Technical Paper 21

HISTORIC SCOTLAND
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Data sources for energy performance assessments of historic buildings in the United Kingdom

Identifying online data sources for the EFFESUS project

Stuart Hay, Tessa Clark, Sophie Simpson & Vicky Ingram

CHANGEWORKS

HERIOT WATT UNIVERSITY

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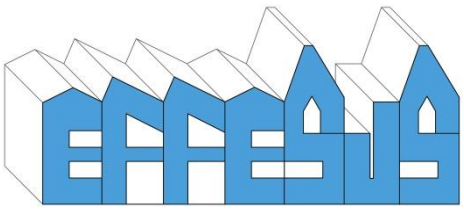


Researching energy efficiency for European historic urban districts

This paper was produced as part of Historic Scotland's contribution to the European project EFFESUS, which researches energy efficiency for historic urban districts. More information about the EFFESUS project is available on the websites www.effesus.eu and www.historic-scotland.gov.uk/effesus. On the former, you can sign up for a free email newsletter. You can email the EFFESUS project at request@effesus.eu

The EFFESUS project has received funding by the European Union's Seventh Framework Programme for research, to technological development and demonstration under grant agreement no. 314678.

Foreword

by Historic Scotland

This Historic Scotland Technical Paper identifies data sources which can be helpful for assessing the energy performance of historic buildings in the United Kingdom (UK). The list of data sources in this paper was originally prepared as one of Historic Scotland's contributions to EFFESUS, a European project researching the energy efficiency of European historic urban districts. (The acronym EFFESUS stands for *Energy Efficiency for EU Historic Districts' Sustainability*.)

Making well-informed decisions on how to improve the energy performance and sustainability of the existing building stock requires reliable data. Energy performance assessments of buildings are often carried out with specific buildings in mind. Strategic assessments – where not only a single building is assessed, but instead groups of buildings, urban districts or towns, or the entire building stock of a country – are conducted less often and hardly ever with historic buildings specifically in mind. The EFFESUS project is trying to fill this gap by researching energy efficiency in the particular context of historic urban districts. The term historic urban district means, in the context of EFFESUS, a significant grouping of old buildings, built before 1945, and representative of the period of their construction or history. These buildings do not necessarily have to be protected by heritage legislation. The project is especially interested in supporting the decision making process at a strategic level. Assessing districts, rather than individual buildings, will help to inform governmental policies (e.g. the types of retrofit measures to support through financial support).

Unlike other assessment approaches, EFFESUS considers energy performance not on its own, but in relation to the reductions of carbon dioxide (CO_2) emission and the heritage significance of the building stock. Where CO_2 reductions are the main driver for retrofitting existing buildings, improvements of the building fabric is one possible option. An alternative option is to decarbonise their energy supply, i.e. to use energy generated from sources that emit less or no CO_2. These could include solar photovoltaics, heat pumps, geothermal and combined heat and power. When carried out at a building scale, assessments are often limited to some solutions for energy generation (e.g. solar photovoltaics or air source heat pumps). Assessment at an urban scale, however, can provide a wider range of solutions (including geothermal systems and combined heat and power generation). Generating low to zero carbon energy within an urban district is, at least in the UK, often limited by building scale assessments, thereby ignoring other solutions, which might be more suitable – technically and financially. This is particularly of interest for some historic buildings – especially those of high heritage significance – where retrofitting of the buildings fabric can be more challenging and costly than installing suitable on-site energy generation systems in appropriate locations at or near the buildings.

The main output of the EFFESUS project will be a decision support system, a software tool for use by local and national authorities, urban planners, architects and consultants, all

concerned with the energy performance of the historic building stock. The software will be based on a multi-scale spatial data model and repositories of improvement measures.

However, the quality of the results from the software tool depends obviously on the quality of the data inputted into the data model. These data will need to be location specific to allow useful simulations of districts across all of Europe and beyond. A Mediterranean city is obviously different from a city in Scotland with regard to its climatic conditions, building materials, construction techniques, energy use and consumption, etc.

To establish what data sources are available for this purpose, EFFESUS project partners have compiled lists of data sources, including assessments of their accessibility, quality and suitability. Historic Scotland, as one of the 23 project partners, was tasked to provide information about data sources covering the whole of the UK. Historic Scotland commissioned Changeworks, a sustainable development organisation based in Edinburgh, with identifying and assessing available data sources relevant to a UK context. The data sources were required to have a degree of compatibility with the EFFESUS software data model. Information from the data sources, for example, had to be digitally extractable.

This Technical Paper presents the results of this commission. In the production of this report, Changeworks collaborated with the Urban Energy Research Group of Heriot-Watt University, Edinburgh.

Although the list of data sources, collated by Changeworks, was produced primarily for use in the data model underlying the EFFESUS software, it was felt that making the list publically available could be useful to other researchers also. Furthermore, the list provides a ‘snapshot’ in time, with data sources, and particularly their accessibility, quality and suitability, changing over time. Some data sources might not be updated in the future; others might be extended or improved; and new ones will emerge. It is therefore hoped that this Technical Paper promotes discussion about the data sources listed, and feedback is encouraged.

April 2014

Research Report

Data sources for energy performance assessments of historic buildings in the United Kingdom

Identifying online data sources for the EFFESUS project

Stuart Hay, Tessa Clark, Sophie Simpson & Vicky Ingram

About the authors

Stuart Hay, Senior Consultant, Changeworks

Since joining Changeworks in 2008, Stuart has led a team developing a range of innovative and awarding winning energy efficiency projects. He has a background in energy conservation in the built environment and barriers to the deployment of insulation and micro-generation technologies. Stuart has managed research work for a range of high profile clients, including the Energy Saving Trust, WWF Scotland, Consumer Focus Scotland, Joseph Rowntree Foundation and eaga Charitable Trust. He is currently leading the Intelligent Energy Europe project Low Energy Apartment Futures (LEAF).

Tessa Clark, Researcher, Changeworks

Tessa has worked at Changeworks since 2011 carrying out research for a variety of sustainable energy projects. Prior to joining Changeworks, she worked at a sustainability consultancy providing evalua tion support for community carbon reduction projects and has previously worked for a sustainable energy charity, delivering household energy efficiency and community-based projects. Tessa also holds an MSc in Ecological Economics.

Sophie Simpson, Research Associate, Heriot-Watt University

Sophie has previous experience of working in industry and is an expert in building energy modelling. She has carried out empirical studies in air quality and ventilation of low-energy houses, and acted as lead researcher on a number of projects, funded by the Scottish Government, analysing domestic energy data. Sophie is completing a PhD entitled *An assessment of the relationship between domestic carbon emissions and occupant awareness of energy efficient living*.

Vicky Ingram, Research Associate, Heriot-Watt University

Vicky has six years in-depth experience with the SAP and RdSAP domestic energy assessment methodologies, as a Domestic Energy Assessor and as a researcher at Heriot-Watt University. Her research has been promoted in journals and at international conferences, and she has contributed to Historic Scotland's knowledgebase as primary author of *Historic Scotland Technical Paper 18: Evaluating energy modelling for traditionally constructed dwellings*.

CONTENTS

Executive summary

This report provides an overview of UK data sources available that may be useful for the development of a multi-scale data model within the EFFESUS project. Data sources have been identified to cover building types (for domestic and non-domestic), energy usage, CO_2 emissions, climatic data, information on historic / heritage-protected buildings, and data in a spatial format.

For some of the required data, there are a number of sources, but for others, there are few data sources. For instance, there are a number of sources of building types and characteristics for domestic properties, but few for non-domestic. There is also a lack of data on building construction materials. In addition, few sources provide data at a low resolution where groups of properties can be identified at an urban neighbourhood scale.

As the EFFESUS project focuses on historic properties, it is essential that it contains information on listed buildings and conservation areas (data which Historic Scotland already has). This could be combined with data sources such as Gazetteers or Census data which provide limited data on most/all properties within the UK. Much of these could be done spatially. However, there are limitations to identifying pre-1945 stock. Other data on energy consumption, energy efficiency ratings of properties and climatic data could then be overlaid with this information. The Home Energy Efficiency Database (HEED) may be a very useful data source in terms of energy efficiency and property characteristics and there are other sources which may complement it.

For some data sources it is difficult to either a) obtain the full dataset due to user restrictions or b) fully appreciate how it may fit into a potential EFFESUS model. For this reason, it is recommended that Historic Scotland carries out a trial on one area to identify the required data and data sources required. This would have to be sensitive to data sources that are only applicable to certain parts of the UK.

This report was compiled in April 2013.

1. Introduction

EFFESUS (Energy Efficiency for EU Historic Districts Sustainability) is a European project that is researching energy efficiency in European historic urban districts. It involves 23 partners from 13 countries, including Historic Scotland as a UK partner. The project runs from 2012 to 2016. Further information about the EFFESUS project is available online at www.effesus.eu.

The project comprises ten work packages, the first of which is the development of a multi-scale data model for the assessment and management of energy use in historic cities. From this, a software tool will be developed to support the decision-making process for improving the energy efficiency of historic urban districts. A key element of this work package (work task 1.1) is the identification and collation of existing data relating to UK building stock and its energy use, to inform development of the above model. As one of three UK partners, Historic Scotland is responsible for collating data sources for the UK for this purpose.

This report feeds into work task 1.1 by identifying appropriate sources for the data required, e.g. climatic data, energy use in buildings. These data sources have been listed and analysed for their usability/relevance for the EFFESUS project. For the purposes of this paper historic buildings refer to buildings built before 1945 and representative of a period of their construction or history. They do not necessarily have to be protected by heritage legislation.

Changeworks was commissioned by Historic Scotland to undertake this report, with input from the Urban Energy Research Group at Heriot-Watt University, Edinburgh.

1.1 Research Objectives

The aim of this research was to identify UK data sources for use in the EFFESUS project. Data will be used in the development of a multi-scale spatial model and an associated software tool.

The data sources needed to cover four categories:

1. **Building stock data** – e.g. age of building, typology, construction type
2. **Urban district / spatial data** – e.g. areas with buildings of a certain typology, building density and city limits
3. **Building energy use and CO_2 emission data**
4. **Climate zoning** – e.g. rainfall, wind-driven rain, sunshine, temperature

As well as identifying the appropriate data sources, it was important to analyse each data source in terms of its usefulness and relevance. The aims were to explore what data each source provides, limitations, access issues and relevance to the project's needs.

1.1. Report Outline

Chapter 2 provides an overview of the methodology for this report and is followed by an introduction to the data sources in chapter 3. The subsequent four chapters (4 – 7) detail the data sources identified for each of the main categories (building stock, urban district/spatial data, building energy use and CO_2 emissions, and climate zoning). Each data source is summarised in a table, with a short critique and discussion on applicability for the project. The beginning of each of these chapters also provides an overview of the data sources for that category. Chapter 8 summarises the main data sources which may be of use to the EFFESUS project, and provides key conclusions. Recommendations for EFFESUS are provided in chapter 9, and there is a glossary in the final chapter.

2. Methodology

The first stage of the methodology was to identify potential data sources that may provide relevant information. Many data sources were already identified prior to the research commencing, including those provided by Historic Scotland and commonly used by Changeworks or Heriot-Watt University. An internet search was carried out to identify other potential data sources. This included a wide range of sources from government reports, census information, national housing surveys and research work.

After the data sources were identified, each one was analysed in more detail to determine its relevance, any limitations and usefulness. This included analysing:

- Geographical applicability within the UK
- If data is freely available or not, and owner of data source
- Whether data is spatial or not
- Limitations of data source
- Whether data source can identify buildings built before 1945 or other historic buildings

A table detailing this information for each data source has been provided in the most relevant section.

The heading for each table is colour coded using a traffic light system:

- data sources considered **most useful**
- data sources of **some use**
- data sources **unlikely to be of use**

The accompanying Microsoft Excel spreadsheet also shows the colour attached to each data source.

Finally, an analysis was undertaken of how the data sources could be combined to produce the required data.

3. Introduction to data sources

The data sources are outlined in the next chapter. These are outlined under four categories:

a) Building stock data
b) Urban district / spatial data
c) Building energy use and CO_2 emission data
d) Climate zoning

Each category contains:

1. Detailed information on data sources that are deemed most useful
2. Links to detailed information on data sources that are useful, but are stored under other categories (since there is overlap between categories)
3. Data sources that are unlikely to be of particular use but are retained for information

A summary of the data sources, particularly those most relevant, along with a discussion of how data sources could be combined is in section 8.

The accompanying Microsoft Excel spreadsheet provides detail of all of the data sources identified.

4. Data sources: Building stock

4.1 Overview

This section provides data sources on building stock including data on whether properties are domestic or non-domestic, age of buildings, type of buildings, construction type, heritage-protection and architectural type. Sources detailed in this section are shown in the table below (click on the data source to go to this section).

This chapter contains a variety of data sources. Firstly, data on heritage protection (i.e. listed buildings and conservation areas) are essential to include in EFFESUS since it is focused on historic properties. This data can be obtained from national or local authorities but should essentially be the same data.

Data sources on building age, type and characteristics could be obtained from a variety of sources. HEED may provide the most reliable data for this purpose, but could be complemented with house condition surveys, for instance.

There are few data sources on non-domestic buildings, and so the Buildings at Risk register, although not very relevant, may actually be a useful source of information.

In addition, Google Streetview (from Google Maps) may be very useful for identifying certain visual characteristics of buildings such as height. However, this would be for specific buildings only.

Data Source	Summary of data provided
Listed Building Data	Identification of listed buildings
Conservation Area Data	Conservation area boundaries
Home Energy Efficiency Database (HEED)	Provides information on energy efficiency measures that have been installed, property characteristics. Data has been collated from a variety of data sources.
Home Analytics	Property characteristics and potential for energy efficiency measures. Based on probabilities, so accuracy at small scale is limited.
House Condition Surveys	Overview of housing in each nation – includes age, type, energy efficiency measures. Taken from a small sample so limited accuracy.

UK Housing Review 2012	Housing stock and finances. Data is mainly for England.
National statistics websites statistics websites	Variety of statistics including some on housing and fuel poverty
Building at Risk registers	Historic buildings deemed to be in a state of disrepair
Fuel poverty and ECO mapping	Identification of geographical areas in fuel poverty, and areas that are eligible for new ECO funding
Registry sources	Data on ownership and selling of properties
TABULA	EU project showing domestic and non-domestic properties, excludes UK.
Google Streetview	Photographic images of properties, allowing identification of specific properties such as building height and construction.

Other data sources, detailed in other sections, which may be relevant are:

- DECADE (Domestic Equipment and Carbon Dioxide Emissions)
- Digest of UK Energy Statistics (DUKES)
- EPC Register
- Housing Energy Fact File
- MLSOAs, IGZ and LLSOA
- Scotland's 2011 Census – contains data on the type of house, house size and main heating systems (not energy efficiency of buildings)

4.2 Listed Building Data

Data on listed buildings is held by each country within the UK and details of each of these sources is provided in tables below. This includes:

- Historic Scotland Data Services
- Listed Buildings in Wales GIS Point dataset
- National Heritage List for England
- Northern Ireland Listed Buildings Database

In addition there is a data source which contains UK-wide data: British Listed Buildings Online. This combines listed building information from Wales, Scotland and England into a single portal. In addition to the information contained in the country wide databases, this includes online mapping. This allows, for instance, all the Scottish sites to be viewed 'on the map'.

The Welsh site, a web portal that should allow a dataset of Welsh listed buildings to be downloaded, was not operational at the time of writing. Therefore the British source may be particularly useful. (Downloadable datasets for Welsh listed buildings should be available at http://jura.rcahms.gov.uk/NMW/start.jsp and http://data.gov.uk/dataset/listed-buildings-in-wales-gis-point-dataset.)

All of these data sources provide a database that is searchable for specific records. However datasets are not exportable via the website.

4.2.1 Historic Scotland Data Services

Historic Scotland provides an online database of listed buildings and this can also be downloaded as a GIS dataset. Similarly much of the interesting data is in a free text making it awkward to interrogate and compare.

Historic Scotland Data Services	
Website	http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2100:10:0::::CURRENT_GIS:about
Geographic coverage	Scotland
Owner / limitations on use	Historic Scotland Available to download. No limitations on use except through copyright.
Summary information	Information about listed buildings, noting points of architectural significance.
Description of spatial elements e.g. place specific or GIS	Addresses are given for listed buildings, but not post-codes. Information is available as GIS Downloads and GIS Web Services
Description of use for the assessment of historic buildings	Identifies all listed buildings in Scotland
Commentary on limitations, and enhancements needed	There is no information on the energy efficiency of buildings. For example there are no notes on the heating system employed or the age of the current boiler.
Complimentary, over lapping or matching data sets	Complements English Heritage and British Listed Buildings online. The webpage also provides a link to 'Past-map' the RCAHMS mapping webpage.
Data examples, illustrations and notes	
<u>Example of data</u> 10 and 11 Shore Street, Anstruther Easter (Ref:36145) This building is in the Fife Council and the Kilrenny Burgh. It is a category C building	

and was listed on 09/05/1972.

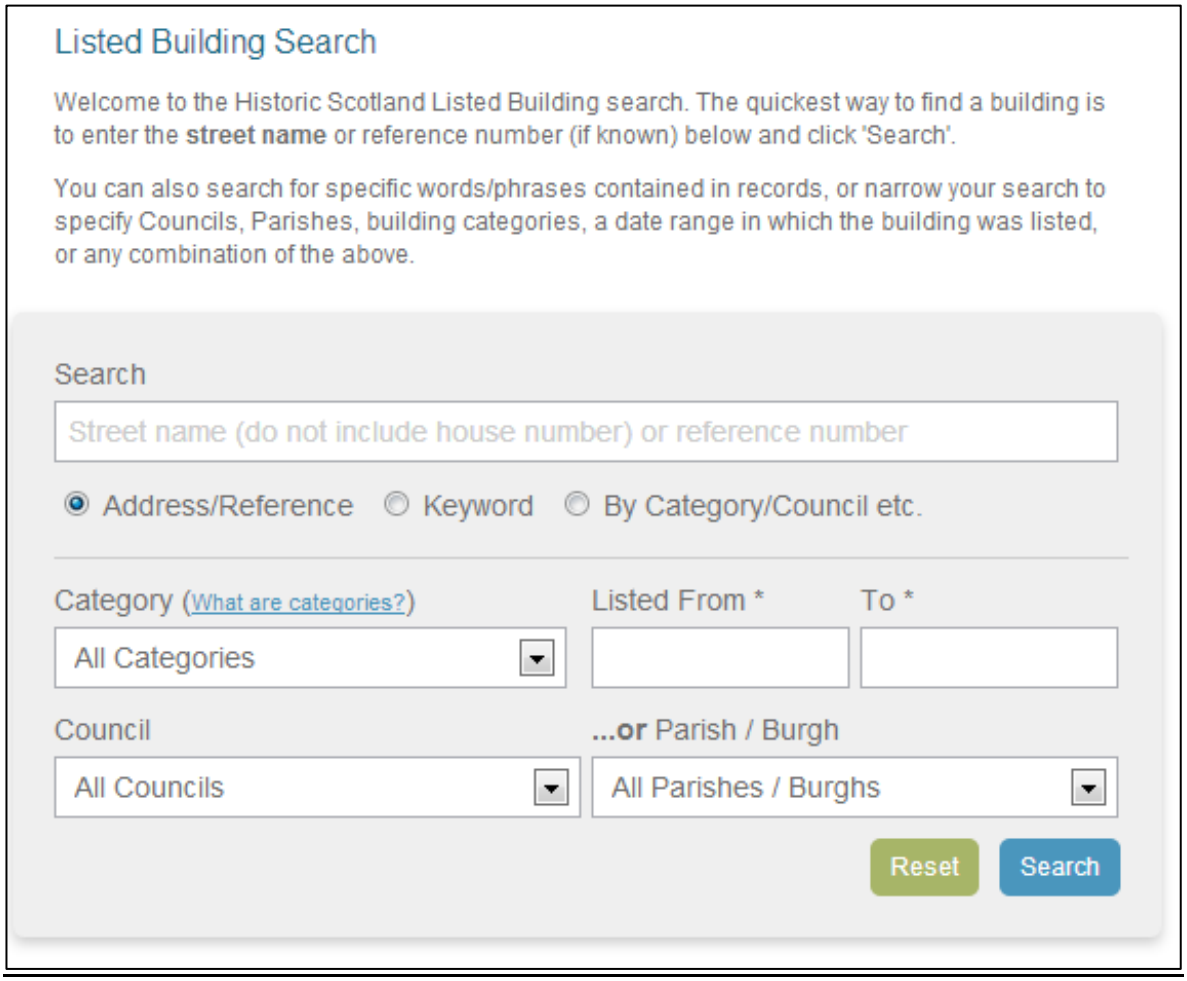
Group Items: N/A

Group Cat: N/A

Map Ref: NO

Description: 17th / 18th century; 3-storey 2-window painted stucco with margins, slated; windows widened with metal frames, 2 ground floor shops, 1 original.

Illustrations



4.2.2 National Heritage List for England

As with Historic Scotland, English Heritage provides an online database of listed buildings and this can also be downloaded as GIS shape files. This appears to be available free of charge, although a registration process is required.

National Heritage List for England	
Website	http://www.english-heritage.org.uk/professional/protection/process/spatial-data/
Geographic coverage	England
Owner / limitations on use	English Heritage GIS datasets are available to download from the website with login details which means adhering to user agreement.
Summary information	The National Heritage List for England identifies every listed building in England and has a web based database with which to search for properties. Alongside the buildings it also identifies other listed items that include: monuments, parks and gardens, wreak sites and buildings with preservation notices. The data includes shape files indicating the location and/or extent of the designation and basic textual information, for example, heritage asset name and number and date of designation
Description of spatial elements e.g. place specific or GIS	GIS shape files, each listing records a national grid reference
Description of use for the assessment of historic buildings	Allows all listed building to be identified on a map.
Commentary on limitations, and enhancements needed	Most of the detail of a property is in free text.
Complimentary, over lapping or matching data sets	Cross reference other parts of report

Data examples, illustrations and notes
Example of data House, with barn converted to annex. C17, late C18 and early C19 alterations and additions, further C20 work. Coursed and squared rubble, tile roofs, some stone tiles to eaves, coped verges, brick stacks. Irregular plan, irregular L-shaped road frontage, 2 storeys, 1:2 bays; that to left in a projecting wing with a front facing gable, 2-light wooden-mullioned windows and a 16-pane sash window; right return of wing with 16-pane sash windows; right 2 bays with 3-light casements with glazing bars to first floor, dormer gables; 3-light casement to ground floor. Door opening to right return, 6-panelled door. Former door opening in angle between wing and right range now blocked, 3-light casement inserted. Part of contiguous barn at right-angles to rear converted to flat (Holmans Annex). Interior with some early Cl9 features including fireplace and doors

4.2.3 Northern Ireland Listed Buildings Database

Northern Ireland Listed Buildings Database	
Website	http://www.nidirect.gov.uk/finding-a-listed-building
Geographic coverage	Northern Ireland
Owner / limitations on use	Northern Ireland Environment Agency The database is publicly available, so users can search for buildings which are listed. Further information is available for the Northern Ireland Environment Agency or from local authorities.
Summary information	The Northern Ireland Buildings Database holds information on over 9,000 historic buildings and each building is recorded individually. Most of these buildings have been listed for their special architectural or historic interest. Those that are not listed have been recorded as 'record only' on the database as part of the Second Survey of Northern Ireland's buildings. Whilst these buildings did not meet listing criteria many nevertheless make a valuable contribution to the built heritage or record thereof. The level of information available on each building differs as NIEA: PHB is updating current records by undertaking a Second Survey of buildings in Northern Ireland. The information available on buildings on the database which have been second surveyed is of greater detail. Users can contact NIBD to find out whether a building is listed.
Description of spatial elements e.g. place specific or GIS	Some properties will be listed with an OS map and grid reference, but not all properties have this information.
Description of use for the assessment of historic buildings	Many listed buildings will either be pre-1945 or historic; therefore identifying these properties is essential to the project.

Commentary on limitations, and enhancements needed	Does not appear to be downloadable as a map or GIS format.
Complimentary, over lapping or matching data sets	This is the only data source of listed buildings in North-ern Ireland.
Data examples, illustrations and notes	
Example of data HB Ref No: HB20/01/008 A Extent of Listing: House Date of Construction: 1780 - 1799 Address: Former Market House 28 Main Street Toomebridge Co Antrim BT41 3TF Townland: Toome Survey 2: B2 Date of Listing: 9/9/1974 Current Use: Shop Former Use: Market House OS Map No: 94/7 IG Ref: H9908 9065	

4.2.4 British Listed Buildings Online

This website combines listed building information from Wales, Scotland and England into a single portal. It extracts data from the datasets held by Historic Scotland and English Heritage (see previous) and in addition it includes online mapping so all the Scottish sites can be viewed 'on the map'. Since the Welsh Listed Buildings site is inoperative, it is a particularly useful source of data on Welsh listed buildings. As with the official listed buildings sites, the database is searchable for specific records but the dataset is not exportable via the website. However the data contained in this website should be treated with caution, as its accuracy is not verified by Historic Scotland or English Heritage.

British Listed Buildings Online	
Website	http://www.britishlistedbuildings.co.uk/
Geographic coverage	UK (Britain)

Owner / limitations on use	Data for this website is sourced from each nation's heritage organisation that is responsible for listed buildings: English Heritage, Historic Scotland and Cadw (Wales). Information is publicly accessible.
Summary information	A database of all listed buildings in the UK, excluding Northern Ireland
Description of spatial elements e.g. place specific or	Each building is plotted on a map and spatial data for that building is available on the database.
Description of use for the assessment of historic buildings	Could identify all buildings in any area. Note the database also includes other objects (e.g. sundial or telephone box) so it will show items that are not buildings. Only detailed examination will reveal their true nature.
Commentary on limitations, and enhancements needed	See above
Complimentary, over lapping or matching data sets	Based on Historic Scotland / English Heritage / Welsh data

Data examples, illustrations and notes

Example of data

Church of St Mary, Trelawnyd and Gwaenysgor

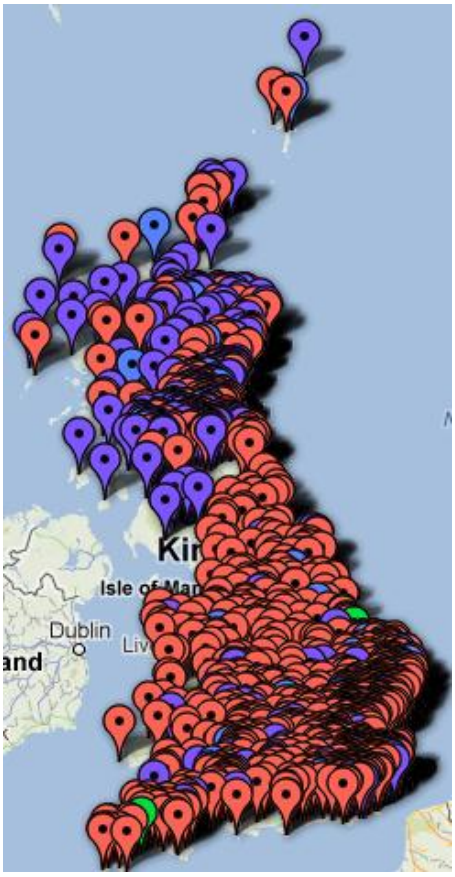
DESCRIPTION:	Church of St Mary
GRADE:	II*
DATE LISTED:	11 June 1962
CADW BUILDING ID:	280
OS GRID COORDINATES:	307519, 381028
LATITUDE/LONGITUDE:	53.3178, -3.3884
LOCATION:	Gwaenysgor, Rhyl
LOCALITY:	Trelawnyd and Gwaenysgor
COUNTY:	Flintshire
COUNTRY:	Wales
POSTCODE:	LL18 6EW

Listing text is not available for this building.

NOTES: In a walled churchyard in the centre of the village.

Illustrations

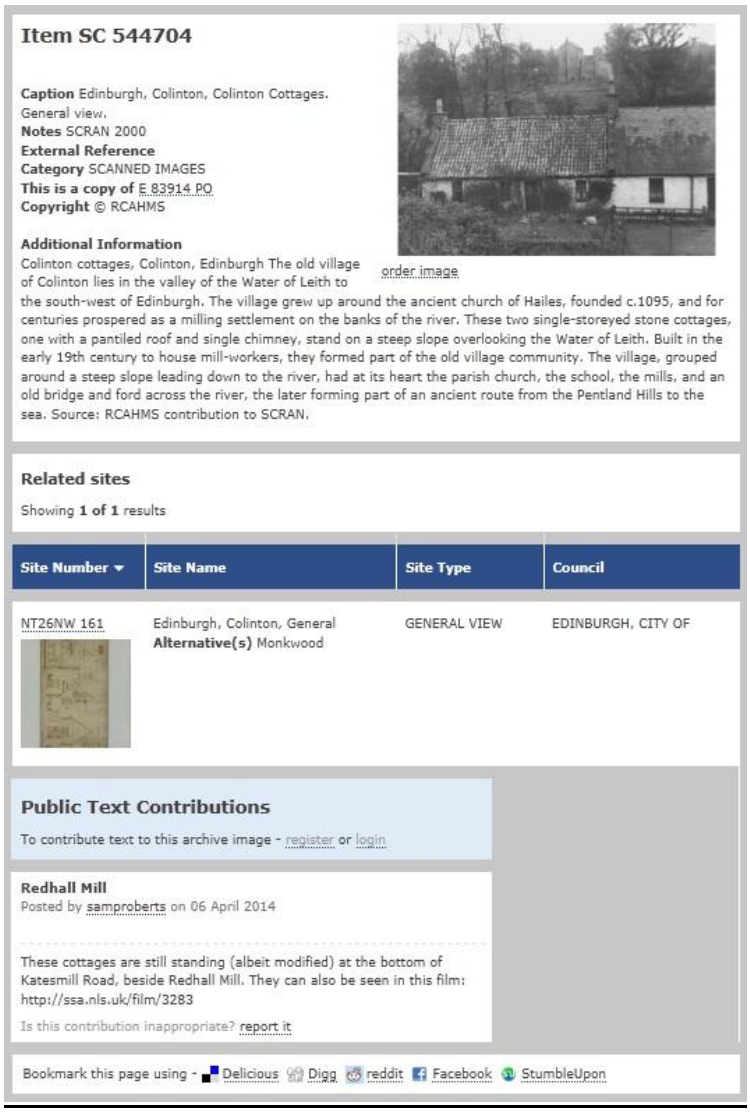
All listed buildings in England, Scotland and Wales plotted on a google map. You can zoom in and identify where all listed buildings are located.



4.2.5 Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS)

RCAHMS database – Canmore and Pastmap	
Website	http://canmore.rcahms.gov.uk/ http://pastmap.org.uk/
Geographic coverage	Scotland
Owner / limitations on use	RCAHMS The database is publicly available, so users can search for buildings which are listed and unlisted, considered of historic merit.

Summary information	Scotland's national collection of buildings, archaeology and industry. The Canmore website contains photographs (including aerial photography), drawings and survey information on a variety of important buildings both listed and unlisted. It also contains Pastmap, a mapping tool showing the location of each building/monument documented.
Description of spatial elements e.g. place specific or GIS	Properties and structures are shown on an OS Map and are linked back to Historic Scotland and Canmore archives for further information
Description of use for the assessment of historic buildings	Many buildings shown will either be pre-1945 or historic; therefore identifying these properties is essential to the project.
Commentary on limitations, and enhancements needed	Some limited functionality e.g. whether it is possible to search a GIS dataset.
Complimentary, over lapping or matching data sets	Historic Scotland listing number and website linked to each property
Data examples, illustrations and notes (following page)	



Item SC 544704

Caption Edinburgh, Colinton, Colinton Cottages. General view.
Notes SCRAN 2000
External Reference
Category SCANNED IMAGES
This is a copy of E 83914 PO
Copyright © RCAHMS

order image

Additional Information
Colinton cottages, Colinton, Edinburgh The old village of Colinton lies in the valley of the Water of Leith to the south-west of Edinburgh. The village grew up around the ancient church of Hailes, founded c.1095, and for centuries prospered as a milling settlement on the banks of the river. These two single-storeyed stone cottages, one with a pantiled roof and single chimney, stand on a steep slope overlooking the Water of Leith. Built in the early 19th century to house mill-workers, they formed part of the old village community. The village, grouped around a steep slope leading down to the river, had at its heart the parish church, the school, the mills, and an old bridge and ford across the river, the later forming part of an ancient route from the Pentland Hills to the sea. Source: RCAHMS contribution to SCRAN.

Related sites

Showing **1 of 1** results

Site Number	Site Name	Site Type	Council
NT26NW 161	Edinburgh, Colinton, General **Alternative(s)** Monkwood	GENERAL VIEW	EDINBURGH, CITY OF

Public Text Contributions

To contribute text to this archive image - register or login

Redhall Mill
Posted by samproberts on 06 April 2014

These cottages are still standing (albeit modified) at the bottom of Katesmill Road, beside Redhall Mill. They can also be seen in this film: http://ssa.nls.uk/film/3283

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4.3 Conservation Areas Data

Data on conservation areas is held by local authorities and Historic Scotland. This is essentially the same information and both are publicly available, but may be provided in different formats. This data is essential to the EFFESUS model. The data held by Historic Scotland is likely to be of most use as it is provided as a GIS shape file.

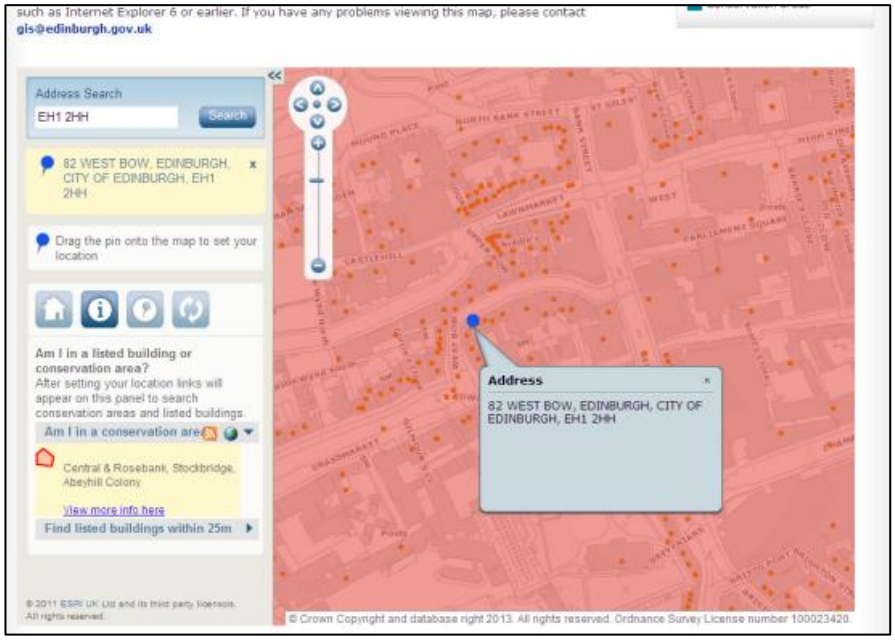
4.3.1 Local Authority Information

Local Authority Information	
Website	Website for each local authority.
Geographic coverage	UK
Owner / limitations on use	Local authorities hold the data. It is publicly accessible, although gaining access to GIS information is not readily available.
Summary information	Local authorities designate conservation areas on account of their special character. This allows enhanced planning control. In most cases this is through designating a boundary or envelope within which controls apply. In most cases conservation areas will be of historic character with a high concentration of older buildings. Maps are held by individual local authorities and usually available online. Depending on the local authority it should be possible to utilise this data to identify the most important groups of older buildings – although not all pre-1945 buildings are likely to be covered. In particular, common buildings dating from the 1920s and 1930s may not merit conservation status.
Description of spatial elements e.g. place specific or GIS	Conservation areas are inherently spatial as defined by a spatial boundary. Local authorities will hold data as GIS datasets, although what is publicly available through their websites may vary. Some local authorities (e.g. Edinburgh) have online GIS systems that allow online verification of whether a particular building is within a conservation area. Other local authorities (e.g. East Lothian) only have downloadable maps on their website, but might be able to extract a list of either streets or individual properties in a conservation area.
Description of for the assessment of historic buildings	Most but not all conservation areas will be defined by the number and character of historic buildings.

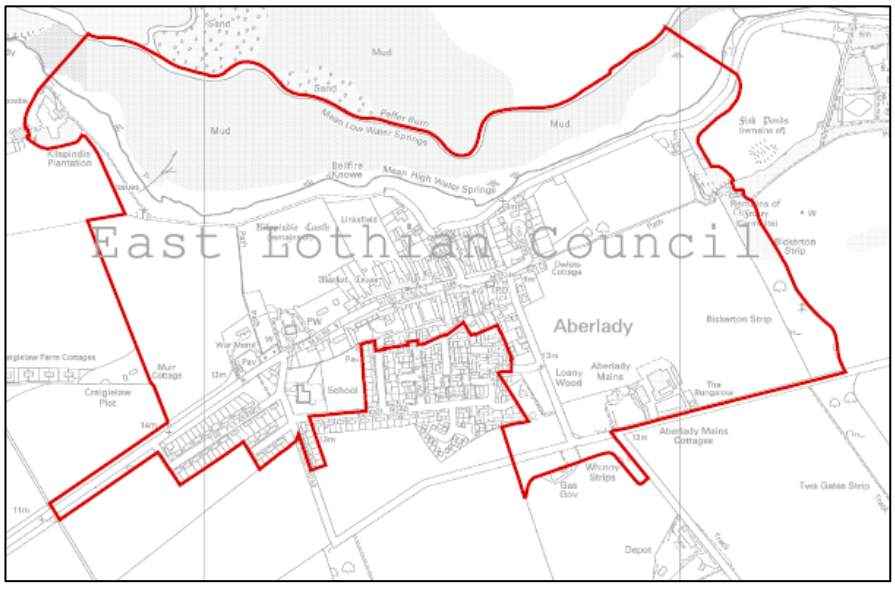
Commentary on limitations, and enhancements needed	Some limited functionality e.g. whether it is possible to search a GIS dataset, or extract GIS files of conservation areas.
Complimentary, over lapping or matching data sets	Will overlap with the data held by Historic Scotland (further on in this section).
Data examples, illustrations and notes	

Illustrations

Searchable map from the City of Edinburgh Council



Boundary map from East Lothian Council



4.3.2 Historic Scotland Data Services (Conservation Areas)

Historic Scotland Data Services	
Website	http://data.historic-scot-land.gov.uk/pls/htmldb/f?p=2100:10:0::::CURRENT_GIS:about
Geographic coverage	Scotland
Owner / limitations on use	Historic Scotland Available to download - no limitations on use except through copyright.
Summary information	Historic Scotland also holds spatial locations of conservation areas for Scotland with links online to the relevant local authority. This will be the same information as held by local authorities.
Description of spatial elements e.g. place specific or GIS	Information is available as GIS Downloads and GIS Web Services . Conservation area GIS shape file data can be downloaded which suggest it is possible to map the areas and to identify street/property addresses from this data. It is not clear whether it is possible to search the data for addresses or postcodes.
Description of use for the assessment of historic buildings	Most but not all conservation areas will be defined by historic buildings.
Commentary on limitations, and enhancements needed	To find out whether addresses or postcodes fall within a conservation boundary the address or postcode information is required to do this through a spatial query.
Complimentary, over lapping or matching data sets	Local authorities hold additional complimentary information such as Conservation Area Appraisals.
Data examples, illustrations and notes	
N/A	

4.4 Home Energy Efficiency Database (HEED)

HEED has been developed by the Energy Saving Trust on behalf of the UK Government to register the uptake of sustainable energy measures and related survey data throughout the UK housing stock. HEED holds a vast amount of information about the energy efficiency of domestic properties which has been gathered on a property basis from a variety of sources. This means the data is highly relevant and up to date; however there will be gaps in the data as installers often only collect essential information. Reports are available from a national level down to a data zone level (c. 500 homes), but data will be less reliable at a lower level. Whilst it has limitations, this data source is likely to prove one of the most useful data sources on the characteristics and energy properties of dwellings.

HEED online	
Website	http://www.energysavingtrust.org.uk/Organisations/Government-and-local-programmes/Free-resources-for-local-authorities/Homes-Energy-Efficiency-Database
Geographic coverage	UK national
Owner / limitations on use	Owned by Energy Saving Trust Is limited to certain non-commercial organisations engaged in activities related to the energy efficiency of UK's housing stock. This includes central and local government, not-for-profit organisations and organisations contracted by these organisations to carry out domestic energy efficiency related projects (provided that an individual from the contracting organisation requests the account on behalf of the commercial organisation). Access to data at Local Authority level is available to Universities, Community Groups and Not for Profit Organisations. Data can only be used for the purposes of energy efficiency monitoring, targeting and reporting and not for any other purpose. It cannot be used to cross reference other data. Access requires registration and costs may be incurred dependent on the complexity and level of custom report development required.

Summary information	Data includes: a) Property details: building type, full address building age band, insulation levels, building fabric and main heating system (this does not include any information on occupants). b) Recorded energy efficiency installations on a property-by-property basis e.g. those through fuel poverty energy efficiency schemes (Warm Deal, Central Heating Programme and Energy Assistance Package) or utility company schemes (EEC, CERT). Data is sourced from a wide variety of sources including energy suppliers, government scheme managing agents, local authorities and other landlords, EST Home Energy Checks as well as other EST programmes. This includes data from Home Energy Checks (HECs), Energy Performance Certificates (EPCs), CIGA cavity wall installations data, Corgi works notifications, FENSA installed double glazing and data from Government microgeneration schemes such as Clear Skies, Low Carbon Buildings Programme and SCHRI. However, it is not possible to tell where the data from a report has come from – some available data would over-ride other data. This is an online tool and three types of report can be generated: area-based schemes, installation summaries and status report. By special request, EPC reports can be provided that details both energy and carbon emissions based on properties that are in the EPC register. It currently has data on 43% of properties in Scotland.
Description of spatial elements e.g. place specific or GIS	Data is available from a national level down to datazone (c. 500 properties). Can be drilled down: Country – ESSac – Local Authority – Ward – Medium Super Output Area – Datazone. Certain governmental bodies can access data beyond datazone level to National Land and Property Gazetteer level. Reports are available in spreadsheet, HTML, Adobe Acrobat PDF and various other data formats, and are ac-

	cessed via a web based reporting application. No GIS yet.
Description of use for the assessment of historic buildings	Can be used to get statistical information on the proportion of properties which were built in a geographical location. An area based summary report will not provide filtering to look solely at properties within a specific building age. However information can be filtered to provide information on what installation measures have been recorded as being installed in properties of a specific age (Installation summaries). Some form of filtering for the "area based report" would be beneficial, e.g. to look solely at pre-war properties.
Commentary on limitations, and enhancements needed	Only properties assessed and classified by one of the sources listed above (e.g. HECs or EPCs) are included, leaving holes in the data. However, as the datasets are made from a variety of data sources (partial and complete), a great deal of caution should be used analysing the data. Local knowledge and cross referencing other data sources can be useful if profiling small geographical areas. It is anticipated that as more EPC assessments are carried out the dataset would become more robust. Older datasets supplied by installers, are likely to be less accurate and comprehensive than from existing energy efficiency schemes. The age bands reflect SAP and building regulations. This can identify bands pre-1900, 1900 to 1929 and 1930 to 1949. However, there is no guarantee that the collected survey data will accurately reflect the actual distribution on properties in a data zone. While data is collected on a property-by-property basis, users can only retrieve data on an aggregated basis. At present the smallest geographical area for the common user is by datazone level. This can be complicated when looking at specific geographical areas where datazone boundaries are not confined to these geographical areas (e.g. conservation areas). Ease of use could be made on further drilling down the geographical areas to full post-

	code level. Considering the amount of information that is contained within a full dataset (e.g. HEC or EPC), there are limitations to the range of report outputs. The process of using this on-line facility can be unintuitive and time consuming for processing.
Complimentary, over lapping or matching data sets	HEED includes data on installations of measures under CERT and EPC data. HEED can be matched with other data collected at data zone level, Medium Level or Super Output Area ward or local authority level.
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

HOMES ENERGY EFFICIENCY DATABASE (HEED)

Area Summary Report

(Edinburgh, City of)

Total homes in location: 234,091 | Total homes in HEED for location: 90,940 | Data Density: 38.8%

Property Type		
Flat / Maisonette	28,339	31.2%
Mid Terrace House / Bungalow	8,003	8.8%
End Terrace House / Bungalow	5,576	6.1%
Semi Detached House / Bungalow	14,187	15.6%
Detached House / Bungalow	12,407	13.6%
House (Unknown Detachment)	6,278	6.9%
Bungalow (Unknown Detachment)	104	0.1%
Unknown	16,046	17.6%
Total:	**90,940**	**100%**

Tenure		
Owner Occupier	60,966	67.0%
Privately Rented	3,409	3.7%
Rented from Local Authority	5,760	6.3%
Rented from Housing Association	1,864	2.0%
Other	113	0.1%
Social Housing	6,484	7.1%
Unknown	12,344	13.6%
Total:	**90,940**	**100%**

Loft Insulation		
Properties with no loft insulation	5,580	6.1%
Up to 24mm Loft Insulation	189	0.2%
25 - 49mm Loft Insulation	597	0.7%
50 - 74mm Loft Insulation	1,690	1.9%
75 - 99mm Loft Insulation	1,209	1.3%
100 - 149mm Loft Insulation	2,098	2.3%
150 - 199mm Loft Insulation	2,814	3.1%
200mm - 249mm Loft Insulation	2,609	2.9%
250 - 299mm Loft Insulation	21,734	23.9%
300mm or more Loft Insulation	1,451	1.6%
Loft Insulation Unknown	50,969	56.0%
Total:	**90,940**	**100%**

Property Age		
Built Pre-1900	6,108	6.7%
Built 1900-1929	6,657	7.3%
Built 1930-1949	12,895	14.2%
Built 1950-1966	14,396	15.8%
Built 1967-1975	12,212	13.4%
Built 1976-1982	3,826	4.2%
Built 1983-1990	3,941	4.3%
Built 1991-1995	3,141	3.5%
Built 1996-2002	129	0.1%
Built 2003-2006	49	0.1%
Built Part-2006		
Unknown Built Date	27,586	30.3%
Total:	**90,940**	**100%**

External Wall Type		
Cavity Wall Unfilled	4,195	4.6%
Cavity Wall Filled	38,499	42.3%
Solid Wall - Uninsulated	11,858	13.0%
Solid Wall - Externally Insulated		
Solid Wall - Internally Insulated		
Solid Wall - Built Insulated	705	0.8%
Unknown Insulation	35,683	39.2%
Total:	**90,940**	**100%**

Glazing Type		
Single Glazing	8,369	9.2%
1 - 24% Double Glazing	5	0.0%
25 - 49% Double Glazing	2,057	2.3%
50 - 74% Double Glazing	80	0.1%
75 - 99% Double Glazing	2,135	2.3%
Full Double Glazing	21,361	23.5%
Unknown Glazing	56,933	62.6%
Total:	**90,940**	**100%**

Main Heating Fuel		
Gas	72,491	79.7%
Electric	5,971	6.6%
Oil	156	0.2%
Solid Fuel	646	0.7%
LPG	115	0.1%
Biomass	15	0.0%
Unknown	11,546	12.7%
Total:	**90,940**	**100%**

Main Heating System		
Non-Condensing Regular Boiler	21,882	24.1%
Unknown	51,768	56.9%
Condensing Regular Boiler	7,317	8.0%
Non-Condensing Combination Boiler	4,077	4.5%
Condensing Combination Boiler		
HC - Back Boiler	1,935	2.1%
Electric Storage Heaters	3,008	3.3%
Community Heating	24	0.0%
Heat Pump		
Warm Air	657	0.7%
Room Heaters		
Other	272	0.3%
Total:	**90,940**	**100%**

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4.5 Home Analytics

Home Analytics contains a lot of useful data on properties (e.g. property age, type, number of beds, building footprint (m^2), wall type, loft insulation, glazing type, fuel and heating system). However, a high proportion of the data is "probable", so therefore should be used with caution – it may not be accurate for individual properties and is therefore better for area-based analysis only.

Home Analytics	
Website	http://www.energysavingtrust.org.uk/Organisations/Government-and-local-programmes/Home-Analytics-housing-data-and-analysis
Geographic coverage	UK nation
Owner / limitations on use	Energy Saving Trust Data is available on purchase of a licence. Energy Saving Scotland Advice Centres and local authorities have licences but can't share data with third parties.
Summary information	The model utilises data from installers and the England and Wales plus Scottish House Conditions Surveys. Individual property data combines Experian (QAS) and Royal Mail (PAF). It does not have addresses for every domestic property in Scotland. Includes data on property age, type, number of beds, building footprint (m^2), wall type, loft insulation, glazing type, renewable energy potential, occupancy, fuel and heating system.
Description of spatial elements e.g. place specific or GIS	Information on individual properties with building footprint areas (sometimes over-estimated). GIS co-ordinates and datazones are provided for each address.
Description of use for the assessment of historic buildings	Individual addresses with property ages can be filtered. Listed building grades are provided – these too could be filtered.
Commentary on limitations, and enhancements needed	A lot of the information is "probable". Caution should be taken, especially on an individual property basis. Less

	caution is needed for larger geographical areas, where the accuracy of the data is better understood.
Complimentary, over lapping or matching data sets	Installer data, combined Experian (QAS) and Royal Mail (PAF) data.
Data examples, illustrations and notes	
N/A	

4.6 House Condition Surveys

Each country in the UK carries out its own survey of domestic housing:

- House Condition Survey (HCS) – Northern Ireland
- English Housing Survey (EHS)
- Living in Wales Survey (LIWS)
- Scottish House Condition Survey (SHCS)

The House Condition Surveys provide detail on various aspects of domestic housing including age, tenure, size and energy efficiency properties (e.g. level of insulation). However, they have a small sample size and it is therefore doubtful whether they could accurately depict the variation in homes much beyond the level of local authority (where the sample size would average approximately 460 homes per local authority).

Note that there are no similar lists for non-domestic buildings, although there are lists of 'buildings at risk'.

4.6.1 House Condition Survey (HCS) – Northern Ireland

House Condition Survey (HCS)	
Website	http://www.nihe.gov.uk/index/corporate/housing_research/house_condition_survey.htm
Geographic coverage	Northern Ireland
Owner / limitations on use	Northern Ireland Housing Executive (NIHE) Data is laid out in a pdf document freely available from the NIHE website, with in-depth comparisons.
Summary information	Survey of 2,000 households comprising interviews and questionnaires. Topics include socio-economic and demographic variables, dwelling type, age and size, the Decent Homes standard, energy efficiency, insulation levels, boiler types. Also includes rural/urban location.
Description of spatial elements e.g. place specific or GIS	Data has been collected in every District Council (and 4 Council areas in Belfast); the data is not given by District Council, but should be available.
Description of use for the assessment of historic buildings	Could provide useful detailed information on particular age groups of dwellings.
Commentary on limitations, and enhancements needed	The number of surveys completed fell for the 2011 survey due to budget restraints, but 2,000 (rather than 3,000) still represent the 760,000 dwellings in NI.
Complementary, over lapping or matching data sets	The HCS informs UK stock reports, but due to the low numbers of housing in comparison with the overall UK stock, the NI HCS occasionally is excluded.
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

Example of data plotted for age of dwelling, HCS, 2011

Table 3.6 Dwelling Age - Dwelling Type

	Bungalow		Terraced House		Semi-Detached House		Detached House		Flat/Apartment		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Pre- 1919	17450	19.9	26240	29.9	*	9.2	30490	34.8	*	6.2	**87660**	**100.0**
	10.9		12.5		4.9		19.2		8.2		**11.5**	
1919-1944	*	11.8	21110	31.0	22660	33.3	11760	17.3	*	6.7	**68130**	**100.0**
	5.0		10.1		13.7		7.4		6.9		**9.0**	
1945-1964	23260	17.4	52980	39.5	37360	27.9	13820	10.3	*	4.9	**133960**	**100.0**
	14.5		25.3		22.6		8.7		9.8		**17.6**	
1965-1980	41010	24.2	64890	38.3	31240	18.4	18880	11.1	13530	8.0	**169550**	**100.0**
	25.6		30.9		18.9		11.9		20.3		**22.3**	
Post 1980	70290	23.4	44550	14.8	65920	21.9	83560	27.8	36380	12.1	**300700**	**100.0**
	43.9		21.2		39.9		52.7		54.7		**39.6**	
Total	**160020**	**21.1**	**209770**	**27.6**	**165220**	**21.7**	**158510**	**20.9**	**66480**	**8.7**	**760000**	**100.0**
	100.0		**100.0**		**100.0**		**100.0**		**100.0**		**100.0**	

4.6.2 English Housing Survey (EHS)

English Housing Survey (EHS)	
Website	https://www.gov.uk/government/organisations/department-for-communities-and-local-government/series/english-housing-survey
Geographic coverage	England
Owner / limitations on use	Department for Communities and Local Government (DCLG) Spreadsheet data tables are freely available via the gov.uk web portal. Bespoke requests for data are chargeable and made via the BRE. Cost depends on complexity of data request. Example cost given of £300 for an afternoon's work.
Summary information	Survey of 13,300 households every year comprising interviews and questionnaires, with approximately half of those interviewed having a physical inspection of their property (6,200 every year). Topics include socio-economic and demographic variables, dwelling type, dwelling size, the Decent Homes standard, energy efficiency, insulation levels, boiler types, neighbourhood and housing market.
Description of spatial elements e.g. place specific or GIS	Full access to the original dataset is available in SPSS format from the UK Data Archive. Information is presented at National level.
Description of use for the assessment of historic buildings	Could provide useful detailed (national average) information on particular age groups of dwellings.
Commentary on limitations, and enhancements needed	Freely available data is sorted by tenure, and a bespoke request would therefore be needed for historic dwellings for the stock model. Small sample: it is based on 13,000 homes and there are 26.47 million households in England.
Complementary, over lapping	The EHS informs other reports on the building stock and

or matching data sets	energy consumption of dwellings in England, such as the Housing Energy Fact File. Similar to the SHCS, however the age bands used are different (see images from the two sources).
Data examples, illustrations and notes	
N/A	

4.6.3 Living in Wales Survey

The Living in Wales household survey was an annual survey carried out from 2004 to 2008. It was based on face to face interviews with the household reference person or another appropriate adult in a sample of households across Wales. In 2004 and 2008 a property survey was also carried out, which meant that some respondents received a follow-up visit by a qualified surveyor to undertake a property assessment of their home. The information is all for Wales as a whole and on energy efficiency includes the following information:

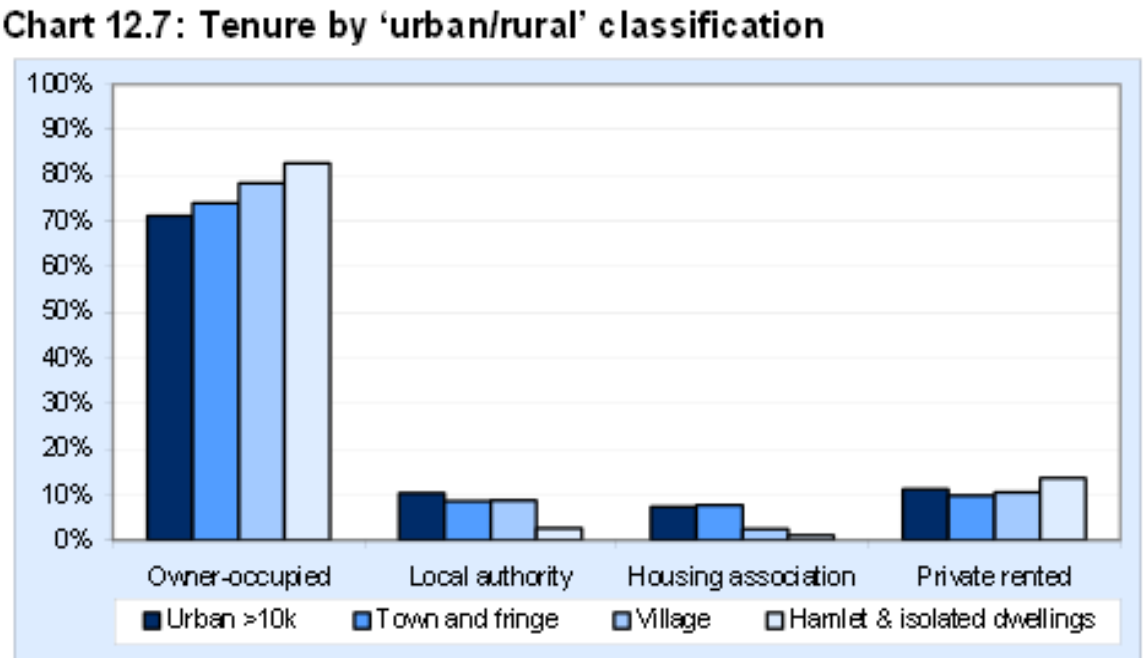
Living in Wales Survey (LIWS)	
Website	http://wales.gov.uk/about/aboutresearch/social/ocsropage/living-wales/?lang=en
Geographic coverage	Wales
Owner / limitations on use	Welsh Assembly Data is laid out in a pdf document freely available from the Wales.gov.uk website.
Summary information	An annual interview-based survey of 8,000 addresses between 2004 and 2008 (with property survey in 2004 and 2008). The Living in Wales survey covered all aspects of life in Wales, with a chapter on housing within it: tenure, over-crowding, utilities, health and safety, and finance.
Description of spatial elements e.g. place specific or GIS	Data has been collected in every local authority; the data is not given at this level, but may be available.
Description of use for the assessment of historic buildings	No information was collected on the age of the dwelling. Would provide little use in determining historic urban districts.
Commentary on limitations, and enhancements needed	The survey fails to identify historic homes, as this was not the primary aim of the survey. Additional sources of information would be needed. Alternative statistics publications for Wales reflect other areas of housing, for example the number of homes, and the numbers of homes achieving Code for Sustainable Homes certification, primarily new-build housing.

Complementary, over lapping or matching data sets	There is little overlap of this source with other sources outlined in these data sheets. The Survey has significant limitations in usefulness towards this project.

Data examples, illustrations and notes

Example of data with illustration

Example of data plotted for dwelling location by tenure, Living in Wales survey, 2008



"27 per cent of households had all possible insulation measures present; a further 48 per cent had some insulation measures present. 22 per cent of respondents didn't know whether some or all of the insulation measures were present.

26 per cent of those households located in 'urban' areas had all possible insulation measures present, this compared with 32 per cent of those households located in 'rural' areas. Only 14 per cent of those households in 'private rented' accommodation stated that they had all possible insulation measures present, this compares with 23 per cent in 'social housing' and 30 per cent in 'owner occupied' households.

Furthermore 7 per cent of those in 'private rented' accommodation stated they had no possible insulation measures present, compared with the 'all household' average of 2 per cent."

4.6.4 Scottish House Condition Survey (SHCS)

Scottish House Condition Survey (SHCS)	
Website	http://www.scotland.gov.uk/Topics/Statistics/SHCS
Geographic coverage	Scotland
Owner / limitations on use	Scottish Government Reports are available free on the Scottish Government website under the Open Government License (pdf). Ad hoc data requests can be made free of charge for be-spoke data sets (Excel).
Summary information	Annual survey of 3,000 homes in Scotland, concerning physical condition and experiences of the occupants. Data includes dwelling age, type, condition, tenure, urban/rural split, fuel use, EPC rating, CO_2 emissions, household income, insulation measures, fuel poverty metrics, Scottish Housing Quality Standard and condition of the dwelling (damp, condensation, disrepair). Data is also compared to previous years to identify trends.
Description of spatial elements e.g. place specific or GIS	Data for individual dwellings is not available. The data has been extrapolated for a national picture of housing, and no spatial data is available.
Description of use for the assessment of historic buildings	Ad-hoc data requests allow focus on particular age groups, e.g. for the number of detached pre-1919 dwellings, or the level of loft insulation in 1919-1944 age dwellings.
Commentary on limitations, and enhancements needed	Access to the dataset is not possible except through requests directly to the SHCS department. The sample size is small in comparison to the overall stock (0.6% of Scottish housing) and there is insufficient data to draw out information below the level of local authority. However, it is published as a National Statistics report, and is therefore robust.

Complementary, over lapping or matching data sets	The SHCS informs other reports on the building stock and energy consumption of dwellings in Scotland, such as the Housing Energy Fact File. Similar to the English Housing Survey, however the age bands used are different (see images from the two sources).

Data examples, illustrations and notes

Examples of data

Example of data from SHCS report:

Table 2 Type of dwelling by age of dwelling (000s)

Age of dwelling	Detached 000s	Semi-detached 000s	Terraced 000s	Tenement 000s	Other flats 000s	Total 000s	*Unweighted sample size*
Pre 1919	100	61	63	178	56	**459**	*590*
1919-1944	47	91	35	29	100	**303**	*422*
1945-1964	29	142	182	100	70	**523**	*747*
1965-1982	115	103	204	94	48	**565**	*768*
Post-1982	217	84	67	128	23	**519**	*692*
Total	**509**	**482**	**551**	**529**	**297**	**2,368**	***3,219***
Unweighted sample size	*801*	*691*	*781*	*557*	*389*	***3,219***	

Source: SHCS 2011

Example of data available using an Ad-Hoc request for pre-1919 dwellings:

Scottish House Condition Survey

Ad-hoc request

Scottish House Condition Survey

Request For pre-1919 dwellings□- Urban/rural split□- fuel poverty by type of dwelling□- NHER band by type of dwelling□- EPC rating by type of dwelling

Of pre-1919 dwellings:

		Detached		Semi		Terrace		Tenement		Other Flat		Total	
		Households	*Col %*	*Households*	*Col %*	*Households*	*Col %*	*Households*	*Col %*	*Households*	*Col %*	*Households*	*Col %*
Rural/Urban	*Urban*	31,000	29%	41,000	67%	37,000	56%	163,000	98%	51,000	91%	323,000	71%
	Rural	74,000	71%	20,000	33%	29,000	44%	3,000	2%	5,000	9%	132,000	29%
	Total	105,000	100%	62,000	100%	67,000	100%	166,000	100%	56,000	100%	455,000	100%
	Column Sample		*156*		*86*		*91*		*149*		*71*		*553*
Fuel Poverty	*Not Fuel Poor*	41,000	39%	44,000	71%	50,000	75%	123,000	74%	37,000	67%	294,000	65%
	Fuel Poor	64,000	61%	18,000	29%	17,000	25%	44,000	26%	19,000	33%	162,000	35%
	Total	104,000	100%	61,000	100%	66,000	100%	155,000	100%	52,000	100%	438,000	100%
	Column Sample		*152*		*83*		*90*		*140*		*66*		*531*
NHER band	*Poor*	27,000	26%	1,000	1%	2,000	3%	7,000	4%	2,000	4%	38,000	8%
	Moderate	69,000	66%	49,000	80%	34,000	52%	48,000	29%	30,000	57%	231,000	51%
	Good	8,000	8%	11,000	19%	30,000	45%	110,000	67%	21,000	40%	180,000	40%
	Total	104,000	100%	62,000	100%	66,000	100%	164,000	100%	53,000	100%	449,000	100%
	Column Sample		*153*		*84*		*90*		*147*		*68*		*542*
EPC	*B*	0	0%	0	0%	0	0%	1,000	0%	0	0%	1,000	0%
	C	2,000	2%	1,000	1%	7,000	10%	55,000	34%	7,000	13%	71,000	16%
	D	15,000	14%	22,000	36%	35,000	52%	77,000	47%	27,000	51%	176,000	39%
	E	48,000	46%	35,000	56%	23,000	34%	23,000	14%	14,000	26%	142,000	32%
	F	31,000	29%	4,000	6%	2,000	4%	5,000	3%	4,000	7%	46,000	10%
	G	8,000	8%	0	0%	0	0%	2,000	1%	1,000	2%	12,000	3%
	Total	104,000	100%	62,000	100%	66,000	100%	164,000	100%	53,000	100%	449,000	100%
	Column Sample		*153*		*84*		*90*		*147*		*68*		*542*

4.7 UK Housing Review 2012

The primary objective of the 20th edition of the UK Housing Review (initially called the Housing Finance Review), is simply to draw together key current financial and related data about both public and private housing in the United Kingdom, and rapidly assemble them in a coherent and accessible format. To that end, the Review draws on a wide range of expenditure plans and departmental reports, as well as official or other statistical volumes, survey reports, web portals and publications based on specific research projects.

The review contains some useful information such as property tenure, age, etc. but much of this is likely to overlap with house condition surveys. However, there will be some economic data which is not contained in the housing surveys.

UK Housing Review 2012	
Website	http://www.york.ac.uk/res/ukhr/
Geographic coverage	UK, values provided by Government region.
Owner / limitations on use	University of York/Chartered Institute of Housing. Data is freely available to all, in either pdf or Excel format.
Summary information	Collation of data regarding (primarily) England's housing stock, by Government region. Data includes tenure, property age, stock condition, private and social housing. Also includes house condition surveys and economics (expenditure, investment and rent) of Scotland, Wales and Northern Ireland.
Description of spatial elements e.g. place specific or GIS	Data is by Government region, since 1970.
Description of use for the assessment of historic buildings	Data contains tenure information of dwellings by property age.
Commentary on limitations, and enhancements needed	Government regions have been redefined since 1970, data uses the definition of the region for each particular year. Despite being published in 2012, much of the data is sourced prior to then, with little consistency across the categories as to when the data was collected.

Complementary, over lapping or matching data sets	The data will overlap with that contained in the Scottish House Condition Survey and English Housing Survey. The economic data, while not relating to the same dataset, should complement the data from those two surveys.

Data examples, illustrations and notes

	A	B	C	D	E	F	G	H	I	J	K
1	Table 30b Property age by tenure in Great Britain in 2004										
2	Percentages of households										
3											
4			Owner-occupiers			Social rented			Private rented		
5											
6			Owned	With	All	Local	Housing	All social			All private
7			outright	mortgage	owners	authority	association	rented	Unfurnished	Furnished	rented
8											
9	Property age										
10		Pre-1919	20	22	21	4	10	6	37	39	40
11		1919 - 1944	20	19	20	20	10	16	18	21	18
12		1945 - 1964	24	19	21	39	23	33	13	13	13
13		1965 - 1984	24	22	23	31	25	29	15	14	15
14		1985 or later	11	18	15	6	32	15	17	14	16
15											
16	Total		100	100	100	100	100	100	100	100	100
17											

4.8 National statistics websites

There are government websites which hold a large amount of data. This exists for Northern Ireland, Scotland, Wales and for the UK as a whole. There are statistics on fuel poverty and housing which may prove useful. However, a full analysis of these datasets cannot be carried out without knowing exactly what data is required; thus these datasets could be examined if there was missing information in the EFFESUS model.

4.8.1 UK National Statistics

UK National Statistics	
Website	http://www.statistics.gov.uk/hub/index.html
Geographic coverage	UK
Owner / limitations on use	Government owned. Most data should be publicly accessible.
Summary information	The site contains national statistics on a wide variety of subjects, including 'Business and Energy' and 'Housing and Households'. The data tends to be of national interest but, dependant on the topic, it may be broken down to local authority levels or lower. Some relevant energy information can be found, for example information on the Welsh Housing Quality Standard includes the proportion of homes across Wales with an acceptable energy rating. Within the Business and Energy section there is a Fuel Poverty subsection and this includes an Excel table showing the levels of fuel poverty at the sub local authority level across England
Description of spatial elements e.g. place specific or GIS	Most data will not be spatial, although there will be regional breakdowns.
Description of use for the assessment of historic buildings	
Commentary on limitations, and enhancements needed	This would require analysis of each individual dataset.
Complementary, over lapping or matching data sets	
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

LSOA Code	LSOA Name	LA Code	LA Name	English Region	All Households	Fuel Poor Households	Percent Fuel Poor
E01000001	City of London 001A	00AA	City of London	London	994	45	4.5%
E01000002	City of London 001B	00AA	City of London	London	846	40	4.7%
E01000003	City of London 001C	00AA	City of London	London	841	62	7.4%
E01000004	City of London 001D	00AA	City of London	London	1,480	41	2.8%
E01000005	City of London 001E	00AA	City of London	London	538	26	4.8%
E01000006	Barking and Dagenham 016A	00AB	Barking and Dagenham	London	620	68	11.0%
E01000007	Barking and Dagenham 015A	00AB	Barking and Dagenham	London	555	50	9.0%
E01000008	Barking and Dagenham 015B	00AB	Barking and Dagenham	London	492	43	8.7%
E01000009	Barking and Dagenham 016B	00AB	Barking and Dagenham	London	651	83	12.7%
E01000010	Barking and Dagenham 015C	00AB	Barking and Dagenham	London	990	123	12.4%
E01000011	Barking and Dagenham 016C	00AB	Barking and Dagenham	London	455	70	15.4%
E01000012	Barking and Dagenham 015D	00AB	Barking and Dagenham	London	664	55	8.3%
E01000013	Barking and Dagenham 013A	00AB	Barking and Dagenham	London	590	98	16.6%
E01000014	Barking and Dagenham 013B	00AB	Barking and Dagenham	London	627	96	15.3%
E01000015	Barking and Dagenham 009A	00AB	Barking and Dagenham	London	803	118	14.7%

4.8.2 Northern Ireland Statistics and Research Agency

Northern Ireland Statistics and Research Agency	
Website	http://www.nisra.gov.uk/
Geographic coverage	Northern Ireland
Owner / limitations on use	Northern Ireland Statistics and Research Agency. Most data will be publicly available.
Summary information	This portal) has much the same structure as UK Statistics online. Within the Housing and accommodation section, Excel tables are available that identify housing types and the absence or not of heating systems down to the census output area, as shown in the example below.
Data examples, illustrations and notes	

SOA	2011													
	All households	Households: No central heating	Households: Gas central heating	Households: Electric (including storage heaters) central heating	Households: Oil central heating	Households: Solid fuel (for example wood, coal) central heating	Households: Other central heating	Households: Two or more types of central heating	Households: No central heating (%)	Households: Gas central heating (%)	Households: Electric (including storage heaters) central heating (%)	Households: Oil central heating (%)	Households: Solid fuel (for example wood, coal) central heating (%)	Hou
Northern Ireland	703275	3766	120956	24671	437269	18120	4083	94410	0.54	17.20	3.51	62.18	2.58	
Abbey 1	636	1	126	125	346	10	1	27	0.16	19.81	19.65	54.40	1.57	
Abbey 2	621	7	46	28	502	11	1	26	1.13	7.41	4.51	80.84	1.77	
Abbey Park	904	6	3	34	682	41	6	132	0.66	0.33	3.76	75.44	4.54	
Academy	836	7	40	15	637	16	4	117	0.84	4.78	1.79	76.20	1.91	
Aghagallon 1	802	7	7	3	585	18	6	176	0.87	0.87	0.37	72.94	2.24	
Aghagallon 2	777	1	3	10	573	13	8	169	0.13	0.39	1.29	73.75	1.67	
Aghanloo 1	853	2	27	1	667	4	4	148	0.23	3.17	0.12	78.19	0.47	

4.8.3 Scottish Government Statistics

Scottish Government Statistics	
Website	http://www.scotland.gov.uk/Topics/Statistics/About/NationalStatistics
Geographic coverage	Scotland
Owner / limitations on use	Scottish Government
Summary information	As with the other websites, this provides data on a whole range of topics such as housing, economy, health, transport, etc. The most relevant dataset is likely to be the House Condition Survey, as outlined earlier.
Data examples, illustrations and notes	
N/A	

4.8.4 Stats Wales

Stats Wales	
Website	https://statswales.wales.gov.uk/Catalogue
Geographic coverage	Wales
Owner / limitations on use	Welsh Government
Summary information	StatsWales is the Welsh Government's free-to-use online repository for detailed statistical data for Wales. StatsWales allows users to view and manipulate datasets on-screen, including the ability to produce charts. Data can be downloaded in a variety of formats and can be saved and shared. The system covers nearly 1,000 datasets, including key information on Wales' population, economy, government spending and performance as well as the environment, education, transport and health. At the moment the data from the 2011 census is limited to four reports: Households with at least one usual resident by local authority; Usual resident population by broad age group and local authority; Usual resident population by single year of age and gender, Usual resident population by five year age band and gender. There is also no statistical information available on housing.
Data examples, illustrations and notes	
N/A	

4.9 Buildings at Risk Register

Historic buildings which are in a state of disrepair are defined as 'buildings at risk' in lists compiled by each nation. These buildings usually include listed buildings or those located in conservation areas.

These lists may be useful to the EFFESUS project to identify specific buildings or even types of buildings in an area. However, it will be of limited use as only buildings in poor condition are listed, and these buildings will not represent all types of buildings in an area. Data collected will not be a representative cross section and should be treated with caution. Aside from registers there are few other data sources for non-domestic properties.

Of all the lists, the Scottish website contains the most information about each building. Less information is available for buildings in Wales.

4.9.1 Save Britain's Heritage

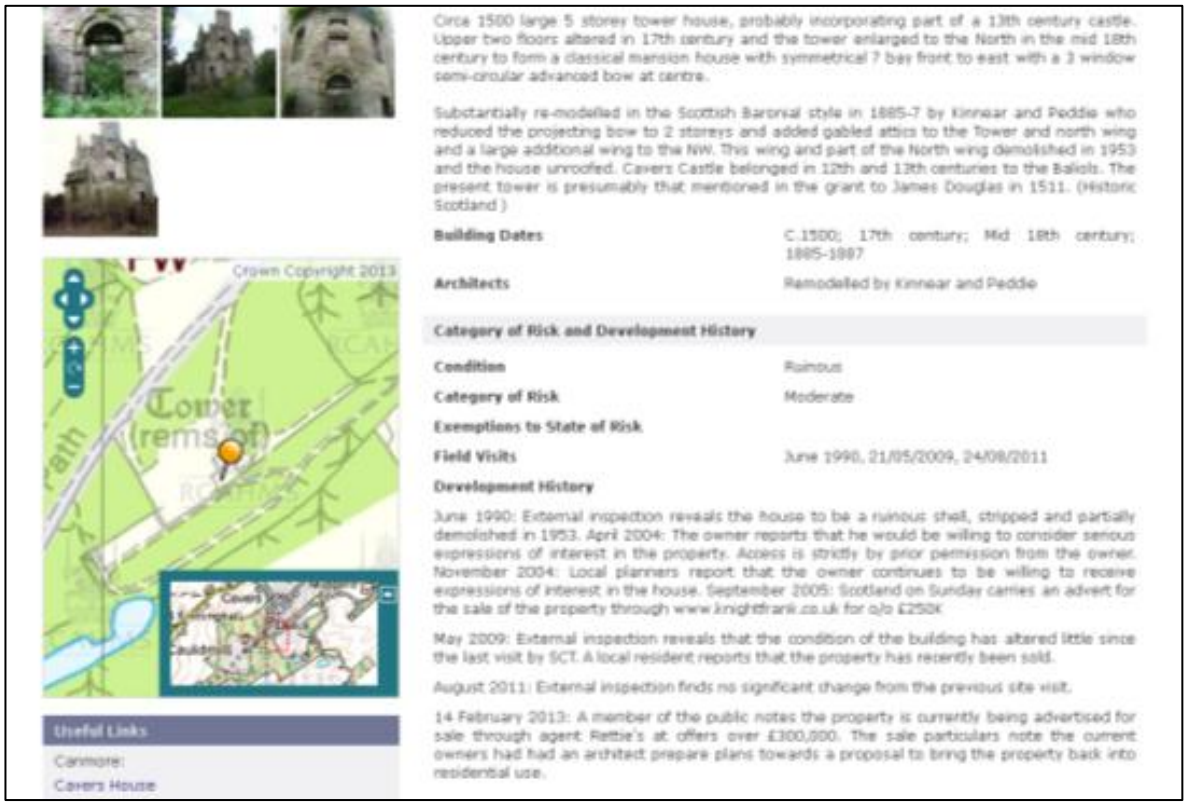
Save Britain's Heritage	
Website	http://www.savebritainsheritage.org/buildings_at_risk/
Geographic coverage	UK (Britain)
Owner / limitations on use	SAVE - only accessible to members.
Summary information	This website has a summary and photo of each building, which includes full address and post code.
Description of spatial elements e.g. place specific or GIS	It is not clear whether address and post code are provided for each building in the catalogue; however, contact details are provided so this data should be accessible.
Description of use for the assessment of historic buildings	Most of the buildings are historic properties.
Commentary on limitations, and enhancements needed	The full list could not be obtained to examine limitations.
Complementary, over lapping or matching data sets	The same data will be available in specific nation sites; although it cannot be checked if information is exactly the same.
Data examples, illustrations and notes	
Cross Winds, Oxhill **Status**: Unlisted **Planning Authority**: County Durham Dating to 1874, Cross Winds presents an opportunity to own and live in a unique building with bags of history and many retained period features. Converted by the current owner, the building boasts a double height living space which makes the most of the building's original use as a place of worship, four bedrooms, large gardens, and additional storage space suitable for a home business. With the hard work of converting the building to residential use already accomplished, Cross Winds could make an exceptional home. Whilst the current décor may not be to everyone's taste, the intrinsic qualities of the plain stone walls and gothic style windows and doors shine through, and combine to make something quite beautiful. For sale, £395,000.	

4.9.2 Buildings at Risk Register (Scotland)

Buildings at Risk: Register for Scotland	
Website	http://www.buildingsatrisk.org.uk/
Geographic coverage	Scotland
Owner / limitations on use	The Buildings at Risk Service compiles this data. It is publicly available.
Summary information	Provides a list and description of 'buildings at risk' in Scotland. These are usually buildings which are listed or located within a conservation area that meet criteria such as suffering from neglect or suffering from structural problems. Information on each building includes: • Name of building • Address and postcode • Planning authority • Reference number • OS Grid Reference • Historic Scotland reference number • Age of building • Description • Development history Buildings can be searched for by postcode or LA area. It is compiled from a number of sources, including local planners, Historic Scotland, local civic trusts, building preservation trusts, other heritage bodies and the public.
Description of spatial elements e.g. place specific or GIS	Map and OS Grid Reference provided for each building.
Description of use in relation to 1945 and historic buildings	All buildings on this list will be listed buildings or located in a conservation area. Age of property and history provided for each building.

Commentary on limitations, and enhancements needed	
Complementary, over lapping or matching data sets	Will overlap with the British list.
Data examples, illustrations and notes	

Example information for a building at risk:



4.9.3 Buildings at Risk Register (England)

Buildings at Risk: Register for England	
Website	http://www.english-heritage.org.uk/caring/heritage-at-risk/
Geographic coverage	England
Owner / limitations on use	English Heritage, but publicly available
Summary information	The information contained is similar to the list for Scotland but it contains less detail. This includes a short summary of the building, address, category and contacts.
Description of spatial elements e.g. place specific or GIS	There is limited spatial information on each building; an address is provided but no grid reference.
Description of use for the assessment of historic buildings	Majority of buildings listed on here will be historic.
Commentary on limitations, and enhancements needed	Contains limited data; little detail on each property and limited spatial data.
Complementary, over lapping or matching data sets	Will overlap with the British list.
Data examples, illustrations and notes	

United Reformed Church, High Pavement, Sutton in Ashfield, Ashfield, Nottinghamshire

Large urban Edwardian red brick church, formerly Congregational church. Designed in 1905 and built as a single construction. Internally, the church contains its original split-level tiered pine bench seating. Persistent water ingress through extensive range of complex slate roofs and valleys is causing significant internal damage and risking loss of high quality joinery bench pews and fittings. Grant offered in March 2011 and repairs expected to commence in 2012.

Asset Type:	**Place of Worship at Risk**
Name:	United Reformed Church
Street:	High Pavement
Parish:	Sutton in Ashfield
District/London Borough:	Ashfield
County:	Nottinghamshire
Parliamentary Constituency:	Ashfield
Region:	East Midlands
Postcode:	NG17 1BU
Designation:	Grade II listed building
List Entry Number:	1221994
Condition:	Poor
Priority Category:	D
Previous Priority Category:	D
New Entry:	No
Owner Type:	Religious organisation
Contact:	Principal Heritage at Risk Adviser 01604 735400

4.9.4 Buildings at Risk Register (Wales)

Buildings at Risk: Register for Wales	
Website	http://cadw.wales.gov.uk/historicenvironment/recordsv1/buildingsatrisk/?lang=en
Geographic coverage	Wales
Owner / limitations on use	Welsh Government / Welsh local authorities. Publicly available.
Summary information	Unlike the Scottish and English databases, there is not an online register of all buildings at risk in Wales (although it is being developed). Until this is developed, information on buildings at risk can be gained from local authorities. A number of local authorities have recently reviewed and updated their lists. A summary document across Wales was carried out in 2008 and is available online.
Description of spatial elements e.g. place specific or GIS	Local authorities will have location data for each building at risk (address and postcode). It is not clear whether any further spatial data is available.
Description of use for the assessment of historic buildings	The majority of these properties will be historic properties.
Commentary on limitations, and enhancements needed	A whole list of listed buildings across Wales is not yet available, so would need to contact individual local authorities. Local authorities are likely to have varying levels of detail on their at risk buildings.
Complementary, over lapping or matching data sets	Will overlap with the British list.
Data examples, illustrations and notes	
N/A	

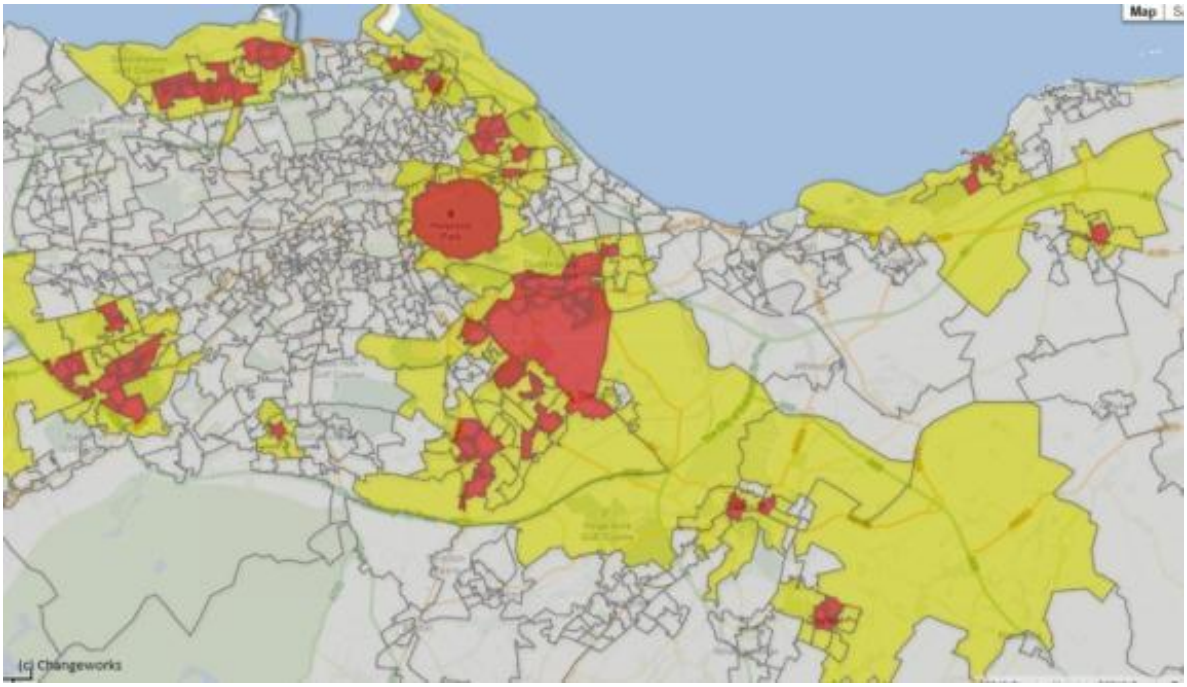
4.10 Fuel poverty and ECO mapping

Properties in low-income areas (defined through multiple deprivation indices) are eligible for new Energy Company Obligation (ECO) funding for energy efficiency improvements. These areas can be mapped using data obtained from UK and Scottish Government websites. For some historic areas, this could be useful for identifying funding sources for energy efficiency improvements. Changeworks initial investigation of eligible areas shows few are of a historic nature.

In addition, areas deemed to be in fuel poverty can also be mapped (see next table). Fuel poverty is defined as households who spend 10% or more of their income on household energy bills. Fuel poverty is usually a symptom of inefficient housing and/or low incomes. Therefore, this data could be used to highlight areas either with housing that is energy inefficient and/or where households are on low income and are struggling to pay their energy bills.

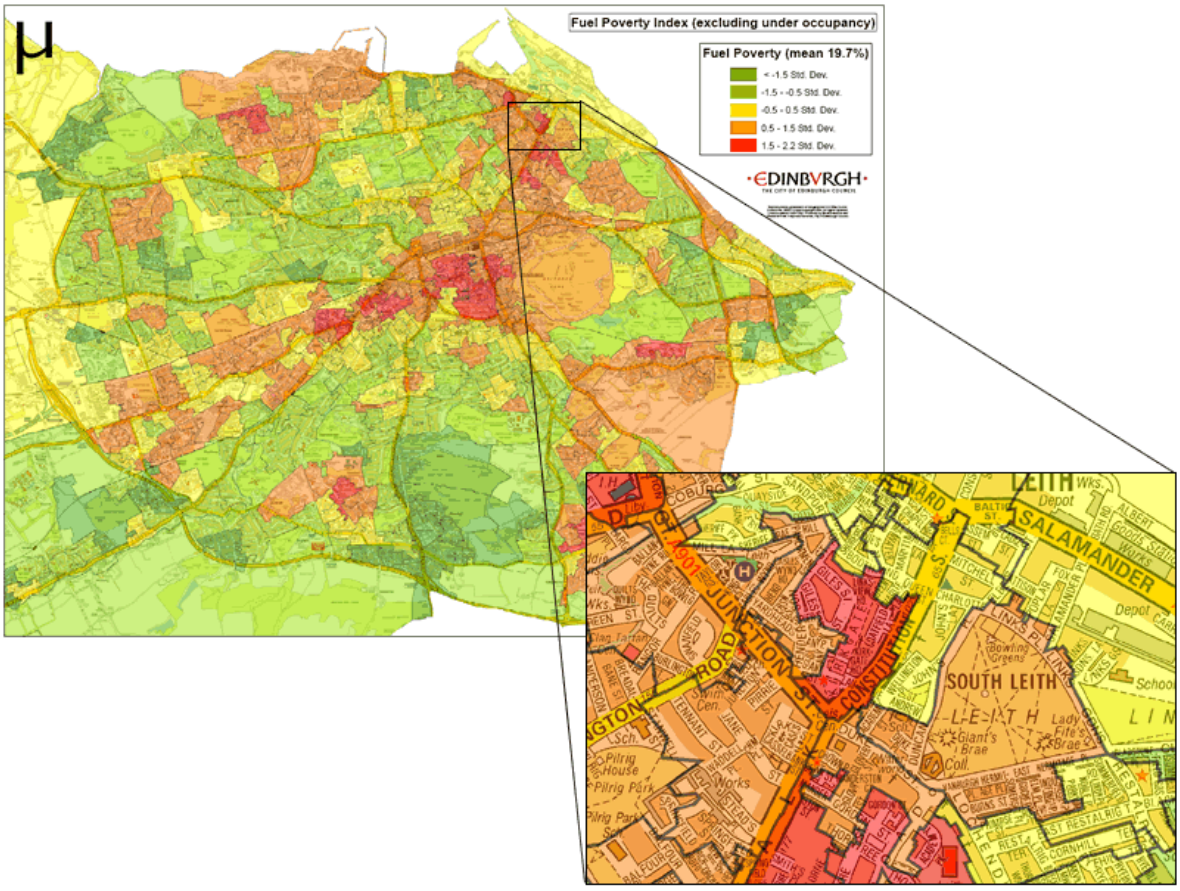
4.10.1 ECO eligible areas

ECO eligible areas	
Website	• England: http://www.communities.gov.uk/communities/research/indicesdeprivation/ • Scotland: http://www.scotland.gov.uk/Topics/Statistics/SIMD • Wales: http://wales.gov.uk/topics/statistics/theme/wimd/?lang=en
Geographic coverage	England, Scotland and Wales
Owner / limitations on use	Government data is available on low income areas (see weblinks above). This is publicly available. These areas can be mapped with GIS expertise.
Summary information	Energy Company Obligation (ECO) is a new policy providing funding for energy efficiency measures. One stream of funding (Carbon Saving Communities Obligation (CSCO)) is directed at properties in low income areas defined as the bottom 15% of ranked in the Indices of Multiple Deprivation (IMD). These are SIMD areas in Scotland and Lower Layer Super Output Areas (LSOA) in England and Wales. Adjoining areas are also eligible. These areas can be mapped using data available from UK and Scottish Government websites. They highlight areas eligible for ECO funding.
Description of spatial elements e.g. place specific or GIS	Available as GIS data.
Description of use for the assessment of historic buildings	This does not relate specifically to historic buildings. Generally focused on low income areas, where modern social housing is present rather than more affluent areas where historic buildings are often found.
Commentary on limitations,	The data isn't mapped and is defined by data zone rather than postcode making cross-referencing individual build-

and enhancements needed	ings more challenging.
Complementary, over lapping or matching data sets	Relates closely to Scottish Index of multiple deprivation
Data examples, illustrations and notes	
Example map of Edinburgh below showing eligible areas in red and adjoining areas (yellow). This analysis was carried out by Changeworks. 	

4.10.2 Fuel poverty mapping

Fuel poverty mapping (example)	
Website	n/a
Geographic coverage	Fuel poverty mapping could be carried out anywhere in Scotland. Similar data is likely to be available for rest of the UK, allowing mapping to be undertaken in virtually any location.
Owner / limitations on use	n/a
Summary information	Fuel poverty can be mapped spatially (this is not a direct data source, but mapping that could be carried out). For instance, the following fuel poverty map of Edinburgh was created by Changeworks in 2006. This was based on the Scottish Fuel Poverty Indicator (FPI) developed by Energy Action Scotland and Alembic Research using 2001 Census data. Areas in dark green are those with the lowest level of fuel poverty, and those in red are the highest proportion of fuel poverty.
Description of spatial elements e.g. place specific or GIS	Map and GIS data can be produced.
Description of use for the assessment of historic buildings	This is not specific to historic buildings; however, many areas with hard-to-treat housing often have high fuel poverty levels since energy bills in these properties are high. Some of these properties will be historic properties such as tenements.
Commentary on limitations, and enhancements needed	It provides an estimate of fuel poverty only, and is not directly measured (i.e. household incomes and fuel bills are not measured for each household in this scenario. However this is how most fuel poverty data is calculated.
Complementary, over lapping or matching data sets	Income data will feed into this analysis, and this also feeds into other data sets such as areas of multiple deprivation eligible for ECO. As it uses Census data, it also overlaps with this.

Data examples, illustrations and notes
Fuel poverty map for Edinburgh: 

4.11 Registry sources

The registry service is available in each UK country. It mainly provides information on ownership of property, their boundaries and recent sale prices for properties. It is therefore expected to be of limited use for understanding where energy efficiency improvements could be made.

4.11.1 Land registry

Land Registry	
Website	http://www.landregistry.gov.uk/
Geographic coverage	England and Wales Similar data is available in the Land Registry of Northern Ireland
Owner / limitations on use	It allows access to copies of title registers showing ownership details, copies of title plans showing property extent and flood risk indicator results.
Summary information	Provides information on property ownership, property boundaries and recent sale prices for more than 23 million registered properties in England and Wales. Expected to be of limited use for understanding where energy efficiency improvements could be made.
Description of spatial elements e.g. place specific or GIS	Provides spatial boundaries of properties.
Data examples, illustrations and notes	
N/A	

4.11.2 Land registers for Scotland

Land registers for Scotland	
Website	http://www.scotlandlandregistry.co.uk/
Geographic coverage	Scotland
Owner / limitations on use	
Summary information	The Registry of Scotland can provide a range of reports and information on properties in Scotland. This information generally pertains to prices, sales, ownership and boundaries, rather than any details about the property. It would therefore be of little value in targeting energy efficiency improvements.
Description of spatial elements e.g. place specific or GIS	Provides spatial boundaries of properties.
Data examples, illustrations and notes	
N/A	

4.12 TABULA

This is an EU project which provides data on domestic and non-domestic properties. Whilst it would be extremely useful data, there is no information provided for the UK (as it was not a project partner). Typologies for buildings have been created using input data including construction type, age, size, etc.

TABULA	
Website	http://www.building-typology.eu/ and http://webtool.building-typology.eu/
Geographic coverage	Number of EU states, but not UK
Owner / limitations on use	Data tool is an outcome from an Intelligent Energy Europe (IEE) funded programme. Publicly available.
Summary information	The project has created a data structure which can class buildings into typologies. This takes into a number of factors about the buildings including: type/size of building, region, floor area, etc. Provides data on residential properties such as size, age, energy consumption and potential impact on energy saving improvement. Also takes into account national climatic data. For 'exemplary' buildings, it provides data on visual appearance, commonly found construction elements and their U-values. Typologies for non-domestic buildings have also been created for some partner countries. This was deemed to be particularly useful as there is limited data on non-domestic buildings, and this had not previously been done.
Description of spatial elements e.g. place specific or GIS	n/a
Description of use for the assessment of historic buildings	Identifies the age of properties so would be useful in identifying the characteristics of historic properties. Also identifies 'exemplar' buildings which could include his-

	toric buildings.
Commentary on limitations, and enhancements needed	n/a
Complementary, over lapping or matching data sets	n/a
Data examples, illustrations and notes	
N/A	

4.13 Google Streetview

Google Street View is extremely useful for gathering or verifying some data on individual buildings. Only characteristics visible from the exterior of the property (and probably only one angle) can be verified and therefore there are obvious limitations. However, this can provide useful information on construction type, height and detail across the country. To gather this data would require the postcode or address of the property.

Google Streetview	
Website	http://maps.google.co.uk/
Geographic coverage	Global
Owner / limitations on use	Available for anyone to use. Images are copyright to Google.
Summary information	From Google Maps website, it is possible to click on 'street view' in order to get a photographic image of that street. This is extremely useful for verifying building height, detail, etc.
Description of spatial elements e.g. place specific or GIS	All data is accessible by searching under place name or postcode.
Description of use for the assessment of historic buildings	No information on age of buildings, but as it is visual would allow visual identification of these properties.
Commentary on limitations, and enhancements needed	It is very widespread across the UK and the majority of streets should be covered. Some photographs may be out of date, for example, may not show recent construction.
Complementary, over lapping or matching data sets	
Data examples, illustrations and notes (following page)	


2 Ashley Place, Edinburgh, Scotland, United Kingdom

5. Data sources: Urban district / spatial

5.1 Overview

This section provides detail on data sources that contain urban district / spatial data on properties, for example within city limits/wards or GIS data. Sources detailed in this section are shown in the table below (click on the data source to go to this section).

The gazetteers may be the most useful reference for providing a full list of properties in the UK, although it provides little other information and is not specific to pre-1945 properties. Census data could also be used for this purpose, although this may be less reliable. Census data could also be combined with maps from the national library from which pre-1945 settlements could be identified.

Data source	Summary of data provided
National Library of Scotland	Maps which may be used to identify pre-1945 settlements.
National Office of Statistics	Similar data held to the census (below) but also a source of more comprehensive data.
Gazetteers	Database of properties and their addresses. Regularly updated.
Census data	National survey of population; contains some useful information on household occupants.

Other data sources, detailed in other sections, which may be relevant are:

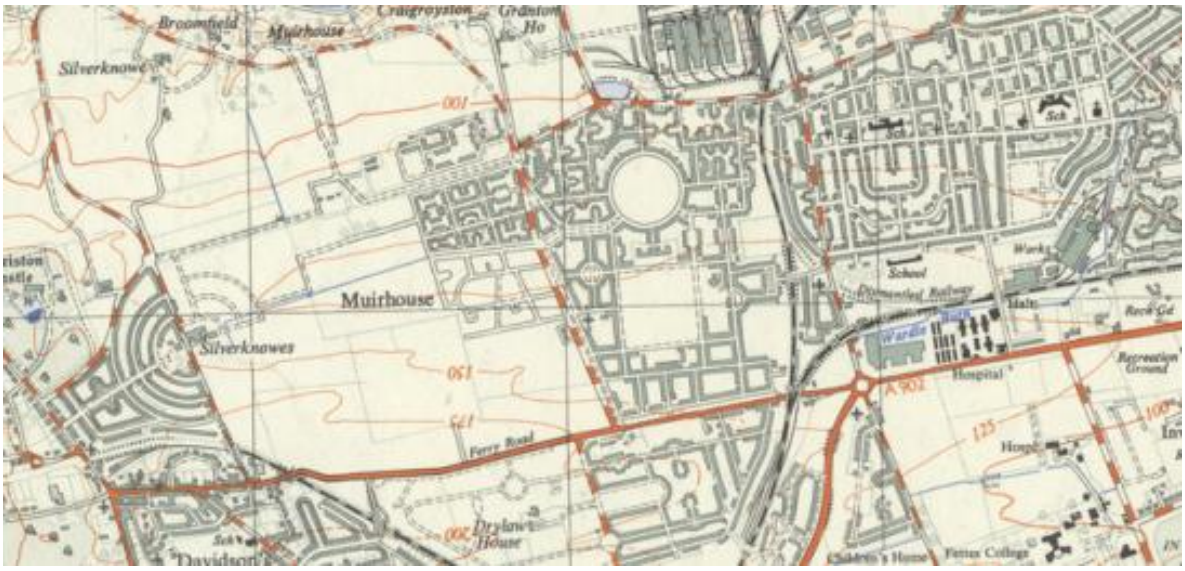
- Digest of UK Energy Statistics (DUKES)
- MLSOAs, IGZ and LLSOA

5.2 National Library of Scotland

National Library of Scotland	
Website	http://maps.nls.uk/
Geographic coverage	UK
Owner / limitations on use	Publicly available online
Summary information	The National Library of Scotland holds online copies of maps covering much of the UK. These include many historic maps such as the 1:50,000 Ordinance Survey map from 1945-47 and a 1:25,000 map made between 1937-61. These maps can be used to show where settlements existed that would have buildings dating from before 1945. (i.e. if they are not mapped in 1945-47 they must have been later developments).
Description of spatial elements e.g. place specific or GIS	These are maps but are not available as a GIS file.
Description of use for the assessment of historic buildings	Settlements built post 1945 could be identified from maps from this period, and therefore identification of pre-1945 settlements carried out.
Commentary on limitations, and enhancements needed	This methodology could be quite time consuming. Maps for required dates may not be available for all areas.
Complementary, over lapping or matching data sets	Could be used in conjunction with conservation area boundaries which are likely to include primarily historic areas.
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

Silverknowes, Muirhouse and Granton: at 1:25,000 mapped between 1937 and 61



Silverknowes, Muirhouse and Granton: at 1:50,000 mapped between 1945 and 48

5.3 Office for National Statistics

Office for National Statistics	
Website	http://www.ons.gov.uk/ons/index.html
Geographic coverage	UK
Owner / limitations on use	Publicly accessible.
Summary information	The Office for National Statistics holds very similar information to the General Registrar for Scotland based on the census. However it holds much more data and provides a compendium of statistical information for England and Wales. It also includes some information on Scotland, although the relevant information is covered by such sources as the Scottish House Condition Survey and Scotland's 2011 Census. As with the General Registrar for Scotland, data sets are available on an ad hoc basis although these may be chargeable, dependent on the nature of the request.
Description of spatial elements e.g. place specific or GIS	Most datasets are not spatial except for regional breakdowns.
Description of use for the assessment of historic buildings	Most data does not relate to pre-1945 stock.
Commentary on limitations, and enhancements needed	This analysis would need to be undertaken in reference to specific datasets.
Complementary, over lapping or matching data sets	Will be the source of a number of other data sources, such as house condition surveys.
Data examples, illustrations and notes	
N/A	

5.4 Gazetteers

Gazetteers provide a comprehensive address list of properties across the UK and spatial information on properties. This should be relatively up-to-date as it will be updated by local authorities when, for example, new buildings are built. The database holds little information on each property but it could be used to cross-reference against other data. It is likely to be the most comprehensive data on all properties, although other data sources may contain just as relevant information on the pre-1945 stock.

5.4.1 One Scotland Gazetteer

One Scotland Gazetteer	
Website	http://www.onescotlandgazetteer.org.uk/
Geographic coverage	Scotland
Owner / limitations on use	This forms part of the Customer First programme which has been developed in partnership with all Scottish local authorities, managed by the Improvement Service with the Convention of Scottish Local Authorities (COSLA) and the Society of Local Authority Chief Executives (SOLACE). It is a Scottish Government-backed programme. One Scotland Gazetteer data is available to all Scottish public sector organisations and any organisation that is a member of the One Scotland Mapping Agreement. It is not currently commercially available.
Summary information	An address database made up of all 32 individual local authority gazetteers. This includes information from local authorities (such as house number, town and locality), and Royal Mail (post town and postcode). Some local authority data comes through planning applications and building warrant completions, to show when properties are created or demolished. Data is available either through a web service or as an export (Scottish Data Transfer Format (SDTF) as a CSV file). A subset of data may be supplied to match specific requirements.
Description of spatial elements e.g. place specific or GIS	Addresses are spatially referenced.
Description of use for the assessment of historic buildings	Not clear whether building age is provided.
Commentary on limitations, and enhancements needed	This provides address information only so will be of limited use. Only available in Scotland.

Complementary, over lapping or matching data sets	It uses Open Space data from Ordnance Survey.
Data examples, illustrations and notes	

Searching for an individual property produces a map of the location:

5.4.2 National Land and Property Gazetteer

National Land and Property Gazetteer	
Website	http://www.nlpg.org.uk
Geographic coverage	England and Wales
Owner / limitations on use	The Data Co-operation Agreement issued by GeoPlace™ LLP to all District, County and Unitary councils in England and Wales, provides for a legally binding agreement between the parties to support the creation and maintenance of GeoPlace Databases (particularly related to address and street information for England and Wales and address information for Scotland through separate agreements). Local authorities will have access to this data but commercial bodies would need to purchase the data.
Summary information	This is an authoritative national address list providing unique identification of land and property. The NLPG is updated on a continual basis by every local authority in England and Wales - the bodies with statutory responsibility for street naming and numbering, with updates available every working day. The NLPG and NSG provide the foundation of the national address gazetteer database, together with data from Royal Mail and Ordnance Survey. Local authorities legal responsibilities place them at the source of the property lifecycle for addressable objects. Activities such as street naming and numbering, planning applications, building and environmental control, licensing, electoral registration, council tax and non-domestic ratings repeatedly bring local authorities in contact with land and property enabling documentation of its lifecycle. The NLPG was initiated in 1999 to become the master address dataset for England and Wales. It is the central hub for the 348 address creating local authorities' Local Land and Property Gazetteers (LLPGs), which are also knows as Authority Addressing Datasets.

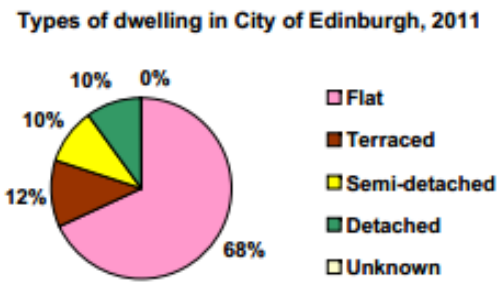
Description of spatial elements e.g. place specific or GIS	Addresses are spatially referenced.
Description of use for the assessment of historic buildings	Not clear whether building age is provided.
Commentary on limitations, and enhancements needed	This provides address information only so will be of limited use.
Complementary, over lapping or matching data sets	This uses Open Space data from Ordnance Survey.
Data examples, illustrations and notes	
N/A	

5.5 Census Data

5.5.1 Scotland's Census data

The most recent census was carried out in 2011; so the data contained in this is up-to-date. It contains information on households such as type of property (flat, semi-detached house etc.), numbers of rooms, main heating systems and tenure and ownership. Detail beyond this is limited and most of the other information is related to occupants. So whilst information from the census is limited, it may be useful to cross-reference against other data sources.

Scotland's 2011 Census	
Website	http://www.scotlandscensus.gov.uk/en/censusresults/
Geographic coverage	Scotland
Owner / limitations on use	General Registrar's Office for Scotland The data is publically available and commissioned tables are available under an Open Government Licence. Data is not available on individuals but will become available down to census output areas (no smaller than 20 households and 50 individuals).
Summary information	Information about people and their households as of 27 March 2011. Data is likely to be available down to census output area (50 to 100 homes) and datazone (300-500 homes). The General Registrar's Office for Scotland compiles census data for the whole of Scotland. The most recent census was in 2011 so the data is up to date. However not all information from the census has been released and the timetable for release of data (Scotland's 2011 Census Outputs Prospectus, Published on 6 November 2012) suggests that the detailed information at datazone or census output area that might show where homes without heating systems are concentrated will not be available until Winter 2013, and even then this might have to done as a bespoke piece of work. The census will form the most detailed profile of house-

	holds and included questions on type of accommodation (flat, semi-detached house etc.), numbers of rooms, main heating systems and tenure and ownership. Alongside these questions about the house are other questions such as car ownership, health, employment, education, travel that could be used to build up a picture of a households' likely prosperity. It is therefore probably the most comprehensive source of data.
Description of spatial elements e.g. place specific or GIS	Data will be available in a variety of spatial formats, down to census output areas. Tables will be available to convert between postcodes, data-zones and census output areas).
Description of use for the assessment of historic buildings	There is no scope within the census to identify buildings that are pre-1945 or historic. There is, however, information on main heating systems and the ability to infer prosperity.
Commentary on limitations, and enhancements needed	See above. This data could be used in conjunction with other data sources (such as listed buildings databases) to determine what geographic areas may be good prospects for improving the energy efficiency of particular buildings.
Complimentary, over lapping or matching data sets	The questions used are the same as for the census elsewhere in the UK, but the process of dissemination is conducted at the Scotland level. This means that the same data may not be available at the same time across the UK.
Data examples, illustrations and notes	
	

6. Data sources: Building energy use and CO_2 emissions

6.1 Overview

This section provides detail on data sources that cover building energy use, CO_2 emissions and energy generation. Sources detailed in this section are shown in the table below (click on the data source to go to this section).

There are a number of sources providing different information on energy. One of the most useful sources will be MSLOAs, IGZ and LLSOA which provide domestic and non-domestic energy consumption for geographical areas. This is also likely to be the best source of data for CO_2 emissions; this can be calculated by multiplying average energy consumption by CO_2 factors for each fuel (available on the DECC website). Above this level, data is only available for local authorities on their CO_2 emissions at National Atmospheric Emissions Inventory.

Other data sources in this section can provide regional or national overviews of energy use and generation; this may be useful as an overview but less useful for integration into the database model for EFFESUS as they do not provide data on a lower resolution. Data sources described in other sections, such as HEED and Home Analytics, will be useful in providing energy efficiency ratings of housing stock which could be cross-referenced against property characteristics.

Data source	Summary of data provided
Annex 42 of the Energy Conservation in Building & Community Systems Program	Simulation model from 1990s on energy use.
BPIE Data HubBPIE Data Hub	EU database showing energy consumption and energy efficiency measures potential.
DECADE	Data on domestic electric appliance use.
Digest of UK Energy Statistics (DUKES)	Non-spatial (aside from some regional data) on energy consumption and production.
EPC register	Collation of EPC data, which shows energy efficiency rating of properties and recommended improvements.
Housing Energy Fact File	Comprehensive annual review of energy use in homes.

Low Energy Buildings Database (LEB)	Information from 100 retrofit case studies across the UK.
MLSOAs, IGZ and LLSOA	Domestic energy consumption in geographical areas.
Energy Consumption in the UK (ECUK)	Overview of energy consumption in the UK.

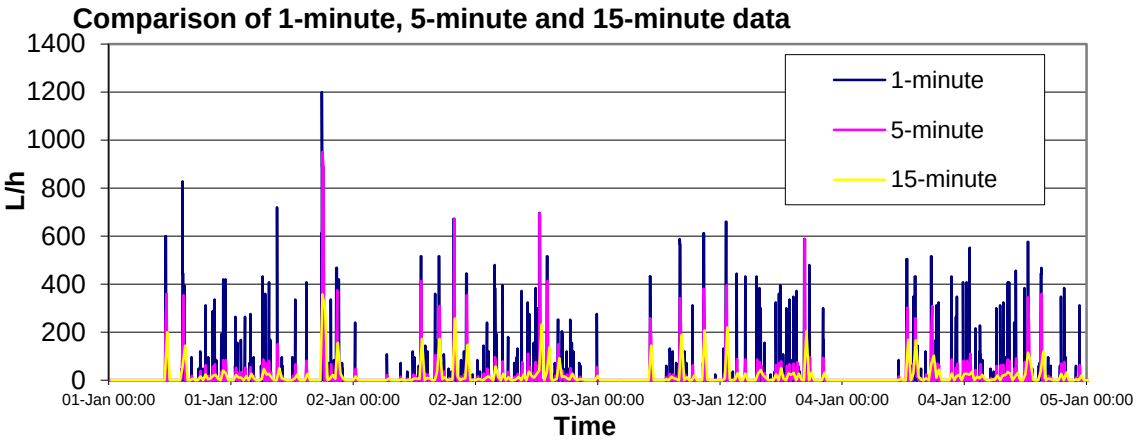
Other data sources, detailed in other sections, which may be relevant are:

- Home Energy Efficiency Database (HEED) – records of energy efficiency measures installed through previous schemes and property characteristics.
- Home Analytics - property characteristics including energy efficiency, based on probabilities.
- House Condition Surveys – dwelling characteristics, including some detail of energy efficiency levels such as insulation levels.

6.2 Annex 42 of the Energy Conservation in Building & Community Systems Program

This is a simulation model for co-generation systems. It was created in the 1990s and therefore is not very up-to-date. However, many studies have drawn upon this data.

Annex 42 of the Energy Conservation in Building & Community Systems Program	
Website	http://www.ecbcs.org/annexes/annex42.htm#p
Geographic coverage	UK
Owner / limitations on use	International Energy Agency (IEA) Data is free to download from the website
Summary information	The Energy Conservation in Buildings and Community Systems Programme (ECBCS) from the IEA was designed to facilitate and accelerate energy conservation and sustainable technology implementation through innovation and research. Of the 50 annexes across the larger project, Annex 42 developed simulation models to advance the design, operation and assessment of cogeneration systems for the domestic sector. Despite the age of the data (1990s), this was a seminal piece of research and *numerous* studies have been carried out using the data from the project.
Description of spatial elements e.g. place specific or GIS	This is a non-spatial source of data.
Description of use for the assessment of historic buildings	The load profiles and data used are not specific to 1945 and historic buildings, but are more concerned with occupancy and electrical use than energy use associated with the buildings, and could be applicable to all dwellings.
Commentary on limitations, and enhancements needed	There is currently no description of the dwellings used except dwelling type, so it is unclear if any of the datasets were from a historic dwelling.
Complementary, over lapping or matching data sets	Despite the age of the data (1990s), this was a seminal piece of research and *numerous* studies have been carried out using the data from the project.

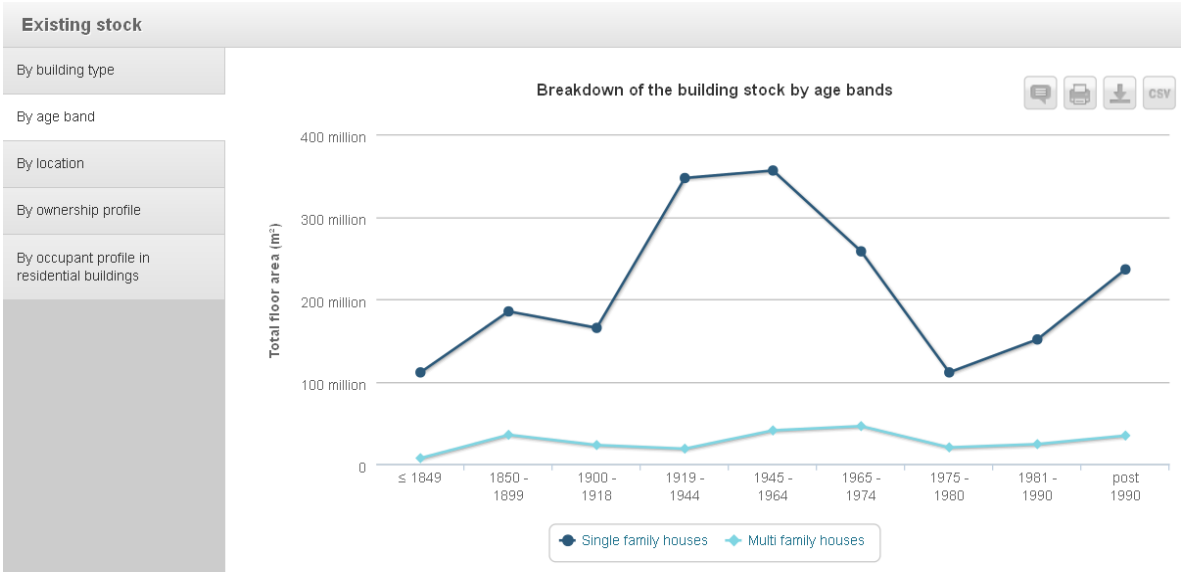
Data examples, illustrations and notes
Example DHW load profile for 5 days: 

6.3 BPIE Data Hub

This is an EU wide database highlighting an overview of energy usage, policies, existing stock and envelope performance. It may be useful as an overview, but does not provide property specific information and in addition, there are limits to its coverage within the UK.

BPIE Data Hub	
Website	http://www.buildingsdata.eu/
Geographic coverage	UK
Owner / limitations on use	Buildings Performance Institute Europe
Summary information	A database of energy policy, energy usage, envelope performance, district heating, climatic zones, and the existing stock across the EU. Results of searches are freely available, and data behind the results is not available, although in each case the source is provided. Source for the UK is the BRE, suggesting much of the data provided in the BPIE Data Hub is available elsewhere.
Description of spatial elements e.g. place specific or GIS	Data is by member state, therefore single top level for the UK, with the only split below that being for rural and urban housing numbers.
Description of use for the assessment of historic buildings	Buildings can be identified by building age, although data specific to those buildings is not available.
Commentary on limitations, and enhancements needed	Information can be uploaded to the site; greatly needed for the UK as currently the database has gaps with respect to the devolved nations, so some data is shown as UK, but in the notes is limited to England & Wales only.
Complementary, over lapping or matching data sets	Much of the data comes from the BRE, suggesting the data is available in other formats from sources within the UK already, for example in the Housing Energy Fact File, which relies on data from the BRE.

Data examples, illustrations and notes



6.4 DECADE

An EU Save programme, based at the Environmental Change Unit of Oxford University. DECADE was a two year project to assemble market, behavioural and other information about domestic electric appliances (including lighting) and, using this data, constructed a model of electricity use in the UK domestic appliance sector.

DECADE	
Website	http://www.eci.ox.ac.uk/research/energy/decade.php
Geographic coverage	UK nation
Owner / limitations on use	Environmental Change Institute (ECI) at University of Oxford. Findings and reports are freely available to download from the ECI website. The dataset used to inform the reports is not available.
Summary information	A two year project to assemble market, behavioural and other information about domestic electric appliances (including lighting) and, using this data, constructed a model of electricity use in the UK domestic appliance sector. Used actual consumption data to inform the model as a check on model accuracy.
Description of spatial elements e.g. place specific or GIS	Non-spatial source of data
Description of use for the assessment of historic buildings	Model provides averages and is unable to focus on a particular house type, as it more related to ownership and occupancy. Nevertheless, it is a good source of information for average electrical energy use.
Commentary on limitations, and enhancements needed	The research includes ownership of appliances and consumption data from 1970 to 1993, excluding Northern Ireland. An extension of the project to current day would be advisable with the introduction of new technologies.
Complementary, over lapping or matching data sets	The space heating and hot water energy use was gained from the BREHOMES model (Building Research Establishment Housing Model for Energy Studies which is a

	model for predicting energy use within the UK housing stock and takes into account both physical and social factors to calculate the energy use and CO_2 emissions associated with the UK housing stock). The DECADE model informed the BREHOMES model with electricity usage.

Data examples, illustrations and notes

Example chart from the Second Report, 1995:

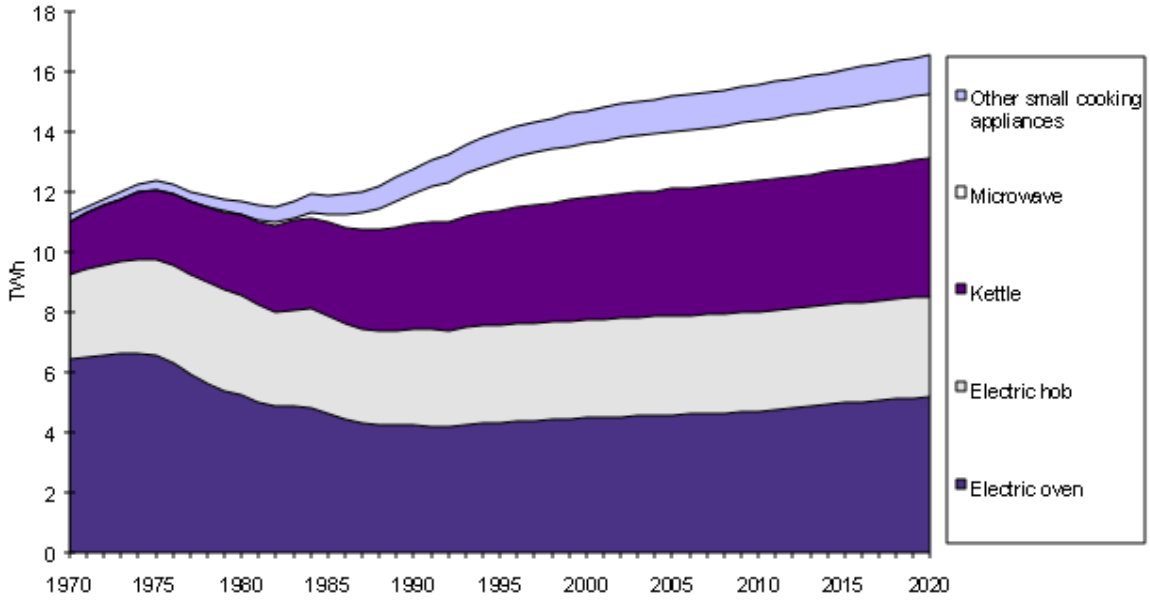


Figure 6.1 UK electricity consumption by cooking appliances

6.5 Digest of UK Energy Statistics (DUKES)

The Digest provides a highly comprehensive analysis of energy generation and consumption across the UK. It is much more focused on energy rather than housing so it provides very good background information, but would be unlikely to provide much spatial information concerning the energy performance of housing.

Digest of UK Energy Statistics (DUKES)	
Website	https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/digest-of-uk-energy-statistics-dukes
Geographic coverage	UK, values given as UK average
Owner / limitations on use	DECC. Data is freely available through the Gov.uk portal.
Summary information	UK national statistics on energy production (for example electricity supply from gas, coal, renewables, nuclear), export and import, consumers (by end use and by fuel).
Description of spatial elements e.g. place specific or GIS	This source is not spatial, and provides UK national values with some regional breakdowns within the larger reports, e.g. for electrical consumption. Data is in Excel format for data and pdf for plotted trends.
Description of use for the assessment of historic buildings	The data provides energy trends back to 1970, but is more connected to energy use than individual buildings or areas, although it does split energy users into Domestic/Non-Domestic/Transport/Agriculture sectors.
Commentary on limitations, and enhancements needed	Data is available primarily as a UK average, with some sub-national breakdowns, useful for an area comparison with national average, or background information only.
Complementary, over lapping or matching data sets	The Digest informs many other reports and much research, and vice versa. (e.g. Housing Energy Fact File, BREHOMES).
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

Thousand tonnes of oil equivalent

	Domestic								
	Coal	Coke and breeze	Other solid fuels	Natural gas *(8)*	Electricity	Heat sold	Bioenergy & waste	Petroleum	Total *(4)*
1981	6,214	368	1,202	22,076	7,260	..	..	2,554	**39,674**
1982	6,242	365	1,146	21,963	7,116	..	..	2,385	**39,218**
1983	5,796	335	1,141	22,346	7,129	..	..	2,267	**39,014**
1984	4,733	335	728	22,502	7,212	..	..	2,385	**37,896**
1985	6,290	385	957	24,394	7,582	..	..	2,454	**42,062**
1986*(11)*	6,121	335	965	25,797	7,892	..	..	2,590	**43,700**
1987	5,189	315	1,018	26,450	8,015	..	..	2,474	**43,460**
1988	4,741	300	907	25,833	7,940	..	205	2,441	**42,367**
1989	3,719	239	815	24,988	7,935	..	207	2,355	**40,258**
1990	3,153	254	762	25,835	8,066	..	206	2,480	**40,756**
1991	3,582	210	785	28,721	8,436	..	209	2,825	**44,768**
1992	3,105	176	709	28,389	8,555	..	243	2,889	**44,066**
1993	3,498	147	751	29,254	8,639	..	241	3,019	**45,549**
1994	2,957	67	601	28,355	8,721	..	242	3,004	**43,947**
1995	2,077	78	470	28,037	8,790	..	242	2,997	**42,691**
1996	2,084	129	588	32,317	9,244	..	241	3,518	**48,120**
1997	1,992	59	419	29,710	8,982	..	225	3,389	**44,775**
1998	1,819	85	439	30,601	9,408	..	230	3,543	**46,126**
1999	1,916	86	410	30,788	9,485	44	230	3,162	**46,121**
2000	1,448	95	365	31,806	9,617	44	236	3,239	**46,851**
2001	1,461	48	328	32,625	9,917	32	240	3,527	**48,178**
2002	1,009	127	289	32,362	10,319	33	243	3,087	**47,471**
2003	813	92	255	33,232	10,576	11	247	3,068	**48,293**
2004	733	36	230	34,085	10,679	52	252	3,265	**49,333**
2005	474	24	199	32,836	10,809	52	318	3,092	**47,804**
2006	426	16	200	31,550	10,723	52	358	3,249	**46,574**
2007	487	11	182	30,341	10,583	52	400	2,876r	**44,931**
2008	515	9	229	30,916	10,301	52	431	3,032	**45,485**
2009	514	7	210	28,590	10,193	52	466	3,012	**43,044r**
2010	536	7	242	33,499	10,217r	52	506r	3,427r	**48,486r**
2011	540	6	210	25,191	9,595	52	567	2,681	**38,842**

6.6 EPC Register

This is a register compiled from completed EPCs (Energy Performance Certificates) in England and Wales. A similar database should be available soon in Scotland. EPCs show the energy efficiency rating for that properties and energy efficiency recommendations. Authorised users can access much of the input data to EPCs as well (e.g. construction type, level of insulation, etc.). This is useful data but the main limitation is that the sample of properties will be biased towards social housing (more energy efficient), private rented properties and properties which have been recently sold (as these will have required an EPC to be carried out). Fewer owner-occupied properties will be included.

EPC Register	
Website	https://www.epcregister.com/
Geographic coverage	England & Wales (A separate EPC database is available in Scotland but data can only be accessed by special request see section 4.4 on HEED)
Owner / limitations on use	Landmark There is public access to EPCs, searchable by postcode. More detailed information is available to authorised users: local, regional, national, central Governments, higher and further education institutions, charities, registered providers of social housing, certified people associated with the Green Deal or Microgeneration Certification Scheme. There is a cost per "order" as Landmark charge for the collation and dispatch of the data. The order cost depends on the size: small, medium or large. The large data packet contains the information needed for the EFFESUS tool, by including the assessor input data, e.g. dwelling age, type, size, heating systems, energy consumption, CO_2 emissions. Each large data packet costs £0.10, but there is also a £100 minimum fee for each order. For example, 150 dwellings would cost £115.
Summary information	Free to access: EPC for any assessed home, searchable by postcode or EPC reference number.

	Authorised user: The EPC (energy use, cost and emissions), plus data behind the EPCs including construction information (including age, size, materials, construction type, level of insulation, heating systems, cooling systems, renewable energy generation and lighting).
Description of spatial elements e.g. place specific or GIS	Data can be made available by region, country, Local Authority area or constituency. Format of data unknown.
Description of use for the assessment of historic buildings	EPC data is on a property by property basis. Dependent on the format of the database file, it may be able to highlight specific postcodes, age and construction type.
Commentary on limitations, and enhancements needed	Currently just England & Wales, although the Scottish EPC register was due in Spring 2013. Only covers those homes that have been assessed (9million so far). The sheer volume of data could be a limitation. EPCs are a random sample of properties in the area. However, the sample is biased towards properties that have required an EPC e.g. properties that have been sold, social landlords, private landlords (not owner-occupiers where not sold).
Complementary, over lapping or matching data sets	HEED will also have EPC ratings for the properties within the database. Beyond the datasets mentioned here for the UK, this register would be useful to inform a web tool, such as the TABULA project (http://webtool.building-typology.eu/), that has energy assessment data available for particular examples of buildings from a number of EU member states. There is a separate register for non-domestic buildings see: https://www.ndepcregister.com/reportSearchAddressTerms.html?redirect=reportSearchAddressByPostcode
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

Example of the front page of an EPC:

Energy Performance Certificate

SAP

[redacted]

Dwelling type:	Detached bungalow	**Reference number:**	[redacted]
Date of assessment:	17 July 2012	**Type of assessment:**	RdSAP, existing dwelling
Date of certificate:	17 July 2012	**Total floor area:**	113 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

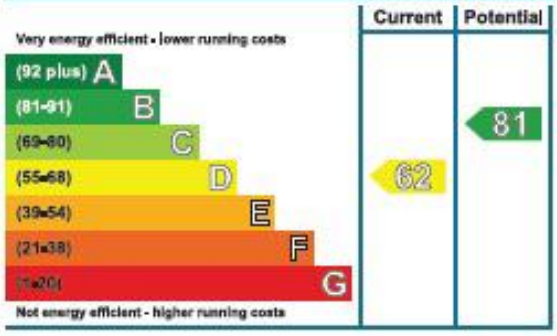
Estimated energy costs of dwelling for 3 years:	**£ 3,027**
Over 3 years you could save	**£ 633**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 279 over 3 years	£ 174 over 3 years	You could save £ 633 over 3 years
Heating	£ 2,475 over 3 years	£ 2,025 over 3 years	
Hot Water	£ 273 over 3 years	£ 195 over 3 years	
Totals	£ 3,027	£ 2,394	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£ 144	✓
2 Floor insulation	£800 - £1,200	£ 324	✓
3 Low energy lighting for all fixed outlets	£50	£ 87	

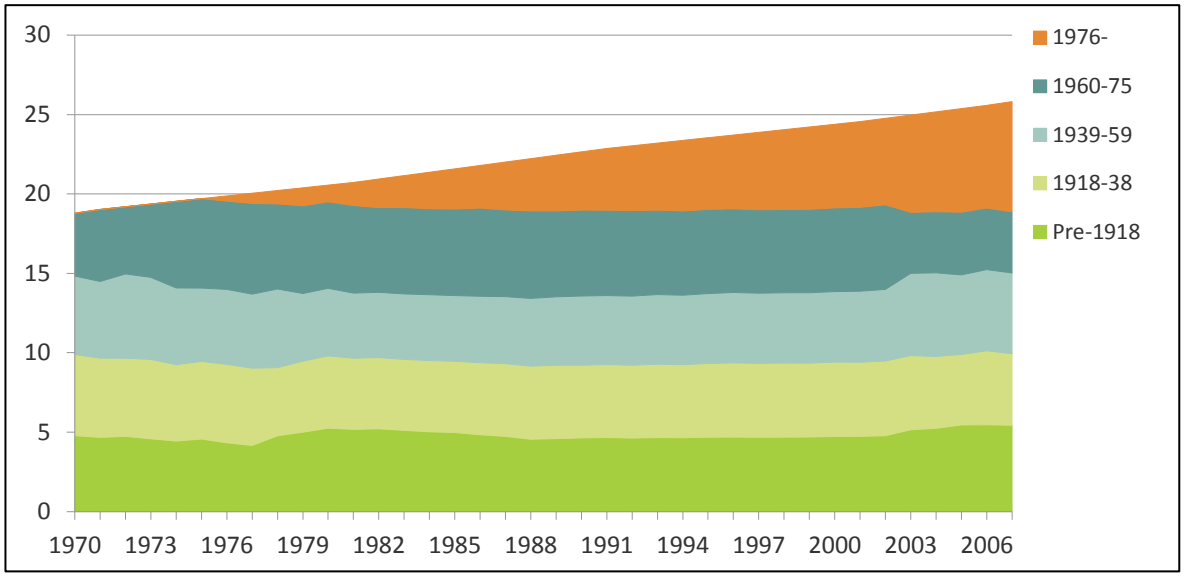
See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234** (standard national rate). The Green Deal may allow you to make your home warmer and cheaper to run at no up-front cost.

6.7 Housing Energy Fact File

This is a comprehensive overview of energy in the UK. On the whole it is nation or region wide and not available at a lower level. However, there are some very useful sections and tables, as shown below. It includes a whole range of topics such as energy end-use and insulation levels.

Housing Energy Fact File	
Website	https://www.gov.uk/government/publications/housing-energy-fact-file-2012-energy-use-in-homes
Geographic coverage	UK
Owner / limitations on use	DECC. Data is freely available on the Gov.uk web portal.
Summary information	*"Statistics available to download that draw together most of the important data about energy use in homes in Great Britain since 1970."* The most pertinent document is Housing Energy Fact File 2012: energy use in homes. Comprehensive annual review of energy use in housing across the UK. Includes: end-use energy (heating, lighting etc.), emissions, insulation levels, heating types, construction heat loss, and renewable energy generation.
Description of spatial elements e.g. place specific or GIS	Data is available as UK total, GB total, national (England, Wales, Scotland, Northern Ireland), or regional (South West, South East, London, East, West Midlands, East Midlands, Yorkshire and the Humber, North West & North East).
Description of use for the assessment of historic buildings	Has information specific to each age band, defined as: pre-1918, 1919-1938, 1939-1958, 1960-1975, post-1976.
Commentary on limitations, and enhancements needed	Data is grouped by region, therefore not able to obtain data for historic urban districts. Useful for comparison with national/regional averages. Data goes back to 1970. Much of the accompanying spreadsheet has a single cross comparison, e.g. age of stock each year, however data may be available (perhaps on request) to find in-

	formation specific to a particular age-band, e.g. number of semi-detached pre-1919 dwellings. Parts of the data are based on modelling and assumptions, rather than actual energy use.
Complementary, over lapping or matching data sets	The data is from a number of sources, including DUKES and BREHOMES. The updated 2012 Fact File includes representation of uncertainty in the data giving a range, rather than a single value and estimation of energy consumption.
Data examples, illustrations and notes	
Example of plot from the HEFF showing, in this example, age bands of the housing stock from 1970  **continued overleaf**	

Accompanying spreadsheet data source to the above graphic

1	1a - Energy use by fuel users	2011
2	2a - Domestic energy consumption	1970-2011
3	3a - CO2 emissions	1990-2011
4	3b - Fuel input for electricity generation	1970-2011
5	3c - Energy prices	1996-2011
6	3d - Indexed energy prices	1970-2010
7	3e - Fuel poverty	1996-2010
8	4a - Housing stock - population	1970-2010
9	4b - Housing stock - region	1981-2010
10	4c - Housing stock by type	1970-2010
11	4d - Housing stock - age bands	1970-2010
12	4e - Housing stock - tenure	1970-2010
13	4f & 4g - Household expenditure	1970-2010
14	4h - HH spending on energy	1970-2011
15	4i - HH gas bills	1990-2011
16	4j - HH electricity bills	1990-2011
17	4k - HH expenditure and income	2010
18	5a - Weather	1970-2010
19	5b - Energy consumption-space heating	1970-2010
20	5c - Energy consumption-water heating	1970-2010
21	5d - Energy consumption-lighting	1970-2010
22	5e - Energy consumption-appliances	1970-2010
23	5f - Energy consumption-cooking	1970-2010
24	5g - SAP rating	1970-2010
25	5h - Effects - efficient homes	1970-2007
26	5i - CO2 emissions per HH	1970-2010
27	6a - Home - heating	1970-2010
28	6b - Heating - central	1970-2010

6.8 Low Energy Buildings Database (LEB)

This database shows information from 100 retrofit case studies across the UK. This includes a number of historic properties. Although the scale of this data is obviously limited, the case studies may be useful to integrate into a data model.

Low Energy Buildings Database (LEB)	
Website	http://www.aecb.net/featured/low-energy-buildings/
Geographic coverage	UK, values given specific to each case study
Owner / limitations on use	Technology Strategy Board (TSB) Data is freely available via a number of websites. Primarily the LEB database, but also through EMBED and reports at RetrofitAnalysis.org
Summary information	Under the Retrofit for the Future project from the TSB, 100 retrofit projects were carried out across the UK with the aim of reducing energy consumption by 80%. The LEB is a database of the projects, including data on the building, the energy and CO_2 before and after retrofit. There are also new-build projects and non-domestic projects listed on the LEB, while the EMBED is solely domestic.
Description of spatial elements e.g. place specific or GIS	The case studies are mapped on the homepage (see below). Additional work would be needed to provide a spatial map of energy etc., although the sparsity of data would be a drawback.
Description of use for the assessment of historic buildings	A number of the retrofit projects were in pre-1919 buildings, including refurbishing a Victorian terrace in London to Passivhaus standards.
Commentary on limitations, and enhancements needed	Whilst small, this project and associated databases are an excellent starting point for the EFFUSUS end tool, having some measured (but mostly modelled or forecast) data pre and post retrofit, in a number of historic homes. The databases are all new, with EMBED only hosting 37 of the 100 projects so far. Additional time will be needed for a fuller database. LEB is more complete, but only a minority of pro-

	jects specify the measured post-retrofit data. The pre-retrofit and forecast data is modelled, while the post-retrofit data is measured. This makes analysis of savings through a refurbishment a complex and inaccurate subject.
Complementary, over lapping or matching data sets	This project was unique, but has many spin offs such as retrofitanalysis.org and the EMBED database.
Data examples, illustrations and notes	

Example of data:

	Pre-development	Forecast	Measured
Electricity use	4300 kWh/yr	2728 kWh/yr	3312 kWh/yr
Natural gas use	24000 kWh/yr	6724 kWh/yr	6937 kWh/yr

Map of projects, UK coverage, albeit sparse.

6.9 MLSOAs, IGZ and LLSOA

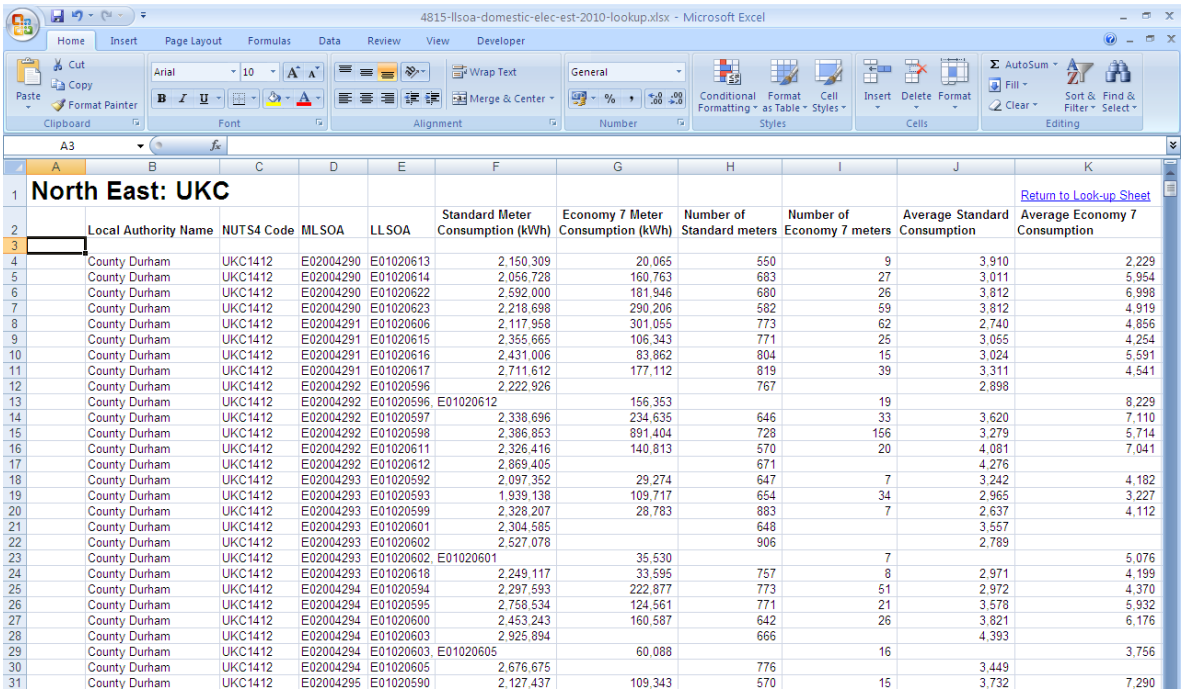
The Middle Layer Super Output Area (MLSOA) data provide estimates of domestic and non-domestic gas consumption and electricity consumption across the England and Wales (similarly IGZs, Intermediate Geography Zone, are used in Scotland). This dataset provides an opportunity to geographically compare fuel consumption and highlight how fuel use varies across the country at a reasonably detailed level. Typically these MLSOAs cover between 2,000 and 4,000 households and a city like Edinburgh is broken down into 103 different output areas.

This is a very useful data source for energy consumption in data in different areas of the country. It could also be used to calculate CO_2 emissions from properties using a CO_2 factor for each fuel.

MLSOAs, IGZs and LLSOAs	
Website	https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/mlsoa-and-llsoa-electricity-and-gas-estimates
Geographic coverage	Estimated electricity and gas consumption data, for both the domestic and non-domestic sectors, is available at MLSOA (Middle Layer Super Output Areas) levels for England and Wales, and IGZ (Intermediate Geography Zone) levels for Scotland. Estimated electricity and gas consumption data is available at LLSOA (Lower Layer Super Output Area) level for only England and Wales, just for the domestic sector. The methodology to obtain this information is still in development, therefore DECC considers this data as 'experimental'. Data at a higher resolution was previously available covering data zones but this was withdrawn due to issues with accuracy.
Owner / limitations on use	Data is published by DECC via the Gov.UK website. Domestic electricity and gas consumption at data zone (DZ) levels for Scotland is not available, nor is non-domestic information at LLSOA level for England and Wales; the energy suppliers who provide DECC with the data have not granted permission to publish this information due to disclosure reasons.

	It is available as an Excel file.
Summary information	This data has been produced for the purpose of providing local authorities with information, allowing them to target and monitor specific areas for intervention in relation to energy efficiency strategies. This data is currently available up to the year 2010. This describes electricity and gas consumption, for domestic and non-domestic sectors, at MLSOA and IGZ levels, for England, Wales and Scotland. 'Experimental' LLSOA data for England and Wales is also available up to this year. Information is reported for annual kWh consumption (split by ordinary electricity, economy7 electricity, industrial/commercial electricity, domestic gas and industrial/commercial gas), number of meters and average consumption per meter. Combined figures follows this, with an indicator showing the percentage of domestic gas meters to electricity meters. Finally, social-economic information obtained via the last census is included, such as population, area sizes, and number of households in each MLSOA.
Description of spatial elements e.g. place specific or GIS	The MLSOA's have a minimum population of about 5,000 people, or 2,000 households. IGZ's are slightly smaller, with a minimum population of 4,000, equal to about 1,000 households, whereas the LLSOA's have a minimum population of 1,000, or about 400 households. The aforementioned 'data zones' (DZs) have a population of 500.
Description of use for the assessment of historic buildings	MLSOA's and LLSOA's are a statistical geography developed by the Office for National Statistics (ONS) for the 2001 Census in the UK. These have been generated in consideration of population size, mutual proximity and social homogeneity.
Commentary on limitations, and enhancements needed	The gas-meter data provided to DECC does not differentiate between domestic or non-domestic premises. The gas-industry standard of 73,200 kWh was used as a cut-off point to differentiate between these sectors, where

	values equal to or greater than this value are assumed to be industrial/commercial. This has resulted in the incorrect allocation of about 2 million small and medium businesses. The methodology used to collect data was significantly improved in 2005. It is therefore only possible to compare data between years subsequent to 2005, where the information was obtained using the same data collection methodology. A number of inaccuracies or limitations are noted for the data collected prior to 2005. Changes in the housing stock between census data collections means there can sometimes be inconsistencies associated with some of the data.
Complimentary, over lapping or matching data sets	The boundaries associated with these areas correspond to the census geographies. This makes it possible to correlate the information with data obtained via the census, and reported by the ONS.
Data examples, illustrations and notes	



North East: UKC

Return to Look-up Sheet

Local Authority Name	NUTS4 Code	MLSOA	LLSOA	Standard Meter Consumption (kWh)	Economy 7 Meter Consumption (kWh)	Number of Standard meters	Number of Economy 7 meters	Average Standard Consumption	Average Economy 7 Consumption
County Durham	UKC1412	E02004290	E01020613	2,150,309	20,065	550	9	3,910	2,229
County Durham	UKC1412	E02004290	E01020614	2,056,728	160,763	683	27	3,011	5,954
County Durham	UKC1412	E02004290	E01020622	2,592,000	181,946	680	26	3,812	6,998
County Durham	UKC1412	E02004290	E01020623	2,218,698	290,206	582	59	3,812	4,919
County Durham	UKC1412	E02004291	E01020606	2,117,958	301,055	773	62	2,740	4,856
County Durham	UKC1412	E02004291	E01020615	2,355,665	106,343	771	25	3,055	4,254
County Durham	UKC1412	E02004291	E01020616	2,431,006	83,862	804	15	3,024	5,591
County Durham	UKC1412	E02004291	E01020617	2,711,612	177,112	819	39	3,311	4,541
County Durham	UKC1412	E02004292	E01020596	2,222,926		767		2,898	
County Durham	UKC1412	E02004292	E01020596, E01020612		156,353		19		8,229
County Durham	UKC1412	E02004292	E01020597	2,338,696	234,635	646	33	3,620	7,110
County Durham	UKC1412	E02004292	E01020598	2,386,853	891,404	728	156	3,279	5,714
County Durham	UKC1412	E02004292	E01020611	2,326,416	140,813	570	20	4,081	7,041
County Durham	UKC1412	E02004292	E01020612	2,869,405		671		4,276	
County Durham	UKC1412	E02004293	E01020592	2,097,352	29,274	647	7	3,242	4,182
County Durham	UKC1412	E02004293	E01020593	1,939,138	109,717	654	34	2,965	3,227
County Durham	UKC1412	E02004293	E01020599	2,328,207	28,783	883	7	2,637	4,112
County Durham	UKC1412	E02004293	E01020601	2,304,585		648		3,557	
County Durham	UKC1412	E02004293	E01020602	2,527,078		906		2,789	
County Durham	UKC1412	E02004293	E01020602, E01020601		35,530		7		5,076
County Durham	UKC1412	E02004293	E01020618	2,249,117	33,595	757	8	2,971	4,199
County Durham	UKC1412	E02004294	E01020594	2,297,593	222,877	773	51	2,972	4,370
County Durham	UKC1412	E02004294	E01020595	2,758,534	124,561	771	21	3,578	5,932
County Durham	UKC1412	E02004294	E01020600	2,453,243	160,587	642	26	3,821	6,176
County Durham	UKC1412	E02004294	E01020603	2,925,894		666		4,393	
County Durham	UKC1412	E02004294	E01020603, E01020605		60,088		16		3,756
County Durham	UKC1412	E02004294	E01020605	2,676,675		776		3,449	
County Durham	UKC1412	E02004295	E01020590	2,127,437	109,343	570	15	3,732	7,290

Local Authority	Middle Layer Super Output Area (MLSOA) Code	Ordinary Domestic Consumption (kWh)	Economy 7 Consumption (kWh)	Number of Ordinary Domestic Meters	Number of Economy 7 Meters	Average Ordinary Domestic Consumption (kWh)	Average Economy 7 Consumption (kWh)
UKNM5001	S02000001	5,490,475	1,376,567	1,327	238	4,138	5,784
UKNM5001	S02000002	8,109,984	978,173	2,051	158	3,954	6,191
UKNM5001	S02000003	8,242,059	2,679,840	2,030	393	4,060	6,819
UKNM5001	S02000004	13,222,227	1,657,754	2,390	203	5,532	8,166
UKNM5001	S02000005	5,697,591	2,325,083	1,418	387	4,018	6,008
UKNM5001	S02000006	6,951,372	686,301	1,879	118	3,646	5,816

6.10 Energy consumption in the UK (ECUK)

This data source provides an overview of energy consumption in the UK. It may be useful as an overview of energy consumption but as it is on a national level, may provide limited use for EFFESUS.

Energy consumption in the UK (ECUK)	
Website	https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/energy-consumption-in-the-uk
Geographic coverage	UK
Owner / limitations on use	UK Government
Summary information	This publication provides interesting information at a UK level. It shows overall energy consumption in the UK with details of the transport, domestic, industry and services sectors. On domestic energy it includes such details as energy use broken down by appliances and the role energy efficiency has played in offsetting energy consumption. Data is available in Excel sheets.
Description of spatial elements e.g. place specific or GIS	Non-spatial.
Description of use for the assessment of historic buildings	n/a
Commentary on limitations, and enhancements needed	n/a
Complementary, over lapping or matching data sets	n/a
Data examples, illustrations and notes	
N/A	

7. Data sources: Climate zoning

7.1 Overview

This section provides detail on climatic data sources such as rainfall levels, wind-driven rain, sunshine and temperatures. Sources detailed in this section are shown in the table below (click on the data source to go to this section).

Aside from the NOABL wind speed database and UKCIP data, most of the data sources seek to provide reasonably similar information e.g. weather from the past c. 20 - 30 years for particular areas within the UK. Weather Analytics provides the greatest density of data as it is for 35km x 35km squares. CIBSE may be very useful for calculating overheating in buildings, and some of its data will be sourced from the Met Office.

UKCIP provides data on predicted weather under various climate change scenarios. This would be useful in estimating heat requirements for buildings in the future, and would therefore be relevant to the EFFESUS model as well.

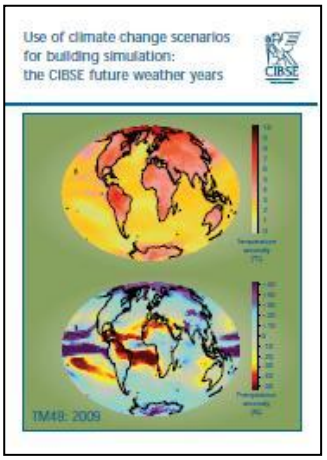
Data source	Summary of data provided
CIBSE TRY & DSY Hourly Weather Datasets	Weather data for 14 locations in the UK for past 23 years
NOABL Wind Speed Database	Average wind speed for 1km square for three given heights
SAP and RdSAP Regional Climate Data	Regional weather information
UK Climate Impact Program (UKCIP)	Weather in predicted climate change scenarios
UK Met Office (UKMO)	Hold all data from UK weather stations
Weather Analytics	Global data for past 30 years. Data can be obtained for 35km^2 areas.

Other data sources, detailed in other sections, which may be relevant are:

- **Home Analytics** - includes likelihood of exposure to wind driven rain (which would affect certain insulation methodologies) and wind speed at 10m above ground level.

7.2 CIBSE TRY & DSY Hourly Weather Datasets

The CIBSE (Chartered Institute for Building Surveyors) Test Reference Year (TRY) and Design Summer Year (DSY) weather data are used for building simulations to better understand energy requirements and overheating risk respectively. It provides data from 14 UK locations for 23 years. This is likely to be a useful source of climatic information in the UK.

CIBSE TRY & DSY Hourly Weather Datasets	
Website	http://www.cibse.org/index.cfm?go=page.view&item=1300
Geographic coverage	14 sites across the UK: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London, Manchester, Newcastle, Norwich, Nottingham, Plymouth, Southampton, Swindon.
Owner / limitations on use	TRY and DSY datasets can be purchased from CIBSE at £150 for each location, or £850 for all sites. Future TRY and DSY datasets can be purchased from CIBSE at £300 for each location, or £1700 for all sites. Current and future TRY and DSY datasets can be purchased from CIBSE at £400 for each location, or £2200 for all sites. Purchase of current datasets also includes a copy of "TM48: The use of climate change scenarios for building simulation" which provides information and guidance on their production and use.
Summary information	 The CIBSE Test Reference Year (TRY) and Design Summer Year (DSY) weather data are used for building simulations to better understand energy requirements and overheating risk respectively. The hourly datasets are derived from 23 years of measured data, from 1983 to 2005, but different methods are applied to compile the two file types.

	The TRY weather file is assembled using the Finkelstein-Schafer statistic to determine the 12 most typical months from the 23 years of data. Three climate parameters are used to assess each month: dry bulb temperature, global horizontal solar irradiance and wind speed. Linear interpolation is used to smooth the mismatch in data between the months. Determination of the DSY weather file is a much simpler process. The mean dry bulb temperature is calculated for the period from April to September inclusive for each year. The complete climate year featuring the third hottest summer for this period is selected, to represent a year with a near- extreme summer.
Description of spatial elements e.g. place specific or GIS	Detailed data is available for the 14 sites. These datasets may be used to represent nearby areas; the geographically closest dataset may not always be the most representative. However, the effect of other factors (e.g. coastal areas are likely to experience different conditions from locations inland) should be taken into consideration.
Description of use for the assessment of historic buildings	The hourly datasets can be used for dynamic calculations (e.g. with thermal modelling software such as IES). This makes it possible to analyse parameters with respect to vernacular architecture, such as thermal mass, and how it can affect the building performance on a daily (e.g. internal temperature variations) or annual basis (e.g. reduced energy consumption).
Commentary on limitations, and enhancements needed	Similar datasets may be available via other sources (e.g. the International Weather for Energy Calculations, IWEC, or Weather Analytics). The CIBSE files for 14 locations are, however, accepted as industry standard within the UK. A number of studies have expressed concerns with the use of the DSY files. The method of deriving the data fails to consider parameters, other than the dry bulb temperature, which may affect overheating (e.g. wind direction

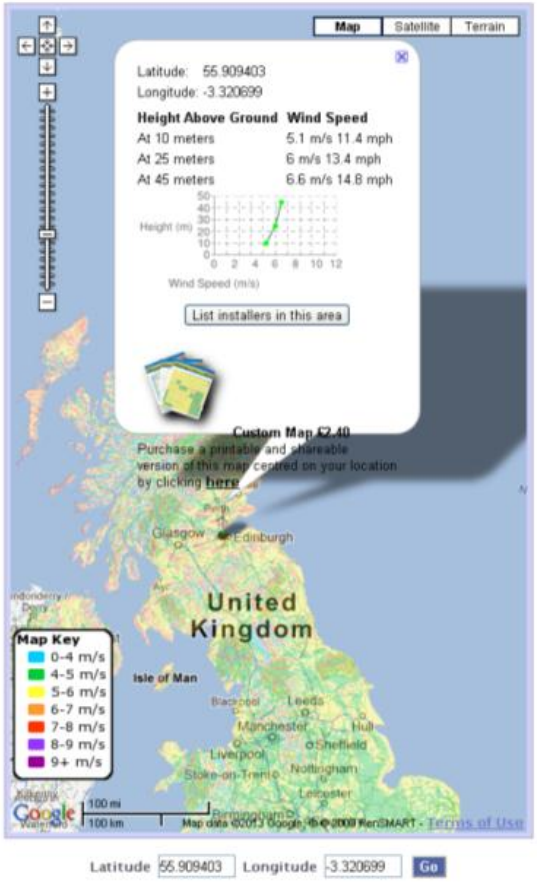
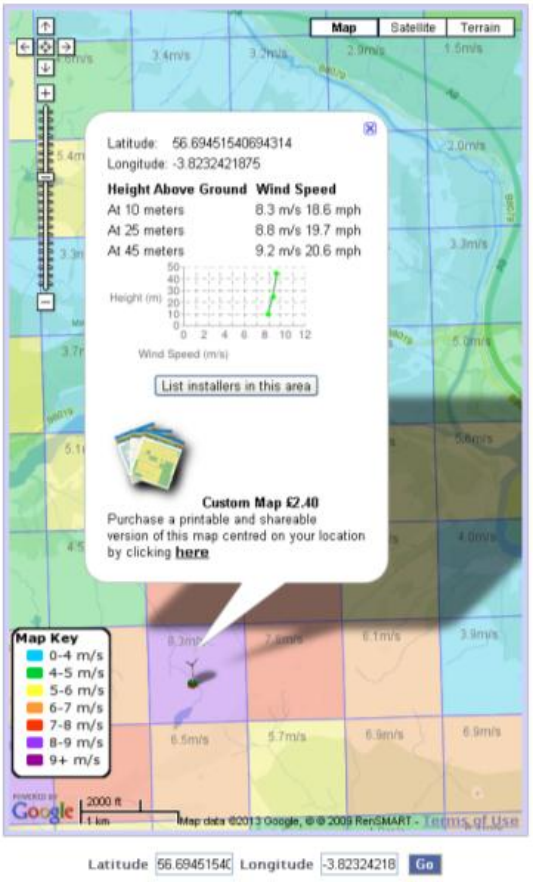
	and wind speed). Should these be particularly unusual for the selected year, the climate file is at risk of under-estimating the extent of overheating. The datasets are compiled from 23 years of observed and historic data. The following section discusses the use of future climate files, to assess the risks that climate change presents for the operational performance of a building.
Complimentary, over lapping or matching data sets	Future climate datasets have been developed for the 14 CIBSE locations which incorporate the UKCIP02 future climate projections. The TRY and DSY datasets are available for each location, for three time lines (2020s [2011-2040], 2050s [2041-2070] and 2080s [2071-2100]) and four emission scenarios (Low, Medium-Low, Medium-High, High).
Data examples, illustrations and notes	
N/A	

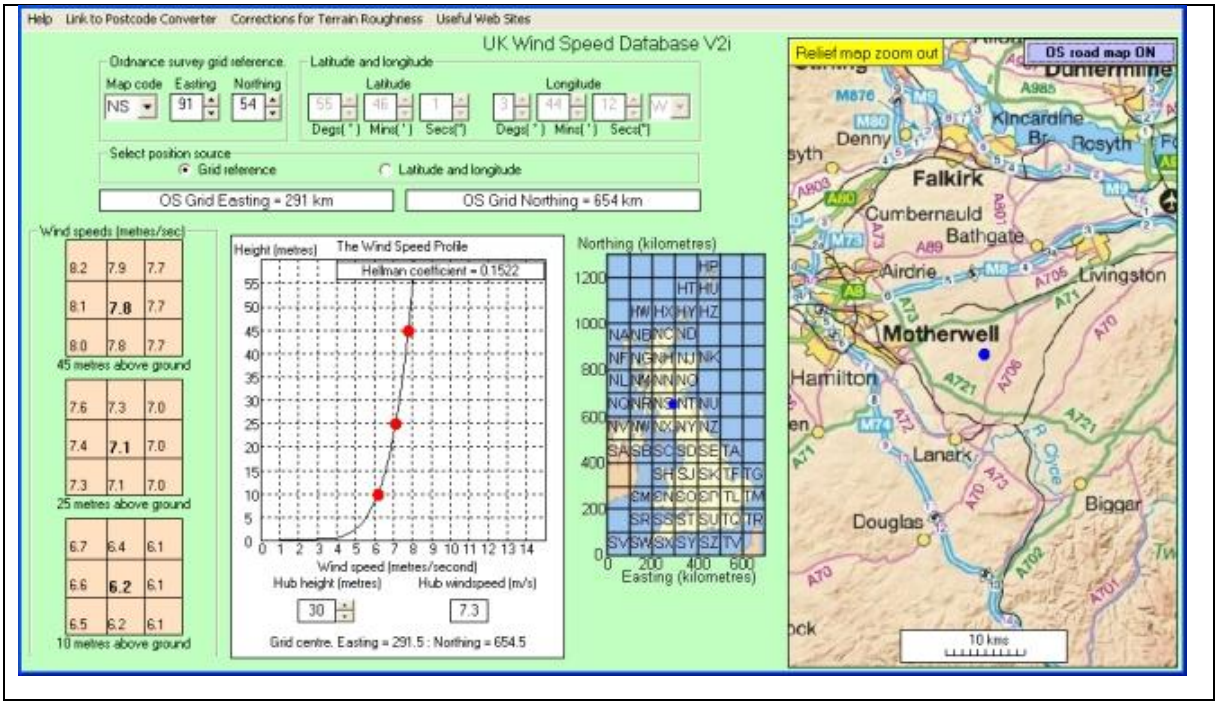
7.3 NOABL Wind Speed Database

The NOABL database provides wind speeds for 1km square areas at three heights. This is the best data source for accessing wind speeds, which is useful for calculating potential for wind energy. However, this is of limited use in itself for the EFFESUS project.

NOABL Wind Speed Database	
Website	http://www.rensmart.com/Weather/BERR
Geographic coverage	UK wide, data can be obtained for points located 1km apart.
Owner / limitations on use	The NOABL (Numerical Objective Analysis Boundary Layer) wind speed database is available from DECC.
Summary information	The NOABL wind speed database outputs data for points located 1km apart. Information is available at three heights: 10m, 25m and 45m. RenSMART has compiled databases which detail average wind speeds for square kilometre areas across the UK. This information is available for free to visitors of the website. For a charge of £50 per year, RenSMART also provides a service whereby the NOABL wind map can be made available to be view via the Google Earth application. The Wind Power Program has developed a computer program which allows users to access the NOABL data in a more convenient format, and is available for download (http://www.wind-power-program.com/download.htm) at a cost of £25.
Description of spatial elements e.g. place specific or GIS	A site within the UK can be identified by post-code, or latitude and longitude co-ordinates. The data is available at 1km resolution.
Description of use for the assessment of historic buildings	Whilst the use of the data may be limited for urban sites (see comments in next section), the database may be used to help identify more remote sites for renewable energy systems.

Commentary on limitations, and enhancements needed	The calculations which inform the database make use of large scale geographical topography, but this does not consider the topography at a detailed level, in particular in reference to man-made contributions. As such, it is not possible to obtain reliable outputs relating to urban environments, where wind speed is strongly influenced by the built environment. In these instances, the data-base may be susceptible to over-estimating wind-speed. The NOABL wind speed database does not provide a convenient method of accessing data, and as such, web-sites and programs have been developed to provide the data in more suitable formats. The Wind Power Program outputs data based on a post-code entry, however this does not apply for Northern Ireland, Jersey or the Isle of Man. Users are directed to the RenSMART website for data in these locations.
Complimentary, over lapping or matching data sets	For a charge, RenSMART provides a service allowing the data to be viewed via the Google Earth application. Visitors to the website can also view a 'live' interactive map which details hourly wind speed data. This is ob-tained from 96 weather stations across the UK, and read-ings are generally updated once an hour.
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes
RenSMART Wind Speed Maps:       Wind Power Program:


Help
Link to Postcode Converter
Corrections for Terrain Roughness
Useful Web Sites
UK Wind Speed Database V2i
Ordnance survey grid reference
Map code
Easting
Northing
NS
91
54
Latitude and longitude
Latitude
Longitude
Degs(°) Mins(') Secs(")
Select position source
Grid reference
Latitude and longitude
OS Grid Easting = 291 km
OS Grid Northing = 654 km
Wind speeds (metres/sec)
8.2 7.9 7.7
8.1 7.8 7.7
8.0 7.8 7.7
45 metres above ground
7.6 7.3 7.0
7.4 7.1 7.0
7.3 7.1 7.0
25 metres above ground
6.7 6.4 6.1
6.6 6.2 6.1
6.5 6.2 6.1
10 metres above ground
Height (metres)
The Wind Speed Profile
Hellman coefficient = 0.1522
Wind speed (metres/second)
Hub height (metres)
Hub windspeed (m/s)
30
7.3
Grid centre. Easting = 291.5 : Northing = 654.5
Northing (kilometres)
Easting (kilometres)
Relief map zoom out
OS road map ON
Falkirk
Cumbernauld
Bathgate
Airdrie
Motherwell
Hamilton
Lanark
Douglas
Bigger
Livingston
Dunfermline
Kincardine
Rosyth
Denny
10 kms

7.4 SAP and RdSAP Regional Climate Data

SAP and RdSAP is the energy modelling software used widely in the UK; for instance RdSAP is used to produce Energy Performance Certificates (EPCs). The data is accessible and somewhat useful, but it is only available on a regional basis and therefore there is limited accuracy to this. Caution needs to be taken depending on the version of SAP/RdSAP used.

SAP and RdSAP regional climate data	
Website	http://www.bre.co.uk/sap2009/page.jsp?id=1642
Geographic coverage	Dwelling specific calculations throughout the UK.
Owner / limitations on use	Data is published in the "The Government's Standard Assessment Procedure for Energy Rating of Dwellings" document. Current and future draft versions are available free to download via the BRE website.
Summary information	The revisions applied for RdSAP 2009 v9.91 (for existing buildings) and the forthcoming SAP 2012 v9.92 (for new constructions) now detail climate data for 21 locations, describing external temperature and solar radiation parameters, as well as wind speed for the SAP calculation only. The UK average climate data is still used within core components of the domestic EPC calculation; it is therefore important to clarify between the calculation outputs which use UK average climate data, and those which use regional climate data. RdSAP v9.91 (implemented from 1 April 2012 in England, Wales and Northern Ireland, and from 1 October 2012 in Scotland) states the following: The SAP rating and Environmental Impact (EI) rating will be calculated using **UK average** climate data for external temperature and all solar radiation data. Costs, savings, total emissions and primary energy will be calculated using **location specific** external temperature data detailed in table S20, and solar radiation data detailed in tables S21 and S22 (but still using the solar radiation calculations following Table 6a in SAP 2009 v9.90). SAP 2012 v9.92, which is still in draft format, has proposed the

	following changes to the calculation methodology: Calculation of '*space heating'* for the fabric energy efficiency (FEE), regulation compliance (TER and DER) and ratings (SAP and EI ratings) will use the **UK average** climate data. Calculation of 'space cooling' will refer to the climate data for the applicable region. The climate region data was introduced for the RdSAP methodology prior to SAP, for the purpose of the Green Deal. This is why a split exists between the average climate data used to determine the EPC ratings, and regional data used to determine costs and CO_2 emissions. The 'SAP' rating and 'EI' rating are derived from operational costs and CO_2 emissions; therefore care should be taken when considering results determined by the different calculation approaches.
Description of spatial elements e.g. place specific or GIS	The SAP methodology details monthly climate data, or regional factors for 21 locations, in addition to the UK average. These include the following: Thames, South East England, Southern England, South West England, Severn, Midlands, West Pennines, North West England / South West Scotland, Borders, North East England, East Pennines, East Anglia, Wales, West Scotland, East Scotland, North East Scotland, Highland, Western Islands, Orkney, Shetland, Northern Ireland.
Description of use for the assessment of historic buildings	SAP and RdSAP calculations are widely referenced to describe the energy performance of domestic buildings. It is therefore important that the effect of the regional climate variables on current and future calculations, relative to previous versions, is fully understood.
Commentary on limitations, and enhancements needed	Great care needs to be demonstrated when using data obtained from EPCs, SAP or RdSAP, particularly where this data consists of multiple versions of the calculation methodology. Whilst both RdSAP 2009 v9.91 and SAP 2012 v9.92 take into consideration regional climate data, the former is limited in its ability to do this: regional wind data is not included in the calculation, nor is the effect of location and orientation on solar

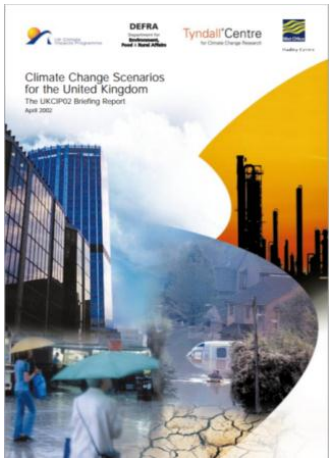
	gain. This use of different climate data has the potential to cause significant confusion when comparing EPC data. This risk is at its greatest when calculations are undertaken before and after the implementation of energy efficiency measures which use old baseline data. In some cases the improved EPC ratings may not correlate with the cost and emission savings detailed on the original certificate.
Complimentary, over lapping or matching data sets	An awareness of the changes to the calculation methodology, associated with the climate data used by SAP and RdSAP, will be important for any database which refers to SAP ratings, EI ratings, or costs and emissions reported by EPCs for existing dwellings.
Data examples, illustrations and notes	

7.5 UK Climate Impact Program (UKCIP)

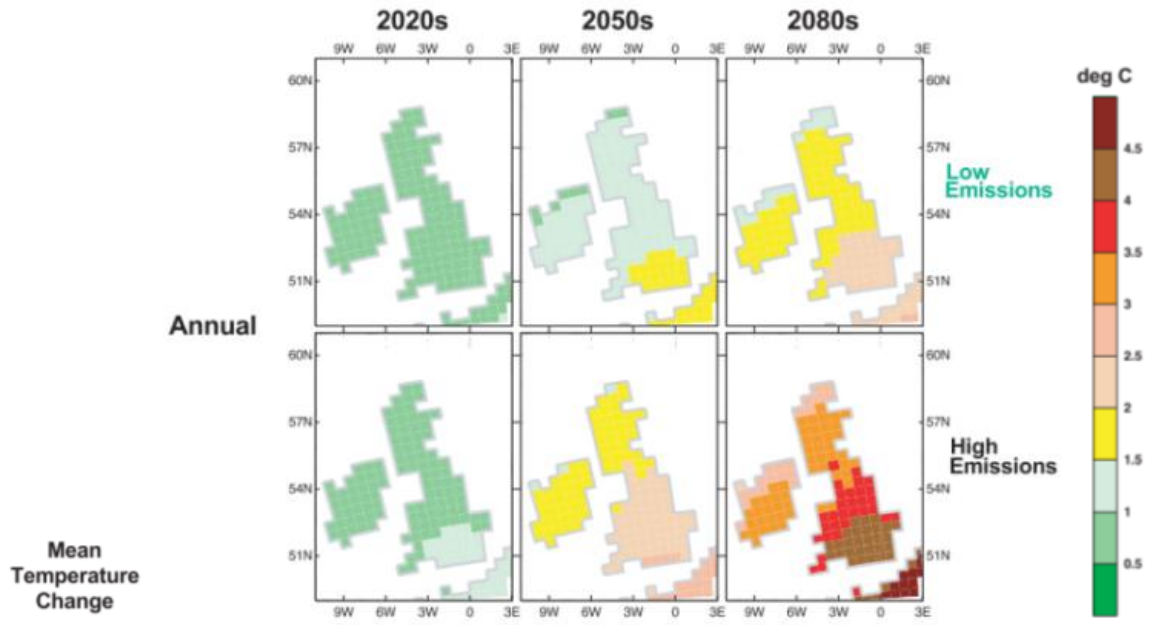
The UK Climate Impact Program (UKCIP) produced climate change scenarios in 2002 and 2009 (data from 2009 has replaced that of 2002). The 2002 version models the four emission scenarios across three time periods (2020's, 2050's and 2080's). The 2009 version models three emission scenarios (Low, Medium and High) for each decade between 2010 and 2080.

There is a large amount of data within these models, which would need to be managed and processed before use. However, this has been done by other projects (e.g. PROMETHEUS and COPSE). UKCP09 provides data for all UK regions in 5km blocks, and therefore might be useful in terms of integrating future climate predictions into the EFFESUS model.

7.5.1 UKCIP02 Climate Projections

UKCIP02 Climate Projections	
Website	http://ukclimateprojections.defra.gov.uk/
Geographic coverage	UK wide, available at a spatial resolution of 50km.
Owner / limitations on use	The UKCIP02 climate change scenarios were produced by the UK Climate Impact Program (UKCIP). The data was available for download via the website – this has since been superseded by UKCP09, however access to the archived site is still available upon request of log-in information.
Summary information	 The UKCIP02 data was developed in response to the emission scenarios (Low, Medium-Low, Medium-High and High) published by the Intergovernmental Panel on Climate Change (IPCC). The climate projection model produces data at a 50km spatial resolution for the four emission scenarios across three time periods (2020's, 2050's and 2080's). This information is determined relative to a baseline period running from 1961 to 1990 even though temperatures had already increased by the time this model was being developed; this maintained consistency with other UKCIP data being developed. No probabilities are attached to the data; therefore each scenario is considered equally likely. The "morphing" methodology is described in Belcher S.E. Belcher, J.N. Hacker & D.S. Powell: *Building Service and Engineering Research Technology*, 26 (1) (2005), pp. 49-61. This method can be applied to existing hourly climate data, to produce future climate files for use with building simulation and

	constructing design weather data for future climates. This approach gets its name from the way existing climate data is "morphed" using algorithms which shift, stretch, or shift and stretch the existing weather data parameters to create future climate change data based on the UKCIP02 output.
Description of spatial elements e.g. place specific or GIS	The UKCIP02 projections can be produced at a spatial resolution of 50km. Where future climate files are developed using Belcher's morphing methodology, these will be constrained by the location of the original files, relative to the UKCIP02 spatial resolution.
Description of use for the assessment of historic buildings	This data can be used to consider the effect of future climate on the operational performance of the UK's building stock. Morphed climate files can be used with building simulation to interrogate energy efficiency strategies.
Commentary on limitations, and enhancements needed	Concerns have been raised in relation to the application of the UKCIP02 data, where the morphing algorithms, derived from the baseline data from the period of 1961-1990 are applied to the most recent CIBSE climate files constructed from 1983 to 2004 data. This has a propensity to overestimate the extent of overheating. Belcher's morphing algorithms can be applied to the DSY climate files, however these will be subject to the same concerns raised for the CIBSE climate data.
Complimentary, over lapping or matching data sets	UKCIP02 has since been superseded by UKCP09, but still provides a relatively straightforward method by which to consider the effect of changing climates, for the purpose of building simulation. The main advantage associated with the Belcher algorithms is that they can be applied to existing hourly climate files.

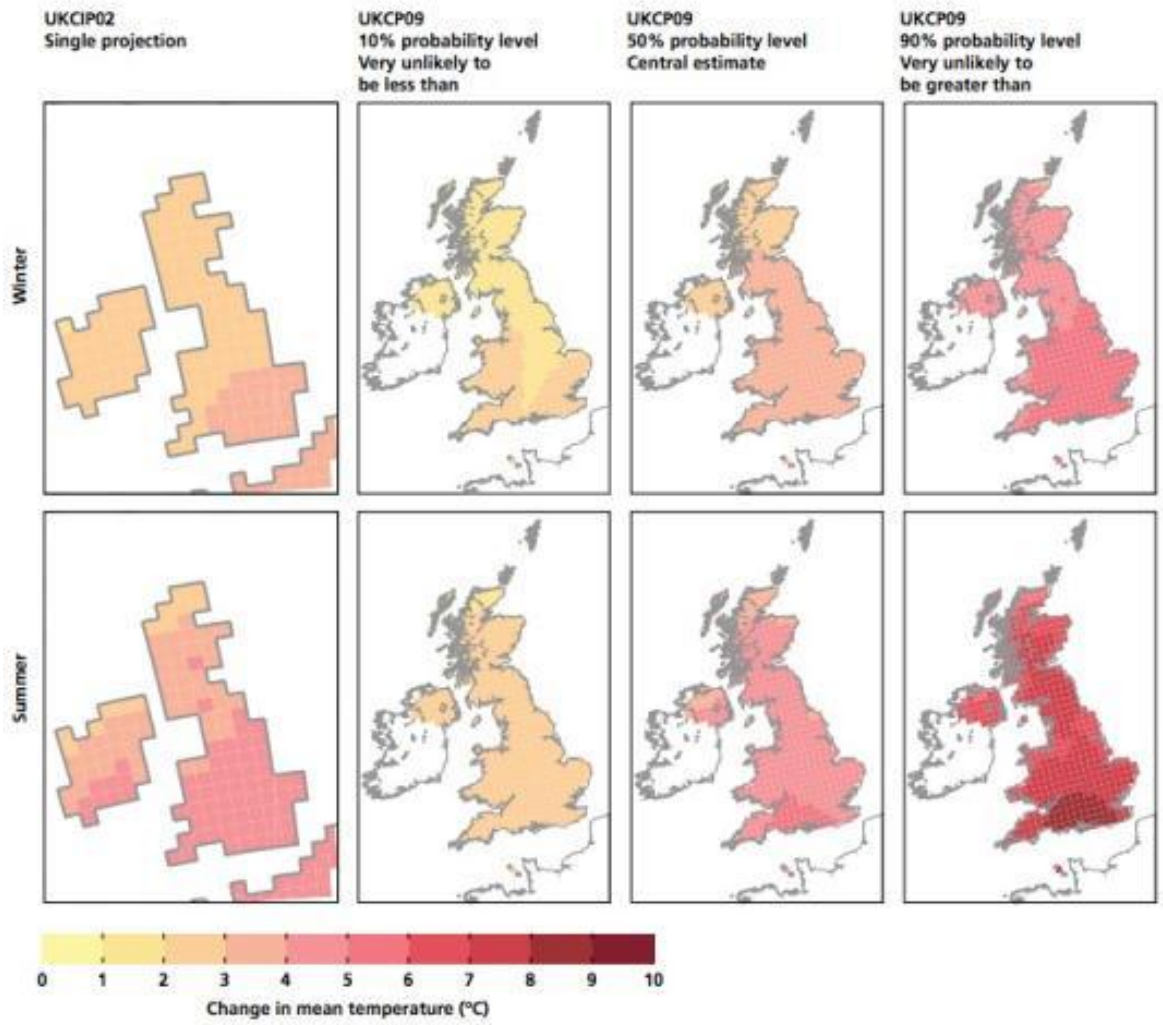
Data examples, illustrations and notes


7.5.2 UKCP09 Climate Projections

UKCP09 Climate Projections	
Website	http://ukclimateprojections.defra.gov.uk/
Geographic Coverage	UK nation, available at a 5km spatial resolution
Owner / limitations on use	UKCP09 data is available for download via the weather generator; however this outputs a vast quantity of data which must be managed and processed. Other sources exist which provide access to pre-processed data, including the PROMETHEUS and COPSE research projects.
Summary information	Continuing on from the UKCIP02 data, the Hadley Centre developed a probabilistic climate science model, which produced detailed data at a greater resolution. The UKCP09 data provides probabilistic climate change projections, relative to the same baseline period of 1961-1990, for a particular climate change variable, spatial location, time period, emission scenario and probability level. The information provides an indication of whether the change in a given climate variable will be more or less than a certain value. UKCP09 outputs data for seven overlapping 30 year periods (2010-2039, 2020-2049, 2030-2059, 2040-2069, 2050-2079, 2060-2089, 2070-2099), which for simplicity are described by their middle decade (2020s to 2080s respectively), and for three emission scenarios (Low, Medium and High). The UKCP09 weather generator uses stochastic models to generate synthetic time series of weather variables, produced for a 5 km grid pattern at an hourly resolution. For a given emission scenario and time period, up to 100 files can be produced by the weather generator, each featuring a 30 year time-series of climate data. For the given timeframe, the frequency analysis assumes stationarity, which means the data represents 30 possible annual climate files for that period, but not 30 climate years occurring subsequent to one another.

Description of spatial elements e.g. place specific or GIS	The weather output generator outputs data down to a 5 km spatial resolution for across the UK. This involves an extensive quantity of data, which may not necessarily be useful in its original format.
Description of use for the assessment of historic buildings	The data can be formatted to produce hourly climate files for the purpose of building simulation, as per the CIBSE data. Care needs to be taken to ensure that the concept of the 'probabilistic' data is understood and effectively communicated.
Commentary on limitations, and enhancements needed	In its original format, the data output by the weather generator is extensive, where it outputs data for 3,000 weather years for a given scenario. This needs to be managed and processed before it can be used. The data output by the weather generator does not contain all the variables present in the CIBSE file format, therefore the missing variables need to first be calculated. These include wind speed, wind direction, cloud cover and barometric pressure. It has been noted that the solar radiation calculations also required correction for low solar altitudes. The PROMETHEUS and COPSE projects have both produced climate files for use with building simulation based on the UKCP09 outputs, however these will be limited in terms of location and scenarios.
Complimentary, over lapping or matching data sets	The PROMETHEUS project has created probabilistic future reference years in .epw format, compatible with a range of building simulation software. These are available to download via their website (see below) for a range of locations, emission scenarios (excluding 'Low') and probabilities. An explanation of the methodology is also provided detailing how the climate files were derived. The COPSE project also looked to develop climate files for the purpose of building simulation. Their work included the development of a Design Reference Year (DRY) in an effort to overcome some of the concerns associated with the DSY files. These can be made available

	upon request. http://emps.exeter.ac.uk/research/energy-environment/cee/projects/prometheus/downloads/
Data examples, illustrations and notes	



7.6 UK Met Office (UKMO)

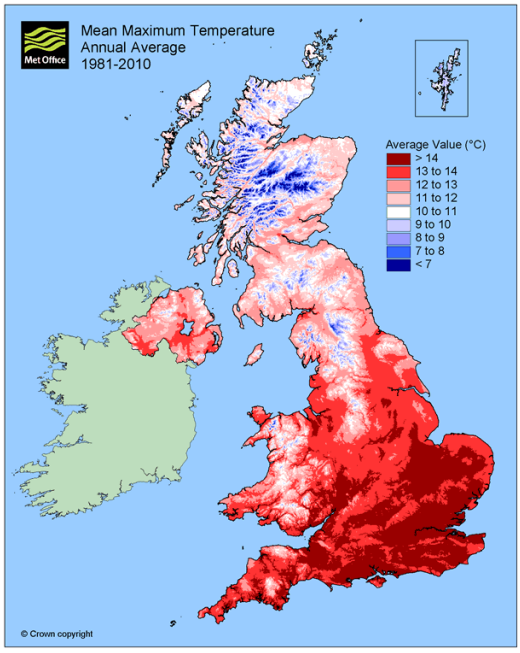
The UK Met Office holds weather data for all the observation stations across the UK. This would provide the required information; however, a data request would incur a charge. Other sources, such as CIBSE and SAP, use data from the UKMO and present it in a different way. Data is available in tabled or mapped format.

UK Met Office (UKMO)	
Website	http://www.metoffice.gov.uk/climate and http://data.gov.uk/metoffice-data-archive
Geographic coverage	UK
Owner / limitations on use	Met Office, Crown Copyright Data requests beyond that already on the public website incur a handling charge, the amount dependent on the complexity of the request. Gridded observation data sets are available through the UKCP09 website (registered users only).
Summary information	A number of datasets exist from the UKMO that include weather and climate information at high resolution for the UK. The UKMO has responsibility for weather forecasts, warnings, and Government contracts such as Defence. Within the UKMO is the Hadley Centre for Climate Research, that produces research and climate projection models for the world. The data is based on a network of manual and automatic weather stations across the country, and includes (but is not limited to): minimum and maximum air temperature, rainfall, days of air frost, sunshine duration, and weather events such as lightning strikes, heat waves, and snowfall.
Description of spatial elements e.g. place specific or GIS	Data is available in tabled or mapped format. Tabled data provides observations for individual weather stations; the mapped data has undergone modelling to extrapolate it using the observation stations data for complete UK coverage.

Description of use for the assessment of historic buildings	The mapped climates are provided online (example below) but do not have a zoom feature so may be inexact for providing weather or climate information at a specific point. In these cases, the climate information for a specific observation station may be better suited.
Commentary on limitations, and enhancements needed	There are very long temperature records available (longest in the world) for the Central England Temperature, since 1772, but this only represents an area enclosed by Lancashire, London and Bristol. While not encompassing the rest of the UK, the length and volume of data can enable good comparisons with current and future climates. A similar dataset exists for rainfall. The England & Wales precipitation monthly record began in 1766, with Scotland and Northern Ireland included from 1931. Daily data for the whole of the UK is available from 1931, and this is a more useful tool for rainfall data. The vast majority of information is freely available on the website, but if large scale data is required in a specific format for the multi-scale spatial model and software tool, then requests can be made direct to the UKMO for a charge.
Complementary, over lapping or matching data sets	As the National Weather Service, the UKMO holds all data for observation stations across the UK, and as such, a number of other sources use the raw data from the UKMO but present it in alternative ways, such as the CIBSE and SAP data sources.
Data examples, illustrations and notes (following page)	

Data examples, illustrations and notes

Example of mapped averages: the mean maximum temperature (annual average) for 1981-2010



Example climate information sheet:

Llanfairpwllgwyngll

Climate estimates (1961 90)

National Grid Reference: 2530E 3710N
Lat: 53 deg 12 min 55 sec N
Long: 4 deg 12 min 6 sec W
Altitude: 15 metres above mean sea level

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max temp °C	7.7	8.0	9.7	12.1	15.2	17.9	19.4	19.3	17.4	14.6	10.5	8.7	13.4
Min temp °C	2.6	2.2	3. 4	4.9	7.4	10.1	11.9	11.9	10.4	8.3	5.0	3.5	6.8
Mean temp °C	5.2	5.1	6.6	8.5	11.3	14.0	15.7	15.6	13.9	11.5	7.8	6.1	10.1
Temp range °C	5.1	5.7	6.3	7.2	7.8	7.8	7.5	7.4	6.9	6.3	5.4	5.2	6.6
Highest max °C	16	17	22	24	28	29	31	34	27	25	18	17	34
Lowest min °C	-9	-8	-7	-3	-1	2	5	4	1	-1	-4	-8	-9
Lowest max °C	-3	-1	1	4	7	10	12	13	10	7	2	-1	-3
Highest min °C	12	11	12	12	16	18	20	20	17	18	13	12	20
Grass min °C	-0.6	1.2	-0.2	0.9	3.5	6.8	8.9	8.9	7.0	4.8	1.5	0.1	3.4
30 cm soil temp °C	4.9	4.8	6.1	8.8	12.1	15.1	16.8	16.7	15.0	12.1	8.5	6.1	10.6
Sunshine hr/day	1.6	2.6	3.4	5.1	6.3	6.1	5.6	5.3	4.2	3.0	1.9	1.3	3.87
Rainfall mm	107	72	85	65	65	68	74	95	98	120	130	123	1102
Wind at 10 m knots	11.6	10.5	11.1	9.5	9.3	9.0	8.8	8.9	9.9	10.4	10.8	11.2	10.1
Min hourly RH %	79	76	73	69	67	68	70	71	73	75	78	80	73
Max hourly RH %	88	88	88	88	89	91	91	92	91	90	89	89	89
Air frost days	5.8	5.9	2.2	0.9	0.0	0.0	0.0	0.0	0.0	0.1	1.8	4 4	21
Grass frost days	17.1	16.9	15.3	12.5	6.0	1.2	0.2	0.1	1.3	4.7	12.2	15.9	104
>=10 mm rain days	2.5	1.7	2.0	1.5	1.2	1.6	2.2	2.7	2.8	3.4	3.8	3.5	29
>=1 mm rain days	15.6	11.2	13.0	10.4	10.9	10.3	9.5	11.7	12.3	15.0	15.7	15.1	151
>=0.2 mm rain days	19.7	15.0	17.4	14.1	14.9	13.7	13.1	15.1	15.8	18.7	19.5	19.5	197
Snow falling days	2.9	3.1	1. 7	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.4	1.6	10
Sleet/snow fall days	4.6	4.5	3.4	1.5	0.2	0.0	0.0	0.0	0.0	0.0	1.0	2.9	18
Snow lying days	1.0	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	2.8
Hail days	1.7	1.2	1.6	1.1	0.8	0.2	0.0	0.1	0.2	1.0	1.8	1.4	11
Thunder heard days	0.2	0.2	0.3	0.4	1.4	1.3	1.2	1.2	0.7	0.6	0.4	0.3	8.3

7.7 Weather Analytics

This provides weather data for the past 30 years. It has information from across the globe and for the UK, provides data for 35km x 35km areas. It therefore provides a greater density of information than provided by CIBSE (beginning of this section); however, many of the files in this data source may have been derived from measurements taken elsewhere. Building simulations should ensure that any AMY (Actual Meteorological Year) files used are as close to the site as possible.

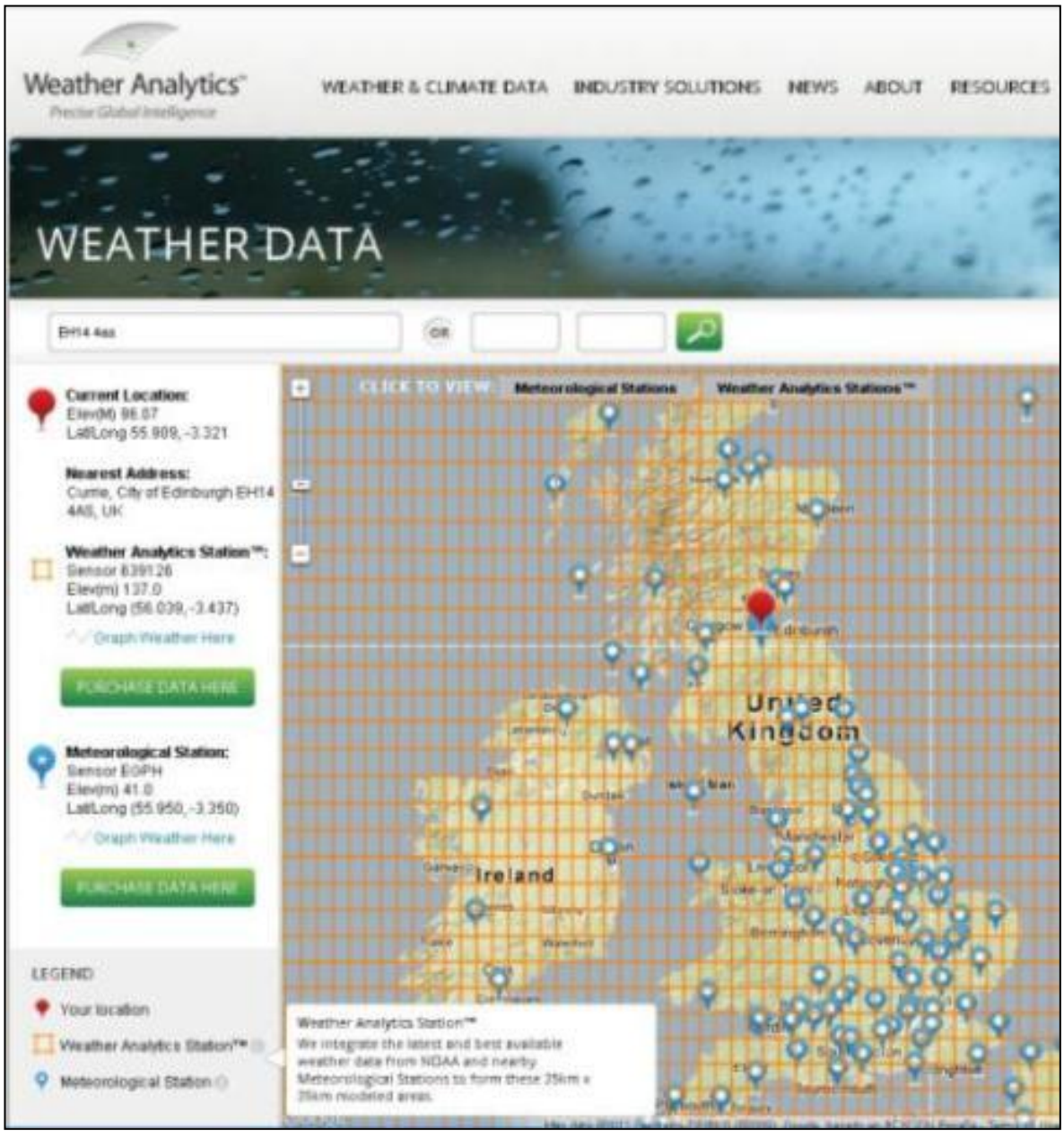
<table>
<tr><th colspan="3">Weather Analytics</th></tr>
<tr><td>Website</td><td colspan="2">http://www.weatheranalytics.com</td></tr>
<tr><td>Geographic coverage</td><td colspan="2">Uninterrupted hourly data is available upon request for sites around the world, from January 1980 up to predictions for 7 days into the future.</td></tr>
<tr><td rowspan="3">Owner / limitations on use</td><td colspan="2">Requested data is produced by ‘Weather Analytics’ based on proprietary algorithms and technologies. Their website details the following costs (where one unit = one location for one continuous historic year, e.g. two locations, two years per location = four unit):</td></tr>
<tr><td>Units Cost/Unit</td><td>Units Cost/Unit</td></tr>
<tr><td>1 - 4.....$25.00
5 - 9.....$18.75
10 - 24.....$17.50
25 - 49.....$16.25</td><td>50 - 99.....$15.00
100 - 249.....$13.75
Over 249.....Call for quote</td></tr>
<tr><td>Summary information</td><td colspan="2">Weather Analytics processes and analyses information obtained via the National Oceanic and Atmospheric Administration (NOAA) and 8,000 official Meteorological Stations. This is used to produce data for 35km x 35km areas.

For building simulation, Typical Meteorological Year (TMY) files are available, derived from the last 15-30 years of hourly data. Actual Meteorological Year (AMY) files are also available, which describe the measured</td></tr>
</table>

	weather data for a specified year. Both file types are available in a range of formats (including EPW, TM2, TM3, CSV and BIN) and include the following climate variables: surface air temperature, dew point temperature, relative humidity, surface air pressure, extra terrestrial solar radiation, extra-terrestrial direct normal solar radiation, global horizontal solar radiation, direct normal solar radiation, diffuse horizontal solar radiation, wind direction, wind speed, liquid equivalent precipitation. In addition to the above files, Weather Analytics can provide information describing over 580 weather variables (including, for example, snow depth and wind at high altitudes) which are available upon request.
Description of spatial elements e.g. place specific or GIS	Weather Analytics produces data for 35km x 35km square areas around the world – the figure below demonstrates how this grid relates to a map of the UK.
Description of use for the assessment of historic buildings	More location specific climate files can be obtained for use with building simulation software, compared to the 14 files offered by CIBSE. These describe a 35km x 35km area, but are not necessarily representative of measured data.
Commentary on limitations, and enhancements needed	Whilst Weather Analytics provides a greater density of data describing weather across the UK, many of these files will be dependent on calculated data derived from measurements taken elsewhere. Building simulations using actual weather data are generally specific to a given location, therefore analyses should ensure that any AMY files used are as close to the site as possible. As per the CIBSE climate files, the data is predominantly representative of historic data (with the exception of the 7-day forecast).
Complimentary, over lapping or matching data sets	Data provided by official Meteorological Stations throughout the UK are critical to informing the datasets

	produced by Weather Analytics. This information, used in conjunction with other data sources, allows Weather Analytics to determine climate data for a more extensive representation of the country.

Data examples, illustrations and notes



8. Summary and conclusions

This report has identified data sources to be used in the multi-spatial model to be developed as part of the EFFESUS project. The table below provides a summary of the most useful data sources and can be summarised in the four main categories:

1) Building Stock

- Data on listed buildings and conservation areas, either from national or local authorities is essential. The full list of properties in a conservation area may not be available, but the GIS set is likely to be most useful.
- Data on building age, type and characteristics – HEED is likely to be most useful but could be complemented with other sources.
- The Buildings at Risk register may be useful as a reference to non-domestic buildings as there are few sources on these properties.
- Google Streetview will be useful for verifying the visual appearance of buildings, such as height.
- Areas with high fuel poverty levels and those eligible for ECO funding could also be mapped.

2) Urban district / spatial

- Gazetteers may be the most useful reference for providing a full list of properties in the UK, although it provides little other information. Census could also be used for this purpose, although may be less reliable.
- This data could be combined with maps from the national library from which pre-1945 settlements could be identified.

3) Building energy use and CO_2 emissions

- MSLOAs, IGZ and LLSOA data provide energy consumption in geographical locations – this will be useful for estimating energy use in domestic and non-domestic properties. From this CO_2 emissions can also be estimated (by multiplying average energy consumption by CO_2 factors for each fuel which are available on the DECC website).
- Sources such as DUKES may provide an overview of energy consumption, but will provide little at a lower resolution.
- Sources such as HEED, Home Analytics or the EPC register will be useful to provide data on the energy efficiency ratings of housing stock and potential improvements.

4) Climatic zoning

- A wide range of weather data is available at various resolutions. The best data is likely to be that related to the nearest weather station to the target group of buildings – either CIPSE, Met Office data or Weather Analysis.
- UK UKCP09 Climate Projections will provide useful data for predicted future weather patterns. However, care will have to be taken in requesting only essential information rather than large datasets.
- It will be important to consider data on likelihood of wind driven rain and overall rainfall when considering wall solutions. Data on temperature might also influence decision on insulation solutions and ventilation requirements. Integration with GIS should also be possible was data zones have been identified.

Other considerations

The resolution of data needs to be considered. Datazones are the lowest grouping that equates with other data sets. Most databases don't give free outputs beyond this level due to data protection issues with details of individual properties.

Pre-1945 properties

Key to EFFESUS is identifying pre-1945 stock. The most useful data to help understand where pre-1945 building are and their scope for energy efficiency improvements will come from combining a number of existing resources such as the Gazetteer or Census data, maps from the National Library of Scotland, data on listed buildings and data on conservation areas. In some cases, Household Condition Surveys may also be useful for this.

The main limitation faced is finding out which homes are likely to be of the correct age range (i.e. 1945 and older). There are a few ways with the given data to infer where clusters of older properties exist. These may be:

- a lack of central heating
- hard to heat properties
- where there are a number of listed buildings in the area or the presence of a conservation area
- where certain housing types (e.g. terraced houses) are prevalent
- using the pre-1945 maps available at the National Library of Scotland

Such information could be sourced from data sources concerning energy efficiency such as Home Analytics, MSLOAs and HEED. However none of these indicators are going to be completely reliable and any data would probably provide an indication of where to initially investigate.

Using a GIS approach could also be used to identify where properties that are pre-1945 that need energy efficiency improvement are located. By mapping data it would be possible to gain a visual understanding of where likely properties could be found and then this map

could be interpreted by people with local knowledge to refine the accuracy of the search for suitable properties. In any area there is likely to be a variety of building ages although some areas will have extremely high concentrations of pre-1945 buildings.

Combining data sources

With a suitable GIS system it should be possible to map out the areas of any particular region where the energy efficiency of properties was poor. This could be through using information from the MLSOA energy data or HEED and to overlay data on listed properties and conservation areas.

HEED and the EST's Home Analytics database would give good indications of energy efficiency in any locality and the listed building databases can show property locations.

Changeworks has some experience of this as it developed fuel poverty mapping at the data zone and census output area level and the techniques required for matching data are likely to be similar.

There was no single data source that provided all the information that might be needed to identify pre-war buildings which might benefit from energy efficiency improvements. However, combined data sets there is plenty of information that might be combined using GIS to show where these buildings may be found.

Data source	Overview	Does it provide info on these categories?				Data it can provide	Level
		1: Buildings	2: Spatial	3: Energy / CO2	4: Climate		
British Listed Buildings Online (or country lists)	Listed properties Searchable, but not exportable dataset	✓	✓			Identify all listed buildings and some information on their architecture	Exact locations
Conservation areas	Boundary map. GIS file from Historic Scotland probably most use	✓	✓			Boundary map of conservation areas, may identify certain addresses.	Street level
HEED	Large amount of data on energy efficiency	✓	✓	✓		Property details, energy efficiency measures installed.	Variety of levels
House Condition Surveys	Detailed surveys of housing in each UK country but limited sample size	✓		✓		Average NHERs and ages of housing stock	Local authority
Buildings at Risk register	Historic buildings at risk	✓	✓	✓	✓	Details of specific buildings	Building specific
Google Streetview	Visual appearance of properties and streets	✓	✓	✓	✓	Visual details of buildings	Property / street level
Home Analytics	A high proportion of the data is "probable", so therefore should be used with caution.	✓	✓			Property details e.g. age, wall type, heating system	Down to individual addresses but this level not recommended

Gazetteer	Property listings and addressed for UK	✓	✓	✓	✓	Addresses of property	Down to individual addresses
Census data	Detailed profile of households across the UK. Limited info about buildings; most on occupants	✓	✓	✓	✓	Basic housing type and heating system	Census output area
National Library of Scotland	Can be used to identify pre-1945 settlements	✓	✓	✓	✓	Online maps of the UK from various historic dates; these show settlements.	1:50,000 and 1:25,000 scales
MLSOA electricity and gas 2010	Estimates of energy consumption in properties	✓	✓	✓	✓	Average consumption data per household	Middle layer super output area
Met Office, CIBSE or Weather Analytics	All provide weather data for UK locations on different scales	✓	✓	✓	✓	Climate data including temperatures, wind and rainfall	Varying levels
UKCP09	Predictions of future climate conditions	✓	✓	✓	✓	Future predictions of climate	5 km grid pattern at an hourly resolution

9. Recommendations

It is recommended for the EFFESUS project:

- Use of a GIS based system to locate where properties are that may be eligible for improvement, records of listed buildings and conservation areas and pre-1945 maps.
- Combine the property datasets with energy data from DECC at a MLSOA/IGZ level energy data.
- Explore The Energy Saving Trust's Home Analytics and HEED databases to further consider levels, measures and potential in each area. It suggested that a number of areas are tested and compared with local knowledge to verify robustness as there are some limitations with the data which might affect accuracy at an individual datazone level
- When considering insulation measures these should be tested for suitability against future climate change projections from UKCP09 Climate Projections.
- Profile one area as a pilot of what can be achieved with the data sources available.

Other recommendations:

- A database of building materials in the UK on a low-resolution basis would be useful. This would be similar to those available in other EU countries such as the Tabula project explained in section 4.

Glossary

AMY (Actual Meteorological Year) - Weather data for a specific location for one year.

BPIE (**Buildings Performance Institute Europe)** – Owns the BPIE Data Hub: a database of energy policy, energy usage, envelope performance, district heating, climatic zones, and the existing stock across the EU. http://www.bpie.eu/

BRE (used to be **Building Research Establishment)** – Owns BREHOMES (below) http://www.bre.co.uk/

BREHOMES - (BRE Housing Model for Energy Studies) is a model for predicting energy use within the UK housing stock.

Census – National study of population.

CERT (Carbon Emissions Reduction Target) – Obligation on energy companies to fund energy efficiency measures in homes. Ended at the end of 2012. It was the main programme funding energy efficiency measures until this point and focused mainly on loft insulation and cavity wall insulation installations.

CIBSE (Chartered Institution of Building Services Engineers) – Own the TRY & DSY Hourly Weather Datasets.

DECADE (Domestic Equipment and Carbon Dioxide Emissions) - A two year project to assemble market, behavioural and other information about domestic electric appliances (including lighting) and, using these data, construct a model of electricity use in the UK domestic appliance sector.

DECC (Department for Energy and Climate Change)

DUKES (Digest of UK Energy Statistics) – Owned by DECC, this is a highly comprehensive analysis of energy generation and consumption across the UK.

ECUK (Energy Consumption in the UK) – Owned by DECC, this is an annual statistical publication that provides a comprehensive review of energy consumption and changes in efficiency.

EFFESUS (Energy Efficiency for EU Historic Districts' Sustainability) – a European project researching energy efficiency for historic urban districts www.effesus.eu

EPC (Energy Performance Certificate) – Certificate required for selling or renting a property, Shows the energy efficiency rating of the dwelling and recommendations for improvement.

EST (Energy Saving Trust) www.energysavingtrust.org.uk/

Gazetteer – Lists and details the addresses of properties and is updated by local authorities.

GIS (Geographical Information Systems) – Computerised system for capturing and mapping geographical data.

Google Streetview – Feature on Google Map (http://maps.google.co.uk), providing photographic images of streets.

HEED (Home Energy Efficiency Database) – Database from the EST to register the uptake of sustainable energy measures and related survey data throughout the UK housing stock.

Home Analytics – Database from EST about property characteristics and potential for energy efficiency measures. Based on probabilities.

House Condition Surveys - Each country in the UK carries out a housing survey to provide detailed surveys of various aspects of domestic housing including energy efficiency and related information This includes the: ***House Condition Survey (HCS)*** – Northern Ireland; ***English Housing Survey (EHS); Living in Wales Survey*** and ***Scottish House Condition Survey.***

Housing Energy Factfile – Owned by DECC, contains an overview of the data about energy use in homes.

IGZ (Intermediate Geography Zone) - Energy consumption from registered electricity and gas metres in Scotland is available at this level.

Land Registry – Details property ownership, property boundaries and sale prices.

LLSOA (Lower Layer Super Output Area) - Energy consumption from registered electricity and gas metres is available at this level.

LEB (Low Energy Buildings Database) - Project results from Retrofit for the Future project from the TSB on 100 retrofit projects across the UK.

Met Office - The Met Office is the UK's National Weather Service.
http://www.metoffice.gov.uk/

MLSOA (Middle Layer Super Output Area) - energy consumption from registered electricity and gas metres for England and Wales.

NOABL – Publishes map of UK with average wind speeds.

ONS (Office for National Statistics) http://www.statistics.gov.uk

RdSAP (Reduced Standard Assessment Procedure) – Modelling software used UK wide to calculate energy efficiency rating of properties and recommendations for improvement. This is a 'reduced' version of a full SAP survey and is used to generate EPCs.

SAP (Standard Assessment Procedure) – Similar to RdSAP, but a SAP survey of a property contains more detail.

TSB (Technology Strategy Board) – Government advisory body around innovation and technology development. Owns data sources such as the LEB database, EMBED and reports at RetrofitAnalysis.org http://www.innovateuk.org/

TMY (Typical Meteorological Year) – Weather data for a specific location based on all collated data for that location (going back much further than one year).

UKCP09 / UKIP02 – Climate change scenarios produced by the UK Climate Impact Program (UKCIP) in 2002 and 2009 respectively (data from 2009 has replaced that of 2002).

Historic Scotland Technical Papers

Available at www.historic-scotland.gov.uk/technicalpapers

1 Thermal performance of traditional windows
2 In situ U-value measurements in traditional buildings – *Preliminary results*
3 Energy modelling analysis of a traditionally built Scottish tenement flat
4 Energy modelling in traditional Scottish Houses (EMITSH)
5 Energy modelling of a mid 19th century villa
6 Indoor air quality and energy efficiency in traditional buildings
7 Embodied energy in natural building stone in Scotland
8 Energy modelling of the Garden Bothy, Dumfries House
9 Slim-profile double glazing – *Thermal performance and embodied energy*
10 U-values and traditional buildings – *In situ measurements and their comparison to calculated values*
11 Scottish Renaissance interiors – *Facings and adhesives for size-tempera painted wood*
12 Indoor environmental quality in refurbishment
13 Embodied energy considerations for existing buildings
14 Keeping warm in a cooler house – *Creating thermal comfort with background heating and locally used supplementary warmth*
15 Assessing insulation retrofits with hygrothermal simulations – *Heat and moisture transfer in insulated solid stone walls*
16 Green Deal financial modelling of a traditional cottage and tenement flat
17 Green Deal, Energy Company Obligations and traditional buildings
18 Evaluating energy modelling for traditionally constructed dwellings
19 Monitoring of thermal upgrades of ten traditional properties
20 Slim-profile double-glazing in listed buildings – *Re-measuring the thermal performance*
21 Data sources for energy performance assessments of historic buildings in the United Kingdom – *Identifying online data sources for the EFFESUS project*
22 Scotstarvit Tower Cottage - *A study of infrared electric heating installed in a refurbished 19th Century dwelling*