EPS Group
Energy Consultancy and Compliance Services

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

STROMA CERTIFIED · elmhurst accredited energy assessor · Independent Airtightness ATS Testing Scheme · SAP · THE CODE FOR SUSTAINABLE HOMES · Constructionline Part of Capita plc

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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_2) 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).

Table of Contents

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_2) 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_2 emission factor ($kgCO_2/kWh$)
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/m^{2}K	**0.28 W/m^{2}K**
New External Walls	0.28 W/m^{2}K	**0.26 W/m^{2}K**
Party Walls	0.50 W/m^{2}K	**0.00 W/m^{2}K**
Ground Floor (As Built – No Insulation)	0.70 W/m^{2}K (Max. threshold)	**0.41-0.68 W/m^{2}K (plot dependent)**
Pitched Roof (Insulated at Joist)	0.16 W/m2k	**0.13 W/m^{2}K**
Pitched Roof (Insulated at Rafter)	0.18 W/m2k	**0.18 W/m^{2}K**
Windows	1.60 W/m^{2}K	**1.40 W/m^{2}K**
Rooflights	1.60 W/m^{2}K	**1.40 W/m^{2}K**
Entrance Doors	3.00 W/m^{2}K	**1.80 W/m^{2}K**
Lighting	75% Low Energy Lights	**100% Low Energy Lights**
Proposed HVAC Details		
Heating & Hot Water	88.0% (SEDBUK 2009) efficient mains gas fired condensing combi boiler	
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^{2}K	**0.24 W/m^{2}K**
Stud Walls (Room in Roof)	0.30 W/m^{2}K	**0.28 W/m^{2}K**
Ground Floor	0.25 W/m^{2}K	**0.14 W/m^{2}K**
Pitched Roof (Insulated at Joist)	0.16 W/m2k	**0.13 W/m^{2}K**
Pitched Roof U-value (Insulated at Rafters)	0.20 W/m2k	**0.18 W/m^{2}K**
Windows	1.60 W/m^{2}K	**1.40 W/m^{2}K**
Rooflight	1.60 W/m^{2}K	**1.40 W/m^{2}K**
Entrance Door	3.00 W/m^{2}K	**1.80 W/m^{2}K**
Target Air Leakage Rate	10.00 m3/m2.h	**5.00 m^3/m^2.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 Time and Temperature Zone Control	
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_2 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	• Not aesthetically pleasing and would not be in keeping with the local area. • The site is too sheltered and therefore inadequately exposed to obtain reliable outputs from this technology. • Require ongoing maintenance which future occupants may neglect. • Can produce unacceptable levels of noise to occupants and neighbours. • Increased capital costs.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

4.3 Solar Photovoltaic

Benefits	• 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. • Minimal ongoing costs & maintenance issues following installation. • The majority of the dwellings have an area of optimal south facing pitched roof space that could accommodate a small number of panels • Easy to integrate into a conventional build specification.
Site Limitations / Restrictions	• Not aesthetically pleasing. • Increased capital costs.
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

Benefits	• 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 installation. • Eligible for payments under the Renewable Heat Incentive. • 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	• 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. • Not always aesthetically pleasing. • 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. • Increased capital costs.
Conclusion	• 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.

4.5 Ground Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Reliable and proven technology. • Generally low maintenance costs. • No visual impact on the property. • Eligible for payments under the Renewable Heat Incentive.
Site Limitations / Restrictions	• Detailed ground surveys required. • Minimal space to facilitate an installation. • Trench installations require significant area of land. • 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. • High capital installation costs.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development..

4.6 Air Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Reduced visual impact on the property. • Reliable and proven technology. • Generally low maintenance costs. • Eligible for payments under the Renewable Heat Incentive.
Site Limitations / Restrictions	• Often require a supplementary immersion heating system. • 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. • 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. • Increased capital costs.
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	• Reliable and proven technology. • Eligible for payments under the Renewable Heat Incentive. • Could adequately meet the entire heat demand of the development via a communal heating and hot water system.
Site Limitations / Restrictions	• Require large storage facilities for the fuel. • Ongoing cleaning, maintenance and management requirements. • Require regular fuel deliveries. • Would contribute to poor urban air quality. • The use of a communal heating and hot water system is not feasible or desirable for the site. • Increased capital costs.
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_2) 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^2)**	**Dwelling Emission Rate (DER)*1**	**Annual Regulated CO_2 Emissions ($kgCO_2$/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 ($kgCO_2$/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_2 Emissions Arising From The New Detached House (SAP 2012)			
Plot	**TFA (m^2)**	**Target Emission Rate (TER)*2**	**Annual Regulated CO_2 Emissions ($kgCO_2$/year)**
6	84.84	20.55	1,743.78
Total Regulated Annual Baseline Carbon Dioxide Emissions ($kgCO_2$/year)			**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):

Table 5: Predicted Annual CO_2 Emissions Arising From The Dwellings Created From the Church Conversion (SAP 2012)			
Plot	**TFA (m^2)**	**Dwelling Emission Rate (DER)**	**Annual Regulated CO_2 Emissions ($kgCO_2$/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 Regulated Annual Carbon Dioxide Emissions ($kgCO_2$/year)			**12,787.18**

Table 6: Predicted Annual CO_2 Emissions Arising From The New Detached House (SAP 2012)			
Plot	**TFA (m^2)**	**Dwelling Emission Rate (DER)**	**Annual Regulated CO_2 Emissions ($kgCO_2$/year)**
6	84.84	20.46	1,735.69
Total Regulated Annual Carbon Dioxide Emissions ($kgCO_2$/year)			**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_2 emission savings arising from the proposed development.

Table 7: Comparison of Baseline and Predicted CO_2 Emission Calculations	
Annual Baseline CO_2 Emissions (Part L1A/L1B 2013 Compliant)	15,340.51 $kgCO_2$/Year
Annual Proposed CO_2 Emissions	**14,522.87 $kgCO_2$/Year**
Total CO_2 Emission Savings per Annum	817.64 $kgCO_2$/Year
Annual Percentage Reduction in CO_2 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

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Project Information

Building type End-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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 (m^3)			233.09	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.13	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.88	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.75	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.95	0.93	0.91	0.82	0.80	0.71	0.71	0.69	0.75	0.80	0.84	0.88

9.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W7			1.010	1.50 (1.60)	1.52			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W6			1.010	1.50 (1.60)	1.52			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W1			0.530	1.50 (1.60)	0.80			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W2			2.090	1.50 (1.60)	3.14			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W3			0.810	1.50 (1.60)	1.22			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W4			2.090	1.50 (1.60)	3.14			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W5			0.810	1.50 (1.60)	1.22			(27)
Solid door Front Door			2.280	3.00	6.84			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.600	1.50 (1.60)	0.90			(27)
Pitched roofs insulated between joists			68.43	0.16	10.95	9.00	615.87	(30)
Walls Upgraded walls			18.70	0.30	5.61	9.00	168.30	(29)
Walls New walls			67.94	0.28	19.02	60.00	4076.40	(29)
Ground floors Solid ground floor			42.24	0.62	26.19	110.00	4646.40	(28)
Pitched roofs insulated between rafters			33.63	0.18	6.05	9.00	302.67	(30)
Party wall			52.73	0.00	0.00	180.00	9491.40	
Party floor			11.10	0.00	0.00	30.00	333.00	

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K

Total area of external elements Sigma A, m²	242.17	(31)
Fabric heat loss, W/K	88.12	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	36.33	(36)
Total fabric heat loss	124.45	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, 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	
											188.86	(39)

Heat loss parameter (HLP), W/m²K

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 (average)	2.34	(40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.48 (42)

Annual average hot water usage in litres per day Vd,average 93.05 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage 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 water used												
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 content (annual) 1464.03 (45)

Distribution loss												
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)

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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	(56)
Net storage 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)
Combi loss calculated for each month												
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)
Total heat required for water heating calculated for each 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	(62)
Output from water heater for each month, kWh/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)

Heat gains from water heating, kWh/month												
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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
Lighting gains												
27.75	24.65	20.05	15.18	11.34	9.58	10.35	13.45	18.05	22.92	26.76	28.52	(67)
Appliances gains												
221.10	223.40	217.62	205.31	189.77	175.17	165.41	163.12	168.90	181.21	196.75	211.35	(68)
Cooking gains												
35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	(71)
Water heating gains												
84.96	82.58	77.47	70.77	66.19	60.01	55.29	61.97	64.75	71.67	79.40	82.82	(72)
Total internal gains												
396.98	393.79	378.31	354.42	330.48	307.92	294.22	301.71	314.88	338.97	366.07	385.86	(73)

6. Solar gains (calculation for January)

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

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)

Solar gains

56.31	110.90	184.33	271.21	334.32	343.06	326.27	278.99	215.18	132.05	70.35	46.22

(83)

Total gains

453.29	504.69	562.63	625.63	664.80	650.98	620.49	580.70	530.05	471.03	436.42	432.08

(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W7	0.9 x 1.01	0.80	0.70 x 0.83	0.42
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W6	0.9 x 1.01	0.80	0.70 x 0.83	0.42
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) W3	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 1.00	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
EI = 490

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

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	
Utilisation factor for gains for living area												
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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (22.39 / 80.80) 0.28 (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)

Apply adjustment to the mean internal temperature, where appropriate

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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.95	0.94	0.92	0.88	0.81	0.71	0.58	0.62	0.78	0.89	0.94	0.96	(94)
Useful gains												
431.41	474.59	516.88	549.39	540.62	461.61	358.90	358.16	415.41	421.16	409.77	412.86	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1357.0	1142.2	1071.6	757.61	506.59	-	-	-	-	675.63	1005.3	1342.6	

Total space heating requirement per year (kWh/year) (October to May) 7858.82 (98)

Space heating requirement per m² (kWh/m²/year) 97.26 (99)

8c. Space cooling requirement - not applicable

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	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1357.0	1142.2	1071.6	757.61	506.59	-	-	-	-	675.63	1005.3	1342.6	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	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 system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)
Efficiency of water heater											79.50	(216)
87.47	87.42	87.29	86.99	86.38	79.50	79.50	79.50	79.50	86.74	87.22	87.49	(217)
Water heating fuel												
231.79	203.79	212.34	189.00	184.26	176.34	168.94	188.33	190.41	198.73	210.96	226.28	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	8850.02	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2381.17	(219)
Electricity for pumps, fans and electric keep-hot		
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 -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	11796.31	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity for lighting	490.11	0.519	254.37	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			33.65	(273)

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Project Information

Building type End-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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^3)			343.90	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.12	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.87	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.74	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 5			0.385	1.50 (1.60)	0.58			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 4			3.220	1.50 (1.60)	4.84			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) Window 1			14.320	1.50 (1.60)	21.53			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 2			0.810	1.50 (1.60)	1.22			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 3			0.810	1.50 (1.60)	1.22			(27)
Solid door Front Door			2.590	3.00	7.77			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.50 (1.60)	0.84			(27)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.50 (1.60)	0.84			(27)
Pitched roofs insulated between joists Pitched roof flat ceiling - insulated at rafters (0.18 * 0.72)			7.37	0.13	0.96	9.00	66.33	(30)
Pitched roofs insulated between joists			32.41	0.16	5.19	9.00	291.69	(30)
Walls Upgraded walls			111.99	0.30	33.60	9.00	1007.87	(29)
Walls Room in roof stud walls - insulated at rafters (0.18 * 0.72)			17.56	0.13	2.28	9.00	158.04	(29)
Ground floors Solid ground floor			53.40	0.64	34.18	110.00	5874.00	(28)
Pitched roofs insulated between rafters			26.14	0.18	4.71	9.00	235.26	(30)
Party wall			74.06	0.00	0.00	180.00	13330.80	

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K

Total area of external elements Sigma A, m²	272.12	(31)
Fabric heat loss, W/K	119.75	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	40.82	(36)
Total fabric heat loss	160.57	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, 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	
											254.53	(39)

Heat loss parameter (HLP), W/m²K

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 (average)	2.05	(40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.88 (42)

Annual average hot water usage in litres per day Vd,average 102.55 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage 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 water used											
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 content (annual) 1613.57 (45)

Distribution loss

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 water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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 (56)

Net storage 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)

Combi loss calculated for each month

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 heat required for water heating calculated for each 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 (62)

Output from water heater for each month, kWh/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)

Heat gains from water heating, kWh/month

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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
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	(67)
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	(68)
Cooking gains												
37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	(71)
Water heating gains												
91.89	89.52	84.60	77.91	72.95	66.14	60.94	68.30	71.28	78.21	86.02	89.53	(72)
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	(73)

6. Solar gains (calculation for January)

	Area & Flux		g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.385	10.63	0.63 x 0.70	0.77	1.2511
Window 5					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 3.220	10.63	0.63 x 0.70	0.77	10.4640
Window 4					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East)	0.9 x 14.320	19.64	0.63 x 0.70	0.77	85.9532
Window 1					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.810	10.63	0.63 x 0.70	0.77	2.6323
Window 2					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.810	10.63	0.63 x 0.70	0.77	2.6323
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, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	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 (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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.96	0.95	0.92	0.87	0.79	0.67	0.54	0.59	0.77	0.90	0.95	0.97	(94)
Useful gains												
576.84	669.98	772.70	864.93	872.49	739.14	562.92	556.73	638.29	613.46	559.39	545.81	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
3122.4	3018.5	2730.8	2250.2	1732.6	1141.7	732.71	764.86	1210.9	1855.3	2502.0	3065.0	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1893.8	1578.2	1456.8	997.38	639.95	-	-	-	-	923.97	1398.6	1874.2	

Total space heating requirement per year (kWh/year) (October to May) 10763.17 (98)

Space heating requirement per m² (kWh/m²/year) 86.69 (99)

8c. Space cooling requirement - not applicable

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	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	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	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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 79.50 87.08 87.53 87.75		(217)
Water heating fuel		
248.75 219.35 230.65 207.43 202.53 194.35 186.20 207.57 209.55 215.47 226.80 242.70		(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	12120.69	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2591.35	(219)
Electricity for pumps, fans and electric keep-hot		
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)	590.81	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	15377.85	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity for lighting	590.81	0.519	306.63	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			28.38	(273)

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Project Information

Building type Mid-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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)
Total floor area	92.81			(4)
Dwelling volume (m^3)			239.49	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.17	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.92	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.78	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 5			0.900	1.50 (1.60)	1.35			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 4			0.385	1.50 (1.60)	0.58			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 3			3.220	1.50 (1.60)	4.84			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 2			0.500	1.50 (1.60)	0.75			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 1			0.620	1.50 (1.60)	0.93			(27)
Solid door Front Door			2.590	3.00	7.77			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.50 (1.60)	0.84			(27)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.50 (1.60)	0.84			(27)
Pitched roofs insulated between joists Pitched roof flat ceiling - insulated at rafters (0.18 * 0.72)			8.46	0.13	1.10	9.00	76.14	(30)
Pitched roofs insulated between joists			17.08	0.16	2.73	9.00	153.72	(30)
Walls Upgraded walls			22.46	0.30	6.74	9.00	202.18	(29)
Walls New walls			17.03	0.28	4.77	60.00	1021.80	(29)
Walls Room in roof stud walls - insulated at rafters (0.18 * 0.72)			10.09	0.13	1.31	9.00	90.81	(29)
Ground floors Solid ground floor			37.85	0.41	15.52	110.00	4163.50	(28)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Pitched roofs insulated between rafters			18.02	0.18	3.24	9.00	162.18	(30)
Party wall			131.08	0.00	0.00	180.00	23594.40	

Total area of external elements Sigma A, m²	140.33	(31)
Fabric heat loss, W/K	53.32	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	21.05	(36)
Total fabric heat loss	74.37	(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 transfer coefficient, W/K

152.92	151.40	149.92	142.94	141.63	135.56	135.56	134.43	137.90	141.63	144.27	147.04	
											142.93	(39)

Heat loss parameter (HLP), W/m²K

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 (average) 1.54 (40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.43 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage 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 water used											
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 content (annual) 1532.93 (45)

Distribution loss

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 water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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 (56)

Net storage 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)

Combi loss calculated for each month

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 heat required for water heating calculated for each month

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 water heater for each month, kWh/month

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 gains from water heating, kWh/month

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	
Metabolic gains, 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	(66)
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	(67)
Appliances gains												
244.15	246.69	240.30	226.71	209.55	193.43	182.66	180.12	186.51	200.10	217.26	233.38	(68)
Cooking gains												
36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)
Water heating gains												
88.15	85.90	81.12	74.10	69.31	62.83	57.89	64.89	67.80	75.05	82.58	85.91	(72)
Total internal gains												
431.46	428.03	411.35	384.91	358.37	333.66	318.87	327.05	341.85	368.52	397.80	419.37	(73)

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)	0.9 x 0.900	46.75	0.63 x 0.70	0.77	12.8592
Window 5					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.385	10.63	0.63 x 0.70	0.77	1.2511
Window 4					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 3.220	10.63	0.63 x 0.70	0.77	10.4640
Window 3					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 0.500	19.64	0.63 x 0.70	0.77	3.0012
Window 2					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 0.620	19.64	0.63 x 0.70	0.77	3.7214
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, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

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	
Utilisation factor for gains for living area												
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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (26.68 / 92.81) 0.29 (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)
Apply adjustment to the mean internal temperature, where appropriate												
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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.96	0.95	0.94	0.90	0.85	0.74	0.61	0.65	0.81	0.91	0.95	0.96	(94)
Useful gains												
455.62	484.51	506.40	519.88	504.95	431.98	339.79	340.65	399.74	422.05	427.94	438.75	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
1912.5	1837.6	1649.7	1336.1	1023.5	674.03	443.54	462.32	726.24	1120.0	1517.7	1863.1	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1083.9	909.29	850.68	587.73	385.84	-	-	-	-	519.33	784.62	1059.7	

Total space heating requirement per year (kWh/year) (October to May) 6181.23 (98)

Space heating requirement per m² (kWh/m²/year) 66.60 (99)

8c. Space cooling requirement - not applicable

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	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1083.9	909.29	850.68	587.73	385.84	-	-	-	-	519.33	784.62	1059.7	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
1220.6	1023.9	957.97	661.86	434.50	-	-	-	-	584.83	883.58	1193.4	(211)
Appendix Q - monthly energy saved (main heating system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)
Efficiency of water heater											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)
Water heating fuel												
240.85	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/year	
Space heating fuel used, main system 1	6960.84	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2492.60	(219)
Electricity for pumps, fans and electric keep-hot central heating pump	30.00	(230c)
Total electricity for the above, kWh/year	30.00	(231)
Electricity for lighting (75.00% fixed LEL)	586.67	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	10070.11	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			25.45	(273)

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Project Information

Building type Detached house

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

SAP 2012 worksheet for notional dwelling - calculation of target emissions

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	36.99	2.60	96.17	(3a)
First floor	33.36	2.60	86.74	(3b)
Second floor	14.49	1.97	28.55	(3c)
Total floor area	84.84			(4)
Dwelling volume (m^3)			211.46	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.14	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.39	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.33	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 1			2.640	1.33 (1.40)	3.50	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 2			0.650	1.33 (1.40)	0.86	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 3			1.840	1.33 (1.40)	2.44	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 4			0.410	1.33 (1.40)	0.54	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) Window 5			5.040	1.33 (1.40)	6.68	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) Window 6			1.920	1.33 (1.40)	2.55	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Window 7			0.680	1.33 (1.40)	0.90	(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Window 8			0.680	1.33 (1.40)	0.90	(27)
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Door			1.950	1.00	1.95	(26)
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.950	1.59 (1.70)	1.51	(27)
Pitched roofs insulated between joists			3.63	0.13	0.47	(30)
Pitched roofs insulated between joists			18.87	0.13	2.45	(30)
Walls Timber stud walls - room in roof			8.50	0.18	1.53	(29)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	
Walls			157.14	0.18	28.29	(29)
Ground floors			36.99	0.13	4.81	(28)
Pitched roofs insulated between rafters			15.78	0.13	2.05	(30)

Total area of external elements Sigma A, m²	257.67	(31)
Fabric heat loss, W/K	61.44	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	15.37	(36)
Total fabric heat loss	76.80	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, 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

116.38 (39)

Heat loss parameter (HLP), W/m²K

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 (average) 1.37 (40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.55 (42)

Annual average hot water usage in litres per day Vd,average 94.72 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water 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 water used												
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 content (annual) 1490.35 (45)

Distribution loss												
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 water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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	(56)
Net storage 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)
Combi loss calculated for each month												
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)
Total heat required for water heating calculated for each month												
205.48	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 water heater for each month, kWh/month												
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)

2053.87 (64)

Heat gains from water heating, kWh/month												
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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
Lighting gains												
20.94	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.52	(67)
Appliances gains												
229.26	231.64	225.64	212.88	196.77	181.63	171.51	169.13	175.13	187.89	204.00	219.14	(68)
Cooking gains												
35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	(71)
Water heating gains												
86.18	83.99	78.87	72.04	67.38	61.09	56.29	63.09	65.92	72.96	80.76	84.00	(72)
Total internal gains												
400.60	398.45	383.86	360.59	336.93	314.16	299.83	306.59	318.89	342.37	369.17	388.88	(73)

6. Solar gains (calculation for January)

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

6. Solar gains (calculation for January)

	Area & Flux		g & FF	Shading	Gains	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Window 8	0.9 x 0.680	19.64	0.63 x 0.70	0.77	4.0816	
Solid door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Door	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	26.00	0.63 x 0.70	1.00	9.8034	
Total solar gains, January					119.74	(83-1)

Solar gains

119.74	209.19	301.08	399.53	472.81	480.83	458.79	402.17	334.76	235.11	144.35	101.88	(83)

Total gains

520.34	607.64	684.93	760.12	809.75	795.00	758.62	708.76	653.65	577.48	513.52	490.77	(84)

Lighting calculations

	Area	g	FF x Shading	
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	1.10
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) Window 2	0.9 x 0.65	0.80	0.70 x 0.83	0.27
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	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	0.17
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) Window 5	0.9 x 5.04	0.80	0.70 x 0.83	2.11
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) Window 6	0.9 x 1.92	0.80	0.70 x 0.83	0.80
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Window 7	0.9 x 0.68	0.80	0.70 x 0.83	0.28
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West) Window 8	0.9 x 0.68	0.80	0.70 x 0.83	0.28
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) Rooflight	0.9 x 0.95	0.80	0.70 x 1.00	0.48

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 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	
Utilisation factor for gains for living area												
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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (12.66 / 84.84) 0.15 (91)

Mean internal temperature (for the whole dwelling)

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)

Apply adjustment to the mean internal temperature, where appropriate

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)

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	(94)
Useful gains												
517.72	601.52	669.85	717.88	697.45	551.29	377.01	392.51	533.41	554.11	508.55	488.84	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
1616.1	1570.0	1424.5	1191.9	917.83	608.85	387.02	408.51	655.69	998.06	1329.7	1610.5	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
817.23	650.82	561.48	341.30	163.96	-	-	-	-	330.30	591.26	834.58	

Total space heating requirement per year (kWh/year) (October to May) 4290.94 (98)

Space heating requirement per m² (kWh/m²/year) 50.58 (99)

SAP 2012 worksheet for notional dwelling - calculation of target emissions

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	93.40%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
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	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	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	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
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	(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	(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		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	7449.22	(238)

SAP 2012 worksheet for notional dwelling - calculation of target emissions

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity generated - 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/year	
Emissions per m² for space and water heating	17.83	(272a)
Emissions per m² for lighting	2.26	(272b)
Emissions per m² for pumps and fans	0.46	(272c)
Target Carbon Dioxide Emission Rate (TER)	20.55	(273)

= (17.8332 x 1.00) + 2.2617 + 0.4588

EPS Group
Energy Consultancy and Compliance Services

Appendix 2:

Proposed Example SAP Calculations

Energy Performance & Sustainability Group
3C Pelham Court
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Project Information

Building type End-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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 (m^3)			233.09	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.13	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.88	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.75	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.95	0.93	0.91	0.82	0.80	0.71	0.71	0.69	0.75	0.80	0.84	0.88

9.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W6			1.010	1.33 (1.40)	1.34			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W7			1.010	1.33 (1.40)	1.34			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W5			0.810	1.33 (1.40)	1.07			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W4			2.090	1.33 (1.40)	2.77			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W3			0.810	1.33 (1.40)	1.07			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) W2			2.090	1.33 (1.40)	2.77			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W1			0.530	1.33 (1.40)	0.70			(27)
Solid door Front Door			2.280	1.80	4.10			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.600	1.33 (1.40)	0.80			(27)
Pitched roofs insulated between joists			68.43	0.13	8.90	9.00	615.87	(30)
Walls Upgraded walls			18.70	0.28	5.24	9.00	168.30	(29)
Walls New walls			67.94	0.26	17.66	60.00	4076.40	(29)
Ground floors Solid ground floor			42.24	0.62	26.19	110.00	4646.40	(28)
Pitched roofs insulated between rafters			33.63	0.18	6.05	9.00	302.67	(30)
Party wall			52.73	0.00	0.00	180.00	9491.40	
Party floor			11.10	0.00	0.00	30.00	333.00	

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K

Total area of external elements Sigma A, m²	242.17	(31)
Fabric heat loss, W/K	80.01	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	36.33	(36)
Total fabric heat loss	116.33	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, W/K

189.67	188.32	186.99	180.75	179.59	174.16	174.16	173.15	176.25	179.59	181.95	184.41	
											180.75	(39)

Heat loss parameter (HLP), W/m²K

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 (average)											2.24	(40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.48 (42)

Annual average hot water usage in litres per day Vd,average 93.05 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage 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 water used												
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 content (annual) 1464.03 (45)

Distribution loss												
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)

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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	(56)
Net storage 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)
Combi loss calculated for each month												
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)
Total heat required for water heating calculated for each 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	(62)
Output from water heater for each month, kWh/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)

Heat gains from water heating, kWh/month												
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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
Lighting gains												
22.20	19.72	16.04	12.14	9.08	7.66	8.28	10.76	14.44	18.34	21.41	22.82	(67)
Appliances gains												
221.10	223.40	217.62	205.31	189.77	175.17	165.41	163.12	168.90	181.21	196.75	211.35	(68)
Cooking gains												
35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	-99.11	(71)
Water heating gains												
84.96	82.58	77.47	70.77	66.19	60.01	55.29	61.97	64.75	71.67	79.40	82.82	(72)
Total internal gains												
391.43	388.86	374.30	351.39	328.21	306.01	292.15	299.02	311.27	334.39	360.72	380.15	(73)

6. Solar gains (calculation for January)

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

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)

Solar gains

56.31	110.90	184.33	271.21	334.32	343.06	326.27	278.99	215.18	132.05	70.35	46.22

(83)

Total gains

447.74	499.76	558.62	622.59	662.53	649.06	618.42	578.01	526.44	466.44	431.07	426.37

(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W6	0.9 x 1.01	0.80	0.70 x 0.83	0.42
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) W7	0.9 x 1.01	0.80	0.70 x 0.83	0.42
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) W3	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) 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 (West) W1	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

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

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	
Utilisation factor for gains for living area												
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)
Mean internal temperature in living area 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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 (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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.95	0.94	0.92	0.87	0.81	0.70	0.56	0.60	0.77	0.89	0.94	0.96	(94)
Useful gains												
426.13	469.76	512.47	544.71	534.31	451.69	344.52	345.18	407.84	415.94	404.60	407.48	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
2154.8	2076.8	1867.6	1524.2	1157.8	749.47	467.92	491.66	803.62	1260.6	1720.0	2117.0	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1286.1	1079.9	1008.2	705.25	463.94	-	-	-	-	628.46	947.14	1271.8	

Total space heating requirement per year (kWh/year) (October to May) 7390.97 (98)

Space heating requirement per m² (kWh/m²/year) 91.47 (99)

8c. Space cooling requirement - not applicable

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	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1286.1	1079.9	1008.2	705.25	463.94	-	-	-	-	628.46	947.14	1271.8	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
1448.3	1216.1	1135.4	794.20	522.45	-	-	-	-	707.73	1066.6	1432.2	(211)
Appendix Q - monthly energy saved (main heating system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)
Efficiency of water heater											79.50	(216)
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)
Water heating fuel												
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)

Annual totals	kWh/year	
Space heating fuel used, main system 1	8323.16	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2382.89	(219)
Electricity for pumps, fans and electric keep-hot		
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)	392.09	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	11173.14	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions 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)
Water heating	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)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			31.62	(273)

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Project Information

Building type End-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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^3)			343.90	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.12	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.87	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.74	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 3			0.810	1.33 (1.40)	1.07			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 2			0.810	1.33 (1.40)	1.07			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East) Window 1			14.320	1.33 (1.40)	18.98			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 4			3.220	1.33 (1.40)	4.27			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 5			0.385	1.33 (1.40)	0.51			(27)
Solid door Front Door			2.590	1.80	4.66			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.33 (1.40)	0.74			(27)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.33 (1.40)	0.74			(27)
Pitched roofs insulated between joists Pitched roof flat ceiling - insulated at rafters (0.18 * 0.72)			7.37	0.13	0.96	9.00	66.33	(30)
Pitched roofs insulated between joists			32.41	0.13	4.21	9.00	291.69	(30)
Walls Upgraded walls			111.98	0.28	31.36	9.00	1007.87	(29)
Walls Room in roof stud walls - insulated at rafters (0.18 * 0.72)			17.56	0.13	2.28	9.00	158.04	(29)
Ground floors Solid ground floor			53.40	0.64	34.18	110.00	5874.00	(28)
Pitched roofs insulated between rafters			26.14	0.18	4.71	9.00	235.26	(30)
Party wall			74.06	0.00	0.00	180.00	13330.80	

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K

Total area of external elements Sigma A, m²	272.12	(31)
Fabric heat loss, W/K	109.74	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	40.82	(36)
Total fabric heat loss	150.56	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, 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 (39)

Heat loss parameter (HLP), W/m²K

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 (average) 1.97 (40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.88 (42)

Annual average hot water usage in litres per day Vd,average 102.55 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage 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 water used											
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 content (annual) 1613.57 (45)

Distribution loss

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 water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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 (56)

Net storage 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)

Combi loss calculated for each month

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 heat required for water heating calculated for each 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 (62)

Output from water heater for each month, kWh/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)

Heat gains from water heating, kWh/month

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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
Lighting gains												
26.76	23.77	19.33	14.64	10.94	9.24	9.98	12.97	17.41	22.11	25.80	27.51	(67)
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	(68)
Cooking gains												
37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	-115.12	(71)
Water heating gains												
91.89	89.52	84.60	77.91	72.95	66.14	60.94	68.30	71.28	78.21	86.02	89.53	(72)
Total internal gains												
478.36	476.01	459.05	431.50	402.43	374.72	357.45	364.78	379.80	407.59	439.52	463.92	(73)

6. Solar gains (calculation for January)

	Area & Flux		g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.810	10.63	0.63 x 0.70	0.77	2.6323
Window 3					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.810	10.63	0.63 x 0.70	0.77	2.6323
Window 2					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (East)	0.9 x 14.320	19.64	0.63 x 0.70	0.77	85.9532
Window 1					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 3.220	10.63	0.63 x 0.70	0.77	10.4640
Window 4					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 0.385	10.63	0.63 x 0.70	0.77	1.2511
Window 5					
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, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a)	0.9 x 0.560	26.00	0.63 x 0.70	1.00	5.7789
Rooflight					

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 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	
Utilisation factor for gains for living area												
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)
Mean internal temperature in living area 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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (35.56 / 124.16) 0.29 (91)

Mean internal temperature (for the whole dwelling)

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)

Apply adjustment to the mean internal temperature, where appropriate

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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.96	0.95	0.92	0.87	0.78	0.66	0.52	0.57	0.77	0.90	0.95	0.97	(94)
Useful gains												
570.48	664.14	767.15	858.16	861.86	721.75	538.96	535.74	627.03	606.90	553.15	539.31	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
2993.0	2892.7	2614.6	2148.8	1648.0	1075.5	679.86	711.07	1142.5	1765.4	2390.6	2935.7	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1802.3	1497.6	1374.5	929.26	584.90	-	-	-	-	861.98	1322.9	1782.9	

Total space heating requirement per year (kWh/year) (October to May) 10156.49 (98)

Space heating requirement per m² (kWh/m²/year) 81.80 (99)

8c. Space cooling requirement - not applicable

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	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1802.3	1497.6	1374.5	929.26	584.90	-	-	-	-	861.98	1322.9	1782.9	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
2029.7	1686.5	1547.8	1046.4	658.67	-	-	-	-	970.70	1489.8	2007.8	(211)
Appendix Q - monthly energy saved (main heating system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)
87.69	87.63	87.49	87.14	86.47	79.50	79.50	79.50	79.50	86.98	87.47	87.71	(217)
Water heating fuel												
248.88	219.49	230.82	207.65	202.89	194.35	186.20	207.57	209.55	215.72	226.96	242.83	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	11437.49	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2592.91	(219)
Electricity for pumps, fans and electric keep-hot		
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)	472.65	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	14578.04	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity for lighting	472.65	0.519	245.30	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			26.70	(273)

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Project Information

Building type Mid-terrace house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
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)
Total floor area	92.81			(4)
Dwelling volume (m^3)			239.49	(5)

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.17	(8)
Pressure test, assumed q50		15.00		(17)
Air permeability			0.92	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.78	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 3			3.220	1.33 (1.40)	4.27			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 4			0.385	1.33 (1.40)	0.51			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 5			0.900	1.33 (1.40)	1.19			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 1			0.620	1.33 (1.40)	0.82			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 2			0.500	1.33 (1.40)	0.66			(27)
Solid door Front Door			2.590	1.80	4.66			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.33 (1.40)	0.74			(27)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.560	1.33 (1.40)	0.74			(27)
Pitched roofs insulated between joists Pitched roof flat ceiling - insulated at rafters (0.18 * 0.72)			8.46	0.13	1.10	9.00	76.14	(30)
Pitched roofs insulated between joists			17.08	0.13	2.22	9.00	153.72	(30)
Walls Upgraded walls			22.46	0.28	6.29	9.00	202.18	(29)
Walls New walls			17.03	0.26	4.43	60.00	1021.80	(29)
Walls Room in roof stud walls - insulated at rafters (0.18 * 0.72)			10.09	0.13	1.31	9.00	90.81	(29)
Ground floors Solid ground floor			37.85	0.41	15.52	110.00	4163.50	(28)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Pitched roofs insulated between rafters			18.02	0.18	3.24	9.00	162.18	(30)
Party wall			131.08	0.00	0.00	180.00	23594.40	

Total area of external elements Sigma A, m²	140.33	(31)
Fabric heat loss, W/K	47.71	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	100.00	(35)
Effect of thermal bridges	21.05	(36)
Total fabric heat loss	68.76	(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 transfer coefficient, W/K

147.31	145.79	144.31	137.33	136.02	129.95	129.95	128.82	132.29	136.02	138.66	141.42	
											137.32	(39)

Heat loss parameter (HLP), W/m²K

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 (average)											1.48	(40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.43 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage 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 water used											
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 content (annual) 1532.93 (45)

Distribution loss

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 water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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 (56)

Net storage 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)

Combi loss calculated for each month

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 heat required for water heating calculated for each month

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 water heater for each month, kWh/month

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 gains from water heating, kWh/month

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	
Metabolic gains, 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	(66)
Lighting gains												
26.58	23.60	19.20	14.53	10.86	9.17	9.91	12.88	17.29	21.95	25.62	27.31	(67)
Appliances gains												
244.15	246.69	240.30	226.71	209.55	193.43	182.66	180.12	186.51	200.10	217.26	233.38	(68)
Cooking gains												
36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)
Water heating gains												
88.15	85.90	81.12	74.10	69.31	62.83	57.89	64.89	67.80	75.05	82.58	85.91	(72)
Total internal gains												
424.81	422.13	406.55	381.28	355.66	331.37	316.39	323.83	337.53	363.03	391.39	412.54	(73)

6. Solar gains (calculation for January)

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

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

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	
Utilisation factor for gains for living area												
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)
Mean internal temperature in living area T1												
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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (26.68 / 92.81) 0.29 (91)

Mean internal temperature (for the whole dwelling)

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)

Apply adjustment to the mean internal temperature, where appropriate

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)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.96	0.95	0.94	0.90	0.84	0.73	0.59	0.63	0.80	0.91	0.95	0.96	(94)
Useful gains												
449.42	478.93	501.58	515.28	499.21	422.71	326.33	328.30	392.25	416.29	421.91	432.38	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
1835.4	1762.6	1580.6	1275.8	973.34	634.75	411.89	430.05	685.18	1066.0	1450.9	1785.9	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
1031.2	862.67	802.81	547.61	352.75	-	-	-	-	483.43	740.89	1007.0	

Total space heating requirement per year (kWh/year) (October to May) 5828.37 (98)

Space heating requirement per m² (kWh/m²/year) 62.80 (99)

8c. Space cooling requirement - not applicable

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	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1031.2	862.67	802.81	547.61	352.75	-	-	-	-	483.43	740.89	1007.0	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
1161.2	971.48	904.06	616.68	397.24	-	-	-	-	544.40	834.33	1134.0	(211)
Appendix Q - monthly energy saved (main heating system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)
Efficiency of water heater											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)
Water heating fuel												
241.04	212.67	223.54	199.27	194.73	184.64	176.90	197.20	199.38	209.72	220.31	235.28	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	6563.48	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2494.66	(219)
Electricity for pumps, fans and electric keep-hot central heating pump	30.00	(230c)
Total electricity for the above, kWh/year	30.00	(231)
Electricity for lighting (100.00% fixed LEL)	469.34	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	9557.48	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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)
Water heating	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)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			23.87	(273)

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Project Information

Building type Detached house

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

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

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	36.99	2.60	96.17	(3a)
First floor	33.36	2.60	86.74	(3b)
Second floor	14.49	1.97	28.55	(3c)
Total floor area	84.84			(4)
Dwelling volume (m^3)			211.46	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.14	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.39	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.33	(21)

Infiltration rate modified for monthly wind speed

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)

Wind Factor

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)

Adjusted infiltration rate (allowing for shelter and wind speed)

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)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

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)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 8			0.680	1.33 (1.40)	0.90			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) Window 7			0.680	1.33 (1.40)	0.90			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 6			1.920	1.33 (1.40)	2.55			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North) Window 5			5.040	1.33 (1.40)	6.68			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 4			0.410	1.33 (1.40)	0.54			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 3			1.840	1.33 (1.40)	2.44			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 2			0.650	1.33 (1.40)	0.86			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 1			2.640	1.33 (1.40)	3.50			(27)
Solid door Door			1.950	1.80	3.51			(26)
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.1, soft coat (n/a) Rooflight			0.950	1.33 (1.40)	1.26			(27)
Pitched roofs insulated between joists			18.87	0.13	2.45	9.00	169.83	(30)
Pitched roofs insulated between 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 Timber stud walls - room in roof			8.50	0.28	2.38	9.00	76.50	(29)
Ground floors			36.99	0.14	5.18	110.00	4068.90	(28)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Pitched roofs insulated between rafters			15.78	0.18	2.84	9.00	142.02	(30)

Total area of external elements Sigma A, m²	257.67	(31)
Fabric heat loss, W/K	74.07	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	13.20	(36)
Total fabric heat loss	87.27	(37)

Ventilation heat loss calculated monthly

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 transfer coefficient, 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	
											126.84	(39)

Heat loss parameter (HLP), W/m²K

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 (average) 1.50 (40)

Number of days in month (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

4. Water heating energy requirements kWh/year

Assumed occupancy, N 2.55 (42)

Annual average hot water usage in litres per day Vd,average 94.72 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water 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 water used												
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 content (annual) 1490.35 (45)

Distribution loss												
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)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage 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	(56)
Net storage 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)
Combi loss calculated for each month												
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)
Total heat required for water heating calculated for each month												
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 water heater for each month, kWh/month												
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)

Heat gains from water heating, kWh/month												
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)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, 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	(66)
Lighting gains												
20.94	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.52	(67)
Appliances gains												
229.26	231.64	225.64	212.88	196.77	181.63	171.51	169.13	175.13	187.89	204.00	219.14	(68)
Cooking gains												
35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	35.74	(69)
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	(70)
Losses e.g. evaporation (negative values)												
-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	-101.93	(71)
Water heating gains												
74.52	72.33	67.76	61.56	57.53	51.86	47.05	53.22	55.42	61.84	69.09	72.34	(72)
Total internal gains												
388.94	386.78	372.75	350.11	327.08	304.94	290.59	296.73	308.39	331.25	357.50	377.22	(73)

6. Solar gains (calculation for January)

	Area & Flux		g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 0.680	19.64	0.63 x 0.70	0.77	4.0816
Window 8					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West)	0.9 x 0.680	19.64	0.63 x 0.70	0.77	4.0816
Window 7					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 1.920	10.63	0.63 x 0.70	0.77	6.2394
Window 6					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (North)	0.9 x 5.040	10.63	0.63 x 0.70	0.77	16.3785
Window 5					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South)	0.9 x 0.410	46.75	0.63 x 0.70	0.77	5.8581
Window 4					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South)	0.9 x 1.840	46.75	0.63 x 0.70	0.77	26.2900
Window 3					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South)	0.9 x 0.650	46.75	0.63 x 0.70	0.77	9.2872
Window 2					

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)

Solar gains

119.74	209.19	301.08	399.53	472.81	480.83	458.79	402.17	334.76	235.11	144.35	101.88	(83)

Total gains

508.68	595.98	673.83	749.64	799.90	785.77	749.39	698.89	643.15	566.36	501.85	479.11	(84)

Lighting calculations

	Area	g	FF x Shading	
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	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	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	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	2.11
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 4	0.9 x 0.41	0.80	0.70 x 0.83	0.17
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) Window 3	0.9 x 1.84	0.80	0.70 x 0.83	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	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	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	0.48

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 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	
Utilisation factor for gains for living area												
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)
Mean internal temperature in living area 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)
Temperature during heating periods in rest of dwelling Th2												
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)
Utilisation factor for gains for rest of dwelling												
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)
Mean internal temperature in the rest of 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 area fraction (12.66 / 84.84) 0.15 (91)

Mean internal temperature (for the whole dwelling)

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)

Apply adjustment to the mean internal temperature, where appropriate

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)

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	0.95	0.87	0.71	0.51	0.56	0.83	0.96	0.99	1.00	(94)
Useful gains												
506.04	589.94	659.27	709.92	695.52	556.22	378.68	394.04	530.86	544.25	496.97	477.14	(95)
Monthly average external temperature												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature												
1704.7	1655.4	1499.7	1251.7	959.32	630.46	392.08	415.09	678.40	1043.3	1398.9	1700.1	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
891.86	716.04	625.29	390.12	196.26	-	-	-	-	371.33	649.42	909.88	

Total space heating requirement per year (kWh/year) (October to May) 4750.20 (98)

Space heating requirement per m² (kWh/m²/year) 55.99 (99)

8c. Space cooling requirement - not applicable

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	93.50%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
891.86	716.04	625.29	390.12	196.26	-	-	-	-	371.33	649.42	909.88	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
953.86	765.82	668.76	417.24	209.91	-	-	-	-	397.14	694.57	973.14	(211)
Appendix Q - monthly energy saved (main heating system 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)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
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)

Efficiency of water heater	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 fuel												
189.83	166.60	173.24	153.02	148.82	133.04	125.13	140.97	141.88	158.92	170.80	184.34	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	5080.43	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1886.59	(219)
Electricity for pumps, fans and electric keep-hot		
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		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	7411.74	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions 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)
Water heating	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)
Electricity generated - 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)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			20.46	(273)