

# Project No: 6182 High Peak Borough Council Energy & Sustainability Statement

Redevelopment of Holy Trinity Church, School Road, Peak Dale, Buxton, SK17 8AR

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SAP Calculations – SBEM Calculations – Renewable Energy Statements – Energy Performance Certificates Air Tightness Testing – Extract Fan Testing – Water Calculations – DEC Assessments













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Issue Details:

Version	Date	Author	Checked	Details
1	06/07/2018	AB	JH	Issued for submission

## **Executive Summary**

This report has been commissioned in response to the Planning Policy requirements of High Peak Borough Council in respect to the proposed conversion and redevelopment at Holy Trinity Church, School Road, Peak Dale, Buxton, SK17 8AR.

The statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek enhanced insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L1 2013 of the Building Regulations.

The methodology used herein is consistent with Approved Documents Part L1 of the Building Regulations and the widely acclaimed Energy Hierarchy approach to energy conservation.

Predictive SAP calculations for the proposed development demonstrate that the dwellings will emit at least 5.33% less carbon dioxide (CO<sub>2</sub>) than would ordinarily be permitted by the standard requirements of Part L1 of the Building Regulations.

Whilst at the limit of financial viability the development is deemed to exceed the requirements of Policies S1 & EQ1 of High Peak Borough Council's adopted Local Plan (2016).

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## **1.0 Introduction**

- 1.1 EPS Group have been appointed to provide an Energy & Sustainability Statement to support the planning application in respect to the proposed conversion and redevelopment at Holy Trinity Church, School Road, Peak Dale, Buxton, SK17 8AR.
- 1.2 The proposal is for the conversion of the existing church into 5 residential dwellings. It is also proposed to construct a new detached dwelling on the site.
- 1.3 As the planning application involves the conversion of an existing building, it is anticipated that the proposed works will need to comply with the requirements of Approved Document Part L1B 2010 of the Building Regulations (incorporating 2010, 2011, 2013 and 2016 amendments) if planning is permitted (referred to as Part L1B 2010 from hereon in).
- 1.4 The new detached dwelling will need to comply with the requirements of Approved Document Part L1A 2013 of the Building Regulations.
- 1.5 The energy consumption of the proposed dwellings has therefore been assessed using the National Calculations Method (NCM) SAP 2012 (Standard Assessment Procedure), in order to determine the predicted annual carbon dioxide (CO<sub>2</sub>) emissions of the development and the associated reduction targets.
- 1.6 The following fuel emissions factors have been used within the underlying calculations as defined by the updated National Calculations Method (NCM):

Fuel	CO <sub>2</sub> emission factor (kgCO <sub>2</sub> /kWh)
Natural gas	0.216
Grid supplied electricity	0.519
Grid displaced electricity	0.519

- 1.7 This document should be used for planning purposes only and should be reassessed and where necessary, resubmitted at the Building Control stage if alternative building specifications or proposed systems are adopted as opposed to those outlined within the report.
- 1.8 It is also highlighted that the SAP calculations underlying this report rely on a number of standard operational parameters which may not ultimately match the actual measures adopted within the finalised dwellings. Whilst they provide a 'like for like' comparison for the purpose of this report, they are not valid for Building Control applications or for the actual operation of the development post completion.

## 2.0 Planning Policy Context

#### 2.1 National

The National Planning Policy Framework (NPPF) outlines the Government's planning policies for England and how these are expected to be applied by local authorities. Section 10 of this document details how local policies should address climate change through the promotion of energy efficiency and the adoption of low carbon and renewable technologies. It states:

#### "10.0 Meeting the challenge of climate change, flooding and coastal change

- 93. Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.
- 94. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations.
- 95. To support the move to a low carbon future, local planning authorities should:
  - plan for new development in locations and ways which reduce greenhouse gas emissions;
  - actively support energy efficiency improvements to existing buildings; and
  - when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.
- 96. In determining planning applications, local planning authorities should expect new development to:
  - comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
  - take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.
- 97. To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:
  - have a positive strategy to promote energy from renewable and low carbon sources;
  - design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
  - consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;

- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and
- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."

#### 2.2 Local

Policy S1 of High Peak Borough Council's adopted Local Plan (April 2016) is focused on Sustainable Development and states:

"The Borough Council will expect that all new development makes a positive contribution towards the sustainability of communities and to protecting, and where possible enhancing, the environment; and mitigating the process of climate change, within the Plan Area."

*This will be achieved by:* 

- Meeting most development needs within or adjacent to existing communities;
- Making effective use of land (including the remediation of contaminated land and reuse of brownfield land), buildings and existing infrastructure;
- Making efficient use of land by ensuring that the density of proposals is appropriate (and informed by the surrounding built environment);
- Taking account of the distinct Peak District character, landscape, townscape, roles and setting of different areas and settlements in the High Peak;
- Protecting and enhancing the natural and historic environment of the High Peak and its surrounding areas including the Peak District National Park;
- Providing for a mix of types and tenures of quality homes to meet the needs and aspirations of existing and future residents in sustainable locations;
- Supporting the local economy and businesses by providing for a range of economic development that provide employment opportunities suitable for local people in sustainable locations, and generally encourage larger developments to incorporate mixed uses where possible so as to reduce the need to travel;
- Minimising the need to travel by promoting development in locations where there is access to a broad range of jobs, services and facilities which are accessible by foot, cycle or public transport with minimal reliance on the private car;
- Minimising the risk of damage to areas of importance for nature conservation and/or landscape value, both directly and indirectly and ensuring that there is suitable mitigation for a net gain in biodiversity and the creation of ecological networks;
- Minimising carbon or energy impacts associated with development according to the principles of the 'energy hierarchy' by minimising the need for energy through the appropriate siting, orientation and design of new buildings; the use of renewable energy sources and ensuring building construction and other forms of development address the challenge of climate change by meeting high environmental standards with particular regard to energy efficiency, water efficiency, use of sustainable materials, encouraging waste reduction, recycling, including where appropriate the local- or on site-sourcing of building materials;
- Further mitigating the impacts of climate change by seeking reductions in greenhouse gas emissions across the High Peak; in particular through supporting the delivery of renewable and low-carbon forms of energy (either via stand-alone installations, or installations integrated within new/existing developments), where this is considered acceptable against all other Development Plan Policies as a whole;

- Requiring that all new development addresses flood risk mitigation/adaptation, ensuring for example that sustainable drainage systems are considered at the outset within proposals (and to comply with legislative requirements);
- Seeking to secure high quality, locally distinctive and inclusive design in all development that can be accessed and used by everyone including disabled people;
- Seeking to secure developments provide a high standard of amenity for all existing and future occupants of land and buildings, ensuring communities have a healthy, safe and attractive living and working environment and the risks from potential hazards are minimised
- Maintaining and where possible enhancing accessibility to a good range of services and facilities, and ensuring existing infrastructure and services have the capacity to support development when required.

In order to enable required development to take place, in some cases mitigation measures will be needed to address the impacts of new development on existing infrastructure and on nearby sensitive areas.

In all cases development should not conflict with the relevant policies in this Local Plan. Development should be designed to be sustainable; seek to enhance the environment; have regard to both its direct and indirect cumulative impact over the longer term; and should provide any necessary mitigating or compensatory measures to address harmful implications."

Of further relevance, Policy EQ1 Climate Change states:

"The Council will adopt strategies to mitigate and adapt to climate change. In addressing the move to a low carbon future for High Peak, the Council will plan for new development in locations and ways that reduce greenhouse gas emissions and adopt the principles set out in the energy hierarchy.

The Council intends to meet part of its future energy needs through renewable or low carbon energy sources and will therefore encourage and support the provision of renewable and low carbon technologies, including both stand-alone installations, and micro renewables integrated within new or existing development.

A low carbon future for High Peak will be achieved by:

- Requiring new development to be designed to contribute to achieving national targets to reduce greenhouse gas emissions by using land-form, layout, building orientation, tree planting, massing and landscaping to reduce likely energy consumption and resilience to increased temperatures
- Ensuring that renewable energy installations do not have an adverse impact on the integrity of any European sites, (including by project- level HRA where appropriate), wildlife sites, protected species or habitats, or the landscape and landscape setting of the Peak District National Park
- Supporting opportunities to deliver decentralised energy systems, particularly those which are powered by a renewable or low carbon source
- Supporting connection to an existing decentralised energy supply system where there is capacity to supply the proposed development, or design for a future connection where there a firm proposals for such a system
- Ensuring that renewable / low carbon energy generation developments and associated infrastructure are supported by requiring Design Statements to include an assessment of how any impacts on the environment and heritage assets, including cumulative landscape, noise and visual impacts, can be avoided and/or

mitigated through careful consideration of location, scale, design and other measures

- Applications for new build residential development in the Buxton Sub-Area should meet the optional national technical requirement for water efficiency of 110 litres per person per day to minimise the phosphate load to the River Wye via discharges from the Buxton Sewage Treatment Works, unless it can be demonstrated that doing so would adversely impact on a scheme's viability.
- Unless it can be demonstrated that it would not be technically feasible or financially viable, requiring that commercial developments over 1,000m2 the Building Research Establishment Environmental Assessment Method (BREEAM) good standard as a minimum
- Promoting energy efficiency and the use of renewable / low carbon energy in new development and through retro-fitting of existing buildings
- Supporting sustainable waste management by provision of space for recycling and composting
- Supporting the use of sustainable design and construction techniques including the use of recycled materials in construction, including where appropriate the local or on-site sourcing of these building materials
- Supporting high water efficiency standards and measures to recycle and minimise water consumption

#### 2.3 Conclusions

On review of the above planning policies, it is evident that there is a need for development to adopt the principles of the energy hierarchy by considering the use of increased energy efficiency standards and the potential for district heating and renewable / low carbon technology in order to meet the standards set out by Part L1 of the Building Regulations.

## **3.0 Proposed Energy Strategy**

- 3.1 In response to local Planning Policies S1 and EQ1 a number of improved energy efficiency standards are proposed for the development which represent a significant improvement on the respective versions of Part L1 of the Building Regulations, which the proposed dwellings will need to comply with if Planning Permission is granted.
- 3.2 In accordance with the 'Lean' principles of the Energy Hierarchy, it is provisionally proposed to adopt the following minimum fabric, lighting and heating standards within the dwellings that are to be created from the conversion of the existing church as a means of reducing the overall energy demand of the respective dwellings:

Table 1: Proposed Design Specifications for the Conversion Dwellings				
Fabric Insulation and Lighting Standards				
Element / Feature	Current Part L1B Minimal Acceptable Standard	Proposed Development Design Target		
Existing External Walls (Thermally Upgraded)	0.30 W/m²K	0.28 W/m²K		
New External Walls	0.28 W/m <sup>2</sup> K	0.26 W/m²K		
Party Walls	0.50 W/m <sup>2</sup> K	0.00 W/m²K		
Ground Floor (As Built – No Insulation)	0.70 W/m²K (Max. threshold)	0.41-0.68 W/m <sup>2</sup> K (plot dependent)		
Pitched Roof (Insulated at Joist)	0.16 W/m2k	0.13 W/m²K		
Pitched Roof (Insulated at Rafter)	0.18 W/m2k	0.18 W/m²K		
Windows	1.60 W/m <sup>2</sup> K	1.40 W/m²K		
Rooflights	1.60 W/m <sup>2</sup> K	1.40 W/m²K		
Entrance Doors	3.00 W/m <sup>2</sup> K	1.80 W/m²K		
Lighting	75% Low Energy Lights	100% Low Energy Lights		
Proposed HVAC Details				
Heating & Hot Water	88.0% (SEDBUK 2009 condensing combi boile	) efficient mains gas fired r		
Heating Controls	Delayed Start Thermostat, Programmer & TRVs			
Ventilation	Natural Ventilation with	Intermittent Extract Fans		

3.3 Table 2 below outlines the proposed build standards for the new build detached house which will need to comply with the more stringent requirements of Part L1A 2013:

Table 2: Proposed Design Specifications for the New Build Dwelling			
Fabric Insulation and Lighting Standards			
Element / Feature	Current Part L1A Minimal Acceptable Standard	Proposed Development Design Target	
External Walls	0.30 W/m <sup>2</sup> K	0.24 W/m²K	
Stud Walls (Room in Roof)	0.30 W/m <sup>2</sup> K	0.28 W/m²K	
Ground Floor	0.25 W/m <sup>2</sup> K	0.14 W/m <sup>2</sup> K	
Pitched Roof (Insulated at Joist)	0.16 W/m2k	0.13 W/m²K	
Pitched Roof U-value (Insulated at Rafters)	0.20 W/m2k	0.18 W/m²K	
Windows	1.60 W/m <sup>2</sup> K	1.40 W/m²K	
Rooflight	1.60 W/m <sup>2</sup> K	1.40 W/m <sup>2</sup> K	
Entrance Door	3.00 W/m <sup>2</sup> K	1.80 W/m²K	
Target Air Leakage Rate	10.00 m3/m2.h	5.00 m³/m².h	
Thermal Bridging	-	The use of Aircrete Product Association's Thermal Bridging Detailing	
Lighting	75% Low Energy Lights	100% Low Energy Lights	
Proposed HVAC Details			
Heating & Hot Water	89.60% (SEDBUK 2009) efficient mains gas fired condensing combi boiler (Ideal Logic Combi ESP1 24 or equiv.)		
Heating Controls Weather Compensator & Delayed Start Ti Temperature Zone Control		& Delayed Start Time and rol	
Ventilation	Natural Ventilation with Intermittent Extract Fans		

- 3.4 The above build standards will ensure that the development has a reduced energy demand in comparison to the minimum requirements of Part L1 of the Building Regulations. This will help to reduce the overall energy consumption of each dwelling and the associated CO<sub>2</sub> emissions arising from occupancy.
- 3.5 Whilst the orientation of the dwellings are dictated by the confines of the existing building and site, it is noted that the risk of overheating has been reduced by adopting layouts that will facilitate natural cross ventilation. This should reduce the likelihood of any future occupants installing mechanical cooling.
- 3.6 As per the 'Clean' step of the Energy Hierarchy, the feasibility of a district heating or communal based heating system has also been considered.
- 3.7 It is noted that the proposed development is not within close proximity of a District Heat Network and owing to the relatively small scale nature of the development, it is

evident that any connection is unfeasible. As such this option for heating the proposed dwellings has been discounted

- 3.8 It was also concluded that the installation of a full communal based heating system for the development would be cost prohibitive, with minimal benefit to be gained by the end occupants owing to the reduced demand for heating and hot water as a result of the enhanced insulation levels detailed within Tables 1 & 2.
- 3.9 In recognition of the above, it is proposed to heat the individual dwellings with highly efficient gas fired boilers with sophisticated controls that will ensure that the boilers operate at maximum efficiency for the optimal amount of time to deliver the required comfort levels within the dwellings. This will generate significant savings in the demand for heating.

## 4.0 Review of Low Carbon and Renewable Technologies

4.1 In accordance with the 'Green' requirement of the Energy Hierarchy and specifically in response to local Planning Policy a number of different renewable technologies were reviewed in terms of their overall suitability for use within the proposed development.

#### 4.2 Wind Turbine (Column or Roof Mounted)

Benefits	• When installed in optimum positions, wind turbines can generate a large amount of renewable electricity, the surplus of which can be exported at financial gain to the national grid via the Feed-in-Tariff scheme.
Site Limitations / Restrictions	<ul> <li>Not aesthetically pleasing and would not be in keeping with the local area.</li> <li>The site is too sheltered and therefore inadequately exposed to obtain reliable outputs from this technology.</li> <li>Require ongoing maintenance which future occupants may neglect.</li> <li>Can produce unacceptable levels of noise to occupants and neighbours.</li> <li>Increased capital costs.</li> </ul>
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

#### 4.3 **Solar Photovoltaic**

Benefits	<ul> <li>When installed in optimum positions, photovoltaic (PV) arrays can generate a large amount of renewable electricity which can be used locally or exported to the national grid via the Feed-in-Tariff scheme.</li> <li>Minimal ongoing costs &amp; maintenance issues following installation.</li> <li>The majority of the dwellings have an area of optimal south facing pitched roof space that could accommodate a small number of panels</li> <li>Easy to integrate into a conventional build specification.</li> </ul>			
Site Limitations / Restrictions	<ul><li>Not aesthetically pleasing.</li><li>Increased capital costs.</li></ul>			
Conclusion	• Whilst potentially suitable, it is not proposed to use this technology within the development as it is deemed to be financially unviable.			

#### 4.4 Solar Thermal

	• Solar hot water systems can provide an efficient way of			
	contributing to a dwelling's overall hot water requirements.			
	Minimal ongoing costs & maintenance issues following			
Benefits	installation.			
	<ul> <li>Eligible for payments under the Renewable Heat Incentive.</li> </ul>			
	• As with PV, south facing pitched roof spaces would provide an			
	ideal location for the installation of a small number of panels.			

Site Limitations / Restrictions	<ul> <li>There is no benefit to producing more hot water than is used within a dwelling, limiting the total carbon savings that can be achieved with this technology.</li> <li>Not always aesthetically pleasing.</li> <li>Requires the installation of hot water cylinders / thermal stores which would introduce an additional source of energy loss to the dwellings whilst also potentially restricting useable floor space.</li> <li>Increased capital costs.</li> </ul>
Conclusion	<ul> <li>The technology is not deemed as being suitable for use within the proposed development owing to the desire to avoid the additional loss of energy and available floor space.</li> </ul>

## 4.5 **Ground Source Heat Pump**

Benefits	<ul> <li>High operating efficiencies (CoPs).</li> <li>Reliable and proven technology.</li> <li>Generally low maintenance costs.</li> <li>No visual impact on the property.</li> <li>Eligible for payments under the Renewable Heat Incentive.</li> </ul>
Site Limitations / Restrictions	<ul> <li>Detailed ground surveys required.</li> <li>Minimal space to facilitate an installation.</li> <li>Trench installations require significant area of land.</li> <li>Requires the installation of hot water cylinders / thermal stores which would introduce an additional source of energy loss to the dwellings whilst also potentially restricting useable floor space.</li> <li>High capital installation costs.</li> </ul>
Conclusion	• The technology is not deemed as being suitable for use within the proposed development

#### 4.6 **Air Source Heat Pump**

Benefits	<ul> <li>High operating efficiencies (CoPs).</li> <li>Reduced visual impact on the property.</li> <li>Reliable and proven technology.</li> <li>Generally low maintenance costs.</li> <li>Eligible for payments under the Renewable Heat Incentive.</li> </ul>
Site Limitations / Restrictions	<ul> <li>Often require a supplementary immersion heating system.</li> <li>Requires the installation of hot water cylinders / thermal stores which would introduce an additional source of energy loss to the dwellings whilst also potentially restricting useable floor space.</li> <li>The external units can result in some minor background noise although this can be limited through the careful selection of models with low operating acoustic levels and the potential use of acoustic cabinets.</li> <li>Increased capital costs.</li> </ul>
Conclusion	• It is not proposed to use this technology within the development as it is deemed to be financially unviable.

#### 4.7 **Biomass Boilers**

Benefits	<ul> <li>Reliable and proven technology.</li> <li>Eligible for payments under the Renewable Heat Incentive.</li> <li>Could adequately meet the entire heat demand of the development via a communal heating and hot water system.</li> </ul>		
Site Limitations / Restrictions	<ul> <li>Require large storage facilities for the fuel.</li> <li>Ongoing cleaning, maintenance and management requirements.</li> <li>Require regular fuel deliveries.</li> <li>Would contribute to poor urban air quality.</li> <li>The use of a communal heating and hot water system is not feasible or desirable for the site.</li> </ul>		
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.		

4.8 On review of the above technologies, it has been concluded that it would not be technically feasible or economically viable to install any low carbon or renewable technologies within the proposed development. The Applicant's preference therefore is to adopt an enhanced fabric specification as detailed in Section 3 in order to provide dwellings that are inherently cost efficient to occupy.

## 5.0 Calculated Energy Performance (Illustrative)

- 5.1 A set of Baseline SAP calculations were produced for the proposed development as a means of determining the maximum energy consumption and associated carbon dioxide (CO<sub>2</sub>) emissions that would ordinarily be permitted under the applicable versions of Part L1 of the Building Regulations.
- 5.2 The results of the Baseline SAP Calculations for all of the proposed dwellings are summarised within Tables 3 & 4 below, with a selection of the cited SAP derived worksheets provided in Appendix 1 of this report for detailed review (all other instances are available upon request):

Table 3: Baseline Annual $CO_2$ Emissions Arising From The Dwellings Created From the Church Conversion (SAP 2012)			
Plot	TFA (m <sup>2</sup> )	Dwelling Emission Rate (DER) <sup>*1</sup>	Annual Regulated CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /year)
1	80.80	33.65	2,719.23
2	90.46	27.22	2,461.95
3	124.16	28.38	3,523.35
4	92.81	25.45	2,362.00
5	77.74	32.55	2,530.20
Total Regulated Annual Baseline Carbon Dioxide Emissions (kgCO <sub>2</sub> /year)			13,596.73

\*1 – Baseline DER figures utilised as TER is not applicable to Part L1B 2010 Applications. The underlying SAP Calculations are based upon the maximum permitted levels of  $CO_2$  permitted for the dwelling under the requirements of Part L1B 2010.

Table 4: Baseline Annual CO <sub>2</sub> Emissions Arising From The New Detached House (SAP 2012)								
Plot	TFA (m <sup>2</sup> )	Target Emission Rate (TER) <sup>*2</sup>	Annual Regulated CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /year)					
6	84.84	20.55	1,743.78					
Total Regul	ated Annua Emissions	1,743.78						

\*2 – TER figure utilised for new build dwelling as this represents the maximum permitted level of  $CO_2$  permitted for the dwelling under the requirements of Part L1A 2013.

- 5.3 Predicted SAP Calculations were then prepared for the proposed dwellings based upon the proposed energy strategy outlined within Section 3 of this report.
- 5.4 The results of the Proposed SAP calculations are summarised within Tables 5 & 6 below, with a selection of the cited SAP derived worksheets provided in Appendix 2 of this report for detailed review (all other instances are available upon request):

From	Table 5: Predicted Annual CO <sub>2</sub> Emissions Arising From The Dwellings Created From the Church Conversion (SAP 2012)								
Plot	TFA (m <sup>2</sup> )	Dwelling Emission Rate (DER)	Annual Regulated CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /year)						
1	80.80	31.62	2,554.93						
2	90.46	25.54	2,310.70						
3	124.16	26.70	3,314.79						
4	92.81	23.87	2,215.72						
5	77.74	30.76	2,391.04						
Total Re	gulated Ann (k	ual Carbon Dioxide Emissions (gCO <sub>2</sub> /year)	12,787.18						

Table 6: Predicted Annual CO <sub>2</sub> Emissions Arising From The New Detached House (SAP 2012)								
Plot	TFA (m <sup>2</sup> )	Annual Regulated CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /year)						
6	84.84	20.46	1,735.69					
Total Re	gulated Ann (k	1,735.69						

5.5 The Predicted Annual Carbon Dioxide Emissions were then directly compared to the Baseline Emissions within Table7 below as a means of quantifying the respective CO<sub>2</sub> emission savings arising from the proposed development.

Table 7: Comparison of Baseline and Predicted CO <sub>2</sub> Emission Calculations								
Annual Baseline CO <sub>2</sub> Emissions (Part L1A/L1B 2013 Compliant)	15,340.51 kgCO <sub>2</sub> /Year							
Annual Proposed CO <sub>2</sub> Emissions	14,522.87 kgCO₂/Year							
Total CO <sub>2</sub> Emission Savings per Annum	817.64 kgCO <sub>2</sub> /Year							
Annual Percentage Reduction in CO <sub>2</sub> Emissions	5.33%							

- 5.6 On review of the above, it is evident that the proposed development will achieve an overall minimum reduction in carbon dioxide emissions of **5.33%** per annum in comparison to the standard requirements of the current editions of Part L1A and L1B of the Building Regulations.
- 5.7 Whilst the reported improvements are deemed to be at the limit of financial viability for the development, they comfortably exceed the requirements of Policies S1 & EQ1 of High Peak Borough Council's adopted Local Plan (2016).



## Appendix 1:

**Baseline Example SAP Calculations** 



## Energy Performance & Sustainability Group

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#### *Project Information* Building type End-terrace house

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 1 - Baseline
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 0DR		SK17 8AR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	42.24	2.67	112.78	(3a)
First floor	38.56	3.12	120.31	(3b)
Total floor area	80.80			(4)
Dwelling volume (m³)			233.09	(5)

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#### 2. Ventilation rate

											m³ per h	our
							main + s	seondai	ry + oth	ier		
							heating					
Numb	erofchir	nneys					0 + 0 + 0	2	x 40		0.00	(6a)
Numb	erofope	en flues					0 + 0 + 0		x 20		0.00	(6b)
Numb	erofinte	ermitten	t fans				3	2	x 10		30.00	(7a)
Numb	er of pas	sive ven	ts				0	2	x 10		0.00	(7b)
Numb	erofflue	lessgas	fires				0	3	x 40		0.00	(7c)
											Air chan	ges per hour
Infiltra	tion due	tochim	neys, far	is and flu	Jes						0.13	(8)
Pressu	ire test, a	issumed	q50						15.00			(17)
Airper	meability	y									0.88	(18)
Numb	erofside	es on whi	ich shelte	ered							2.00	(19)
Shelte	rfactor										0.85	(20)
Infiltration rate incorporating shelter factor											0.75	(21)
Infiltra	tion rate	modifie	ed for mo	onthly w	ind spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
WindF	actor						I(	-r				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.13	(22a)
Adjust	edinfiltr	ationrat	e (allowi	ng for sh	nelteran	d wind s	peed)					
0.95	0.93	0.91	0.82	0.80	0.71	0.71	0.69	0.75	0.80	0.84	0.88	
<u> </u>	JI	JI.	JL		я	N	Л			/L	9.80	(22b)
Ventila	ation : na	turalver	ntilation,	intermi	ttentext	ract fan:	S					()
Effecti	veaircha	angerate	Э									
0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89	(25)
												. /

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3. Heat losses al	nd heat los.	s parametei	~					
Element (	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	ue A x K	
6	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Double	-glazed,		1.010	1.50 (1.60)	1.52			(27)
argon filled, low-	E, En=0.1,							
soft coat (West) W7								
Window - Double	-glazed,		1.010	1.50 (1.60)	1.52			(27)
argon filled, low-l	E, En=0.1,							
soft coat (West)								
W6								()
Window - Double	-glazed,		0.530	1.50 (1.60)	0.80			(27)
argon filled, low-l	L, Ln=0.1,							
soft coat (West)								
Window - Double	-alazed.		2.090	1.50 (1.60)	3.14			(27)
argon filled, low-	F.Fn=0.1.		2.070		0111			(_ / )
soft coat (East)	L, LII 0.1,							
W2								
Window - Double	-glazed,		0.810	1.50 (1.60)	1.22			(27)
argon filled, low-	E, En=0.1,							
soft coat (East)								
W3								
Window - Double	-glazed,		2.090	1.50 (1.60)	3.14			(27)
argon filled, low-l	E, En=0.1,							
soft coat (East)								
W4								
Window - Double	-glazed,		0.810	1.50 (1.60)	1.22			(27)
argon filled, low-	E, En=0.1,							
soft coat (East)								
W5			0.000	2.00	( 0 )			( <b>0</b> )
Solid door			2.280	3.00	6.84			(26)
Pooflight at 70° c	rloss		0 600	1 50 (1 60)	0.00			(77)
Double-diazed ar	raon filled		0.000	1.50 (1.00)	0.70			(27)
low-E En=0.1 so	ft coat							
(n/a)	noout							
Rooflight								
Pitched roofs insu	ulated betw	een joists	68.43	0.16	10.95	9.00	615.87	(30)
Walls		5	18.70	0.30	5.61	9.00	168.30	(29)
Upgraded walls								
Walls			67.94	0.28	19.02	60.00	4076.40	(29)
Newwalls								
Ground floors			42.24	0.62	26.19	110.00	4646.40	(28)
Solid ground flo	or							
Pitchedroofsinsu	ulated betw	eenrafters	33.63	0.18	6.05	9.00	302.67	(30)
Partywall			52.73	0.00	0.00	180.00	9491.40	
Party floor			11.10	0.00	0.00	30.00	333.00	

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3. Heat	<sup>t</sup> losses á	and heat	loss pai	rameter	-							
Element	t	Gross	Ope	enings	Netare	a U-v	value	ΑxU	ka	ppa-valu	le A x K	
		area, m²	m²		A, m²	W/	′m²K	W/K	kJ/	′m²K	kJ/K	
Totalar	eaofext	ernalele	ments S	igma A, r	m²						242.1	7 (31)
Fabric h	ieat loss,	W/K									88.1	2 (33)
Therma	ıl mass pa	aramete	r, kJ/m²K	(user-sp	ecified 1	ΓMΡ)					100.0	0 (35)
Effector	ftherma	Ibridges									36.3	3 (36)
Total fal	bric heat	loss									124.4	5 (37)
Ventilat	ion heat	losscalc	ulatedm	onthly								
73.34	71.98	70.66	64.42	63.25	57.82	57.82	56.82	59.91	63.25	65.61	68.08	(38)
Heat tra	ansfer co	efficient	, W/K									
197.79	196.43	195.10	188.87	187.70	182.27	182.27	181.27	184.36	187.70	190.06	192.53	
											188.8	6 (39)
Heat los	ss param	eter (HL	P), W/m²	К								
2.45	2.43	2.41	2.34	2.32	2.26	2.26	2.24	2.28	2.32	2.35	2.38	
HLP (ave	erage)										2.3	4 (40)
Numbe	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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4. Wate	er heatin	ng energ	v require	ements							kWh/year	
Assume	doccupa	ancy, N									2.48	(42)
Annuala	average	hotwate	rusagei	in litres p	per day V	d,avera	ge				93.05	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	er usage	e in litres	per day	for each	month							
102.35	98.63	94.91	91.19	87.47	83.74	83.74	87.47	91.19	94.91	98.63	102.35	(44)
Energy	content	of hot wa	ater used	k								
151.79	132.76	136.99	119.43	114.60	98.89	91.64	105.15	106.41	124.01	135.37	147.00	
Energy o Distribu	content ( Ition loss	annual)									1464.03	(45)
22.77	19.91	20.55	17.91	17.19	14.83	13.75	15.77	15.96	18.60	20.30	22.05	(46)
Hotwat	erstoraç	ge volum	e (litres)								0.00	(50)
Hot wat	er cylind	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	aturefac	ctor									0.0000	(53)
Energyl	ost from	n store (k	Wh/day)	)							0.00	(55)
Totalsto	pragelos	S				<b>V</b>						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	ageloss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combile	osscalcu	lated for	reachm	onth								
50.96	45.40	48.37	44.97	44.57	41.30	42.68	44.57	44.97	48.37	48.64	50.96	(61)
Totalhe	atrequi	red for w	aterhea	itingcald	ulated f	oreachr	nonth					
202.75	178.15	185.36	164.40	159.17	140.19	134.31	149.73	151.38	172.37	184.01	197.96	(62)
Output	from wa	ter heate	erforea	ch mont	h, kWh/r	month						
202.75	178.15	185.36	164.40	159.17	140.19	134.31	149.73	151.38	172.37	184.01	197.96	(64)
											2019.77	(64)
Heatgai	insfrom	waterhe	eating, k	Wh/mor	nth							
63.21	55.49	57.64	50.95	49.25	43.21	41.14	46.11	46.62	53.32	57.17	61.62	(65)

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#### 5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89
Lighting	ggains										
27.75	24.65	20.05	15.18	11.34	9.58	10.35	13.45	18.05	22.92	26.76	28.52
Applian	cesgains										
221.10	223.40	217.62	205.31	189.77	175.17	165.41	163.12	168.90	181.21	196.75	211.35
Cooking	ggains										
35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration (	negative	evalues)							
-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11
Waterh	eatingga	ains									
84.96	82.58	77.47	70.77	66.19	60.01	55.29	61.97	64.75	71.67	79.40	82.82
Totalin	ternalgai	ins									
396.98	393.79	378.31	354.42	330.48	307.92	294.22	301.71	314.88	338.97	366.07	385.86

#### Area & Flux Shading Gains g&FF Window - Double-glazed, argon filled, low-E, 0.9 x 1.010 19.64 0.63 x 0.70 0.77 6.0623 En=0.1, soft coat (West) W7 Window - Double-glazed, argon filled, low-E, 0.9 x 1.010 19.64 0.63 x 0.70 0.77 6.0623 En=0.1, soft coat (West) W6 Window-Double-glazed, argon filled, low-E, 0.9 x 0.530 19.64 0.63 x 0.70 0.77 3.1812 En=0.1, soft coat (West) W1 Window-Double-glazed, argon filled, low-E, 0.9 x 2.090 19.64 0.63 x 0.70 0.77 12.5448 En=0.1, soft coat (East) W2 Window - Double-glazed, argon filled, low-E, 0.9 x 0.810 19.64 0.63 x 0.70 0.77 4.8619 En=0.1, soft coat (East) W3 Window-Double-glazed, argon filled, low-E, 0.9 x 2.090 19.64 0.63 x 0.70 0.77 12.5448 En=0.1, soft coat (East) W4 Window - Double-glazed, argon filled, low-E, 0.9 x 0.810 19.64 0.63 x 0.70 0.77 4.8619 En=0.1, soft coat (East) W5 Solid door 0.9 x 2.280 0.00 0.00 x 0.70 0.77 0.0000 Front Door

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6. Solar gains (calculation for January)

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6. Solar gains (calculation for January)					
	Area & Flux	g & FF	Shading	Gains	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.600 26.00	0.63 x 0.70	1.00	6.1916	
Total solar gains, January				56.31	(83-1)
Solargains					
56.31 110.90 184.33 271.21 334.32 34	43.06 326.27 278.	99 215.18 132	.05 70.35 4	6.22	(83)
Totalgains					
453.29 504.69 562.63 625.63 664.80 65	50.98 620.49 580.	70 530.05 471	.03 436.42 4	32.08	(84)
Lighting calculations					
5 5	Area	g	FF x Shading	9	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 1.01	0.80	0.70 x 0.83	0.42	
Window - Double-glazed, argon filled, low-E,	0.9 x 1.01	0.80	0.70 x 0.83	0.42	
En=0.1, soft coat (West) W6					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W1	0.9 x 0.53	0.80	0.70 x 0.83	0.22	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W2	0.9 x 2.09	0.80	0.70 x 0.83	0.87	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East)	0.9 x 0.81	0.80	0.70 x 0.83	0.34	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W4	0.9 x 2.09	0.80	0.70 x 0.83	0.87	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W5	0.9 x 0.81	0.80	0.70 x 0.83	0.34	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.60	0.80	0.70 x 1.00	0.30	
GL = 3.80 / 80.80 = 0.047 C1 = 0.625 C2 = 1.081 FL = 490					

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7. Mean internal temperature												
Temper	rature du	uring hea	iting per	iods in th	nelivinga	area, Th´	l (°C)				21.0	0 (85)
Heating	system	responsi	veness								1.0	0
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
11.35	11.43	11.50	11.88	11.96	12.31	12.31	12.38	12.17	11.96	11.81	11.66	
alpha												
1.76	1.76	1.77	1.79	1.80	1.82	1.82	1.83	1.81	1.80	1.79	1.78	
Utilisati	onfacto	r for gair	ns for livi	ngarea								
0.97	0.97	0.95	0.93	0.88	0.81	0.72	0.76	0.87	0.94	0.97	0.98	(86)
Mean internal temperature in living area T1												
16.70	16.96	17.52	18.36	19.20	19.99	20.44	20.37	19.72	18.65	17.57	16.69	(87)
Temper	rature du	iringhea	itingper	iods in re	estofdw	ellingTh	2					
19.05	19.06	19.07	19.12	19.13	19.17	19.17	19.18	19.15	19.13	19.11	19.09	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
0.97	0.96	0.94	0.91	0.84	0.72	0.55	0.60	0.80	0.92	0.96	0.97	(89)
Meanir	nternal te	emperati	ureinth	erestof	dwelling	T2						
15.32	15.59	16.15	17.01	17.83	18.59	18.97	18.93	18.36	17.31	16.23	15.34	(90)
Living a	rea fract	ion (22.3	39 / 80.8	0)							0.2	8 (91)
Mean internal temperature (for the whole dwelling)												
15.70	15.97	16.53	17.38	18.21	18.98	19.38	19.33	18.74	17.68	16.60	15.72	(92)
Applya	djustmer	nttothei	meanint	ternalte	mperatu	ire, wher	reappro	priate				
15.70	15.97	16.53	17.38	18.21	18.98	19.38	19.33	18.74	17.68	16.60	15.72	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisati	on factoi	forgair	IS								
0.95	0.94	0.92	0.88	0.81	0.71	0.58	0.62	0.78	0.89	0.94	0.96
Usefulgains											
431.41	474.59	516.88	549.39	540.62	461.61	358.90	358.16	415.41	421.16	409.77	412.86
Monthly	yaverage	externa	altemper	ature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat loss rate for mean internal temperature											
2255.4	2174.3	1957.3	1601.6	1221.5	798.25	506.22	530.86	854.73	1329.2	1806.1	2217.5
Fractior	n of mon <sup>-</sup>	th for he	ating								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month					
1357.0	1142.2	1071.6	757.61	506.59	-	-	-	-	675.63	1005.3	1342.6
Total sp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			7858.82
Spaceh	eatingre	quireme	ent per m	n² (kWh/r	m²/year)						97.26

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

					kWh/year	
No secondary heating system selected						
Fraction of space heat from main system(s)			1.0000			(202)
Efficiency of main heating system		3	38.80%	1		(206)
Jan Feb Mar Apr May Jun Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement		- <b>1</b>		10	·	
1357.0 1142.2 1071.6 757.61 506.59	-	-	675.63	1005.3	3 1342.6	(98)
Appendix Q - monthly energy saved (main heating syste	e <b>m 1)</b>					
0.00 0.00 0.00 0.00	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)						
1528.2 1286.2 1206.8 853.16 570.48	-	-	760.84	1132.1	1512.0	(211)
Appendix Q - monthly energy saved (main heating syste	e <b>m 2)</b>					
0.00 0.00 0.00 0.00	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)						
0.00 0.00 0.00 0.00	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating	system)		N			. ,
	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)	I			0.00		
			0.00	0.00	0.00	(215)
Water beating			0.00	0.00	0.00	(210)
Waterheatingrequirement						
202.75 178.15 185.36 164.40 159.17 140.19 134.3	31 149.73	3 151.3	8 172.37	184.01	197.96	(64)
Efficiency of water heater	<u> </u>		<u>oj : / 2:0 /</u>		79.50	(216)
87 47 87 42 87 29 86 99 86 38 79 50 79 50	0 79 50	79 50	86 74	87.22	87.49	(217)
Water beating fuel	0 / 7.00	177.00	00.74	07.22	07.47	(217)
221 70 202 70 212 24 190 00 194 26 176 24 169	01 100 2	2 100 4	1 100 73	210.04	226.20	(210)
231.79 203.79 212.34 189.00 184.20 170.34 188.	<u>94</u> 100.3.	5 190.4	1 190.73	210.90	220.20	(217)
Annualtotals					kWh/year	
Space heating fuel used, main system 1					8850.02	(211)
Space heating fuel (secondary)					0.00	(215)
Flectricity for number fans and electric keep, bot					2381.17	(219)
central heating pump					30.00	(230c)
boiler with a fan-assisted flue					45.00	(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (75.00% fixed LEL)					490.11	(232)
Energy saving/generation technologies						
Appendix Q-					0.000	(2260)
Energy saved of generated 0: Energy used 0:					0.000	(230a) (237a)
					0.000	(2070)
Total delivered energy for all uses					11796.31	(238)

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#### 10a. Does not apply

#### 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	8850.02	0.216	1911.60	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2381.17	0.216	514.33	(264)
Space and water heating			2425.94	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricityforlighting	490.11	0.519	254.37	(268)
Electricitygenerated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2719.23	(272)
			$ka/m^2/m^2$	or

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m<sup>2</sup>/year 33.65 (273)

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## Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

#### *Project Information* Building type End-terrace house

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 3 - Baseline
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 ODR		SK17 8AR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	53.40	2.59	138.31	(3a)
First floor	51.59	3.19	164.57	(3b)
Second floor	19.17	2.14	41.02	(3c)
Total floor area	124.16			(4)
Dwelling volume (m <sup>3</sup> )			343.90	(5)

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#### 2. Ventilation rate

											m³ per h	our
							main + s	seondai	^y + oth	er		
							heating					
Numbe	erofchin	nneys					0 + 0 + 0	)	k 40		0.00	(6a)
Numb	erofope	n flues					0 + 0 + 0	)	k 20		0.00	(6b)
Numb	erofinte	rmitten	tfans				4	)	k 10		40.00	(7a)
Numb	erofpas	sive ven	ts				0	)	k 10		0.00	(7b)
Numb	erofflue	lessgas	fires				0	)	k 40		0.00	(7c)
											Air chang	ges per hour
Infiltra	tion due	to chim	neys, far	ns and fl	Jes						0.12	(8)
Pressu	retest, a	ssumed	q50						15.00			(17)
Airper	meability	/									0.87	(18)
Numb	erofside	es on whi	ich shelte	ered							2.00	(19)
Shelter	factor										0.85	(20)
Infiltra	tionrate	incorpo	ratingsh	nelterfa	ctor						0.74	(21)
Infiltra	tion rate	modifie	ed for mo	onthly w	ind spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
								1				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
			/ 11 .	с I			N				13.13	(22a)
Adjust	edinfiltra	ationrat	e (allowi	ngforsr	neiter an	dwinds	peed)	-r				
0.94	0.92	0.90	0.81	0.79	0.70	0.70	0.68	0.74	0.79	0.83	0.87	
											9.66	(22b)
Ventila	ition : na	turalver	ntilation,	intermi	ttentext	ract fans	S					
Effectiv	veaircha	angerate	9									
0.94	0.92	0.91	0.83	0.81	0.74	0.74	0.73	0.77	0.81	0.84	0.87	(25)

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3. Heat losses	and heat los	s parameter	~					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	le A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Doub	le-glazed,		0.385	1.50 (1.60)	0.58			(27)
argon filled, low	/-E, En=0.1,							
soft coat (North	ו)							
Window 5								
Window - Doubl	le-glazed,		3.220	1.50 (1.60)	4.84			(27)
argon filled, low	/-E, En=0.1,							
soft coat (North	ו)							
Window 4								
Window - Doubl	le-glazed,		14.320	1.50 (1.60)	21.53			(27)
argon filled, low	/-E,En=0.1,							
soft coat (East)								
Window 1								
Window - Doubl	le-glazed,		0.810	1.50 (1.60)	1.22			(27)
argon filled, low	/-E,En=0.1,			. ,				. ,
soft coat (North	ı)							
Window 2	,							
Window - Doub	le-glazed,		0.810	1.50 (1.60)	1.22			(27)
argon filled, low	/-E,En=0.1,			, , , , , , , , , , , , , , , , , , ,				<b>、</b>
soft coat (North	ı)							
Window 3	,							
Solid door			2.590	3.00	7.77			(26)
Front Door								( - )
Rooflight at 70°	or less -		0.560	1.50 (1.60)	0.84			(27)
Double-glazed,	argon filled,							( )
low-E, En=0.1, s	oft coat							
(n/a)								
Rooflight								
Rooflight at 70°	or less -		0.560	1.50 (1.60)	0.84			(27)
Double-glazed,	argon filled,							( )
low-E, En=0.1, s	oft coat							
(n/a)								
Rooflight								
Pitched roofs in	sulated betw	veen ioists	7.37	0.13	0.96	9.00	66.33	(30)
Pitchedrooffl	at ceiling - ins	sulated						()
at rafters (0.1	8 * 0.72)							
Pitchedroofsin	sulated betw	veen ioists	32.41	0.16	5.19	9.00	291.69	(30)
Walls		jelete	111.99	0.30	33.60	9.00	1007.87	(29)
Upgradedwal	ls			0.00	00100	,		(_ / )
Walls			17 56	0 13	2 28	9 00	158 04	(29)
Roominroof	stud walls - in	sulated	17.00	0.10	2.20	,	100101	(27)
at rafters (0.1	8 * 0 72)							
Groundfloors	0 0.72)		53 40	0.64	34 18	110 00	5874 00	(28)
Solid around f	loor		20.10	0.01	0 11 10		227 1.00	()
Pitchedroofsin	sulated betw	veen rafters	26 14	0 18	471	9 00	235 26	(30)
Partywall			74 06	0.00	0.00	180.00	13330 80	(30)
i ai ty wall			74.00	0.00	0.00	100.00	10000	

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3. Heat	<sup>•</sup> losses a	nd heat	loss pai	rameter	-							
Element	t	Gross	Ope	enings	Netarea	a U-v	/alue	ΑxU	ka	ppa-valu	ie A x K	
		area, m²	m²		A, m²	W/	m²K	W/K	kJ/	′m²K	kJ/K	
Totalar	eaofexte	ernalele	ments S	igma A, r	n²						272.1	2 (31)
Fabrich	eat loss,	W/K									119.7	5 (33)
Therma	ıl mass pa	aramete	r, <mark>kJ/m²</mark> K	(user-sp	ecified T	MP)					100.0	0 (35)
Effect of	ftherma	lbridges									40.8	2 (36)
Totalfa	bric heat	loss									160.5	7 (37)
Ventilat	ion heat	losscalc	ulatedm	onthly								
106.76	104.82	102.92	93.97	92.30	84.51	84.51	83.07	87.51	92.30	95.69	99.22	(38)
Heat tra	ansfer.co	efficient	, W/K									
267.33	265.39	263.48	254.54	252.87	245.08	245.08	243.64	248.08	252.87	256.25	259.79	
											254.5	3 (39)
Heat los	ss param	eter (HLI	P), W/m²	К								
2.15	2.14	2.12	2.05	2.04	1.97	1.97	1.96	2.00	2.04	2.06	2.09	
HLP (ave	erage)										2.0	5 (40)
Numbe	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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4. Wate	er heatin	ng energ	y require	ements							kWh/year	
Assume	ed occupa	ancy, N									2.88	(42)
Annual	average	hot wate	erusagei	in litres p	oer day V	d,averaç	ge				102.55	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	erusage	e in litres	per day	for each	month							
112.81	108.71	104.60	100.50	96.40	92.30	92.30	96.40	100.50	104.60	108.71	112.81	(44)
Energy	content	of hot wa	ateruseo	k								
167.29	146.32	150.98	131.63	126.30	108.99	101.00	115.89	117.28	136.68	149.19	162.01	
Energy Distribu	content ( ition loss	(annual) S									1613.57	(45)
25.09	21.95	22.65	19.74	18.95	16.35	15.15	17.38	17.59	20.50	22.38	24.30	(46)
Hot wat	erstorag	ge volum	ne (litres)								0.00	(50)
Hot wat	ercylind	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	aturefac	ctor									0.0000	(53)
Energy	lost from	n store (k	Wh/day	)							0.00	(55)
Totalsto	oragelos	S										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	ageloss	_										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated fo	r each m	onth								
50.96	46.03	50.96	49.32	49.12	45.52	47.03	49.12	49.32	50.96	49.32	50.96	(61)
Total he	eat requi	red for w	vater hea	itingcald	ulated for	oreachr	nonth					
218.25	192.34	201.94	180.95	175.43	154.51	148.03	165.02	166.59	187.64	198.51	212.97	(62)
Output	from wa	ter heat	er for ea	ch mont	h, kWh/r	month						
218.25	192.34	201.94	180.95	175.43	154.51	148.03	165.02	166.59	187.64	198.51	212.97	(64)
											2202.18	(64)
Heatga	ins from	waterhe	eating, k	Wh/mor	ith		1				,,	
68.36	60 16	62 94	56 10	54 28	47 62	45.34	50 82	51 32	58 18	61 94	66 61	(65)

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#### 5. Internal gains

	0										
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90
Lighting	gains										
33.45	29.71	24.16	18.29	13.68	11.55	12.47	16.22	21.76	27.63	32.25	34.38
Appliances gains											
290.53	293.55	285.95	269.78	249.36	230.17	217.35	214.34	221.94	238.11	258.53	277.72
Cookinggains											
37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration(	negative	evalues)							
-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12
Waterh	eatingga	ains									
91.89	89.52	84.60	77.91	72.95	66.14	60.94	68.30	71.28	78.21	86.02	89.53
Total internal gains											
485.05	481.95	463.89	435.15	405.16	377.03	359.94	368.03	384.15	413.12	445.97	470.80

#### 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E,	0.9 x 0.385 10.63	0.63 x 0.70	0.77	1.2511
En=0.1, soft coat (North) Window 5				
Window - Double-glazed, argon filled, low-E,	0.9 x 3.220 10.63	0.63 x 0.70	0.77	10.4640
En=0.1, soft coat (North) Window 4				
Window - Double-glazed, argon filled, low-E,	0.9 x 14.320 19.6	40.63 x 0.70	0.77	85.9532
En=0.1, soft coat (East) Window 1				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.810 10.63	0.63 x 0.70	0.77	2.6323
En=0.1, soft coat (North) Window 2				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.810 10.63	0.63 x 0.70	0.77	2.6323
En=0.1, soft coat (North) Window 3				
Solid door	0.9 x 2.590 0.00	0.00 x 0.70	0.77	0.0000
Front Door				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				

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7. Mean internal temperature												
Temperature during heating periods in the living area, Th1 (°C) 21.00												0 (85)
Heating system responsiveness 1.00												
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
12.90	13.00	13.09	13.55	13.64	14.07	14.07	14.16	13.90	13.64	13.46	13.28	
alpha												
1.86	1.87	1.87	1.90	1.91	1.94	1.94	1.94	1.93	1.91	1.90	1.89	
Utilisation factor for gains for living area												
0.98	0.97	0.95	0.92	0.86	0.77	0.67	0.71	0.86	0.94	0.97	0.98	(86)
Mean internal temperature in living area T1												
16.88	17.18	17.77	18.63	19.46	20.19	20.58	20.50	19.88	18.82	17.75	16.89	(87)
Temperature during heating periods in rest of dwelling Th2												
19.23	19.24	19.25	19.30	19.31	19.35	19.35	19.36	19.33	19.31	19.29	19.27	(88)
Utilisation factor for gains for rest of dwelling												
0.97	0.96	0.94	0.90	0.82	0.68	0.51	0.57	0.79	0.92	0.97	0.98	(89)
Mean internal temperature in the rest of dwelling T2												
15.62	15.91	16.50	17.38	18.19	18.88	19.19	19.15	18.62	17.58	16.51	15.64	(90)
Living area fraction (35.56 / 124.16) 0.29												9 (91)
Mean internal temperature (for the whole dwelling)												
15.98	16.27	16.86	17.74	18.55	19.26	19.59	19.54	18.98	17.94	16.86	16.00	(92)
Apply adjustment to the mean internal temperature, where appropriate												
15.98	16.27	16.86	17.74	18.55	19.26	19.59	19.54	18.98	17.94	16.86	16.00	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisati	onfacto	forgair	IS									
0.96	0.95	0.92	0.87	0.79	0.67	0.54	0.59	0.77	0.90	0.95	0.97	(9
Usefulgains												
576.84	669.98	772.70	864.93	872.49	739.14	562.92	556.73	638.29	613.46	559.39	545.81	(9
Monthly	yaverage	externa	altemper	rature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(9
Heatlos	sratefo	r mean ir	nternalte	emperat	ure							
3122.4	3018.5	2730.8	2250.2	1732.6	1141.7	732.71	764.86	1210.9	1855.3	2502.0	3065.0	(9
Fractior	n of mon	th for he	ating									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month						
1893.8	1578.2	1456.8	997.38	639.95	-	-	-	-	923.97	1398.6	1874.2	
Total sp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			10763.17	(9
Spaceh	pace heating requirement per m <sup>2</sup> (kWh/m <sup>2</sup> /year)											(9

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

	kWh/year										
No secondary heating system selected	No secondary heating system selected										
Fraction of space heat from main system(s)	1.0000	(202)									
Efficiency of main heating system	88.80%	(206)									
Jan Feb Mar Apr May Jun Jul Aug Sep	Oct Nov Dec										
Space heating requirement											
1893.8 1578.2 1456.8 997.38 639.95	923.97 1398.6 1874.2	(98)									
Appendix Q - monthly energy saved (main heating system 1)											
0.00 0.00 0.00 0.00	0.00 0.00 0.00	(210)									
Space heating fuel (main heating system 1)											
2132.7 1777.2 1640.5 1123.1 720.66	1040.5 1575.0 2110.7	(211)									
Appendix Q - monthly energy saved (main heating system 2)											
0.00 0.00 0.00 0.00	0.00 0.00 0.00	(212)									
Space heating fuel (main heating system 2)											
0.00 0.00 0.00 0.00	0.00 0.00 0.00	(213)									
Appendix Q - monthly energy saved (secondary heating system)	нн	· · /									
		(214)									
Space heating fuel (secondary)		(_ · · )									
		(215)									
Water beating	0.00 0.00 0.00	(210)									
Waterheating											
218 25 192 34 201 94 180 95 175 43 154 51 148 03 165 02 166	59 187 64 198 51 212 97	(64)									
Efficiency of water heater	79 50	(216)									
87 74 87 69 87 55 87 23 86 62 79 50 79 50 79 50 79 5	50 87 08 87 53 87 75	(217)									
Water beating fuel	07.00 07.03 07.73	(217)									
	EE 21E 47 224 90 242 70	(210)									
248.75 219.35 230.05 207.43 202.53 194.35 180.20 207.57 209	.55 215.47 228.80 242.70	(219)									
Annual totals	kWh/year										
Space heating fuel used, main system 1	12120.69	(211)									
Space heating fuel (secondary)	0.00	(215)									
Waterheatingfuel	2591.35	(219)									
Electricity for pumps, fans and electric keep-hot	20.00	(000-)									
central neating pump	30.00	(230C)									
Doller with a fan-assisted flue	45.00	(2300)									
Electricity for lighting (75,00% fixed LEL)	73.00 500.81	(231)									
Energy saving/generation technologies	590.01	(232)									
Appendix Q -											
Energy saved or generated ():	0.000	(236a)									
Energy used ():	0.000	(237a)									
Total delivered energy for all uses	15377.85	(238)									

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### 10a. Does not apply

# 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	12120.69	0.216	2618.07	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2591.35	0.216	559.73	(264)
Space and water heating			3177.80	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricityforlighting	590.81	0.519	306.63	(268)
Electricitygenerated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			3523.35	(272)
			ka/m²/w	ar

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m<sup>2</sup>/year 28.38 (273)

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# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

# *Project Information* Building type Mid-terracehouse

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 4 - Baseline
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 0DR		SK17 8AR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	37.85	2.60	98.41	(3a)
First floor	37.85	2.76	104.47	(3b)
Second floor	17.11	2.14	36.62	(3c)
Totalfloorarea	92.81			(4)
Dwelling volume (m³)			239.49	(5)

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#### 2. Ventilation rate

											m³ per h	our
							main + s	seonda	ry + oth	er		
							heating					
Numbe	erofchir	nneys					0 + 0 + 0		x 40		0.00	(6a)
Numbe	er of ope	nflues					0 + 0 + 0		x 20		0.00	(6b)
Numbe	er of inte	rmitten	t fans				4	:	x 10		40.00	(7a)
Numbe	erofpas	sive ven <sup>-</sup>	ts				0	:	x 10		0.00	(7b)
Numbe	erofflue	lessgas	fires				0	:	x 40		0.00	(7c)
											Air chang	ges per hour
Infiltrat	ion due	to chim	neys, far	ns and flu	Jes						0.17	(8)
Pressu	retest, a	ssumed	q50						15.00			(17)
Airperr	neability	/									0.92	(18)
Numbe	erofside	es on whi	ich shelte	ered					2.00	(19)		
Shelter	factor										0.85	(20)
Infiltrat	ionrate	incorpo	ratingsh	nelterfac	ctor						0.78	(21)
Infiltrat	ion rate	modifie	ed for mo	onthly w	nd spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Min d F	ator										52.50	(22)
VVIIIGFa								1				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
			/ 11	с I			N				13.13	(22a)
Adjuste	ed infiltra	ationrat	e (allowi	ngforsr	elteran	dwinds	peed)			1		
0.99	0.97	0.95	0.86	0.84	0.74	0.74	0.72	0.78	0.84	0.88	0.92	
											10.23	(22b)
Ventila	tion : na	turalver	ntilation,	intermi	ttentext	ract fans	S					
Effectiv	e air cha	angerate	9									
0.99	0.97	0.96	0.87	0.85	0.77	0.77	0.76	0.80	0.85	0.88	0.92	(25)

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3. Heat losses	and heat los	s parameter	r					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	le A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Doub	le-glazed,		0.900	1.50 (1.60)	1.35			(27)
argon filled, low	/-E, En=0.1,							
soft coat (South	ר)							
Window 5	,							
Window - Doub	le-glazed.		0.385	1.50 (1.60)	0.58			(27)
argon filled. low	/-F.Fn=0.1.							( )
soft coat (North	יייבי בייק (ר							
Window 4	·/							
Window - Doubl	le-alazed		3 2 2 0	1 50 (1 60)	4 84			(27)
argon filled low	/-F Fn=0.1		0.220	1.00 (1.00)	1.01			(27)
soft coat (North	, בו סון,							
Window 3	')							
Window - Doubl	hozeln-ol		0 500	1 50 (1 60)	0.75			(27)
argon filled low	i = glazed, i = F = Fn = 0.1		0.000	1.50 (1.00)	0.75			(27)
soft cost (Most)	/-L, LII=0. I,							
Window 2	,							
Window Doubl	lo alazod		0.620	1 50 (1 60)	0 03			(27)
argon filled low	v E En=0 1		0.020	1.50 (1.00)	0.75			(27)
argonnieu, iow	7-E, EH=0. I,							
Mindow 1	1							
				2.00				(21)
Solid door			2.590	3.00	1.11			(26)
Front Door			0 5 4 0		0.04			(07)
Rooflight at 70°	OF IESS -		0.560	1.50 (1.60)	0.84			(27)
Double-glazed,	argon filled,							
IOW-E, EN=0.1, S	ort coat							
(n/a)								
Rooflight			0 5 ( 0					$(a, \overline{a})$
Rooflight at 70°	or less -		0.560	1.50 (1.60)	0.84			(27)
Double-glazed,	argonfilled,							
low-E, En=0.1, s	soft coat							
(n/a)								
Rooflight								
Pitchedroofsin	sulated betw	veen joists	8.46	0.13	1.10	9.00	76.14	(30)
Pitched roof fl	at ceiling - ins	sulated						
at rafters (0.1	8 * 0.72)							
Pitchedroofsin	sulated betw	veenjoists	17.08	0.16	2.73	9.00	153.72	(30)
Walls			22.46	0.30	6.74	9.00	202.18	(29)
Upgraded wal	ls							
Walls			17.03	0.28	4.77	60.00	1021.80	(29)
Newwalls								
Walls			10.09	0.13	1.31	9.00	90.81	(29)
Roominroofs	stud walls - in	sulated						
at rafters (0.1	8 * 0.72)							
Groundfloors			37.85	0.41	15.52	110.00	4163.50	(28)
Solid ground f	loor							

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3. Heat	losses a	and heat	loss pai	rameter	-							
Element	t	Gross	Ope	enings	Netare	a U-v	alue	ΑxU	ka	ppa-valu	le A x K	
		area, m <sup>2</sup>	m²		A, m²	W/	m²K	W/K	kJ/	′m²K	kJ/K	
Pitched	roofsins	sulated b	etween	rafters	18.02	2	0.18	3.2	4	9.00	162.18	(30)
Partywa	all				131.08	3	0.00	0.0	0 18	80.00	23594.40	
Totalare	eaofext	ernalele	ments S	igma A, r	n²						140.33	(31)
Fabrich	eat loss,	W/K									53.32	(33)
Therma	l mass pa	aramete	r, kJ/m²K	(user-sp	ecifiedT	TMP)					100.00	(35)
Effectof	ftherma	Ibridges	i								21.05	(36)
Totalfat	Total fabric heat loss74.37(37)											(37)
Ventilation heat loss calculated monthly												
78.55	77.03	75.54	68.57	67.26	61.18	61.18	60.06	63.52	67.26	69.90	72.66	(38)
Heat tra	insfer co	efficient	, W/K									
152.92	151.40	149.92	142.94	141.63	135.56	135.56	134.43	3 137.90	141.63	144.27	147.04	
											142.93	(39)
Heat los	sparam	eter (HL	P), W/m²	K								
1.65	1.63	1.62	1.54	1.53	1.46	1.46	1.45	1.49	1.53	1.55	1.58	
HLP (ave	erage)										1.54	(40)
Number	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate	er heatin	ng energ	v requir	ements							kWh/year	
Assume	edoccup	ancy, N									2.66	(42)
Annual	average	hot wate	erusage	in litres p	oer day V	d,averaç	ge				97.43	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	ter usage	e in litres	per day	for each	month							
107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	(44)
Energy	content	of hot wa	aterused	b								
158.93	139.00	143.44	125.05	119.99	103.54	95.95	110.10	111.42	129.85	141.74	153.92	
Energy Distribu	content ( ution loss	annual) S									1532.93	(45)
23.84	20.85	21.52	18.76	18.00	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)
Hot wat	erstora	ge volum	ne (litres)								0.00	(50)
Hot wat	ter cylinc	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	raturefac	ctor									0.0000	(53)
Energy	lost from	n store (k	Wh/day	)							0.00	(55)
lotalste	oragelos	SS	10	0	1	1	1	v	1	1		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	rageloss	V	10				1			10		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated fo	r each m	onth								
50.96	46.03	50.64	47.09	46.67	43.24	44.68	46.67	47.09	50.64	49.32	50.96	(61)
Total he	eatrequi	red for w	ater hea	tingcald	ulated for	oreachr	nonth					
209.89	185.03	194.08	172.14	166.66	146.79	140.63	156.77	158.50	180.49	191.05	204.88	(62)
Output	from wa	ter heate	er for ea	ch mont	h, kWh/r	nonth						
209.89	185.03	194.08	172.14	166.66	146.79	140.63	156.77	158.50	180.49	191.05	204.88	(64)
											2106.91	(64)
Heat ga	insfrom	waterhe	eating, k'	Wh/mor	nth							
65 58	57.73	60.35	53.35	51.56	45.24	43.07	48.28	48.82	55.83	59.46	63.92	(65)

# 5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11
Lighting	gains										
33.22	29.51	24.00	18.17	13.58	11.46	12.39	16.10	21.61	27.44	32.03	34.14
Applian	cesgains										
244.15	246.69	240.30	226.71	209.55	193.43	182.66	180.12	186.51	200.10	217.26	233.38
Cooking	ggains										
36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration (	negative	evalues)							
-106.4	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49
Waterh	eatingga	ains									
88.15	85.90	81.12	74.10	69.31	62.83	57.89	64.89	67.80	75.05	82.58	85.91
Totalint	ternalgai	ins									
431.46	428.03	411.35	384.91	358.37	333.66	318.87	327.05	341.85	368.52	397.80	419.37

#### 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E,	0.9 x 0.900 46.75	0.63 x 0.70	0.77	12.8592
En=0.1, soft coat (South) Window 5				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.385 10.63	0.63 x 0.70	0.77	1.2511
En=0.1, soft coat (North) Window 4				
Window - Double-glazed, argon filled, low-E,	0.9 x 3.220 10.63	0.63 x 0.70	0.77	10.4640
En=0.1, soft coat (North) Window 3				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.500 19.64	0.63 x 0.70	0.77	3.0012
En=0.1, soft coat (West) Window 2				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.620 19.64	0.63 x 0.70	0.77	3.7214
En=0.1, soft coat (West) Window 1				
Solid door	0.9 x 2.590 0.00	0.00 x 0.70	0.77	0.0000
Front Door				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				

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7. Meai	n interna	al tempe	erature									
Temper	rature du	iringhea	ating per	iods in th	nelivinga	area, Th´	l (°C)				21.00	J (85)
Heating	system	esponsi	veness								1.00	С
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
16.86	17.03	17.20	18.04	18.20	19.02	19.02	19.18	18.70	18.20	17.87	17.53	
alpha												
2.12	2.14	2.15	2.20	2.21	2.27	2.27	2.28	2.25	2.21	2.19	2.17	
Utilisati	onfacto	r for gair	ns for livi	ngarea								
0.98	0.97	0.96	0.94	0.90	0.82	0.72	0.75	0.88	0.95	0.97	0.98	(86)
Mean internal temperature in living area T1												
17.57	17.79	18.26	18.98	19.67	20.32	20.65	20.61	20.10	19.24	18.35	17.61	(87)
Temper	rature du	iring hea	itingperi	iods in re	estofdw	ellingTh	2					
19.58	19.59	19.60	19.66	19.67	19.72	19.72	19.73	19.70	19.67	19.65	19.62	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
0.97	0.97	0.95	0.93	0.87	0.75	0.60	0.64	0.83	0.93	0.96	0.98	(89)
Meanir	nternalte	emperat	ureinthe	erestof	dwelling	T2						
16.50	16.73	17.20	17.95	18.63	19.27	19.56	19.53	19.07	18.21	17.32	16.57	(90)
Living a	rea fract	ion (26.	68 / 92.8	1)							0.29	9 (91)
Mean internal temperature (for the whole dwelling)												
16.81	17.04	17.50	18.25	18.93	19.57	19.87	19.84	19.37	18.51	17.62	16.87	(92)
Applya	djustmer	nttothe	meanint	ternalte	mperatu	ure, wher	reappro	priate				
16.81	17.04	17.50	18.25	18.93	19.57	19.87	19.84	19.37	18.51	17.62	16.87	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisati	onfacto	r for gair	IS									
0.96	0.95	0.94	0.90	0.85	0.74	0.61	0.65	0.81	0.91	0.95	0.96	(
Usefulgains												
455.62	484.51	506.40	519.88	504.95	431.98	339.79	340.65	399.74	422.05	427.94	438.75	(
Monthly	average	eexterna	altemper	rature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(
Heatlos	sratefo	r mean ir	nternalte	emperat	ure							
1912.5	1837.6	1649.7	1336.1	1023.5	674.03	443.54	462.32	726.24	1120.0	1517.7	1863.1	(
Fractior	n of mon	th for he	ating									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month						
1083.9	909.29	850.68	587.73	385.84	-	-	-	-	519.33	784.62	1059.7	
Total sp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			6181.23	(
Spaceh	eatingre	quireme	ent per m	ո²(kWh/r	m²/year)						66.60	(

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

											kWh/year	
Noseco	ondaryhe	eating sy	stem sel	ected								(202)
Fificien	noi spac	in heatin	om main in system	i systeri 1	1(5)			8	8 80%			(202)
lan	Feb	Mar	Anr	May	lun	hul	Ана	Sen	Oct	Nov	Dec	(200)
Spaceh	neating re	auireme	ent	iviay		501	riag			1101	Dee	
1083.9	9 9 0 9 . 2 9	850.68	587.73	385.84	L _	-	_	-	519.33	784.62	1059.7	(98)
Append	dix Q - mo	onthly er	nerav sav	red (mai	n heatin	a svsten	n 1)	J	10.7.00			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Spaceh	neating fu	uel (main	heating	system	1)							· /
1220.6	6 1023.9	, 957.97	661.86	434.50	) -	-	-	-	584.83	883.58	1193.4	(211)
Append	dix Q - ma	onthly er	nergy sav	ved (mai	n heatin	gsysten	n 2)		J			. ,
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space	neating fu	uel (main	heating	system	2)		ц.		ļ	ļi.		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	dix Q - ma	onthly er	nergysav	ed (seco	ondary h	eatings	ystem)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Spaceh	neatingfu	uel (secor	ndary)		я.		1	R				
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Waterh	neating											
Waterh	neatingre	equireme	ent									
209.89	9 185.03	194.08	172.14	166.66	5 146.79	140.63	156.77	158.50	180.49	191.05	204.88	(64)
Efficien	ncyofwat	erheate	er								79.50	(216)
87.15	87.08	86.91	86.51	85.77	79.50	79.50	79.50	79.50	86.20	86.81	87.15	(217)
Waterh	neatingfu	lel										
240.85	5 212.49	223.31	198.99	194.30	184.64	176.90	197.20	199.38	209.38	220.08	235.09	(219)
Annual	totals										kWh/vear	
Spaceh	neatingfu	lel used,	mainsy	stem 1							6960.84	(211)
Spaceh	neatingfu	uel (secor	ndary)								0.00	(215)
Waterh	neatingfu	lel									2492.60	(219)
Electric	ity for pu	imps, far	ns and ele	ectric ke	ep-hot							
centra	Iheating	pump									30.00	(230c)
Totalel	ectricity	for the al	bove, kW	/h/year							30.00	(231)
Electric	soving/a	hting (75	o.00% fix n tochno	ed LEL)							586.67	(232)
Annen	saviriy/y∙ dix∩-		riechilo	logies								
Energ	y saved c	orgenera	ated ():								0.000	(236a)
Energ	y used ():	:	v								0.000	(237a)
Totalde	eliverede	energyfo	oralluses	6							10070.11	(238)

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#### 10a. Does not apply

### 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	6960.84	0.216	1503.54	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2492.60	0.216	538.40	(264)
Space and water heating			2041.94	(265)
Electricity for pumps and fans	30.00	0.519	15.57	(267)
Electricity for lighting	586.67	0.519	304.48	(268)
Electricitygenerated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2362.00	(272)
			$ka/m^2/m^2$	or

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m²/year

25.45 (273)

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# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

# *Project Information* Building type Detached house

Reference	6182				
Date	3 July 2018				
Client	Mr Mark Thompson	Project	Unit 6 - Baseline		
	Greenhalgh & Williams Architects	Conversion Of Holy Trinity Church			
	3 Manchester Road		School Road, Peak Dale		
	Bury		Buxton		
	BL9 ODR		SK17 8AR		

SAP 2012 worksheet for notional dwelling - calculation of target emissions

# 1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	36.99	2.60	96.17	(3a)
First floor	33.36	2.60	86.74	(3b)
Secondfloor	14.49	1.97	28.55	(3c)
Totalfloorarea	84.84			(4)
Dwelling volume (m <sup>3</sup> )			211.46	(5)

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# 2. Ventilation rate

											m³ per h	our
							main + s	seondai	ry + oth	er		
							heating					
Numbe	rofchim	nneys					0 + 0 + 0	2	k 40		0.00	(6a)
Numbe	rofope	nflues					0 + 0 + 0	2	k 20		0.00	(6b)
Numbe	rofinte	rmittent	t fans				3	2	k 10		30.00	(7a)
Numbe	rofpass	sive vent	ts				0	2	k 10		0.00	(7b)
Numbe	roffluel	essgas	fires				0	2	k 40		0.00	(7c)
											Air chan	ges per hour
Infiltrat	ion due	to chimi	neys, far	is and flu	Jes						0.14	(8)
Pressur	retest, re	esult q50	C						5.00			(17)
Airpern	neability	,									0.39	(18)
Numbe	rofside	s on whi	ch shelte	ered							2.00	(19)
Shelter	factor										0.85	(20)
Infiltrat	ionrate	incorpo	ratingsh	elterfac	tor						0.33	(21)
Infiltrat	ion rate	modifie	d for mo	onthly wi	nd spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
WindFa	lctor							· · · · · ·				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.13	(22a)
Adjuste	dinfiltra	ationrat	e (allowi	ng for sh	elteran	d wind s	beed)					
0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39	
											4.37	(22b)
Ventilat	ion : nat	uralver	tilation,	intermi	ttentext	ract fans	5					× ,
Effectiv	eaircha	ngerate	; ;									
0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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SAP 2012 worksheet for notional dwelling - calculation of target emissions

3. Heat losses	and heat los	ss parametei	r			
Element	Gross	Openings	Netarea	U-value	ΑxU	
	area, m²	m²	A, m²	W/m²K	W/K	
Window - Doub	le-glazed,		2.640	1.33 (1.40)	3.50	(27)
air-filled, low-E,	En=0.1,					
soft coat (South	ר)					
Window 1						
Window - Doub	le-glazed,		0.650	1.33 (1.40)	0.86	(27)
air-filled, low-E,	En=0.1,			. ,		. ,
soft coat (South	ר)					
Window 2						
Window - Doub	le-alazed,		1.840	1.33 (1.40)	2.44	(27)
air-filled, low-E,	En=0.1,					( )
soft coat (South						
Window 3	-,					
Window - Doub	le-glazed.		0.410	1.33 (1.40)	0.54	(27)
air-filled low-F.	Fn=0.1.					()
soft coat (South	בוי פווי, ר)					
Window 4	')					
Window-Doub	le-alazed		5 040	1 33 (1 40)	6 68	(27)
air-filled low-F	Fn=0.1		01010	1.00 (1.10)	0.00	(27)
soft coat (North	בור ס. ו, ר					
Window 5	')					
Window-Doub	le-alazed		1 920	1 33 (1 /0)	2 55	(27)
air-filled low-F	Fn=0.1		1.720	1.00 (1.40)	2.00	(27)
soft coat (North	בוו=0.1, ר					
Window 6	')					
Window-Doub	le-alazed		0.680	1 33 (1 /0)	0 90	(27)
air-filled low-F	Fn=0.1		0.000	1.00 (1.40)	0.70	(27)
soft coat (West)	)					
Window 7	)					
Window-Doub	le-alazed		0.680	1 33 (1 /0)	0 90	(27)
air-filled low-F	Fn=0.1		0.000	1.00 (1.40)	0.70	(27)
soft coat (West)	)					
Window 8	)					
Solid door - Dou	iple-alazed		1 950	1 00	1 95	(26)
air-filled low-F	Fn=0.1		1.750	1.00	1.75	(20)
soft coat (Mest)	)					
Door	)					
Rooflight at 70°	° or less -		0.950	1 59 (1 70)	1 51	(27)
Double-dlazed	air-filled		0.750	1.57 (1.70)	1.51	(27)
low-E En=0.1 s	coft coat					
(n/a)	Son coar					
Rooflight						
Pitchedroofsin	sulated betw	veenioists	3 63	0.13	0.47	(30)
Pitchedroofsin	isulated betw	veenioists	18.87	0.13	2 45	(30)
Walls		1001303	8 50	0.13 0.18	2.40 1.52	(30)
Timberstudy	valls - room in	nroof	0.00	0.10	1.00	(27)

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3. Heat	t losses a	and heat	t loss pai	rameter	~							
Elemen	t	Gross	Ope	enings	Netare	a U-v	value	ΑxU				
		area, m <sup>2</sup>	² m²		A, m²	W/	m²K	W/K				
Walls					157.14	4	0.18	28.2	9			(29)
Ground	floors				36.99	9	0.13	4.8	1			(28)
Pitched	roofsins	sulated b	etween	rafters	15.78	3	0.13	2.0	5			(30)
Totalar	eaofext	ernalele	ements S	igma A, r	m²						257.6	57 (31)
Fabrich	neat loss,	W/K									61.4	4 (33)
Therma	al mass pa	aramete	r, kJ/m²K	(user-sp	ecified 7	TMP)					250.0	0 (35)
Effect of	ftherma	Ibridges	5								15.3	37 (36)
Total fa	bric heat	loss									76.8	30 (37)
Ventilat	tion heat	losscalc	ulatedm	nonthly								
41.18	40.94	40.70	39.57	39.36	38.38	38.38	38.20	38.76	39.36	39.79	40.23	(38)
Heat tra	ansfer co	efficient	, W/K									
117.99	117.74	117.50	116.38	116.17	115.19	115.19	115.01	115.57	116.17	116.59	117.04	
											116.3	8 (39)
Heat los	ss param	eter (HL	P), W/m²	K								
1.39	1.39	1.38	1.37	1.37	1.36	1.36	1.36	1.36	1.37	1.37	1.38	
HLP (av	erage)										1.3	(40)
Numbe	er of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate	er heatin	ng energ	v require	ements							kWh/year	
Assume	ed occupa	ancy, N									2.55	(42)
Annual	average	hot wate	erusagei	in litres p	ber day V	d,averaç	ge				94.72	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	ter usage	in litres	per day	for each	month							
104.19	100.41	96.62	92.83	89.04	85.25	85.25	89.04	92.83	96.62	100.41	104.19	(44)
Energy	content	of hot wa	aterused	b								
154.52	135.14	139.45	121.58	116.66	100.67	93.28	107.04	108.32	126.24	137.80	149.64	
Energy Distribu	content ( ution loss	annual)									1490.35	(45)
23.18	20.27	20.92	18.24	17.50	15.10	13.99	16.06	16.25	18.94	20.67	22.45	(46)
Hot wat	erstorag	je volum	ie (litres)								0.00	(50)
Hot wat	ter cylind	er loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	aturefac	tor									0.0000	(53)
Energy	lost from	store (k	Wh/day)	)							0.00	(55)
Totalsto	oragelos	S										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	rageloss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	/loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated for	reachm	onth								
50.96	46.03	49.23	45.78	45.37	42.04	43.44	45.37	45.78	49.23	49.32	50.96	(61)
Totalhe	eat requir	red for w	aterhea	itingcald	culated for	oreachr	nonth					
205.48	8 181.17	188.69	167.36	162.03	142.71	136.73	152.42	154.10	175.47	187.12	200.60	(62)
Output	from wa	ter heate	erforea	ch mont	h, kWh/r	nonth						
205.48	8 181.17	188.69	167.36	162.03	142.71	136.73	152.42	154.10	175.47	187.12	200.60	(64)
											2053.87	(64)
Heat ga	insfrom	waterhe	eating, k	Wh/mor	nth							
64 12	56.44	58.68	51.87	50.13	43.98	41.88	46.94	47.46	54.28	58.15	62.50	(65)

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# 5. Internal gains

	0										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42
Lighting	ggains										
20.94	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.52
Applian	cesgains										
229.26	231.64	225.64	212.88	196.77	181.63	171.51	169.13	175.13	187.89	204.00	219.14
Cooking	ggains										
35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g.evap	oration (	negative	evalues)							
-101.9	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93
Waterh	eatingga	ains									
86.18	83.99	78.87	72.04	67.38	61.09	56.29	63.09	65.92	72.96	80.76	84.00
Totalin	ternalgai	ins									
400.60	398.45	383.86	360.59	336.93	314.16	299.83	306.59	318.89	342.37	369.17	388.88

# 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window-Double-glazed, air-filled, low-E,	0.9 x 2.640 46.75	0.63 x 0.70	0.77	37.7204
En=0.1, soft coat (South) Window 1				
Window-Double-glazed, air-filled, low-E,	0.9 x 0.650 46.75	0.63 x 0.70	0.77	9.2872
En=0.1, soft coat (South) Window 2				
Window-Double-glazed, air-filled, low-E,	0.9 x 1.840 46.75	0.63 x 0.70	0.77	26.2900
En=0.1, soft coat (South) Window 3				
Window-Double-glazed, air-filled, low-E,	0.9 x 0.410 46.75	0.63 x 0.70	0.77	5.8581
En=0.1, soft coat (South) Window 4				
Window - Double-glazed, air-filled, low-E,	0.9 x 5.040 10.63	0.63 x 0.70	0.77	16.3785
En=0.1, soft coat (North) Window 5				
Window-Double-glazed, air-filled, low-E,	0.9 x 1.920 10.63	0.63 x 0.70	0.77	6.2394
En=0.1, soft coat (North) Window 6				
Window-Double-glazed, air-filled, low-E,	0.9 x 0.680 19.64	0.63 x 0.70	0.77	4.0816
En=0.1, soft coat (West)				
Window 7				

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6. Solar gains (calculation for January)					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	Area & Flux 0.9 x 0.680 19.6	g & FF 4 0.63 x 0.70	Shading 0.77	Gains 4.0816	
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 1.950 0.00	0.63 x 0.70	0.77	0.0000	
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.950 26.0	0 0.63 x 0.70	1.00	9.8034	
Total solar gains, January				119.74	(83-1)
Solargains					
119.74 209.19 301.08 399.53 472.81 4	80.83 458.79 402	2.17 334.76 235	5.11 144.35	101.88	(83)
Totalgains					
520.34 607.64 684.93 760.12 809.75 7	95.00 758.62 708	8.76 653.65 57	7.48 513.52	490.77	(84)
Lighting calculations					
	Area	g	FF x Shadir	ng	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 1	0.9 x 2.64	0.80	0.70 x 0.83	3 1.10	
Window - Double-glazed, air-filled, low-E,	0.9 x 0.65	0.80	0.70 x 0.83	3 0.27	
En=0.1, soft coat (South) Window 2					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 3	0.9 x 1.84	0.80	0.70 x 0.83	3 0.77	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 4	0.9 x 0.41	0.80	0.70 x 0.83	3 0.17	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 5.04	0.80	0.70 x 0.8	3 2.11	
Window 5 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 1.92	0.80	0.70 x 0.83	3 0.80	
Window 6 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 0.68	0.80	0.70 x 0.83	3 0.28	
Window / Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 0.68	0.80	0.70 x 0.83	3 0.28	
Rooflight at 70° or less - Double-glazed,	0.9 x 0.95	0.80	0.70 x 1.00	0.48	

air-filled, low-E, En=0.1, soft coat (n/a) Rooflight

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# SAP 2012 worksheet for notional dwelling - calculation of target emissions

7. Meai	n interna	al tempe	erature									
Temperature during heating periods in the living area, Th1 (°C) 21.00 (8												
Heating	system	responsi	veness								1.00	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
49.93	50.04	50.14	50.63	50.72	51.15	51.15	51.23	50.98	50.72	50.53	50.34	
alpha												
4.33	4.34	4.34	4.38	4.38	4.41	4.41	4.42	4.40	4.38	4.37	4.36	
Utilisati	onfacto	r for gair	ns for livi	ngarea								
1.00	1.00	0.99	0.97	0.91	0.78	0.63	0.68	0.89	0.98	1.00	1.00	(86)
Mean internal temperature in living area T1												
19.46	19.63	19.91	20.28	20.63	20.88	20.97	20.95	20.77	20.32	19.82	19.43	(87)
Temper	ature du	iringhea	atingper	iods in re	estofdw	ellingTh	2					
19.77	19.77	19.77	19.79	19.79	19.80	19.80	19.80	19.79	19.79	19.78	19.78	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
1.00	0.99	0.98	0.95	0.87	0.69	0.47	0.53	0.82	0.97	0.99	1.00	(89)
Meanir	nternal te	emperat	ureinth	erestof	dwelling	T2						
17.74	17.99	18.40	18.94	19.42	19.71	19.78	19.78	19.60	18.99	18.27	17.70	(90)
Living a	rea fract	ion (12.	66 / 84.8	4)							0.15	(91)
Meanin	iternalte	mperati	ure(fort	hewhole	edwellin	g)						
18.00	18.23	18.62	19.14	19.60	19.89	19.96	19.95	19.77	19.19	18.51	17.96	(92)
Applya	djustmer	nttothe	meanint	ernal tei	mperatu	ire, wher	reappro	priate				
18.00	18.23	18.62	19.14	19.60	19.89	19.96	19.95	19.77	19.19	18.51	17.96	(93)

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# SAP 2012 worksheet for notional dwelling - calculation of target emissions

### 8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.99	0.99	0.98	0.94	0.86	0.69	0.50	0.55	0.82	0.96	0.99	1.00	
Usefulgains												
517.72	601.52	669.85	717.88	697.45	551.29	377.01	392.51	533.41	554.11	508.55	488.84	
Monthly	yaverage	eexterna	altemper	rature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	
Heatlos	sratefo	r mean ir	nternalte	emperat	ture							
1616.1	1570.0	1424.5	1191.9	917.83	608.85	387.02	408.51	655.69	998.06	1329.7	1610.5	
Fractior	n of mon	th for he	ating									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month						
817.23	650.82	561.48	341.30	163.96	-	-	-	-	330.30	591.26	834.58	
Total sp	aceheat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			4290.94	
Space h	eatingre	quireme	ent per m	ո²(kWh/i	m²/year)						50.58	

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# 9a. Energy requirements

Nosecondaryheatingsystem selected Fraction of space heat from main system (s) 1.0000 (202) Efficiency of main heating system 93.40% (206) Earn Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Spaceheating requirement 817.23 650.82 651.48 341.30 163.96 3330.30 591.26 834.58 (98) Appendix 0 - monthly energy saved (main heating system 1) 0.00 0.00 0.00 0.00 0.00 0.00 0										kWh/year	
Fraction of space heat from main system(s)  1.0000  (202)    Efficiency of main heating system  93.40%  (206)    Space heating requirement  817.23 650.82 561.48 341.30 163.96 -  -  -  330.30 591.26 834.58  (98)    Appendix 0 - monthly energy saved (main heating system 1)  0.00  0.00  0.00  0.00  (210)    Space heating fuel (main heating system 1)  874.98 696.81 601.16 365.42 175.55 -  -  -  353.64 633.04 893.56  (211)    Appendix 0 - monthly energy saved (main heating system 2)  0.00  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  0.00  0.00  0.00  (214)    Space heating fuel (main heating system 2)  0.00  0.00  (214)    Space heating fuel (secondary)  0.00  0.00  0.00  (215)    Water heating  Water heating  (216)  (217)    Space heating fuel (secondary)  (216)  (217)	No secondary heating	ng system se	elected								
Efficiency of main heating system  93.40%  (206)    Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec    Spaceheating requirement  817.23 (650.82 (561.48) (341.30) (63.96)  -  -  -  330.30 (591.26) (834.58)  (98)    Appendix 0  - monthly energy saved (main heating system 1)  0.00  0.00  0.00  0.00  (210)    Spaceheating fuel (main heating system 1)  187.49 (696.81) (601.16) (365.42) (175.55)  -  -  353.64 (633.04) (893.56)  (211)    Appendix 0  - monthly energy saved (main heating system 2)  -  -  0.00  0.00  0.00  (212)    0.00  0.00  0.00  0.00  -  -  -  0.00  0.00  (212)    Space heating fuel (main heating system 2)  -  -  -  0.00  0.00  (213)    Appendix 0  -  -  -  0.00  0.00  (214)    Spaceheating fuel (main heating system 2)  -  -  0.00  0.00  (214)    Spaceheating fuel (secondary) <td< td=""><td>Fraction of space he</td><td>at from mai</td><td>in syste<mark>n</mark></td><td>า(s)</td><td></td><td></td><td></td><td>1.0000</td><td></td><td></td><td>(202)</td></td<>	Fraction of space he	at from mai	in syste <mark>n</mark>	า(s)				1.0000			(202)
Jan    Feb    Mar    Jan    Jun    Jul    Aug    Sep    Oct    Nov    Dec      Spaceheatingrequirement    -    -    330.30 591.26 834.58    (98)      Appendix O-monthly energy saved (main heating system 1)    -    -    0.00    0.00    0.00    (210)      Spaceheating fuel (main heating system 1)    -    -    0.00    0.00    (211)      Appendix O-monthly energy saved (main heating system 2)    -    -    353.64 633.04 893.56    (211)      O.00    0.00    0.00    0.00    -    -    -    0.00    0.00    (212)      Space heating fuel (main heating system 2)    -    -    -    0.00    0.00    (212)      Space heating fuel (main heating system 2)    -    -    -    0.00    0.00    (214)      Space heating fuel (main heating system 2)    -    -    -    0.00    0.00    (214)      Space heating fuel (secondary)    -    -    -    0.00    0.00    (214)	Efficiency of main he	eatingsyste	m	-1	1	][	9	3.40%	1		(206)
Spaceheatingrequirement    817.23 650.82 661.48 341.30 163.96 330.30 591.26 834.58    (98)      Appendix Q - monthly energy saved (main heating system 1)    0.00 0.00 0.00 0.00 0.00 (210)      Space heating fuel (main heating system 1)    874.98 696.81 601.16 365.42 175.55 353.64 633.04 893.56    (211)      Appendix Q - monthly energy saved (main heating system 2)    0.00 0.00 0.00 0.00 (212)    (212)      Space heating fuel (main heating system 2)    0.00 0.00 0.00 0.00 (212)    (213)      Appendix Q - monthly energy saved (secondary heating system)    0.00 0.00 0.00 0.00 (213)      O.00 0.00 0.00 0.00 0.00 0.0.00 0.00 0.00 (214)    (213)      Space heating fuel (secondary)    0.00 0.00 0.00 0.00 (214)      Space heating requirement    (205.48 181.17) 188.69 167.36 162.03 142.71 136.73 152.42 154.10 175.47 187.12 200.60 (64)      Efficiency of water heater    80.30    80.30 80.30 80.30 86.62 87.75 88.25 (217)      Water heating requirement    (206.48 181.17) 188.69 167.36 162.03 142.71 136.73 152.42 154.10 175.47 187.12 200.60 (64)      Efficiency of water heater    80.30    80.30 80.30 86.62 87.75 88.25 (217)      Water heating requirement    (206.13 142.71 136.73 152.42 154.10 175.47 187.12 120.60 (64)      Efficiency of water heater    80.30 80.30 80.30 80.30 86.62 87.75 88.25 (217)	Jan Feb Ma	ir Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
817.23  650.82  561.48  341.30  163.96  -  -  330.30  591.26  834.58  (98)    Appendix Q - monthly energy saved (main heating system 1)  -  -  0.00  0.00  0.00  (210)    Space heating fuel (main heating system 1)  -  -  -  0.00  0.00  (210)    Space heating fuel (main heating system 1)  -  -  353.64  633.04  893.56  (211)    Appendix O - monthly energy saved (main heating system 2)  -  -  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  -  -  0.00  0.00  0.00  (213)    Appendix O - monthly energy saved (secondary heating system)  -  -  0.00  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary) </td <td>Spaceheatingrequir</td> <td>rement</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Spaceheatingrequir	rement									
Appendix Q-monthly energy saved (main heating system 1)  (210)    Boace heating fuel (main heating system 1)  (210)    B74.98 696.81 601.16 365.42 175.55  -  -  353.64 633.04 893.56  (211)    Appendix Q-monthly energy saved (main heating system 2)  -  -  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  -  -  -  0.00  0.00  (212)    Space heating fuel (main heating system 2)  -  -  -  0.00  0.00  (213)    Appendix Q-monthly energy saved (secondary heating system)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating requirement  -  -  0.00  0.00  (214)    Space heating requirement  -  -  0.00  0.00  (214)    Vater heating requirement  205.48 181.17 188.69 167.36 162.03 142.71 136.73 152.42 154.10 175.47 187.12 200.60  (64)    Efficiency of water heater  80.30 80.30 80.30 80.30 80.62 87.75 88.25  (217)    Space heating fuel  2.00 <td< td=""><td>817.23 650.82 56</td><td>1.48 341.3</td><td>0 163.90</td><td>6 -</td><td>-</td><td>-</td><td>-</td><td>330.30</td><td>591.26</td><td>834.58</td><td>(98)</td></td<>	817.23 650.82 56	1.48 341.3	0 163.90	6 -	-	-	-	330.30	591.26	834.58	(98)
0.00    0.00 <td< td=""><td>Appendix Q - month</td><td>ly energy sa</td><td>aved (ma</td><td>in heatin</td><td>gsysten</td><td>n 1)</td><td></td><td></td><td></td><td></td><td></td></td<>	Appendix Q - month	ly energy sa	aved (ma	in heatin	gsysten	n 1)					
Space heating fuel (main heating system 1)	0.00 0.00 0.0	00.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
874.98  696.81  601.16  365.42  175.55  -  -  353.64  633.04  893.56  (211)    Appendix Q - monthly energy saved (main heating system 2)  -  -  0.00  0.00  0.00  (212)    Space heating fuel (main heating system 2)  -  -  -  0.00  0.00  (213)    Appendix Q - monthly energy saved (secondary heating system)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating fuel (secondary)  -  -  -  0.00  0.00  (214)    Space heating requirement  -  -  -  0.00  0.00  (214)    205.48  181.17  188.69  167.36  162.03  142.71  136.73  152.42  154.10  175.47  187.12  200.60  (64)    Efficiency of water heater  80.30  80.30  80.30  86.62  87.75  88.25 <td>Space heating fuel (r</td> <td>main heatin</td> <td>gsystem</td> <td>1)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Space heating fuel (r	main heatin	gsystem	1)							
Appendix Q - monthly energy saved (main heating system 2)  0.00  0.	874.98 696.81 60	1.16 365.4	2 175.5	5 -	-	-	-	353.64	633.04	893.56	(211)
0.00  0.00	Appendix Q - month	ly energy sa	aved (ma	in heatin	gsysten	n 2)					
Space heating fuel (main heating system 2)  (1,00)  (0,00)  (0,00)  (0,00)  (213)    Appendix Q - monthly energy saved (secondary heating system)  (213)    0.00  0.00  0.00  (214)    Space heating fuel (secondary)  (214)    0.00  0.00  0.00  (214)    Space heating fuel (secondary)  (214)    0.00  0.00  0.00  (215)    Water heating  (205.49)  (167.36)  (162.03)  (142.71)  (136.73)  (152.42)  (154.10)  (175.47)  (187.12)  (200.60)  (64)    Efficiency of water heater  80.30  (80.30)  (80.30)  (80.30)  (216)  (88.17)  (87.99)  (87.63)  (86.81)  (85.08)  (80.30)  (80.30)  (80.30)  (217)    Water heating fuel  (233.04)  (205.90)  (215.33)  (192.79)  (197.44)  (217)  (219)    Annual totals  kWh/year  (211)  (211)  (212)  (212)  (214)  (214)  (214)  (215)  (214)  (215)  (214)  (215)  (214)  (215)	0.00 0.00 0.0	00.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
0.00  0.00	Space heating fuel (r	main heatin	gsystem	2)	1	1	<u>.</u>	1	JL		
Line	0.00 0.00 0.0	00.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
0.00  (215)    Water heating requirement  205.48  181.17  188.69  167.36  162.03  142.71  136.73  152.42  154.10  175.47  187.12  200.60  (64)    Efficiency of water heater  80.30  80.30  80.30  80.30  80.30  86.62  87.75  88.25  (217)    Water heating fuel  192.79  190.44  177.72  170.27  189.81  191.91  202.58  213.24  227.31  (219)    Annual totals  kWh/year  4594.15  (211)  5  (219)  2410.35  (219)  219  2410.35  (219) <td>Appendix Q - month</td> <td>lvenergysa</td> <td>aved (sec</td> <td>ondary h</td> <td>eatings</td> <td>vstem)</td> <td></td> <td></td> <td></td> <td></td> <td><b>\</b></td>	Appendix Q - month	lvenergysa	aved (sec	ondary h	eatings	vstem)					<b>\</b>
Labor  Labor <td< td=""><td></td><td></td><td>0.00</td><td> </td><td>_</td><td>_</td><td></td><td>0.00</td><td>0.00</td><td>0.00</td><td>(214)</td></td<>			0.00		_	_		0.00	0.00	0.00	(214)
0.00  (215)    Water heating rule  205.48  181.17  188.69  167.36  162.03  142.71  136.73  152.42  154.10  175.47  187.12  200.60  (64)    Efficiency of water heater  80.30  80.30  80.30  80.30  80.30  80.30  80.30  80.30  (216)  88.17  87.99  87.63  86.81  85.08  (217)  Water heating fuel  233.04  205.90  215.33  192.79  190.44  177.72  170.27  189.81  191.91  202.58  213.24  227.31  (219)  An	Space heating fuel (s	econdary)	0.00		<u> </u>	1		0.00	0.00	0.00	(211)
10.00  10.00 <td< td=""><td></td><td></td><td>0.00</td><td></td><td></td><td></td><td>1</td><td>0.00</td><td>0.00</td><td>0.00</td><td>(215)</td></td<>			0.00				1	0.00	0.00	0.00	(215)
Water heating requirement      205.48    181.17    188.69    167.36    162.03    142.71    136.73    152.42    154.10    175.47    187.12    200.60    (64)      Efficiency of water heater    80.30    8	Waterbeating	0.00	0.00	-	-	_	1-	0.00	0.00	0.00	(215)
205.48  181.17  188.69  167.36  162.03  142.71  136.73  152.42  154.10  175.47  187.12  200.60  (64)    Efficiency of water heater  80.30  (216)  (88.17  87.99  87.63  86.81  85.08  80.30  80.30  80.30  80.30  86.62  87.75  88.25  (217)    Water heating fuel  233.04  205.90  215.33  192.79  190.44  177.72  170.27  189.81  191.91  202.58  213.24  227.31  (219)    Annual totals  kWh/year  Space heating fuel used, main system 1  4594.15  (211)    Space heating fuel (secondary)  0.00  (215)    Water heating fuel  2410.35  (219)    Electricity for pumps, fans and electric keep-hot  central heating pump  30.00  (230e)    Total electricity for the above, kWh/year  75.00  (231)    Electricity for lighting (100.00% fixed LEL)  369.72  (232)    Energy saved or generated ():  0.000  (236a)    Energy saved or generated ():  0.0000  (237a)    Energy	Water heating requir	rement									
Edition: 101:101:101:101:101:101:101:101:101:10	205 48 181 17 18	8 60 167 3	6 162 0'	2 1/2 71	136 73	152 / 2	15/ 10	175 47	187 12	200.60	(64)
Entreletiver water nearer  00.30  (210)    (217)  (217)    Water heating fuel  (217)    (217)  (217)    Water heating fuel  (217)    (219)  (217)    Annual totals  kWh/year    Space heating fuel used, main system 1  4594.15    Space heating fuel (secondary)  0.00    Water heating fuel  2410.35    Water heating fuel  2410.35    Vater heating fuel  2410.35    (219)  (219)    Annual totals  kWh/year    Space heating fuel (secondary)  0.00    Water heating fuel  (210)    Beletricity for pumps, fans and electric keep-hot  (210)    central heating pump  30.00    boiler with a fan-assisted flue  45.00    Total electricity for the above, kWh/year  75.00    Energy saving/generation technologies  Appendix Q-    Energy saved or generated ():  0.000  (236a)    Energy used ():  0.000  (237a)    Total delivered energy for all uses  7449.22  (238)	Efficiency of water b	0.07 107.3	0 102.0	0 142.71	150.75	132.42		<u>173.47</u>	107.12	<u>200.00</u> 80.30	(07)
187.17  187.99  187.83  186.81  180.30				00.20	00.20	00.20	00.20	04.40	07.75	00.30	(210)
233.04  205.90  215.33  192.79  190.44  177.72  170.27  189.81  191.91  202.58  213.24  227.31  (219)    Annual totals  kWh/year    Space heating fuel used, main system 1  4594.15  (211)    Space heating fuel (secondary)  0.00  (215)    Water heating fuel  2410.35  (219)    Electricity for pumps, fans and electric keep-hot  2410.35  (210)    central heating pump  30.00  (230c)    boiler with a fan-assisted flue  45.00  (230e)    Total electricity for the above, kWh/year  75.00  (231)    Electricity for lighting (100.00% fixed LEL)  369.72  (232)    Energy saving/generation technologies  0.000  (236a)    Appendix Q-  0.000  (237a)    Total delivered energy for all uses  7449.22  (238)	88.17 87.99 87	.63 86.81	85.08	80.30	80.30	80.30	80.30	86.62	87.75	88.25	(217)
[233.04] 205.90] 215.33 [192.79] 190.44 [177.72] 170.27] 189.81 [191.91] 202.58 [213.24] 227.31  (219)    Annual totals  kWh/year    Space heating fuel used, main system 1  4594.15  (211)    Space heating fuel (secondary)  0.00  (215)    Water heating fuel  2410.35  (219)    Electricity for pumps, fans and electric keep-hot  2410.35  (210)    central heating pump  30.00  (230e)    boiler with a fan-assisted flue  45.00  (230e)    Total electricity for the above, kWh/year  75.00  (231)    Electricity for lighting (100.00% fixed LEL)  369.72  (232)    Energy saving/generation technologies  0.000  (236a)    Appendix Q-  0.000  (237a)    Energy used ():  0.000  (237a)    Total delivered energy for all uses  7449.22  (238)	water neating fuel										(010)
Annual totals    kWh/year      Space heating fuel used, main system 1    4594.15    (211)      Space heating fuel (secondary)    0.00    (215)      Water heating fuel    2410.35    (219)      Electricity for pumps, fans and electric keep-hot    2410.35    (210)      central heating pump    30.00    (230c)      boiler with a fan-assisted flue    45.00    (230e)      Total electricity for the above, kWh/year    75.00    (231)      Electricity for lighting (100.00% fixed LEL)    369.72    (232)      Energy saving/generation technologies    20.000    (236a)      Appendix Q-    0.000    (237a)      Energy used ():    0.000    (237a)      Total delivered energy for all uses    7449.22    (238)	233.04 205.90 21	5.33 192.7	<u>9  190.44</u>	4 177.72	2 170.27	189.81	191.91	202.58	8 213.24	227.31	(219)
Space heating fuel used, main system 14594.15(211)Space heating fuel (secondary)0.00(215)Water heating fuel2410.35(219)Electricity for pumps, fans and electric keep-hot(230c)boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies0.000(236a)Appendix Q-0.000(237a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Annual totals									kWh/year	
Space heating fuel (secondary)0.00(215)Water heating fuel2410.35(219)Electricity for pumps, fans and electric keep-hot30.00(230c)boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies0.000(236a)Appendix Q-0.000(237a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Space heating fuel u	sed, main s	ystem 1							4594.15	(211)
Water heating fuel2410.35(219)Electricity for pumps, fans and electric keep-hot30.00(230c)boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies2410.35(236a)Appendix Q-0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Space heating fuel (s	econdary)								0.00	(215)
Electricity for pumps, fans and electric keep-hot30.00(230c)central heating pump30.00(230e)boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies369.72(232)Appendix Q-0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Waterheatingfuel									2410.35	(219)
central heating pump30.00(230c)boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies369.72(232)Appendix Q- Energy saved or generated ():0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Electricity for pumps	s, fans and e	electricke	ep-hot							
boiler with a fan-assisted flue45.00(230e)Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologies2000(236a)Appendix Q-0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	centralheatingpur	np								30.00	(230c)
Total electricity for the above, kWh/year75.00(231)Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologiesAppendix Q-0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	boiler with a fan-as	sisted flue								45.00	(230e)
Electricity for lighting (100.00% fixed LEL)369.72(232)Energy saving/generation technologiesAppendix Q-Energy saved or generated ():0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	I otal electricity for t	he above, k	Wh/year	`						/5.00	(231)
Appendix Q- Energy saved or generated ():0.000 0.000(236a) 0.000Total delivered energy for all uses7449.22(238)	Electricity for lightin	g(100.00%	TIXED LEI	_)						369.72	(232)
Energy saved or generated ():0.000(236a)Energy used ():0.000(237a)Total delivered energy for all uses7449.22(238)	Appendix O	anomechin	ologies								
Energy used ():0.000(230a)Total delivered energy for all uses7449.22(238)	Energy saved or de	nerated $\Lambda$								0 000	(236a)
Total delivered energy for all uses 7449.22 (238)	Energy used ():									0.000	(237a)
Total delivered energy for all uses7449.22(238)	<u> </u>										/
	Total delivered ener	gyforalluse	es							7449.22	(238)

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#### 10a. Does not apply

### 11a. Does not apply

#### 12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	4594.15	0.216	992.34	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2410.35	0.216	520.63	(264)
Space and water heating			1512.97	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	369.72	0.519	191.89	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1743.78	(272)
			kg/m²/ye	ear
Emissions per m <sup>2</sup> for space and water heating			17.83	(272a)
Emissions per m <sup>2</sup> for lighting			2.26	(272b)
Emissions per m <sup>2</sup> for pumps and fans			0.46	(272c)
Target Carbon Dioxide Emission Rate (TER)			20.55	(273)

 $=(17.8332 \times 1.00) + 2.2617 + 0.4588$ 

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# Appendix 2:

# **Proposed Example SAP Calculations**



# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

# *Project Information* Building type End-terrace house

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 1 - Proposed
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 ODR		SK17 8AR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	42.24	2.67	112.78	(3a)
First floor	38.56	3.12	120.31	(3b)
Total floor area	80.80			(4)
Dwelling volume (m³)			233.09	(5)

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#### 2. Ventilation rate

											m³ per h	our
							main + s	seondai	ry + oth	ier		
							heating					
Numb	erofchir	nneys					0 + 0 + 0	2	x 40		0.00	(6a)
Numb	erofope	en flues					0 + 0 + 0		x 20		0.00	(6b)
Numb	erofinte	ermitten	t fans				3	2	x 10		30.00	(7a)
Numb	er of pas	sive ven	ts				0	2	x 10		0.00	(7b)
Numb	erofflue	lessgas	fires				0	2	x 40		0.00	(7c)
											Air chan	ges per hour
Infiltra	tion due	tochim	neys, far	is and flu	Jes						0.13	(8)
Pressu	ire test, a	issumed	q50						15.00			(17)
Airper	meability	y									0.88	(18)
Numb	erofside	es on whi	ich shelte	ered							2.00	(19)
Shelte	rfactor										0.85	(20)
Infiltra	tionrate	incorpo	ratingsh	elterfac	ctor						0.75	(21)
Infiltra	tion rate	modifie	ed for mo	onthly w	ind spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
WindF	actor						I(	-r				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.13	(22a)
Adjust	edinfiltr	ationrat	e (allowi	ng for sh	nelteran	d wind s	peed)					
0.95	0.93	0.91	0.82	0.80	0.71	0.71	0.69	0.75	0.80	0.84	0.88	
<u> </u>	JI	JI.	JL		я	N	Л			/L	9.80	(22b)
Ventila	ation : na	turalver	ntilation,	intermi	ttentext	ract fan:	S					()
Effecti	veaircha	angerate	Э									
0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89	(25)
												. /

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3. Heat losses a	and heat los.	s parameter	~					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	ie A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Double	e-glazed,		1.010	1.33 (1.40)	1.34			(27)
argon filled, low	-E, En=0.1,							
soft coat (West)								
Window - Doubl	e-alazed		1 010	1 33 (1 40)	1 34			(27)
argon filled low	r = F F = 0.1		1.010	1.00 (1.10)	1.01			(27)
soft coat (West)	2,211 0.11							
W7								
Window - Doubl	e-alazed.		0.810	1.33 (1.40)	1.07			(27)
argon filled. low	-F. Fn=0.1.		0.010	1.00 (1110)	1.07			(27)
soft coat (Fast)	2,211 0.11							
W5								
Window - Doubl	e-glazed.		2.090	1.33 (1.40)	2.77			(27)
argon filled. low	-E.En=0.1.							()
soft coat (Fast)								
W4								
Window - Doubl	e-glazed,		0.810	1.33 (1.40)	1.07			(27)
argon filled, low	-E, En=0.1,			· · · · ·				<b>、</b>
soft coat (East)								
W3								
Window - Doubl	e-glazed,		2.090	1.33 (1.40)	2.77			(27)
argon filled, low	-E, En=0.1,			· · · · ·				<b>、</b>
soft coat (East)								
W2								
Window - Doubl	e-glazed,		0.530	1.33 (1.40)	0.70			(27)
argon filled, low	-E, En=0.1,							
soft coat (West)								
W1								
Solid door			2.280	1.80	4.10			(26)
Front Door								
Rooflight at 70°	or less -		0.600	1.33 (1.40)	0.80			(27)
Double-glazed, a	argon filled,							
low-E, En=0.1, s	oft coat							
(n/a)								
Rooflight								
Pitched roofs ins	sulated betw	een joists	68.43	0.13	8.90	9.00	615.87	(30)
Walls			18.70	0.28	5.24	9.00	168.30	(29)
Upgraded wall	S							
Walls			67.94	0.26	17.66	60.00	4076.40	(29)
Newwalls								
Ground floors			42.24	0.62	26.19	110.00	4646.40	(28)
Solid ground fl	loor							
Pitched roofs in:	sulated betw	eenrafters	33.63	0.18	6.05	9.00	302.67	(30)
Partywall			52.73	0.00	0.00	180.00	9491.40	
Party floor			11.10	0.00	0.00	30.00	333.00	

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3. Heat	t losses a	and heat	<sup>t</sup> loss pal	rametei	-							
Elemen	t	Gross	Ope	enings	Netare	a U-v	value	ΑxU	ka	ppa-valu	ue A x K	
		area, m²	m²		A, m²	W/	′m²K	W/K	kJ/	′m²K	kJ/K	
Totalar	eaofext	ernalele	mentsS	igma A, ı	m²						242.17	7 (31)
Fabrich	neat loss,	W/K									80.02	1 (33)
Therma	al mass pa	aramete	r, kJ/m²K	(user-sp	pecified 1	TMP)					100.00	) (35)
Effect o	ftherma	Ibridges	5								36.33	3 (36)
Total fa	bric heat	loss									116.33	3 (37)
Ventilat	tion heat	losscalc	ulatedm	nonthly								
73.34	71.98	70.66	64.42	63.25	57.82	57.82	56.82	59.91	63.25	65.61	68.08	(38)
Heat tra	ansfer co	efficient	, W/K									
189.67	188.32	186.99	180.75	179.59	174.16	174.16	173.15	176.25	179.59	181.95	5 184.41	
											180.75	5 (39)
Heat los	ss param	neter (HL	P), W/m²	K								
2.35	2.33	2.31	2.24	2.22	2.16	2.16	2.14	2.18	2.22	2.25	2.28	
HLP (av	erage)										2.24	4 (40)
Numbe	er of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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4. Wate	er heatin	ng energ	v require	ements							kWh/year	
Assume	doccupa	ancy, N									2.48	(42)
Annuala	average	hotwate	rusagei	in litres p	per day V	d,avera	ge				93.05	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	er usage	e in litres	per day	for each	month							
102.35	98.63	94.91	91.19	87.47	83.74	83.74	87.47	91.19	94.91	98.63	102.35	(44)
Energy	content	of hot wa	ater used	k								
151.79	132.76	136.99	119.43	114.60	98.89	91.64	105.15	106.41	124.01	135.37	147.00	
Energy o Distribu	content ( Ition loss	annual)									1464.03	(45)
22.77	19.91	20.55	17.91	17.19	14.83	13.75	15.77	15.96	18.60	20.30	22.05	(46)
Hotwat	erstoraç	ge volum	e (litres)								0.00	(50)
Hot wat	er cylind	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	aturefac	ctor									0.0000	(53)
Energyl	ost from	n store (k	Wh/day)	)							0.00	(55)
Totalsto	pragelos	S				<b>V</b>						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	ageloss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combile	osscalcu	lated for	reachm	onth								
50.96	45.40	48.37	44.97	44.57	41.30	42.68	44.57	44.97	48.37	48.64	50.96	(61)
Totalhe	atrequi	red for w	aterhea	itingcald	ulated f	oreachr	nonth					
202.75	178.15	185.36	164.40	159.17	140.19	134.31	149.73	151.38	172.37	184.01	197.96	(62)
Output	from wa	ter heate	erforea	ch mont	h, kWh/r	month						
202.75	178.15	185.36	164.40	159.17	140.19	134.31	149.73	151.38	172.37	184.01	197.96	(64)
											2019.77	(64)
Heatgai	insfrom	waterhe	eating, k	Wh/mor	nth							
63.21	55.49	57.64	50.95	49.25	43.21	41.14	46.11	46.62	53.32	57.17	61.62	(65)

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# 5. Internal gains

	U										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89	123.89
Lighting	ggains										
22.20	19.72	16.04	12.14	9.08	7.66	8.28	10.76	14.44	18.34	21.41	22.82
Applian	cesgains										
221.10	223.40	217.62	205.31	189.77	175.17	165.41	163.12	168.90	181.21	196.75	211.35
Cooking	ggains										
35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration (	negative	evalues)							
-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11
Waterh	eatingga	ains									
84.96	82.58	77.47	70.77	66.19	60.01	55.29	61.97	64.75	71.67	79.40	82.82
Totalin	ternalgai	ins									
391.43	388.86	374.30	351.39	328.21	306.01	292.15	299.02	311.27	334.39	360.72	380.15

# 6. Solar gains (calculation for January)

Area & Flux	g & FF	Shading	Gains
0.9 x 1.010 19.64	0.63 x 0.70	0.77	6.0623
0.9 x 1.010 19.64	0.63 x 0.70	0.77	6.0623
0.9 x 0.810 19.64	0.63 x 0.70	0.77	4.8619
0.9 x 2.090 19.64	0.63 x 0.70	0.77	12.5448
0.9 x 0.810 19.64	0.63 x 0.70	0.77	4.8619
0.9 x 2.090 19.64	0.63 x 0.70	0.77	12.5448
0.9 x 0.530 19.64	0.63 x 0.70	0.77	3.1812
0.9 x 2.280 0.00	0.00 x 0.70	0.77	0.0000
	Area & Flux 0.9 x 1.010 19.64 0.9 x 1.010 19.64 0.9 x 0.810 19.64 0.9 x 2.090 19.64 0.9 x 0.810 19.64 0.9 x 2.090 19.64 0.9 x 0.530 19.64 0.9 x 2.280 0.00	Area & Flux  g & FF    0.9 x 1.010 19.64  0.63 x 0.70    0.9 x 1.010 19.64  0.63 x 0.70    0.9 x 0.810 19.64  0.63 x 0.70    0.9 x 2.090 19.64  0.63 x 0.70    0.9 x 0.810 19.64  0.63 x 0.70    0.9 x 0.530 19.64  0.63 x 0.70    0.9 x 0.530 19.64  0.63 x 0.70	Area & Flux  g & FF  Shading    0.9 x 1.010 19.64 0.63 x 0.70  0.77    0.9 x 1.010 19.64 0.63 x 0.70  0.77    0.9 x 0.810 19.64 0.63 x 0.70  0.77    0.9 x 2.090 19.64 0.63 x 0.70  0.77    0.9 x 0.810 19.64 0.63 x 0.70  0.77    0.9 x 2.090 19.64 0.63 x 0.70  0.77    0.9 x 2.090 19.64 0.63 x 0.70  0.77    0.9 x 2.090 19.64 0.63 x 0.70  0.77

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6. Solar gains (calculation for January)					
	Area & Flux	g & FF	Shading	Gains	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.600 26.00	0.63 x 0.70	1.00	6.1916	(02.1)
i otai solar gains, January				56.31	(83-1)
Solargains					
56.31 110.90 184.33 271.21 334.32 34	3.06 326.27 278.	99 215.18 132.	05 70.35 4	6.22	(83)
Totalgains					
447.74 499.76 558.62 622.59 662.53 64	9.06 618.42 578.	01 526.44 466.	44 431.07 4	26.37	(84)
Lighting calculations					
	Area	g	FF x Shading	9	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 1.01	0.80	0.70 x 0.83	0.42	
Window-Double-glazed argon filled low-F	09 x 1 01	0.80	070 x 083	0 4 2	
En=0.1, soft coat (West) W7	0.7 X 1.01	0.00	0.70 x 0.00	0.12	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W5	0.9 x 0.81	0.80	0.70 x 0.83	0.34	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W4	0.9 x 2.09	0.80	0.70 x 0.83	0.87	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East)	0.9 x 0.81	0.80	0.70 x 0.83	0.34	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East)	0.9 x 2.09	0.80	0.70 x 0.83	0.87	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 0.53	0.80	0.70 x 0.83	0.22	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.60	0.80	0.70 x 1.00	0.30	
GL = 3.80 / 80.80 = 0.047 C1 = 0.500 C2 = 1.081 EI = 392					

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N:\Energy Performance & Sustainability\Work\Energy Statements\Work\6182 - Conversion of Holy Trinity Church, Buxton\SAP\Conversion Of Holy Trin Approval of JPA Designer by BRE applies only to the software, data is not subject to quality control procedures, users are themselves

responsible for the accuracy of the data. The results of the calculation should not be accepted without first checking the input data.

7. Meai	n interna	al tempe	erature									
Temperature during heating periods in the living area, Th1 (°C) 21.00									0 (85)			
Heating system responsiveness 1.00									0			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
11.83	11.92	12.00	12.42	12.50	12.89	12.89	12.96	12.73	12.50	12.34	12.17	
alpha												
1.79	1.79	1.80	1.83	1.83	1.86	1.86	1.86	1.85	1.83	1.82	1.81	
Utilisati	on facto	r for gair	ns for livi	ngarea								
0.97	0.97	0.95	0.93	0.88	0.81	0.72	0.75	0.87	0.94	0.97	0.98	(86)
Meanin	nternalte	mperati	ure in livi	ngarea	T1							
16.78	17.04	17.60	18.43	19.26	20.04	20.47	20.41	19.77	18.71	17.65	16.78	(87)
Temper	rature du	iringhea	nting peri	iods in re	estofdw	ellingTh	2					
19.11	19.12	19.13	19.18	19.19	19.23	19.23	19.24	19.22	19.19	19.17	19.15	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
0.97	0.96	0.94	0.91	0.84	0.72	0.55	0.60	0.80	0.92	0.96	0.97	(89)
Meanir	nternalte	emperate	ureinthe	erestof	dwelling	T2						
15.44	15.71	16.27	17.12	17.93	18.68	19.04	19.00	18.44	17.41	16.34	15.46	(90)
Living area fraction (22.39 / 80.80) 0.28 (9									8 (91)			
Mean internal temperature (for the whole dwelling)												
15.81	16.08	16.64	17.48	18.30	19.05	19.44	19.39	18.81	17.77	16.70	15.83	(92)
Apply adjustment to the mean internal temperature, where appropriate												
15.66	15.93	16.49	17.33	18.15	18.90	19.29	19.24	18.66	17.62	16.55	15.68	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisati	on factoi	forgair	าร								
0.95	0.94	0.92	0.87	0.81	0.70	0.56	0.60	0.77	0.89	0.94	0.96
Usefulg	ains										
426.13	469.76	512.47	544.71	534.31	451.69	344.52	345.18	407.84	415.94	404.60	407.48
Monthly	yaverage	externa	altemper	rature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heatlos	sratefo	r mean ir	nternalte	emperat	ure						
2154.8	2076.8	1867.6	1524.2	1157.8	749.47	467.92	491.66	803.62	1260.6	1720.0	2117.0
Fractior	n of mon <sup>-</sup>	th for he	ating								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month					
1286.1	1079.9	1008.2	705.25	463.94	-	-	-	-	628.46	947.14	1271.8
Totalsp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	oberto	Vlay)			7390.97
Spaceh	eatingre	quireme	entperm	ո²(kWh/r	m²/year)						91.47

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

							kWh/year	
No secondary heating system selected								
Fraction of space heat from main system	1.0000					(202)		
Efficiency of main heating system	[]		1	8	8.80%			(206)
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Spaceheatingrequirement			1					
1286.1 1079.9 1008.2 705.25 463.94	-	-	-	-	628.46	947.14	1271.8	(98)
Appendix Q - monthly energy saved (main	heating	gsystem	า 1)					
0.00 0.00 0.00 0.00 0.00	-	-	_	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 7	1)							
1448.3 1216.1 1135.4 794.20 522.45	-	-	-	-	707.73	1066.6	1432.2	(211)
Appendix Q - monthly energy saved (main	nheating	gsystem	า 2)					
0.00 0.00 0.00 0.00 0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2	2)	<u>.</u>	ų.					. ,
	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (seco	ndaryh	eatings	/stem)		0.00	0.00		( )
	_	_	_	-	0.00	0.00	0.00	(214)
Space beating fuel (secondary)	_	_		Į -	0.00	0.00	0.00	(211)
					0.00	0.00		(215)
0.00 0.00 0.00 0.00 0.00	-	-	_	-	0.00	0.00	0.00	(215)
Water heating Water heating requirement								
202 75 170 15 195 24 144 40 150 17	140 10	12/ 21	140 72	151 20	170 07	101 01	107.04	(64)
202.75 176.15 165.36 164.40 159.17	140.19	134.31	149.73	101.30	1/2.3/	104.01	70 50	(04)
	70 50	70 50	70.50	70 50	04.40	07.14	79.50	(210)
87.41 87.35 87.22 86.88 86.22	79.50	79.50	79.50	79.50	86.62	87.14	87.42	(217)
Waterheatingfuel	[]	1	1	1	[			( )
231.96 203.95 212.53 189.23 184.60	176.34	168.94	188.33	190.41	199.00	211.16	226.44	(219)
Annualtotals							kWh/year	
Space heating fuel used, main system 1							8323.16	(211)
Space heating fuel (secondary)							0.00	(215)
Waterheatingfuel							2382.89	(219)
Electricity for pumps, fans and electric kee	ep-hot							
centralheatingpump							30.00	(230c)
boiler with a fan-assisted flue							45.00	(230e)
Total electricity for the above, kWh/year							75.00	(231)
Electricity for lighting (100.00% fixed LEL)	)						392.09	(232)
Energy saving/generation technologies								
Appendix Q -							0.000	(22(-)
Energy saved or generated ():							0.000	(236a) (227a)
Lifergy used ().							0.000	(2010)
Total delivered energy for all uses							11173.14	(238)

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#### 10a. Does not apply

### 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating, main system 1	8323.16	0.216	1797.80	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2382.89	0.216	514.70	(264)
Space and water heating			2312.51	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	392.09	0.519	203.49	(268)
Electricitygenerated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2554.93	(272)

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m²/year

31.62 (273)

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# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

## *Project Information* Building type End-terrace house

6182		
3 July 2018		
Mr Mark Thompson	Project	Unit 3 - Proposed
Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
3 Manchester Road		School Road, Peak Dale
Bury		Buxton
BL9 ODR		SK17 8AR
	6182 3 July 2018 Mr Mark Thompson Greenhalgh & Williams Architects 3 Manchester Road Bury BL9 0DR	6182 3 July 2018 Mr Mark Thompson Project Greenhalgh & Williams Architects 3 Manchester Road Bury BL9 0DR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	53.40	2.59	138.31	(3a)
First floor	51.59	3.19	164.57	(3b)
Second floor	19.17	2.14	41.02	(3c)
Total floor area	124.16			(4)
Dwelling volume (m <sup>3</sup> )			343.90	(5)

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### 2. Ventilation rate

											m³ per h	our
							main + s	seondai	^y + oth	er		
							heating					
Numbe	erofchin	nneys					0 + 0 + 0	)	k 40		0.00	(6a)
Numb	erofope	n flues					0 + 0 + 0	)	k 20		0.00	(6b)
Numb	erofinte	rmitten	tfans				4	)	x 10		40.00	(7a)
Numb	erofpas	sive ven	ts				0	)	k 10		0.00	(7b)
Numb	erofflue	lessgas	fires				0	)	k 40		0.00	(7c)
											Air chang	ges per hour
Infiltra	tion due	to chim	neys, far	ns and fl	Jes						0.12	(8)
Pressu	retest, a	ssumed	q50						15.00			(17)
Airper	meability	/									0.87	(18)
Numb	erofside	es on whi	ich shelte	ered							2.00	(19)
Shelter	factor										0.85	(20)
Infiltra	tionrate	incorpo	ratingsh	nelterfa	ctor						0.74	(21)
Infiltra	tion rate	modifie	ed for mo	onthly w	ind spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
								1				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
			/ 11 .	с I			N				13.13	(22a)
Adjust	edinfiltra	ationrat	e (allowi	ngforsr	neiter an	dwinds	peed)	-r				
0.94	0.92	0.90	0.81	0.79	0.70	0.70	0.68	0.74	0.79	0.83	0.87	
											9.66	(22b)
Ventila	ition : na	turalver	ntilation,	intermi	ttentext	ract fans	S					
Effectiv	veaircha	angerate	9									
0.94	0.92	0.91	0.83	0.81	0.74	0.74	0.73	0.77	0.81	0.84	0.87	(25)

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3. Heat losses	and heat los	s parameter	~					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	le A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Doub	le-glazed,		0.810	1.33 (1.40)	1.07			(27)
argon filled, low	/-E, En=0.1,							
soft coat (North	ר)							
Window 3								
Window - Doubl	le-glazed,		0.810	1.33 (1.40)	1.07			(27)
argon filled, low	∕-E,En=0.1,							
soft coat (North	ר)							
Window 2								
Window - Doubl	le-glazed,		14.320	1.33 (1.40)	18.98			(27)
argon filled, low	/-E,En=0.1,			. ,				. ,
soft coat (East)								
Window 1								
Window - Doub	le-glazed,		3.220	1.33 (1.40)	4.27			(27)
argon filled, low	ν-Ε, En=0.1,							. ,
soft coat (North	י ר							
Window 4	,							
Window - Doub	le-glazed,		0.385	1.33 (1.40)	0.51			(27)
argon filled, low	/-E, En=0.1,							( )
soft coat (North	יייב אין בייי, בייי, בייי, בייי)							
Window 5	·/							
Solid door			2 590	1 80	4 66			(26)
Front Door			2.070	1.00	1.00			(20)
Rooflight at 70°	° or less -		0.560	1 33 (1 40)	0 74			(27)
Double-glazed	argonfilled		0.000	1.00 (1.10)	0.71			(27)
$I_{OW}$ -F Fn=0.1 s	oft coat							
(n/a)	on cour							
Rooflight								
Rooflight at 70°	° or less -		0 560	1 33 (1 40)	0 74			(27)
Double-dlazed	argonfilled		0.000	1.55 (1.40)	0.74			(27)
$I_{OW}$ = F = 0.1 s	oft coat							
(n/a)								
Pooflight								
Pitchedroofs in	sulated betw	ioon ioists	7 27	0 13	0.96	9 00	66 33	(30)
Pitchedrooffl	lat coiling - ing	sulated	1.57	0.15	0.70	7.00	00.55	(30)
at rafters (0.1	8 * 0 72)	Sulated						
Ditchodroofs in	o 0.72)	voonioists	22/1	0.13	1 21	0.00	201.60	(30)
Walls	Isulated betw	reenjoists	111 0Q	0.13	4.21 21 26	9.00	291.09	(30)
Ungradodwal	le		111.70	0.20	51.50	9.00	1007.07	(27)
Walls	12		17 54	0.12	2 20	0.00	159.04	(20)
VVdiis	studwalle in	culated	17.30	0.15	2.20	9.00	136.04	(29)
at raftors (0.1	51UU Walls - II 9 * 0 72)	Isulateu						
Croundfloors	0 0.72)		F2 40	0.44	2110	110.00		(20)
Solidaround f	loor		55.40	0.04	54.10	110.00	5674.00	(20)
Ditchod roofs in	iUUI sulatod boty	oon roftoro	26 1 /	0 10	1 71	0.00	225 24	(20)
Partywell	SUIDIEUDEIN	een alteis	20.14 74.04	0.18	4.71	9.00	200.20 10000 00	(30)
raitywall			74.00	0.00	0.00	180.00	13330.80	

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3. Heat	<sup>t</sup> losses a	and heat	' loss pai	rameter	•							
Element	t	Gross	Ope	enings	Netare	a U-v	/alue	ΑxU	ka	ppa-valu	ie A x K	
		area, m²	m²		A, m²	W/	m²K	W/K	kJ/	′m²K	kJ/K	
Totalar	eaofexte	ernalele	ments S	igma A, r	n²						272.12	2 (31)
Fabrich	neat loss,	W/K									109.74	4 (33)
Therma	al mass pa	aramete	r, kJ/m²K	(user-sp	ecified T	MP)					100.00	0 (35)
Effect of	ftherma	Ibridges									40.82	2 (36)
Totalfa	bric heat	loss									150.50	6 (37)
Ventilat	ion heat	losscalc	ulatedm	onthly								
106.76	104.82	102.92	93.97	92.30	84.51	84.51	83.07	87.51	92.30	95.69	99.22	(38)
Heattra	ansfer co	efficient	, W/K									
257.32	255.38	253.48	244.53	242.86	235.07	235.07	233.63	238.07	242.86	246.25	249.78	
											244.53	3 (39)
Heat los	ss param	eter (HLI	P), W/m²	К								
2.07	2.06	2.04	1.97	1.96	1.89	1.89	1.88	1.92	1.96	1.98	2.01	
HLP (ave	erage)										1.9	7 (40)
Numbe	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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4. Wate	er heatin	ng energ	y require	ements							kWh/year	
Assume	ed occupa	ancy, N									2.88	(42)
Annual	average	hot wate	erusagei	in litres p	oer day V	d,averaç	ge				102.55	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	erusage	e in litres	per day	for each	month							
112.81	108.71	104.60	100.50	96.40	92.30	92.30	96.40	100.50	104.60	108.71	112.81	(44)
Energy	content	of hot wa	ateruseo	k								
167.29	146.32	150.98	131.63	126.30	108.99	101.00	115.89	117.28	136.68	149.19	162.01	
Energy Distribu	content ( ition loss	(annual) S									1613.57	(45)
25.09	21.95	22.65	19.74	18.95	16.35	15.15	17.38	17.59	20.50	22.38	24.30	(46)
Hot wat	erstorag	ge volum	ne (litres)								0.00	(50)
Hot wat	ercylind	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	aturefac	ctor									0.0000	(53)
Energy	lost from	n store (k	Wh/day	)							0.00	(55)
Totalsto	oragelos	S										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	ageloss	_										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated fo	r each m	onth								
50.96	46.03	50.96	49.32	49.12	45.52	47.03	49.12	49.32	50.96	49.32	50.96	(61)
Total he	eat requi	red for w	vater hea	itingcald	ulated for	oreachr	nonth					
218.25	192.34	201.94	180.95	175.43	154.51	148.03	165.02	166.59	187.64	198.51	212.97	(62)
Output	from wa	ter heat	er for ea	ch mont	h, kWh/r	month						
218.25	192.34	201.94	180.95	175.43	154.51	148.03	165.02	166.59	187.64	198.51	212.97	(64)
											2202.18	(64)
Heatga	ins from	waterhe	eating, k	Wh/mor	ith		1				,,	
68.36	60 16	62 94	56 10	54 28	47 62	45.34	50 82	51 32	58 18	61 94	66 61	(65)

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## 5. Internal gains

	U										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90	143.90
Lighting	ggains										
26.76	23.77	19.33	14.64	10.94	9.24	9.98	12.97	17.41	22.11	25.80	27.51
Applian	cesgains										
290.53	8 293.55	285.95	269.78	249.36	230.17	217.35	214.34	221.94	238.11	258.53	277.72
Cooking	ggains										
37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g.evap	oration (	negative	evalues)							
-115.1	2-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12
Waterh	eatingga	ains									
91.89	89.52	84.60	77.91	72.95	66.14	60.94	68.30	71.28	78.21	86.02	89.53
Totalin	ternalgai	ins									
478.36	476.01	459.05	431.50	402.43	374.72	357.45	364.78	379.80	407.59	439.52	463.92

#### 6. Solar gains (calculation for January)

Area & Flux	g & FF	Shading	Gains
0.9 x 0.810 10.63	0.63 x 0.70	0.77	2.6323
0.9 x 0.810 10.63	0.63 x 0.70	0.77	2.6323
0.9 x 14.320 19.6	40.63 x 0.70	0.77	85.9532
0.9 x 3.220 10.63	0.63 x 0.70	0.77	10.4640
0.9 x 0.385 10.63	0.63 x 0.70	0.77	1.2511
0.9 x 2.590 0.00	0.00 x 0.70	0.77	0.0000
0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
	Area & Flux 0.9 x 0.810 10.63 0.9 x 0.810 10.63 0.9 x 14.320 19.6 0.9 x 3.220 10.63 0.9 x 0.385 10.63 0.9 x 0.385 10.63 0.9 x 0.560 26.00 0.9 x 0.560 26.00	Area & Flux g & FF 0.9 x 0.810 10.63 0.63 x 0.70 0.9 x 0.810 10.63 0.63 x 0.70 0.9 x 14.320 19.640.63 x 0.70 0.9 x 3.220 10.63 0.63 x 0.70 0.9 x 0.385 10.63 0.63 x 0.70 0.9 x 0.560 26.00 0.63 x 0.70 0.9 x 0.560 26.00 0.63 x 0.70	Area & Flux g & FF Shading   0.9 x 0.810 10.63 0.63 x 0.70 0.77   0.9 x 0.810 10.63 0.63 x 0.70 0.77   0.9 x 14.320 19.640.63 x 0.70 0.77   0.9 x 3.220 10.63 0.63 x 0.70 0.77   0.9 x 0.385 10.63 0.63 x 0.70 0.77   0.9 x 0.385 10.63 0.63 x 0.70 0.77   0.9 x 0.560 26.00 0.63 x 0.70 0.77   0.9 x 0.560 26.00 0.63 x 0.70 1.00

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7. Meai	n interna	al tempe	erature									
Temper	ature du	uring hea	iting per	iods in th	nelivinga	area, Th´	l (°C)				21.00	) (85)
Heating	system	responsi	veness								1.00	)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
13.40	13.50	13.61	14.10	14.20	14.67	14.67	14.76	14.49	14.20	14.01	13.81	
alpha												
1.89	1.90	1.91	1.94	1.95	1.98	1.98	1.98	1.97	1.95	1.93	1.92	
Utilisati	onfacto	r for gair	ns for livi	ngarea								
0.98	0.97	0.95	0.92	0.86	0.76	0.66	0.71	0.85	0.94	0.97	0.98	(86)
Meanin	iternalte	emperati	ure in livi	ngarea	T1							
16.96	17.26	17.85	18.71	19.52	20.24	20.61	20.53	19.93	18.88	17.82	16.97	(87)
Temper	ature du	iringhea	tingper	iods in re	estofdw	ellingTh	2					
19.29	19.30	19.31	19.35	19.36	19.41	19.41	19.41	19.39	19.36	19.34	19.33	(88)
Utilisati	on facto	r for gair	ns for res	st of dwe	lling							
0.98	0.97	0.94	0.90	0.81	0.67	0.51	0.56	0.79	0.92	0.97	0.98	(89)
Meanir	nternal te	emperate	ureinth	erestof	dwelling	T2						
15.73	16.02	16.61	17.49	18.28	18.96	19.26	19.22	18.70	17.67	16.61	15.75	(90)
Living a	rea fract	ion (35.	56 / 124	16)							0.29	) (91)
Meanin	iternalte	mperatu	ure (for t	hewhole	edwellin	g)						
16.08	16.38	16.96	17.84	18.64	19.33	19.64	19.59	19.05	18.02	16.96	16.10	(92)
Applya	djustmer	nttothe	meanint	ernalte	mperatu	ire, wher	reappro	priate				
15.93	16.23	16.81	17.69	18.49	19.18	19.49	19.44	18.90	17.87	16.81	15.95	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisati	onfacto	forgair	IS									
0.96	0.95	0.92	0.87	0.78	0.66	0.52	0.57	0.77	0.90	0.95	0.97	
Usefulg	ains											
570.48	664.14	767.15	858.16	861.86	721.75	538.96	535.74	627.03	606.90	553.15	539.31	
Monthly	average	externa	altemper	rature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	
Heatlos	sratefo	r mean ir	nternalte	emperat	ure							
2993.0	2892.7	2614.6	2148.8	1648.0	1075.5	679.86	711.07	1142.5	1765.4	2390.6	2935.7	
Fractior	n of mon <sup>-</sup>	th for he	ating									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month						
1802.3	1497.6	1374.5	929.26	584.90	-	-	-	-	861.98	1322.9	1782.9	
Total sp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			10156.49	
Spaceh	eatingre	quireme	ent per m	ո²(kWh/r	m²/year)						81.80	

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

										kWh/year	
Nosecondar	yheatingsy	ystem sel	ected	<i>.</i> .							()
Fraction of s	oace heat fr	om mair	nsystem	n(s)			Î	1.0000			(202)
Efficiency of	main neatir	ng systen	n 	1.			8	8.80%			(206)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Spaceheatin	grequirem	ent	1		1	1	r	1	1		
1802.3 149	7.6 1374.5	929.26	584.90	) -	-	-	-	861.98	1322.9	1782.9	(98)
Appendix Q	monthlye	nergy sav	/ed (mai	in heatin	gsystem	n 1)	v	¥	10		
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heatin	ig fuel (mair	n heating	system	1)							
2029.7 168	6.5 1547.8	3 1046.4	658.67	7 -	-	-	-	970.70	1489.8	3 2007.8	(211)
Appendix Q	monthlye	nergy sav	/ed (mai	in heatin	gsystem	า 2)					
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heatir	ng fuel (mair	n heating	system	2)							
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
AppendixQ	monthlyer	nergysav	ved (seco	ondary h	eatings	ystem)	<b>N</b>	λ	Λ		
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heatin	a fuel (seco	ndary)	и		JI	л		1	л		. ,
		0.00	0.00	1_	-	-	-	0.00	0.00	0.00	(215)
Waterheatin	a a	0.00				1		0.00	0.00		( )
Waterheatin	grequirem	ent									
218.25 192	.34 201.94	1 180.95	175.43	3 154.51	148.03	165.02	166.59	187.64	198.51	212.97	(64)
Efficiency of	waterheate	er			. Ц	JI.		1	1	79.50	(216)
87.69 87.0	63 87.49	87.14	86.47	79.50	79.50	79.50	79.50	86.98	87.47	87.71	(217)
Waterheatin	afuel	07111		1.1.00		1.1.00			0,		( )
2/8 88 210	19 230 82	207.65	202.80	10/ 35	186.20	207 57	209 55	215 72	226.96	212 83	(219)
240.00 217	. 4 / 230.02	207.03	202.02	174.00	100.20	207.37	207.00	213.72	220.70	242.00	(217)
Annual totals	5									kWh/year	
Space heatir	ng fuel used	, main sy	stem 1							11437.49	(211)
Spaceheatin	gfuel (seco	ndary)								0.00	(215)
Water neatin	igtuei		o otri o luo	on hot						2592.91	(219)
contral hoat	ing numps, rai	nsandele	еспске	ep-not						30.00	(220c)
boilerwith	ingpump afan-assiste	ad flua								45.00	(2300)
Total electric	rity for the a	bove kM	/h/vear							75.00	(2300)
Flectricity fo	r lighting (1	00.00% f	ixed I FI	)						472.65	(232)
Energysavin	g/generatic	on techno	logies	-7						172100	(202)
Appendix Q			0								
Energysave	ed or gener	ated ():								0.000	(236a)
Energy use	d ():									0.000	(237a)
Total deliver	edenergyfo	oralluses	S							14578.04	(238)

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### 10a. Does not apply

## 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	11437.49	0.216	2470.50	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2592.91	0.216	560.07	(264)
Space and water heating			3030.57	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricityforlighting	472.65	0.519	245.30	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			3314.79	(272)
			$ka/m^2/vc$	ar

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m<sup>2</sup>/year 26.70 (273)

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# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

## *Project Information* Building type Mid-terracehouse

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 4 - Proposed
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 ODR		SK17 8AR

SAP 2012 worksheet for New dwelling created by change of use - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	37.85	2.60	98.41	(3a)
First floor	37.85	2.76	104.47	(3b)
Second floor	17.11	2.14	36.62	(3c)
Totalfloorarea	92.81			(4)
Dwelling volume (m³)			239.49	(5)

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### 2. Ventilation rate

											m³ per h	our
							main + s	seonda	ry + oth	er		
							heating					
Numbe	erofchir	nneys					0 + 0 + 0		x 40		0.00	(6a)
Numbe	er of ope	nflues					0 + 0 + 0		x 20		0.00	(6b)
Numbe	er of inte	rmitten	t fans				4	:	x 10		40.00	(7a)
Numbe	erofpas	sive ven <sup>-</sup>	ts				0	:	x 10		0.00	(7b)
Numbe	erofflue	lessgas	fires				0	:	x 40		0.00	(7c)
											Air chang	ges per hour
Infiltrat	ion due	to chim	neys, far	ns and flu	Jes						0.17	(8)
Pressu	retest, a	ssumed	q50						15.00			(17)
Airperr	neability	/									0.92	(18)
Numbe	erofside	es on whi	ich shelte	ered							2.00	(19)
Shelter	factor										0.85	(20)
Infiltrat	ionrate	incorpo	ratingsh	nelterfac	ctor						0.78	(21)
Infiltrat	ion rate	modifie	ed for mo	onthly w	nd spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Min d F	ator										52.50	(22)
VVIIIGFa								1				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
			/ 11	с I			N				13.13	(22a)
Adjuste	ed infiltra	ationrat	e (allowi	ngforsr	elteran	dwinds	peed)			1		
0.99	0.97	0.95	0.86	0.84	0.74	0.74	0.72	0.78	0.84	0.88	0.92	
											10.23	(22b)
Ventila	tion : na	turalver	ntilation,	intermi	ttentext	ract fans	S					
Effectiv	e air cha	angerate	9									
0.99	0.97	0.96	0.87	0.85	0.77	0.77	0.76	0.80	0.85	0.88	0.92	(25)

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3. Heat losses a	and heat los	s parameter	r					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	еАхК	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Doub	e-glazed,		3.220	1.33 (1.40)	4.27			(27)
argon filled, low	∕-E,En=0.1,							
soft coat (North	ı)							
Window 3								
Window - Doub	e-glazed,		0.385	1.33 (1.40)	0.51			(27)
argon filled, low	<i>i</i> -E,En=0.1,			· · · ·				. ,
soft coat (North	1)							
Window 4	,							
Window - Doub	e-alazed,		0.900	1.33 (1.40)	1.19			(27)
argon filled, low	v-E.En=0.1.							· /
soft coat (South	n)							
Window 5	·/							
Window - Doubl	e-alazed		0.620	1 33 (1 40)	0.82			(27)
argon filled low	-F Fn=0.1		0.020	1.00 (1.10)	0.02			(27)
soft coat (West)	2,211 0.1,							
Window 1								
Window - Doubl	e-ulazed		0.500	1 33 (1 /0)	0.66			(27)
argon filled low	$r_{\rm F}$ Fn=0.1		0.000	1.00 (1.40)	0.00			(27)
soft coat (West)	-L, LN=0.1,							
Window 2								
Solid door			2 500	1 00	1 66			(26)
Front Door			2.390	1.60	4.00			(20)
Pooflight at 70°	orloss		0 540	1 22 (1 40)	0.74			(27)
	OF 1855 -		0.560	1.33 (1.40)	0.74			(27)
	argonnieu,							
10W-E, EII=0.1, S	oncoat							
ROOHight			0 5 4 0	1 22 (1 40)	0.74			(07)
Rooflight at 70°	OF IESS -		0.560	1.33 (1.40)	0.74			(27)
Double-glazed,	argon filled,							
IOW-E, EN=0.1, S	off coat							
(n/a)								
Rooflight			o	0.4.0			7/ 44	(0.0)
Pitchedroofsin	sulated betw	veen joists	8.46	0.13	1.10	9.00	76.14	(30)
Pitchedrooffi	at ceiling - ins	sulated						
at rafters (0.1	8 * 0.72)							(
Pitchedroofsin	sulated betw	veen joists	17.08	0.13	2.22	9.00	153.72	(30)
Walls			22.46	0.28	6.29	9.00	202.18	(29)
Upgraded wal	ls							
Walls			17.03	0.26	4.43	60.00	1021.80	(29)
Newwalls								
Walls			10.09	0.13	1.31	9.00	90.81	(29)
Roominroofs	stud walls - in	nsulated						
at rafters (0.1	8 * 0.72)							
Groundfloors			37.85	0.41	15.52	110.00	4163.50	(28)
Solid ground f	loor							

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3. Heat	' losses a	and heat	<sup>t</sup> loss pai	rameter	-							
Element	t	Gross	Ope	enings	Netare	a U-v	/alue	ΑxU	ka	ppa-valı	le A x K	
		area, m <sup>2</sup>	m²		A, m²	W/	m²K	W/K	kJ	′m²K	kJ/K	
Pitched	roofsins	sulated b	etween	rafters	18.02	2	0.18	3.2	4	9.00	162.18	(30)
Partywa	all				131.08	8	0.00	0.0	0 1	80.00	23594.40	
Totalar	eaofext	ernalele	mentsS	igma A, r	m²						140.33	(31)
Fabric h	eat loss,	W/K									47.71	(33)
Therma	ll mass pa	aramete	r, kJ/m²K	(user-sp	ecified T	[MP)					100.00	(35)
Effectof	ftherma	Ibridges	5								21.05	(36)
Totalfat	bric heat	loss									68.76	(37)
Ventilat	ion heat	losscalc	ulatedm	nonthly								
78.55	77.03	75.54	68.57	67.26	61.18	61.18	60.06	63.52	67.26	69.90	72.66	(38)
Heat tra	ansfer co	efficient	, W/K									
147.31	145.79	144.31	137.33	136.02	129.95	129.95	128.82	2 132.29	136.02	138.66	141.42	
											137.32	(39)
Heat los	ssparam	ieter (HL	P), W/m²	K								
1.59	1.57	1.55	1.48	1.47	1.40	1.40	1.39	1.43	1.47	1.49	1.52	
HLP (ave	erage)										1.48	(40)
Numbe	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate	er heatin	ng energ	v requir	ements							kWh/year	
Assume	edoccup	ancy, N									2.66	(42)
Annual	average	hot wate	erusage	in litres p	oer day V	d,averaç	ge				97.43	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	ter usage	e in litres	per day	for each	month							
107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	(44)
Energy	content	of hot wa	ateruseo	b								
158.93	139.00	143.44	125.05	119.99	103.54	95.95	110.10	111.42	129.85	141.74	153.92	
Energy Distribu	content ( ution loss	annual) S									1532.93	(45)
23.84	20.85	21.52	18.76	18.00	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)
Hot wat	erstora	ge volum	ne (litres)								0.00	(50)
Hot wat	ter cylinc	ler loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	factor										0.0000	(52)
Temper	raturefac	ctor									0.0000	(53)
Energy	lost from	n store (k	Wh/day	)							0.00	(55)
lotalste	oragelos	SS	10	0	1	1	1	v	1	1		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	rageloss	V	10				1			10		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated fo	r each m	onth								
50.96	46.03	50.64	47.09	46.67	43.24	44.68	46.67	47.09	50.64	49.32	50.96	(61)
Total he	eatrequi	red for w	ater hea	tingcald	ulated for	oreachr	nonth					
209.89	185.03	194.08	172.14	166.66	146.79	140.63	156.77	158.50	180.49	191.05	204.88	(62)
Output	from wa	ter heate	er for ea	ch mont	h, kWh/r	nonth						
209.89	185.03	194.08	172.14	166.66	146.79	140.63	156.77	158.50	180.49	191.05	204.88	(64)
											2106.91	(64)
Heat ga	insfrom	waterhe	eating, k'	Wh/mor	nth							
65 58	57.73	60.35	53.35	51.56	45.24	43.07	48.28	48.82	55.83	59.46	63.92	(65)

## 5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11
Lighting	ggains										
26.58	23.60	19.20	14.53	10.86	9.17	9.91	12.88	17.29	21.95	25.62	27.31
Applian	cesgains										
244.15	246.69	240.30	226.71	209.55	193.43	182.66	180.12	186.51	200.10	217.26	233.38
Cooking	ggains										
36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31
Pumps	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration(	negative	evalues)							
-106.4	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49
Waterh	eatingga	ains									
88.15	85.90	81.12	74.10	69.31	62.83	57.89	64.89	67.80	75.05	82.58	85.91
Totalint	ternalgai	ns									
424.81	422.13	406.55	381.28	355.66	331.37	316.39	323.83	337.53	363.03	391.39	412.54

#### 6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E,	0.9 x 3.220 10.63	0.63 x 0.70	0.77	10.4640
En=0.1, soft coat (North) Window 3				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.385 10.63	0.63 x 0.70	0.77	1.2511
En=0.1, soft coat (North) Window 4				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.900 46.75	0.63 x 0.70	0.77	12.8592
En=0.1, soft coat (South) Window 5				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.620 19.64	0.63 x 0.70	0.77	3.7214
En=0.1, soft coat (West) Window 1				
Window - Double-glazed, argon filled, low-E,	0.9 x 0.500 19.64	0.63 x 0.70	0.77	3.0012
En=0.1, soft coat (West) Window 2				
Solid door	0.9 x 2.590 0.00	0.00 x 0.70	0.77	0.0000
Front Door				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				
Rooflight at 70° or less - Double-glazed,	0.9 x 0.560 26.00	0.63 x 0.70	1.00	5.7789
argon filled, low-E, En=0.1, soft coat (n/a) Rooflight				

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7. Meai	n interna	al tempe	erature									
Temper	rature du	iring hea	ating per	iods in th	nelivinga	area, Th'	1 (°C)				21.0	0 (85)
Heating	system	esponsi	veness								1.0	0
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
17.50	17.68	17.87	18.77	18.95	19.84	19.84	20.01	19.49	18.95	18.59	18.23	
alpha												
2.17	2.18	2.19	2.25	2.26	2.32	2.32	2.33	2.30	2.26	2.24	2.22	
Utilisati	onfacto	r for gair	ns for livi	ngarea								
0.98	0.97	0.96	0.94	0.90	0.81	0.71	0.74	0.87	0.95	0.97	0.98	(86)
Meanir	nternalte	mperati	ure in livi	ngarea	Г1							
17.65	17.88	18.34	19.06	19.73	20.36	20.68	20.63	20.14	19.30	18.43	17.70	(87)
Temper	rature du	iringhea	tingperi	iods in re	estofdw	ellingTh	2					
19.62	19.63	19.65	19.70	19.71	19.76	19.76	19.77	19.74	19.71	19.69	19.67	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
0.97	0.97	0.95	0.92	0.87	0.75	0.59	0.63	0.83	0.93	0.96	0.98	(89)
Meanir	nternalte	emperate	ureinthe	erestof	dwelling	T2						
16.61	16.84	17.31	18.05	18.71	19.34	19.61	19.59	19.14	18.30	17.43	16.69	(90)
Living a	rea fract	ion (26.	68 / 92.8	1)							0.2	9 (91)
Meanir	nternal te	mperati	ure (for t	hewhole	edwellin	g)						
16.91	17.14	17.60	18.34	19.01	19.63	19.92	19.89	19.43	18.59	17.71	16.98	(92)
Applya	djustmer	nttothe	meanint	ternalte	mperatu	ire, whei	reappro	priate				
16.76	16.99	17.45	18.19	18.86	19.48	19.77	19.74	19.28	18.44	17.56	16.83	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisati	onfacto	r for gain	IS									
0.96	0.95	0.94	0.90	0.84	0.73	0.59	0.63	0.80	0.91	0.95	0.96	(9
Usefulg	ains											
449.42	478.93	501.58	515.28	499.21	422.71	326.33	328.30	392.25	416.29	421.91	432.38	(9
Monthly	average	eexterna	al temper	rature								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(9
Heatlos	sratefo	r mean ir	nternalte	emperat	ure							
1835.4	1762.6	1580.6	1275.8	973.34	634.75	411.89	430.05	685.18	1066.0	1450.9	1785.9	(9
Fractior	n of mon <sup>-</sup>	th for he	ating									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month						
1031.2	862.67	802.81	547.61	352.75	-	-	-	-	483.43	740.89	1007.0	
Totalsp	ace heat	ingrequ	irement	per year	(kWh/y	ear) (Oct	obertol	May)			5828.37	(9
Spaceh	eatingre	quireme	entperm	ո²(kWh/r	m²/year)						62.80	(9

8c. Space cooling requirement - not applicable

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#### 9a. Energy requirements

											kWh/year	
Noseco	ondaryhe	eating sy	stemsel	ected				1				(202)
Fficien	n or spac icv of mai	e neat in in heatin	om main a system	nsystem n	(S)			ا ع	8 80%			(202)
lan	Fob	Mar	Anr	May	lun	hul	Δυα	Sen		Nov	Dec	(200)
Spacob			Api ont	Iviay		Jui	Aug	Тэср		NOV	Dec	
				252.75					102.12	740.00	1007.0	(00)
1031.2	$\frac{2002.07}{1000}$	002.81	<u>547.01</u>	<u>1352.75</u>	n hoatin	-	<u> -</u>	<u> </u>	483.43	740.89	1007.0	(90)
Append			lei gy sav		n neatin	gsysten	11) 	1	0.00	0.00		(210)
0.00	0.00	0.00	0.00	0.00	1)	-	-	-	0.00	0.00	0.00	(210)
Spacer		lei (main	neating	system	1) I							(014)
1161.2	2 <u>971.48</u>	904.06	616.68	397.24	· · ·	-	-	-	544.40	834.33	1134.0	(211)
Append	dix Q - mo	onthly er	nergy sav	/ed (mai	n heatin 1	g system	ר 2) יי	ir	)i	1		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Spaceh	neatingfu	uel (main	heating	system	2)	٦ <u>ــــــــــــــــــــــــــــــــــــ</u>	7	·	1	10		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	dix Q - ma	onthlyen	nergysav	ed (seco	ondary h	eatingsy	ystem)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Spaceh	neatingfu	iel (secor	ndary)									
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Waterh	neating											
Waterh	neatingre	quireme	ent									
209.89	9 185.03	194.08	172.14	166.66	146.79	140.63	156.77	158.50	180.49	191.05	204.88	(64)
Efficien	icy of wat	erheate	er								79.50	(216)
87.08	87.00	86.82	86.38	85.59	79.50	79.50	79.50	79.50	86.06	86.72	87.08	(217)
Waterh	neatingfu	lel										
241.04	4 212.67	223.54	199.27	194.73	184.64	176.90	197.20	199.38	209.72	220.31	235.28	(219)
امرمم	totala										W/b/woor	
Snaceb	ioiais neating fi	ielused	mainsv	stem 1							6563.48	(211)
Spaceh	neatingfu	iel (secor	ndarv)	Sterri							0.00	(215)
Waterh	neatingfu	uel									2494.66	(219)
Electric	ity for pu	mps, far	ns and ele	ectric ke	ep-hot							、 ,
centra	Iheating	pump									30.00	(230c)
Total el	ectricity	for the al	bove, kW	/h/year							30.00	(231)
Electric	ity for lig	hting (10	00.00% fi	ixed LEL	.)						469.34	(232)
Energy	saving/ge	eneratio	n techno	logies								
Append	dix Q -											
Energ	y saved c	orgenera	ated ():								0.000	(236a)
Energ	y used ():										0.000	(237a)
Totalde	eliverede	energyfo	oralluses	5							9557.48	(238)

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### 10a. Does not apply

## 11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	6563.48	0.216	1417.71	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	2494.66	0.216	538.85	(264)
Space and water heating			1956.56	(265)
Electricity for pumps and fans	30.00	0.519	15.57	(267)
Electricity for lighting	469.34	0.519	243.59	(268)
Electricitygenerated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2215.72	(272)
			$ka/m^2/vc$	ar

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m<sup>2</sup>/year 23.87 (273)

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# Energy Performance & Sustainability Group

3C Pelham Court Pelham Road Nottingham, NG5 1AP 0115 7270599 info@epsgroup.co.uk

## *Project Information* Building type Detached house

Reference	6182		
Date	3 July 2018		
Client	Mr Mark Thompson	Project	Unit 6 - Proposed
	Greenhalgh & Williams Architects		Conversion of Holy Trinity Church
	3 Manchester Road		School Road, Peak Dale
	Bury		Buxton
	BL9 0DR		SK17 8AR

SAP 2012 worksheet for New dwelling as designed - calculation of dwelling emissions

#### 1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	36.99	2.60	96.17	(3a)
First floor	33.36	2.60	86.74	(3b)
Secondfloor	14.49	1.97	28.55	(3c)
Total floor area	84.84			(4)
Dwelling volume (m <sup>3</sup> )			211.46	(5)

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### 2. Ventilation rate

											m³ per h	our
							main + s	seonda	ry + oth	er		
							heating					
Numbe	rofchin	nneys					0 + 0 + 0	)	x 40		0.00	(6a)
Numbe	rofope	n flues					0 + 0 + 0	)	x 20		0.00	(6b)
Numbe	er of inte	rmittent	t fans				3		x 10		30.00	(7a)
Numbe	rofpas	sive vent	ts				0		x 10		0.00	(7b)
Numbe	erofflue	lessgast	fires				0		x 40		0.00	(7c)
											Air chang	ges per hour
Infiltrat	ion due	to chimi	neys, far	is and flu	Jes						0.14	(8)
Pressur	retest, r	esultq50	C						5.00			(17)
Airpern	neability	/									0.39	(18)
Numbe	rofside	es on whi	ch shelte	ered							2.00	(19)
Shelter	factor										0.85	(20)
Infiltrat	ionrate	incorpo	ratingsh	elterfac	tor						0.33	(21)
Infiltrat	ion rate	modifie	d for mo	onthly wi	nd spee	d						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Min d Fa	ator										52.50	(22)
VVITIOF								-)				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
				<b>C</b> 1			N				13.13	(22a)
Adjuste	ed infiltra	ationrat	e (allowi	ngforsh	elteran	dwinds	peed)		1	1		
0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39	
											4.37	(22b)
Ventilat	tion : na <sup>-</sup>	turalver	itilation,	intermi	ttentext	ract fan:	S					
Effectiv	eaircha	ngerate	è									
0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses a	and heat los.	s parametei	~					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-valu	ie A x K	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Doubl	e-glazed,		0.680	1.33 (1.40)	0.90			(27)
argon filled, low	∕-E,En=0.1,							
soft coat (West)								
Window 8								
Window - Doubl	e-alazed,		0.680	1.33 (1.40)	0.90			(27)
argon filled. low	-E.En=0.1.							( )
soft coat (West)	_,							
Window 7								
Window - Doubl	e-alazed		1 920	1 33 (1 40)	2 55			(27)
argon filled low	$r_{\rm F} = 6.1$		1.720	1.00 (1.10)	2.00			(27)
soft coat (North	)							
Window 6	1)							
Window Doubl	o diazod		5.040	1 22 (1 10)	6 6 8			(27)
argon filled low	r = -9122eu		5.040	1.55 (1.40)	0.00			(27)
argonnieu, iow	-E, EH=0.1,							
Soft coat (North	1)							
C WUDINVV			0.410	1 22 (1 40)	0 5 4			(27)
window - Doubi	e-glazed,		0.410	1.33 (1.40)	0.54			(27)
argonnied, iow	/-E, EN=U. I,							
sort coat (South	1)							
Window 4			4 0 4 0	1 00 (1 10)	0.44			(07)
Window - Doubl	e-glazed,		1.840	1.33 (1.40)	2.44			(27)
argon filled, low	/-E,En=0.1,							
soft coat (South	1)							
Window 3								<i>(</i> <b>)</b>
Window - Doubl	e-glazed,		0.650	1.33 (1.40)	0.86			(27)
argon filled, low	/-E,En=0.1,							
soft coat (South	1)							
Window 2								
Window - Doubl	e-glazed,		2.640	1.33 (1.40)	3.50			(27)
argon filled, low	/-E, En=0.1,							
soft coat (South	ו)							
Window 1								
Solid door			1.950	1.80	3.51			(26)
Door								
Rooflight at 70°	or less -		0.950	1.33 (1.40)	1.26			(27)
Double-glazed,	argon filled,							
low-E, En=0.1, s	oft coat							
(n/a)								
Rooflight								
Pitchedroofsin	sulated betw	een joists	18.87	0.13	2.45	9.00	169.83	(30)
Pitched roofs in	sulated betw	een joists	3.63	0.10	0.36	9.00	32.67	(30)
Walls		-	157.14	0.24	37.71	60.00	9428.40	(29)
Walls			8.50	0.28	2.38	9.00	76.50	(29)
Timber stud w	alls - room ir	roof						
Ground floors			36.99	0.14	5.18	110.00	4068.90	(28)

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3. Heat	losses a	and heat	<sup>t</sup> loss pai	rameter	~							
Element	t	Gross	Ope	enings	Netare	a U-v	value	ΑxU	ka	ppa-valu	le A x K	
		area, m <sup>2</sup>	m²		A, m²	W/	m²K	W/K	kJ	′m²K	kJ/K	
Pitched	roofsins	sulated b	etween	rafters	15.78	3	0.18	2.8	4	9.00	142.02	2 (30)
Totalar	eaofext	ernalele	mentsS	igma A, r	m²						257.6	7 (31)
Fabric h	eat loss,	W/K									74.0	7 (33)
Therma	l mass pa	aramete	r, kJ/m²K	(user-sp	ecified 1	TMP)					250.0	0 (35)
Effectof	ftherma	Ibridges	5								13.2	0 (36)
Totalfal	bric heat	loss									87.2	7 (37)
Ventilat	ion heat	losscalc	ulatedm	nonthly								
41.18	40.94	40.70	39.57	39.36	38.38	38.38	38.20	38.76	39.36	39.79	40.23	(38)
Heat tra	insfer co	efficient	, W/K									
128.45	128.21	127.97	126.84	126.63	125.65	125.65	125.47	126.03	126.63	127.06	127.50	
											126.8	4 (39)
Heat los	s param	eter (HL	P), W/m²	K								
1.51	1.51	1.51	1.50	1.49	1.48	1.48	1.48	1.49	1.49	1.50	1.50	
HLP (ave	erage)										1.5	0 (40)
Numbe	r of days	in mont	h (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

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4. Wate	er heatin	ng energ	v require	ements							kWh/year	
Assume	ed occupa	ancy, N									2.55	(42)
Annual	average	hot wate	rusagei	in litres p	per day V	d,averaç	ge			1	94.72	(43)
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	ter usage	inlitres	per day	for each	month							
104.19	100.41	96.62	92.83	89.04	85.25	85.25	89.04	92.83	96.62	100.41	104.19	(44)
Energy	content	of hot wa	ater used	b								
154.52	2 135.14	139.45	121.58	116.66	100.67	93.28	107.04	108.32	126.24	137.80	149.64	
Energy	content (	annual)									1490.35	(45)
Distribu	utionloss											
23.18	20.27	20.92	18.24	17.50	15.10	13.99	16.06	16.25	18.94	20.67	22.45	(46)
storel	oss dete	rmined f	rom EN	13203-2	tests, ta	ken fror	n boiler	data reco	ord			
Hot wat	terstorag	je volum	e (litres)								0.00	(50)
Hot wat	ter cylind	er loss fa	actor (kV	Vh/day)							0.0000	(51)
Volume	efactor										0.0000	(52)
Temper	raturefac	tor									0.0000	(53)
Energy	lost from	store (k	Wh/day)	)							0.00	(55)
Totalsto	oragelos	S										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
Netstor	rage loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary	loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combil	osscalcu	lated for	each m	onth								
16.27	14.68	16.19	15.59	16.06	15.48	15.96	16.02	15.54	16.14	15.70	16.25	(61)
Totalhe	eatrequir	red for w	aterhea	itingcald	ulated for	or each r	nonth					
170.79	149.82	155.64	137.17	132.72	116.15	109.24	123.07	123.86	142.37	153.50	165.89	(62)
Output	from wa	ter heate	er for ea	ch mont	h, kWh/r	nonth						
170.79	149.82	155.64	137.17	132.72	116.15	109.24	123.07	123.86	142.37	153.50	165.89	(64)
											1680.23	(64)
Heatga	insfrom	waterhe	eating, k	Wh/mor	th							
55.45	48.60	50.42	44.32	42.80	37.34	35.01	39.60	39.90	46.01	49.74	53.82	(65)

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## 5. Internal gains

	U										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabo	licgains,	Watts									
127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42	127.42
Lighting	ggains										
20.94	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.52
Applian	cesgains										
229.26	231.64	225.64	212.88	196.77	181.63	171.51	169.13	175.13	187.89	204.00	219.14
Cooking	ggains										
35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74
Pumps	andfans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g.evap	oration (	negative	evalues)							
-101.9	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93
Waterh	eatingga	ains									
74.52	72.33	67.76	61.56	57.53	51.86	47.05	53.22	55.42	61.84	69.09	72.34
Totalin	ternalgai	ins									
388.94	386.78	372.75	350.11	327.08	304.94	290.59	296.73	308.39	331.25	357.50	377.22

## 6. Solar gains (calculation for January)

Area & Flux	g & FF	Shading	Gains
0.9 x 0.680 19.64	0.63 x 0.70	0.77	4.0816
0.9 x 0.680 19.64	0.63 x 0.70	0.77	4.0816
0.9 x 1.920 10.63	0.63 x 0.70	0.77	6.2394
0.9 x 5.040 10.63	0.63 x 0.70	0.77	16.3785
0.9 x 0.410 46.75	0.63 x 0.70	0.77	5.8581
0.9 x 1.840 46.75	0.63 x 0.70	0.77	26.2900
0.9 x 0.650 46.75	0.63 x 0.70	0.77	9.2872
	Area & Flux 0.9 x 0.680 19.64 0.9 x 0.680 19.64 0.9 x 1.920 10.63 0.9 x 5.040 10.63 0.9 x 0.410 46.75 0.9 x 1.840 46.75 0.9 x 0.650 46.75	Area & Flux g & FF 0.9 x 0.680 19.64 0.63 x 0.70 0.9 x 0.680 19.64 0.63 x 0.70 0.9 x 1.920 10.63 0.63 x 0.70 0.9 x 5.040 10.63 0.63 x 0.70 0.9 x 0.410 46.75 0.63 x 0.70 0.9 x 1.840 46.75 0.63 x 0.70	Area & Fluxg & FFShading 0.770.9 x 0.680 19.64 0.63 x 0.700.770.9 x 0.680 19.64 0.63 x 0.700.770.9 x 1.920 10.63 0.63 x 0.700.770.9 x 5.040 10.63 0.63 x 0.700.770.9 x 0.410 46.75 0.63 x 0.700.770.9 x 1.840 46.75 0.63 x 0.700.770.9 x 0.650 46.75 0.63 x 0.700.77

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6. Solar gains (calculation for January)					
	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 1	0.9 x 2.640 46.75	0.63 x 0.70	0.77	37.7204	
Solid door Door	0.9 x 1.950 0.00	0.00 x 0.70	0.77	0.0000	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.950 26.00	0.63 x 0.70	1.00	9.8034	
Total solar gains, January				119.74	(83-1)
Solargains					(0.0)
[119.74] 209.19] 301.08] 399.53] 472.81] 48	0.83 458.79 402. <sup>-</sup>	1/334.76235.	11 144.35	101.88	(83)
				170.11	(0, 1)
508.68 595.98 673.83 749.64 799.90 78	<u>5.77 749.39 698.8</u>	<u>39 643.15 566.</u>	36 501.85	479.11	(84)
Lighting calculations	_				
	Area	g	FF x Shadin	ig	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 8	0.9 x 0.68	0.80	0.70 x 0.83	8 0.28	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 7	0.9 x 0.68	0.80	0.70 x 0.83	8 0.28	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 6	0.9 x 1.92	0.80	0.70 x 0.83	3 0.80	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 5	0.9 x 5.04	0.80	0.70 x 0.83	3 2.11	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South)	0.9 x 0.41	0.80	0.70 x 0.83	8 0.17	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South)	0.9 x 1.84	0.80	0.70 x 0.83	8 0.77	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 2	0.9 x 0.65	0.80	0.70 x 0.83	3 0.27	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 1	0.9 x 2.64	0.80	0.70 x 0.83	3 1.10	
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.95	0.80	0.70 x 1.00	0 0.48	

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7. Meai	n interna	al tempe	erature									
Temper	raturedu	uring hea	atingper	iods in th	nelivinga	area, Th´	l (°C)				21.00	) (85)
Heating	j system r	responsi	veness								1.00	)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
45.87	45.95	46.04	46.45	46.53	46.89	46.89	46.96	46.75	46.53	46.37	46.21	
alpha												
4.06	4.06	4.07	4.10	4.10	4.13	4.13	4.13	4.12	4.10	4.09	4.08	
Utilisati	on facto	r for gair	ns for livi	ngarea								
1.00	1.00	0.99	0.97	0.92	0.81	0.67	0.72	0.90	0.98	1.00	1.00	(86)
Meanir	nternalte	mperati	ureinlivi	ngarea	T1							
19.30	19.47	19.76	20.16	20.54	20.83	20.95	20.92	20.70	20.21	19.68	19.27	(87)
Temper	rature du	uring hea	atingperi	iods in re	estofdw	ellingTh	2					
19.68	19.68	19.68	19.69	19.69	19.70	19.70	19.70	19.70	19.69	19.69	19.69	(88)
Utilisati	on facto	r for gair	ns for res	stofdwe	lling							
1.00	0.99	0.99	0.96	0.89	0.72	0.50	0.56	0.84	0.97	0.99	1.00	(89)
Meanir	nternalte	emperat	ureinthe	erestof	dwelling	T2						
17.44	17.70	18.12	18.70	19.23	19.58	19.68	19.67	19.45	18.78	18.01	17.41	(90)
Living a	rea fract	ion (12.	66 / 84.8	34)							0.15	5 (91)
Meanir	nternalte	mperati	ure (for tl	hewhole	edwellin	g)						
17.72	17.96	18.37	18.92	19.43	19.77	19.87	19.86	19.63	18.99	18.26	17.68	(92)
Applya	djustmer	nttothe	meanint	ternalte	mperatu	ure, wher	reappro	priate				
17.57	17.81	18.22	18.77	19.28	19.62	19.72	19.71	19.48	18.84	18.11	17.53	(93)

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## 8. Space heating requirement

-											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisati	on factoi	r for gair	IS								
0.99	0.99	0.98	0.95	0.87	0.71	0.51	0.56	0.83	0.96	0.99	1.00
Usefulg	jains										
506.04	589.94	659.27	709.92	695.52	556.22	378.68	394.04	530.86	544.25	496.97	477.14
Monthly	yaverage	externa	altempei	rature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heatlos	sratefo	r mean ii	nternalte	emperat	ture						
1704.7	1655.4	1499.7	1251.7	959.32	630.46	392.08	415.09	678.40	1043.3	1398.9	1700.1
Fractior	n of mon <sup>-</sup>	th for he	ating								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Spaceh	eatingre	quireme	entforea	achmon	th, kWh/	month					
891.86	716.04	625.29	390.12	196.26	-	-	-	-	371.33	649.42	909.88
Totalsp	aceheat	ingrequ	irement	peryea	r(kWh/y	ear) (Oct	obertol	vlay)			4750.20
Spaceh	eatingre	quireme	entperm	<sup>2</sup> (kWh/ו	m²/year)						55.99

8c. Space cooling requirement - not applicable

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### 9a. Energy requirements

										kWh/year	
Nosecondaryh	neatingsy	stemsel	lected								
Fraction of space	ce heat fro	om mair	nsystem	า(s)				1.0000			(202)
Efficiency of ma	ain heatin	ig syster	n 1	-1		1	9	3.50%	1		(206)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Spaceheatingr	equireme	ent	γ		1		·	۰ <u>ــــــــــــــــــــــــــــــــــــ</u>	1		
891.86 716.0	4 625.29	390.12	196.20	5 -	-	-	-	371.33	649.42	2 909.88	(98)
Appendix Q - m	onthlyer	nergy sav	ved (ma	in heatin	gsysten	า 1)					
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating f	<sup>f</sup> uel (main	heating	system	n 1)							
953.86 765.8	2 668.76	417.24	209.9	1 -	-	-	-	397.14	694.57	973.14	(211)
Appendix Q - m	onthlyer	nergy sav	ved (ma	in heatin	gsystem	า 2)					
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating f	uel (main	heating	system	12)							
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - m	onthlyen	nergy sav	, ed (sec	ondary h	eatings	ystem)	R	Л			
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating f	uel (secor	ndarv)			1	1		<u>,                                     </u>			. ,
	0.00	0.00	0.00	1_		<b>_</b>	<b>.</b>	0.00	0.00	0.00	(215)
Water heating	0.00	0.00	0.00	_I				0.00	0.00	0.00	(210)
Waterheating	equireme	ent									
170.79 149.8	2 155.64	137.17	132.7	2 116.15	109.24	123.07	123.86	142.37	153.50	165.89	(64)
Efficiency of wa	iter heate	er					1.10.00		100100	87.30	(216)
89 97 89 93	89.84	89.65	89 18	87 30	87 30	87 30	87 30	89 59	89 87	89.99	(217)
Water heating f	 iuel	07.00	07.10	07.00	07.00		07.00		07.07	07.77	(= )
100 02 166 6		152.02	110 0	122 04	125 12	140.07	1/1 00	150 02	170.00	101 21	(210)
109.03 100.0	0 173.24	155.02	. 140.0	2 133.04	120.13	140.97	141.00	130.92	170.80	104.34	(217)
Annualtotals										kWh/year	
Space heating f	fuel used,	main sy	stem 1							5080.43	(211)
Spaceheatingf	uel (secor	ndary)								0.00	(215)
Water heating f	fuel									1886.59	(219)
Electricityforp	umps, far	nsandel	ectricke	ep-hot							
centralheating	gpump									30.00	(230c)
boiler with a fa	in-assiste	dflue								45.00	(230e)
I otal electricity	for the al	bove, kv	/n/year							/5.00	(231)
Electricity for lig	gnting (10	JU.UU% T n tochno		_)						369.72	(232)
			logies								
Energy saved	orgenera	ated ().								0 000	(236a)
Energy used (	):									0.000	(237a)
Total delivered	energyfo	oralluse	S							7411.74	(238)

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### 10a. Does not apply

## 11a. Does not apply

#### 12a. Carbon dioxide emissions

	Energy Emission factor		Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating, main system 1	5080.43	0.216	1097.37	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	1886.59	0.216	407.50	(264)
Space and water heating			1504.88	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	369.72	0.519	191.89	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricitygenerated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1735.69	(272)
			ka/m²/year	

Dwelling Carbon Dioxide Emission Rate (DER)

kg/m²/year

20.46 (273)

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