Water	heating	gains (T	able 5)	i	i		i			i	1	i	1	
(72)m=	50.43	48.83	45.51	41	38.07	33.95	30.45	34.94	36.53	41.2	46.47	48.84]	(72)
Total	ntornal	apine -				(66)	m + (67)m	+ (68)m +	-(69)m +	(70)m + (7)	(1)m + (72)	m		
		yanıs =				(00)		(00)	(00)111		· ///· · (/2)			
(73)m=	438.39	436.92	421.51	395.94	368.63	343.32	327.52	331.89	345.57	371.3	400.96	424.5		(73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orient	tation:	Access Fa Table 6d	ctor	Area m²			Flu Tal	x ble 6a		g Tab	_ ble 6b		Tal	FF ble 6c			Gains (W	S)	
South	0.9x	0.77	x	2.8	88	x	4	6.75	×		0.8	x		0.76		=	22	6.93	(78)
South	0.9x	0.77	×	2.8	38	x	7	6.57	x		0.8	x		0.76		=	37	1.65	(78)
South	0.9x	0.77	×	2.8	38	x	9	7.53	x		0.8	x		0.76		=	47	3.42	(78)
South	0.9x	0.77	×	2.8	38	x	1	10.23	×		0.8	x		0.76		=	53	5.07	(78)
South	0.9x	0.77	×	2.8	38	x	1	14.87	×		0.8	x		0.76		=	55	7.57	(78)
South	0.9x	0.77	×	2.8	38	x	1	10.55	×		0.8	x		0.76		=	53	6.59	(78)
South	0.9x	0.77	×	2.8	38	x	1	08.01	x		0.8	x		0.76		=	52	4.28	(78)
South	0.9x	0.77	×	2.8	38	x	10	04.89	×		0.8	x		0.76		=	50	9.15	(78)
South	0.9x	0.77	×	2.8	38	x	10	01.89	x		0.8	x		0.76		=	49	4.54	(78)
South	0.9x	0.77	x	2.8	38	x	8	2.59	x		0.8	x		0.76		=	40	0.86	(78)
South	0.9x	0.77	x	2.8	88	x	5	5.42	x		0.8	x		0.76		=	26	8.99	(78)
South	0.9x	0.77	x	2.8	38	x	4	40.4	x		0.8	x		0.76		=	19	6.09	(78)
Solar	gains ir	n watts, calo	culated	d for eac	h mont	th			(83)m	n = Sum	n(74)m .	(82)r	n						
(83)m=	380.35	671.78	967.69	1255.93	1441.0	12	440.95	1385.27	1248	8.73 1	069.4	756.	99	460.29	322	2.26			(83)
Total	gains –	internal an	d sola	r (84)m =	= (73)m	1 + ((83)m	, watts											
(84)m=	818.75	5 1108.7	1389.2	1651.87	1809.6	5 1	784.28	1712.79	1580	0.62 1	414.97	1128	.29	861.25	746	6.76	-	12	(84)
7. Me	ean <mark>inte</mark>	ernal tempe	rature	(hea <mark>ting</mark>	seasc	on)													
Tem	peratur	e during he	ating p	periods in	n the liv	ving	area	from Tab	ole 9	, Th1	(°C)							21	(85)
Utilis	ation fa	ctor for gai	ns for	living are	ea, h1,	m (s	see Ta	ble 9a)											
	Jan	Feb	Mar	Apr	May	y	Jun	Jul	A	ug	Sep	00	rt	Nov	D	ec	_		
(86)m=	1	0.99	0.96	0.88	0.73		0.55	0.4	0.4	45	0.71	0.94	4	0.99		1	_		(86)
Mea	n intern	al temperat	ure in	living ar	ea T1 ((follo	ow ste	ps 3 to 7	7 in T	able	9c)						- 1		
(87)m=	19.65	19.92	20.29	20.66	20.89		20.98	21	20.	99	20.93	20.5	7	20.02	19	9.6			(87)
Tem	peratur	e during he	ating p	periods in	n rest o	of dv	velling	from Ta	able 9	9, Th2	(°C)								
(88)m=	19.87	19.87	19.88	19.88	19.89		19.89	19.89	19	.9	19.89	19.8	9	19.88	19	.88			(88)
Utilis	ation fa	ctor for gai	ns for	rest of d	wellina	. h2	2.m (se	e Table	9a)										
(89)m=	1	0.99	0.95	0.85	0.67		0.46	0.3	0.3	35	0.62	0.92	2	0.99		1			(89)
Mear	n intern	al temperat	ure in	the rest	of dwe	lling	n T2 (f	nllow ste	ns 3	to 7 i	n Tabl	e 9c)							
(90)m=	18.65	18.93	19.28	19.63	19.82		19.89	19.89	19.	89	19.86	19.5	7	19.03	18	.61			(90)
		-1 1				_					f	LA = L	iving	area ÷ (4	1) =		0.	17	(91)
Moo	o intorn	al tomporat	uro (fe	or the wh	olo du	ollir) – fl	Λ 🗸 Τ1	⊥ (1	fΙ_Δ`	\ √ T2					I			
(92)m=	18.82	19.09	19.45	19.8	20		19) – 11 20.07	20.08	+ (1 20.		20.04	19.7	3	19.19	18	.77			(92)
Appl	v adiust	tment to the	e meai	interna	l tempe	erati	ure fro	m Table	4e.	where	appro	opriat	<u> </u>						
(93)m=	18.82	19.09	19.45	19.8	20	T	20.07	20.08	20.	08	20.04	19.7	3	19.19	18	.77			(93)
8. Sp	bace he	ating requir	remen	t	1	1			1	I									
Set 7	Fi to the	mean inter	rnal te	mperatu	re obta	ine	d at ste	ep 11 of	Tabl	le 9b,	so tha	t Ti,m	n=(76	6)m an	d re-	-calc	ulate		
the u	Itilisatio	n factor for	gains	using Ta	able 9a	l 			r	i									
1.1.414	Jan	Feb	Mar	Apr	May	y	Jun	Jul	A	ug	Sep	00	t	Nov	D)ec			
Utilis	ation fa	ictor for gai	ns, hn	1:															

0.85

0.68

0.48

0.32

0.36

0.63

0.91

0.99

1

0.94

(94)m=

1

0.98

(94)

Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m	-		-						
(95)m=	814.82	1089.07	1311.82	1396.16	1223.5	848.42	546.89	576.29	889.59	1028.44	850.48	744.37		(95)
Month	nly aver	age exte	rnal tem	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)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2340.8	2283.94	2079.64	1736.58	1319.47	862.68	548.62	579.35	939.63	1452.26	1928.94	2332.52		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mont	h = 0.02	24 x [(97))m – (95)m] x (4 ⁻	1)m			
(98)m=	1135.33	802.95	571.26	245.1	71.4	0	0	0	0	315.32	776.49	1181.58		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	5099.43	(98)
Snac	a hoatin	a requir	amont in	k \//b/m ²	2/voor								20.84	
Space	eneaun	grequit			year								39.64	(33)
8c. Sj	pace co	oling rec	luiremer	nt										
Calcu	lated fo	<u>r June, s</u>	July and	August.	<u>See Tal</u>	ole 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate	e Lm (ca	lculated	using 25	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	1483.21	1167.64	1197.53	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.94	0.97	0.96	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) =	(100)m x	(101)m				-					
(102)m=	0	0	0	0	-0	1400.9	1135.64	1150.46	0	0	0	0	_	(102)
Gains	s (solar g	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)			-		
(103) <mark>m=</mark>	0	0	0	0	0	2203.08	2116.88	1964.56	0	0	0	0		(103)
Spac	e c <mark>oolin</mark>	g require	ement fo	r month,	whole d	dwelling,	continue	ous (kW	/h) = 0.0	24 x [(10)3)m – (102)m];	x (41)m	
set (1	04)m to	zero if (104)m <	: 3 × (98)m									
(104)m=	0	0	0	0	0	577.57	730.04	605.69	0	0	0	0		_
									Tota	= Sum(104)	=	1913.3	(104)
Cooled	d fraction	า							f C =	cooled a	area ÷ (4	4) =	1	(105)
Interm	ittency f	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Tota	l = Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n						_
(107)m=	0	0	0	0	0	144.39	182.51	151.42	0	0	0	0		_
									Tota	= Sum(107)	=	478.32	(107)
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)) ÷ (4) =			3.74	(108)
8f. <u>Fab</u>	oric <u>Ene</u>	rgy Effi <u>ci</u>	ienc <u>y (ca</u>	alcul <u>ated</u>	l onl <u>y un</u>	der <u>spec</u>	cial <u>cond</u>	lition <u>s, s</u>	ee s <u>ectio</u>	on 1 <u>1)</u>				
Fabri	c Enera	y Efficier	псу						(99)	+ (108) =	=		43.58	(109)
	3	-	-						、 /	``'				11 1