UK Government

National Buildings Database

Understanding Great Britain's Non-Domestic Buildings

Department for Energy Security and Net Zero (2026)

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Executive Summary

Meeting the UK's commitment to reduce its greenhouse gas emissions to net-zero by 2050 will require emissions from all buildings to be all but eliminated. Decarbonising energy use in non-domestic buildings is one of the most complex challenges facing the UK. Until now, the complexity and diversity of the non-domestic stock has restricted attempts to develop comprehensive and detailed datasets to inform policy decisions. The National Buildings Database (NBD) aims to fill this void by providing an inventory of all the buildings in Great Britain. The main focus is non-domestic buildings, such as offices, shops, warehouses, schools and hospitals, but there is also information about housing. The database includes information about the size, age, construction and energy performance of each building. The NBD will enable research to inform government policy - particularly work on energy efficiency, decarbonisation and retrofit of buildings – but there are many other potential applications.

The NBD accurately represents the location and the physical form of each building, as well as how much energy each uses and the energy-using activities undertaken in each. It was developed using data from UK and Scottish Government sources (including Energy Performance Certificate data where available), Land Registry, Ordnance Survey mapping data, and a wide range of other sources.

The NBD is more comprehensive and more detailed than any previous inventory of Great Britain's non-domestic buildings. It aims to give a broader description than was available before, covering a wider range of business and public-sector activities; and also to give a deeper description, including full building geometries and measurements, building services, fuel and electricity use, and energy efficiency ratings. While the full database is restricted in usage to DESNZ and wider Government, this published report and the accompanying data tables and synthetic data provide key insights from NBD for public use.

The objective was to provide a snapshot of premises at a specific point in time, so source data was synchronised and the database describes the whole building stock on 1st April 2023. Where data were not available for this date, the nearest date possible was used.

The non-domestic building stock is divided into 15 Activity Classes (e.g. 'Education' or 'Factory', see Figure 0-1), which comprise 84 related Activity Groupings (e.g. 'Schools' or 'Colleges, Universities and Research'), with 365 Activities (e.g. 'University', 'Training Centre', or 'Agricultural Research Centre') in total. Within these, each premises has information about the floor area, the age of construction, the building structure, the main fuel for heating and – where available – the heating, ventilation and air conditioning system.

Buildings are distinct from premises, which may be spread across more than one building, or there may be many premises (with different occupants and uses) in a single building. We have followed the Valuation Office Agency's (VOA - the part of Government responsible for valuing premises for business rates) approach of concentrating on premises.

There are complex relationships between premises and buildings. NBD captures these through the self-contained unit (SCU), which groups buildings that are part of a premises or premises that are part of one or more buildings. The SCU enables data from energy meters to be assigned to a premises or group of premises so that apportionment of energy use is avoided (see Section 4 for more detail). For the first time, NBD identifies the number of premises and SCUs for the whole of GB (previous work covered only England and Wales). The GB non-domestic stock spans 2.2 million premises and 1.3 million SCUs. To give a feel for scale, the largest 100 SCUs contain 4 % of GB's total non-domestic floorspace.

Improved counts of premises and floor areas suggest that previous work on the non-domestic stock was dramatically under-counting the number of premises and the floor area in 'Hospitality'. It was also under-reporting the number of buildings, premises and floor area in ‘Education’ because of limitations in the source data. Previous inventories of non-domestic buildings had no distinct information at all about ‘Agriculture’, ‘Sport’, ‘Transport’ or ‘Utilities’; and the most recent inventory of MoD premises dates from 2014.

The Database reveals that 31% of all non-domestic premises in Great Britain are either in a conservation area (17%), part of a listed building (5%) or both (8%). This has implications for retrofit work on these premises. When measured by floor area, around 20% of the non-domestic floorspace in GB has some form of heritage status. Listed premises and those in conservation areas are on average smaller than other premises.

‘Office’ and ‘Hospitality’ premises are more likely than other Activity Classes to have heritage status, and more than 40% of both are listed or in conservation areas. In contrast, ‘Utilities’, ‘Factory’, ‘Transport’ and ‘Warehouse’ are least likely to have a heritage restriction: less than 15% of these premises have heritage status.

‘Domestic’, or residential buildings, are present in the Database as Unique Property Reference Numbers (UPRNs), but not as fully modelled 3D geometry (apart from the locations where they are close to non-domestic premises). Energy Performance Certificates (EPCs), energy data, rural / urban flags and many of the other variables reported here can also be linked to domestic addresses (but not floorspace). Some non-domestic activities overlap with domestic data, such as self-catering holiday homes. There are 30 million domestic UPRNs, of which 63% have an EPC, compared to 2.23 million non-domestic premises where around 25% have an EPC or a Display Energy Certificate. Whilst domestic is present in NBD, this report does not report directly on it as an activity class in its own right.

Premises and floor area

More than half of non-domestic premises in Great Britain are used as Shops, Offices or Factories and similar activities, see Figure 0-1 below. The largest activity classes by number of premises are ‘Shop’ (25% of all premises), ‘Office’ (21%), ‘Factory’ (14%), ‘Hospitality’ (11%) and ‘Warehouse’ (11%).

However, when analysed by floor area, a different picture emerges. The largest activity class by floorspace is ‘Factory’ (20%), followed by ‘Warehouse’ (19%), ‘Shop’ (15%), ‘Office’ (13%) and ‘Education’ (10%). Taken together, these five activity classes account for more than two thirds of all non-domestic floorspace. This shows that despite many more premises being used as Shops or Offices and similar purposes, Factories and Warehouses are, on average, larger and account for much of the non-domestic stock's floorspace.

In turn, considering energy use (where meter data has been successfully matched) provides yet a different view. The largest percentages of energy use by premises are ‘Factory’ (35%), ‘Shop’ (14%), ‘Hospitality’ (10%) and ‘Education’ (8%). This highlights how across the non-domestic stock there is considerable variation in energy use intensity of premises, with Factories and Hospitality for example accounting for a significantly higher share of energy use than their share of floor area.

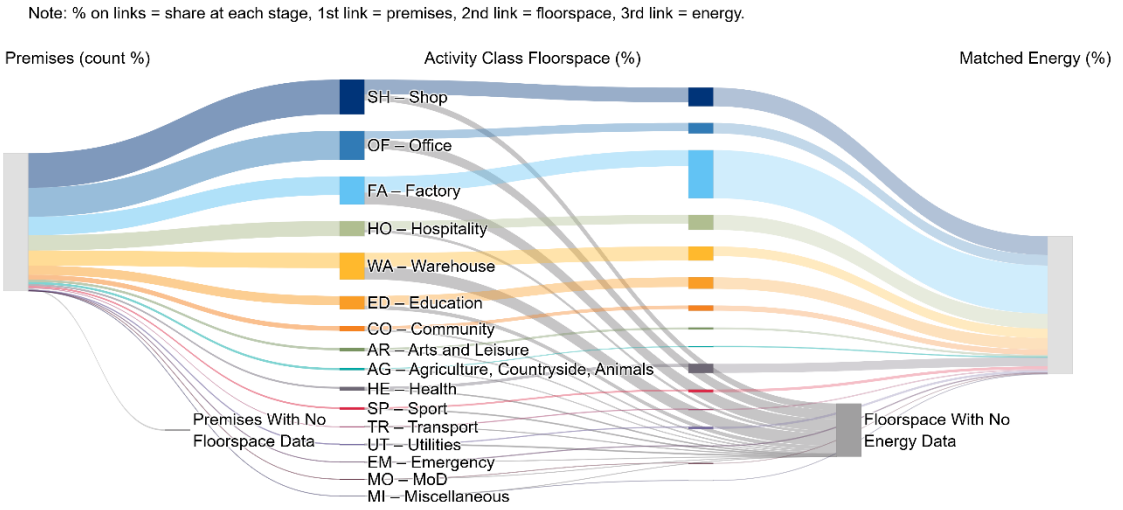

Figure 0-1 Sankey diagram showing percentage of premises, floorspace and matched energy for non-domestic premises in NBD

Mixed-use buildings

NBD is an advance over previous work on GB buildings since it includes and identifies buildings with multiple occupants[1], buildings with a mixture of non-domestic premises and buildings with a mixture of non-domestic and residential premises. Our analysis shows that 59% of non-domestic buildings[2] have just one occupier, while 27% share with one or more domestic address, and 14% are shared with another non-domestic occupier. In total, then, 41% of the non-domestic building stock is 'mixed use'. This is significant when it comes to coordinating any renovation or retrofit work, since there are multiple parties involved who need to be in agreement over such work.

Rural or urban?

Sometimes it is helpful to know whether premises are located in urban areas or in rural areas. For example, heat networks may run more efficiently in high-density, urban areas; or rural areas may be more suitable for using bio-fuels. NBD tells us which premises are located in rural or urban areas. Overall, 79% of premises and 82% of non-domestic floorspace are in 'Urban' areas, while 21% of premises and 18% of floorspace are classified as 'Rural'.

At the activity-class level, there is some variation with 'Education', 'Sport', 'Shop' and 'Health' more likely to have premises in urban areas (80%+), while 'Agriculture, Countryside, Animals' and 'Utilities' are much more likely to have premises in rural areas (<30% in urban areas).

Public-sector buildings

Prior to NBD our understanding of the public sector stock was highly reliant on data from Display Energy Certificates (DECs). However, only buildings over 250 m^2 are required to have a DEC. Analysis run on NBD combined with ownership data from the Land Registry, DECs, Office for Government Property and premises activity provides a much better

[1] For non-domestic premises occupants are likely to be a business or organisation that own or rent the premises to carry out a non-domestic activity on the premises.
[2] Strictly, we used 'self-contained unit' rather than 'buildings' for this analysis, see Section 4.

estimate of the size and distribution of the public sector stock. It can also be used to give robust breakdowns of the stock into different size bands – by floor area, energy use, or country (England/Wales/Scotland).

Nevertheless, it remains hard to be definitive about whether premises are part of the public sector, but it appears that around 9% of non-domestic premises and 19% of floorspace are likely to be part of the public sector (defined by ownership or use). Activity classes with the highest proportions of public sector floorspace are ‘Emergency’ (100%) followed by ‘Education’ (76%) and ‘Health’ (61%).

Validating EPC data

Part of the NBD project sought to explore the value of energy use as reported in Energy Performance Certificates. Detailed audits of 76 premises were carried out, and dynamic models of these premises were built and calibrated. EPC estimates of energy use for different end uses was compared against the calibrated model outputs to establish the extent of agreement and divergence, as a means of qualifying the reliability of the wider EPC data set for non-domestic buildings.

EPCs, which are designed to estimate the energy performance of buildings, often struggle to capture actual meter data accurately (see Appendix B). This discrepancy is particularly evident in the overestimation of lighting energy consumption across all activity classes. Further, EPCs tend to overestimate heating requirements, except in the Offices activity class, where the estimates are more aligned with usage predicted by calibrated models. One significant area of concern is the under-estimate of cooling needs by EPCs. Although current cooling demands are relatively low, they are expected to increase in the future, which could further exacerbate the inaccuracies in EPC estimates.

The audits conducted as part of this analysis also revealed that the actual energy use of equipment (as determined from the audits) was largely overestimated in EPCs and in some cases was even higher than the total measured electricity consumption of the premises. Calibration of the model using audit data indicated the source of the discrepancy related to National Calculation Methodology (NCM) assumptions used to produce the EPC estimated energy consumption. Improving the accuracy of EPCs for non-domestic buildings would require more comprehensive monitoring, including collecting sub-meter data and conducting seasonal audits more than once a year, and relying less on default assumptions.

In the absence of better data from sub-metering or other more detailed information, the breakdown of energy into individual end uses provided by EPC data at scale across most non-domestic building is a useful guide to this disaggregation, noting the caveats above.

Insights for decision making

NBD can be used to support policy analysis and decision making, spanning from a national scale down to individual premises. The spatial nature of the NBD allows it to locate energy demand and end uses, which can support improved zoning of heat networks. At scale the NBD can also provide precise insights into potential carbon savings from policies targeting specific portions of the buildings stock.

NBD can provide detailed insights to support complex premises by premises analysis for example, in considering the question: “How many non-domestic buildings could install an air to water or air to air heat pump?” By applying rules based on the space around buildings and planning constraints (listed status or being in conservation areas) we used the NBD to estimate that 1.3 million buildings (strictly, SCUs), 99% of the non-domestic stock - on paper at least (not considering whether it would be cost effective) - could install a heat pump.

Another example of the detailed insights NBD can offer relates to identifying remaining use of coal in the building stock. Although coal has been phased out as fuel to generate electricity, it is still used as fuel for heating in some premises. We also used NBD to identify the sources of data on fuels and heating systems by the location, type and floor area of premises. This includes using coal for heating, and we can separate this out for each activity class. We found there are 1,440 premises using coal for heating, comprising 0.6 million m^2 of floorspace, and the 'Factory' activity class is the largest user. Previously the evidence base for this figure would have been from energy certificates, which covered only 6% of premises, and 2% of floor area. For comparison, using EPC data alone suggests that just 566 premises use coal for heating, with 0.2 million m^2 of floorspace, and 'Hospitality' is the largest user.

Notes on statistical conventions

All estimates for energy consumption and greenhouse gas emissions are presented on an annual basis.

All results presented relate to 1st April 2023, and where datasets do not align precisely data from the nearest point in time is used.

All the data are derived from the available datasets. There are known limitations meaning that these should be treated as estimates.

Rounding conventions:

- Delivered energy use values presented in this report are quoted in units of gigawatt-hours (GWh) per year, rounded to the nearest integer.
- Electrical and non-electrical energy intensity values are quoted in units of kilowatt-hours per square metre Gross Internal Area (GIA) per year (kWh/m²/year), rounded to the nearest integer.
- Figures for total floor areas for each activity class are quoted in units of millions of square metres and rounded to 1 decimal place. For example, a total floor area of 16,385,312 m² would be presented as 16.4 million m².
- Percentages are quoted to the nearest integer apart from tables where decimal percentages provide more insight. In those cases, values are rounded to one decimal place.
- Values that round to 0% are shown as less than the next highest value. For example, 0.2% would be shown as <0.5%.

Table conventions:

- When there are no data, ‘null values’, or the numbers are so low that the data are at risk of being disclosive, values are replaced and shown using a dash ‘-‘.
- Floor areas are reported as Gross Internal Area (GIA) unless otherwise stated. Where floor area is recorded as something other than GIA, conversion factors have been applied. GIA is the floor area of a building measured to the internal face of the perimeter walls at each floor level. Further information can be found in “Code of measuring practice: definitions for rating purposes”.
- The ‘rule of 10’ is used when reporting aggregate data, so where necessary classifications are combined to only ever show details of 10 or more premises together, to avoid disclosing data.

Acronyms and abbreviations

Acronym / abbreviation	Full title / explanation
AUC	(VOA) Accommodation Use Code
BEES	Building Energy Efficiency Survey (survey of non-domestic buildings from 2014-15)
CaRBE	Carbon Reduction in the Built Environment: activity classification system (improves on CaRB3)
CaRBE activity	The principal activity in premises: mostly derived from VOA data, SAA data, or OSAB data
CaRBE activity grouping	Groupings of CaRBE activities, for analysis purposes. Sits between CaRBE activity and CaRBE class
CaRBE class	High level aggregations of CaRBE activities
CCOD	Commercial and Corporate Ownership Data
CEPC	Commercial (non-domestic) Energy Performance Certificate
DEC	Display Energy Certificate
DESNZ	Department for Energy Security and Net Zero
DfE	Department for Education
DHW	Domestic Hot Water (hot water from taps etc)
Dom	Domestic (residential)
DWP	Department for Work and Pensions
EPC	Energy Performance Certificate
ePIMS	Electronic Property Information Mapping Service
ERIC	Estates Return Information Collection (data describing the NHS estate)
EUI	Energy Use Intensity expressed as kWh/m^2/year
GB	Great Britain (England, Scotland and Wales)
GIA	Gross Internal Area
GPA	Government Property Agency
HMLR	His Majesty's Land Registry
HMRC	His Majesty's Revenue and Customs
HVAC	Heating, ventilation and air conditioning
IDBR	Inter-Departmental Business Register
kWh	kilowatt hour
LiDAR	Light Detection and Ranging (airborne mapping, using a laser to measure building heights)
MoD	Ministry of Defence
MPAN	[Electricity] Meter Point Administration Number
MPRN	[Gas] Meter Point Reference Number
NCM	National Calculation Methodology
ND	Non-domestic (note: ‘domestic’ in the UK refers to housing, so ‘non-domestic’ refers to all non-housing but includes forms of residential buildings such as nursing homes)
NDBS	Non-domestic Building Stock
NEED	National Energy Efficiency Data-Framework [domestic]
ND-NEED	Non-domestic National Energy Efficiency Data-Framework

NDR	Non-domestic Rating List
NGD	Ordnance Survey's National Geographic Database
NHS	National Health Service
NIA	Net Internal Area (measurement of floor area)
NULL	Indicates no data
NUTS	Nomenclature of territorial units for statistics
ONS	Office for National Statistics
OS	Ordnance Survey
OSAB	Ordnance Survey AddressBase
OSMM	Ordnance Survey MasterMap
PD	(VOA) Primary Description
Premises	AKA 'hereditament': unit of real estate property that can change ownership/leasehold. Not necessarily equivalent to 'building'.
PSCG	ONS Public Sector Classification Guide
QA	Quality Assurance
Rateable Value (RV)	The theoretical annual rental value calculated by the VOA for each premises. Used for property tax calculations
ROI	Return on investment
SAA	Scottish Assessors Association
SCAT	(VOA) Special Category
SCU	Self-contained Unit
SEPA	Scottish Environmental Protection Agency
SIC	Standard Industrial Classification. Classification system for categories of economic activity. May not reflect actual activity in premises.
SME	Small or medium-sized enterprise
TOID	Topographical Identifier
TUFA	Total Useful Floor Area. Basically, equivalent to GIA
UARN	Unique Address Reference Number. Unique ID for premises in VOA and SAA data
UPRN	Unique Property Reference Number. Unique ID for an addressable object, e.g. a school, a shop, etc (but can also be for non-buildings, e.g. a bridge).
VOA	Valuation Office Agency
VR	Valuation Roll: the list of premises maintained by the SAA

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Section 3 tables and figures

The tables and figures presented for each Activity Class in Section 3 following the same number and title convention and these are set out below. Page numbers are not provided because these differ for each section.

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Table of figures for each Activity Class in Section 3

1 Introduction

Meeting the UK's commitment to reduce its greenhouse gas emissions to net-zero by 2050 will require emissions from all buildings to be all but eliminated. Decarbonising energy use in non-domestic buildings is one of the most complex challenges facing the UK. Until now, the complexity and diversity of the non-domestic stock has restricted attempts to develop comprehensive and detailed datasets to inform policy decisions. The National Buildings Database (NBD) project brings together existing and new data to develop a comprehensive and uniquely structured database in which every non-domestic building is represented in detail: its energy use and energy efficiency, its geometry and construction materials and the activities of the occupants. Domestic buildings are included in the NBD (containing the majority, but not all of GB's 30 million dwellings) with a lower level of detail compared to the non-domestic stock. Importantly, and for the first time, mixed-use buildings are addressed by the NBD with the inclusion of buildings containing different classes of non-domestic use, and buildings which contain both non-domestic and domestic uses.

The NBD integrates real data at a building-by-building level to create a complete characterisation of the building stock in England, Wales and Scotland. The NBD integrates property tax, Energy Performance Certificate, geo-spatial, business and utilities data with other specialist data sets. Bringing together the wealth of data currently held separately by a range of government departments and agencies has resulted in unique insights into the non-domestic building stock for policy development.

1.1 Aim and Objectives

Aim

This project aims to strengthen the DESNZ evidence base on the building stock – both domestic and non-domestic, with particular emphasis on addressing gaps in evidence about the non-domestic building stock across Great Britain. This project also aims to enable a paradigm shift in the approach to analysis and modelling of the building stock across government.

Objectives

To deliver on this aim the project has the following objectives:

1. Build a database with a record of every building in Great Britain (using the Valuation Office Agency records for England and Wales and/or Scottish equivalent to identify premises to be included).

2. Characterise key features (including but not limited to construction, geometry, public sector status, and activity) and energy consumption and end uses for every building in the database.

3. Design and recruit for targeted, specific surveys to validate energy performance data and characteristics and provide evidence for assumptions to fill gaps in the database.

4. Develop a method for ongoing updates to the database, and sampling synthetic shareable datasets from the database.

5. Make outputs that are accessible to other government departments and external researchers.

1.2 Scope

Building Stock Scope

This project links existing data and carries out activity class-specific surveys for the following 15 non-domestic activity classes (with domestic being the additional, less-detailed, 16th class), as shown in Table 1-1.

Table 1-1: NBD activity classes and codes

Activity class	Class code	Activity class	Class code
Agriculture, Countryside, Animals	AG	MoD	MO
Arts and Leisure	AR	Office	OF
Community	CO	Shop	SH
Education	ED	Sport	SP
Emergency	EM	Transport	TR
Factory	FA	Utilities	UT
Health	HE	Warehouse	WA
Hospitality	HO	Domestic	DO

The database also includes simplified representations of all domestic premises identified through Ordnance Survey AddressBase records with data on energy consumption, geometry (building shape), and construction (wall and roof type etc.) matched in. The address-matching method was designed to be compatible with DESNZ's domestic National Energy Efficiency Data Framework (NEED), through the use of Unique Property Reference Numbers (UPRNs), should analysists need this. Section 1 above says that domestic buildings are included in NBD at less detail than non-domestic, and this report only reports domestic EPC data. Other information about domestic premises was out of scope for this report.

Geographical Scope

This project and the database produced cover all buildings in England, Wales, and Scotland (Great Britain). Data were not available for Northern Ireland at the time of the project (in particular business rates and meter data) so it is not (currently) included in the NBD.

1.3 Building on previous research

Data on floor area and business activities[3] at the premises level, collected by the Valuation Office Agency (VOA) for the majority of non-domestic types, have underpinned work over the last forty years aimed at understanding energy use in the building stock of England and Wales. In this project, these core data sets have been supplemented with additional data sources, models and surveys, both on-site and remote, to develop a more detailed snapshot of the GB building stock.

Four main challenges have been faced in previous studies in the UK:

- There is no common base unit for data collection across the different data sets: VOA data are collected for individual premises. Some premises comprise multiple buildings

[3] *VOA data allows premises to be classified according to the activities which take place within them rather than the sector of the economy which they serve. This is a better way to categorise premises from an energy perspective than the 'sectors' used in the Standard Industrial Classification.*

(e.g. schools) while others share a building with other premises (often seen in traditional high streets). Further, some premises types, such as mobile phone masts and storage land, are not classed as buildings. This makes it difficult to combine data that describe the built environment with data that describe ownership and activities.

- Gas and electricity metering arrangements in multi-user buildings are often complex, making it difficult to determine the relationships between gas and electricity consumption data and floor areas with precision and reliability.
- At a building level, the activity which takes place in a space has a greater bearing on its energy consumption than the sector of the economy it serves. Relating activities to buildings in a consistent manner is essential to allow comparison with previous studies and ensure that no activities are unaccounted for.
- Property taxation data from the VOA provides a very robust source of information about activities and the spaces in which they take place, but only for those activities which are assessed based on floor area and only in England and Wales. This has resulted in a large amount of missing floor space in some activity classes such as agriculture, health, education and hospitality (some of which do not pay property tax, or where property tax is not based on floor area).

In recent times different approaches have been adopted to developing models representing the non-domestic building stock. The following summarises non-exhaustively the main recent historic methods developed to address the UK building stock.

BEES

In November 2017 the government published the Building Energy Efficiency Survey (BEES). BEES reported on the non-domestic building stock in England and Wales in 2014–15. Within this overall scope the stock was split into 10 ‘sectors’ (actually activity classifications, not sectors of economic activity).

The study collected data through a large sample of telephone surveys (3,690) across all ten BEES sectors, tailored to each of 38 sub-sectors. The telephone survey responses were the primary input into two models: an energy-use model, tailored to each sub-sector, which calculated each premises’ annual energy use, broken down by end use; and an abatement model which calculated the energy-saving potential. Each of the 38 sub-sectors was analysed separately.

An overarching BEES report describes the results from across its 10 sectors, whilst more detail is provided in 10 separate sector-specific reports. The BEES study was designed to meet the following research objectives at the time:

- To update understanding of how energy is used, for a snapshot in time, across the non-domestic building stock in England and Wales in more detail than was available at the time;
- To update understanding of how energy use can be reduced across the non-domestic building stock in more detail than was available at the time;
- To understand the barriers and facilitators of energy abatement.

ND-NEED

The ND-NEED method, or the Non-domestic National Energy Efficiency Data-Framework, is a data collection and analysis framework developed by the Department for Energy Security and Net Zero (DESNZ), to understand and track the energy performance of non-domestic buildings in England and Wales. It helps to identify opportunities for energy efficiency improvements and inform policy decisions related to reducing building emissions.

ND-NEED links data from various sources, including the Valuation Office Agency (VOA) for building stock information, electricity and gas consumption data, and the Office for National Statistics (ONS) for geographic information. The collected data are processed and analysed to provide insights into energy consumption patterns and building characteristics for the non-domestic building stock. The data employed in ND-NEED is a key source of data for the NBD.

ND-NEED also incorporates a geographical component, allowing for analysis of energy consumption and efficiency at the local level, such as by Local Authority (LA) or Parliamentary Constituency (PC).

ND-NEED is regularly updated with the latest building stock and energy consumption data, ensuring that the information remains current and relevant.

3DStock

In 2017, UCL published the first description of 3DStock: A new kind of three-dimensional model of the building stock of England and Wales, for use in energy analysis.[4] This model differs from other urban and building stock models, in that it represents explicitly and in detail the spatial relationships between ‘premises’ and ‘buildings’. It also represents the pattern of activities on different floors within buildings. The geometrical/geographical structure of the model is assembled automatically from existing national data sets. Additional data from other sources including data for electricity and gas consumption can then be attached. The model was applied in practice for the Mayor of London in the development of the London Building Stock Model (LBSM).[5] The methods of data linking and analysis in 3DStock form the basis for the construction of the National Buildings Database.

NBD Phase 1

Phase 1 of the National Buildings Database, reported in February 2024, established the basis of the method which was applied at ‘high-level’ for all non-domestic premises and in greater detail to all ‘Hospitality’ premises (hotels, restaurants and bars) in England and Wales.

The project also undertook an analysis of large non-domestic properties not connected to the gas grid.

The method piloted for the ‘Hospitality’ activity class provided a full characterisation of the premises and their associated energy use for different activities. In particular, this method filled in important gaps in knowledge from existing data sets around floorspace, space heating and cooling equipment and their use. Identifying and quantifying mixed-use

[4] *https://journals.sagepub.com/doi/full/10.1177/0265813516652898*
[5] *https://journal-buildingscities.org/articles/10.5334/bc.52*

buildings, including mixed use with domestic addresses, was a key advance over previous work on non-domestic buildings.

This first phase therefore demonstrated a method for developing a digital representation of the entire building stock which has been taken forward in this second phase of the project.

The data for the Hospitality class were enhanced by remote and on-site surveys undertaken for a sample of premises. A supplementary analysis of large premises, not connected to the gas grid, was also undertaken. This included remote and onsite verification surveys, as well as detailed zero-carbon audits.

What makes NDB different?

The NBD differs from other non-domestic data systems in two main ways:

1. Floor space and 3D: The database includes all non-domestic and domestic building premises, which are characterised by activity and include, in nearly all cases, a measurement of floor space. Missing VOA floor space data for activity groupings such as hotels and pubs are estimated from LiDAR data when other data sources are not available, see Chapter 4. Collections of non-domestic premises and mixtures of non-domestic and domestic premises are assembled into 3D Self-Contained Units (SCUs) to allow the attribution of wall, window, roof and other elements. These are the primary differences compared to BEES and ND-NEED.
2. Energy and non-public data: Annualised energy meter data and other non-public data such as non-disclosed VOA data and EPC input data are matched to premises and SCUs. This is the main difference compared to 3DStock and BEES. Although meter data is matched in ND-NEED, the matching is less comprehensive and fewer non-public data sources are matched.

There are other differences that result from the purpose other approaches were developed for. For instance, BEES was developed with a key objective to identify energy-saving opportunities and estimating the mitigation potential of a range of interventions. This was not part of the remit for NBD. A major difference, implied in Point 1 above, is the representation of mixed-use buildings (SCUs) which for the first time bring together mixtures of non-domestic activities, mixtures of non-domestic and domestic activities and multi-building campuses.

1.4 Potential applications of NBD

NBD has a very wide range of applications, for an equally wide range of potential users. It can be used to inform policy decisions related to energy efficiency, decarbonisation, Building Regulations and beyond. Section 7 of this report describes examples of potential use cases, in addressing questions including:

- How many buildings could install a heat pump?
- What is the size breakdown of Great Britain’s building stock?
- How many premises are used by voluntary, community and social enterprises?
- Do we really understand the size of the public-sector stock?
- How does the number of premises compare to the number of buildings in Great Britain?
- How many premises use coal for heating?

Outputs

In addition to this report the project has the following outputs:

- The National Buildings Database (NBD) itself and associated guidance material has been provided to the Department of Energy Security and Net Zero. The full database contains certain confidential information that means that it is not possible to make it available for public use.
- National and regional aggregate data: key statistics for all activity classes and activity groups containing means, medians and distributions. These data are illustrated in the figures in tables in Section 3 but are also available in Excel format.
- Synthetic population data: Representative of all activity classes and most activity groupings at MSOA level (see Section 4.10).

1.5 Navigating this report

This report continues with an overview of the stock in Great Britain in Section 2, which is followed by summaries of the key data for each of the non-domestic activity classes in Section 3. A full explanation of the method employed to develop the database is provided in Section 4 and the quality and confidence limits of the data are discussed in Section 5. This is followed by an explanation of the challenges faced in the analysis, including for future updating, and the caveats that need to be applied to the database in Section 6. The report concludes with discussion of use cases for the database: how it can be used to answer research or policy questions.

Data tables including the data used for charts in this report are available here:

https://tinyurl.com/NBDDataTables

2 Overview of Great Britain's building stock

This chapter provides an overview of the entire non-domestic building stock of Great Britain.

2.1 Overview

NBD reports a total of 2.2 million premises, 896 million m^2 of floorspace and 1.3 million self-contained units (SCUs, similar to buildings) for all non-domestic premises in England, Wales and Scotland (GB) for April 2023.

These premises are classified using an established classification system into the activity classes shown in Table 2-1. More detail can be found in Section 4.5, but this table illustrates how NBD allocates activity, activity groups and activity class to every premises.

Table 2-1: Activity classes, with counts of activity and activity groups per class[6]

Activity Class	Abbreviation	Number of activities in class	Number of activity groups in class
Agriculture, Countryside, Animals	AG	17	4
Arts and Leisure	AR	30	6
Community	CO	17	7
Domestic	DO	12	1
Education	ED	22	7
Emergency	EM	5	4
Factory	FA	58	7
Health	HE	9	5
Hospitality	HO	29	6
Miscellaneous	MI	1	1
MoD	MO	13	5
Office	OF	13	5
Shop	SH	38	5
Sport	SP	39	6
Transport	TR	27	6
UNCODED	UNCODED	1	0
Utilities	UT	17	5
Warehouse	WA	18	4

The breakdown of the non-domestic premises, SCUs and floorspace can be seen in Figure 2-1 and has also been visualised as a Sankey diagram in Figure 2-2. Figure 2-1 shows that 'Factory' has the largest total floor area (181 million m^2), followed by 'Warehouse' (172 million m^2), 'Shop' (137 million m^2) and 'Office' (115 million m^2). Combined, these four activity classes account for more than two thirds of all non-domestic floorspace. The smallest total floor areas are for 'Transport' (5 million m^2), 'Emergency' (4 million m^2) and 'MoD' (Ministry of Defence) (2 million m^2).

[6] The total number of CaRBE activities available can exceed those used for a model snapshot. Table 2-1 lists the numbers of activities available in CaRBE. Some activities may cease to be used by the VOA (for example 'Customs Inspection Facility') whilst for others, there may simply be no trading premises for that activity at the time of the model snapshot. For this reason the numbers of CaRBE activities listed in Table 2-1 may not always align with the numbers reported elsewhere in this report.

The largest activity classes for the number of **premises** as a percentage of all non-domestic premises are 'Shop' (25%), 'Office' (21%), 'Factory' (14%), 'Hospitality' (11%) and 'Warehouse' (11%). This shows that more than half of non-domestic premises in Great Britain are used as Shops, Offices or Factories and similar activities.

The largest activity classes for **floorspace** as a percentage of all non-domestic floorspace are 'Factory' (20%), 'Warehouse' (19%), 'Shop' (15%), 'Office' (13%) and 'Education' (10%). This shows that even though many more premises are used as Shops or Offices and similar activities than as Factories or Warehouses, Factories and Warehouses are larger, on average. The Sankey diagram (Figure 2-2) also shows that Factories are using much more energy than other activity classes.

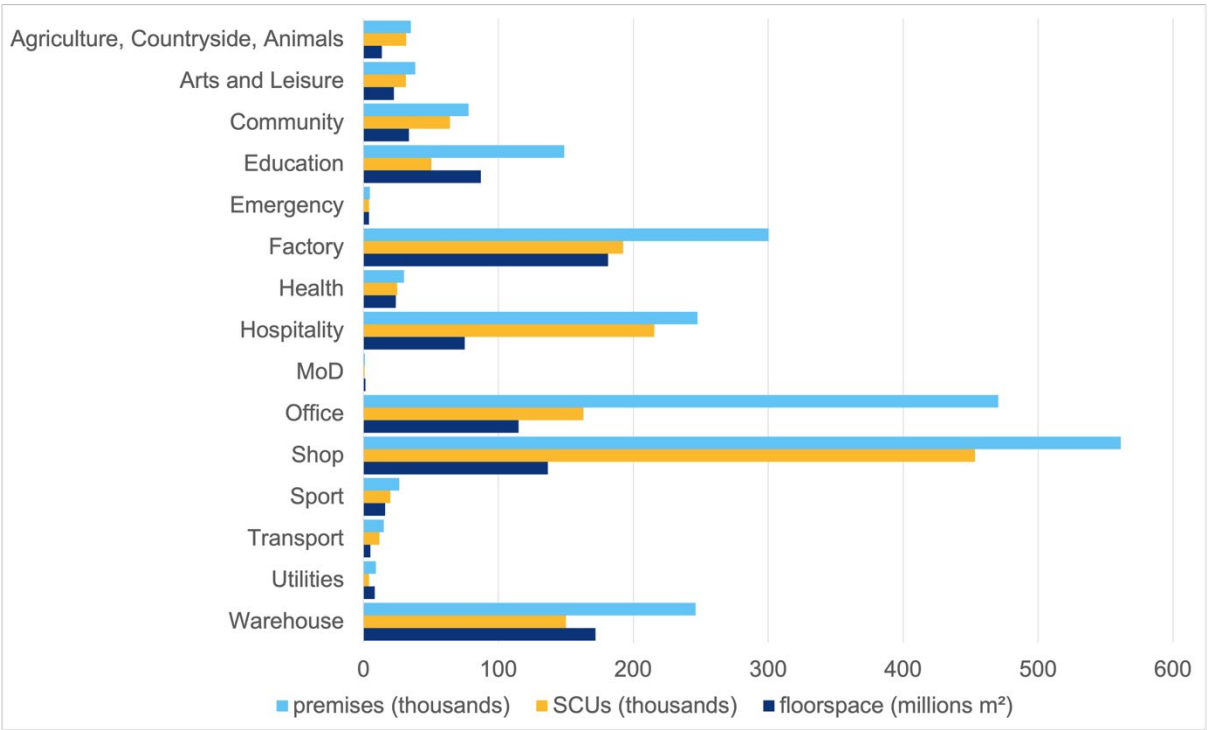


Figure 2-1 Premises, floorspace and SCUs by activity class.

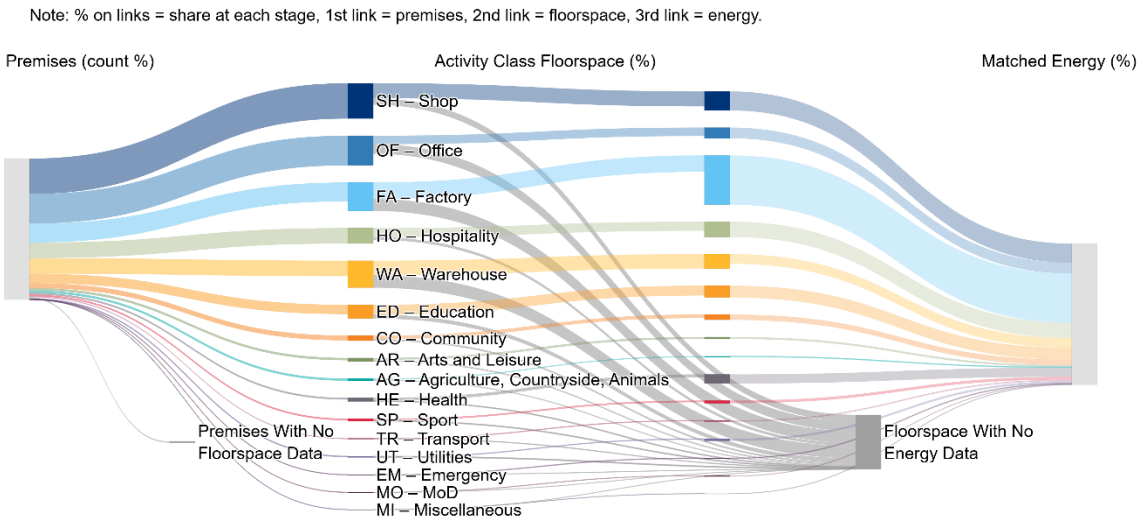


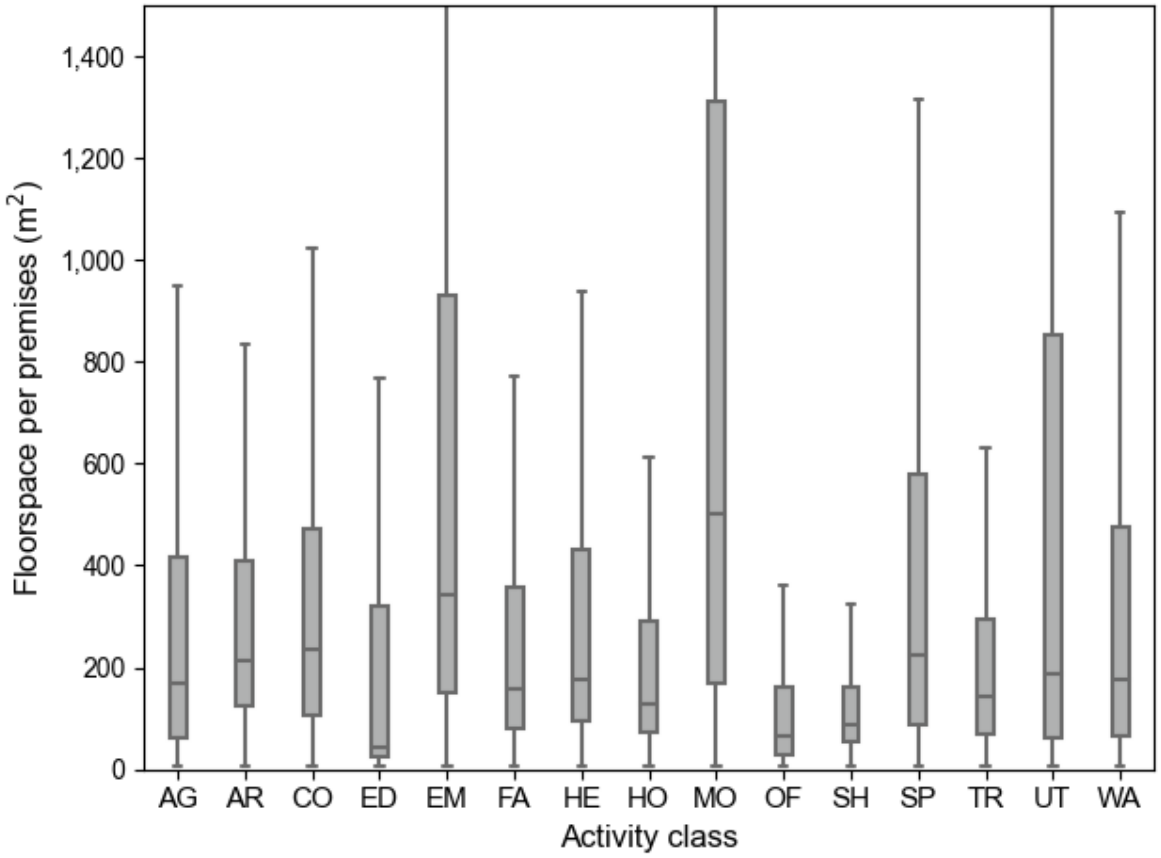
Figure 2-2 Sankey diagram showing percentage of premises, floorspace and matched energy for non-domestic premises in NBD

2.2 Domestic

'Domestic', or residential buildings, are present in NBD as UPRNs but not as fully modelled 3D geometry (apart from the locations where they are in close proximity to non-domestic premises). EPCs, energy data, rural / urban flags and many of the other variables reported here can also be linked to domestic addresses (but not floorspace). Some non-domestic activities overlap with domestic data, such as self- catering holiday homes. Figure 2-6 shows the distribution of domestic EPC numeric scores compared to the DEC and non-domestic EPC ratings. The sample size for these domestic EPCs is far larger with nearly 30 million domestic UPRNs of which 63% have an EPC (as opposed to 2.23 million non-domestic premises where around 25% have an EPC or a DEC). Whilst domestic is present in NBD this report does not report directly on it as an activity class in its own right.

2.3 Floorspace

NBD uses a range of floorspace sources to assign floorspace to non-domestic premises. The sources include VOA data (72% of premises), Energy Certificate data (5%) and a 3D model of the buildings (18%), which has been used to estimate floor area per floor of the building. Around 1% of premises fail to match to any source of floorspace data.



AG = Agriculture, Countryside, Animals	ED = Education	HE = Health	OF = Office	TR = Transport
AR = Arts and Leisure	EM = Emergency	HO = Hospitality	SH = Shop	UT = Utilities
CO = Community	FA = Factory	MO = MoD	SP = Sport	WA = Warehouse

Figure 2-3 Box and whisker plot of floorspace per premises in NBD by activity class

Figure 2-3 shows the box and whisker plots for the floorspace of individual premises by activity class for all non-domestic premises. (Middle lines show median values, boxes show inter-quartile ranges, and 'whiskers' show the minimum/maximum values excluding outliers.) 'MoD' has the largest median floorspace (502 m^2), followed by 'Emergency' (341 m^2) and 'Community' (236 m^2). The smallest median floorspaces are for 'Shop' (87 m^2), 'Office' (65 m^2) and 'Education' (42 m^2). The y axis has been limited to 1,500 m^2 to make the chart more legible (but this means that the 'whiskers' are not visible for 'Emergency', 'MoD' and 'Utilities').

2.4 Energy use

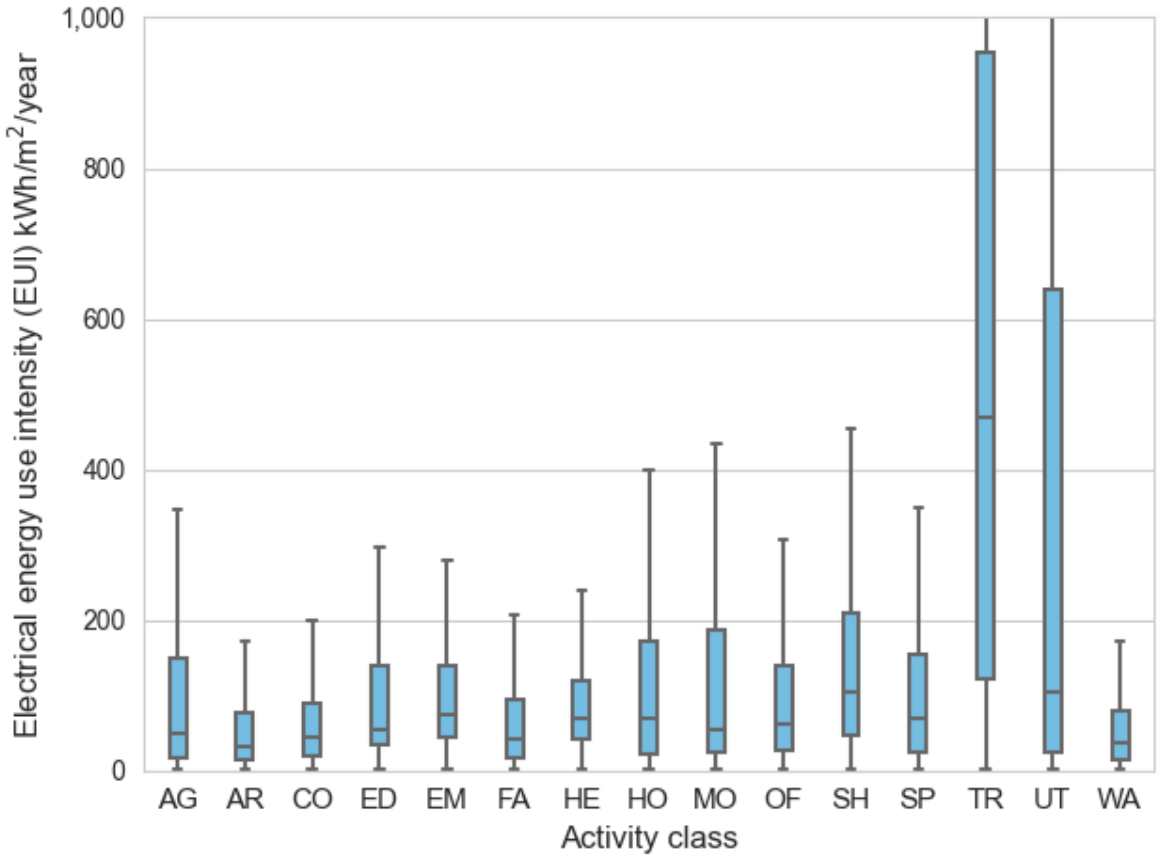
The total energy use from gas and electricity meters that match to non-domestic NBD premises is 64,772 GWh of electricity and 75,972 GWh of gas, for the year 2023[7]. (Note that this is not total energy use – just the proportion that can be matched to premises. It is therefore much lower than the total energy use figures reported in ND-NEED and elsewhere.) The overall match rate for energy meters to non-domestic premises in NBD is

[7] Note that mandatory half-hourly electricity meter data runs from January 1st 2023 to December 31st 2024. All other electricity meter data runs from January 31st 2023, to January 30th 2024. The gas meter year runs from mid-May 2023 to mid-May 2024.

48% for electricity and 22% for gas (although this rate includes premises in postcodes with no gas connections). The individual match rates for each activity class are reported in Chapter 3 and it ranges from 72% for Shop (electricity) down to 20% for Utilities (electricity) and from 51% for Health (gas) down to 3% for Utilities (gas). When 'off gas postcodes' are excluded from this analysis then the overall match rate for gas meters rises to 25%.The proportion of matched data to floorspace that is missing meter data is shown in Figure 2-2.

When the total matched energy is aggregated at the activity-class level, the largest percentages of this for electricity are 'Factory' (27%), 'Shop' (19%), 'Hospitality' (12%) and 'Office' (11%) with the smallest being 'Emergency' (<1%). For gas, the largest percentages are 'Factory' (40%), 'Hospitality' (10%), 'Education' (10%) and 'Health' (9%), with the smallest being 'Agriculture, Countryside, Animals' (<1%).

In terms of energy use intensity (EUI), the largest median electricity EUIs are for 'Transport' (457 kWh/m^2/year), 'Shop' (102 kWh/m^2/year) and 'Utilities' (91 kWh/m^2/year). For Gas use, the largest median EUIs are for 'MoD' (184 kWh/m^2/year), 'Community' (177 kWh/m^2/year) and 'Emergency' (165 kWh/m^2/year). This can be seen in the box and whisker plots in Figure 2-4 and Figure 2-5.



AG = Agriculture, Countryside, Animals	ED = Education	HE = Health	OF = Office	TR = Transport
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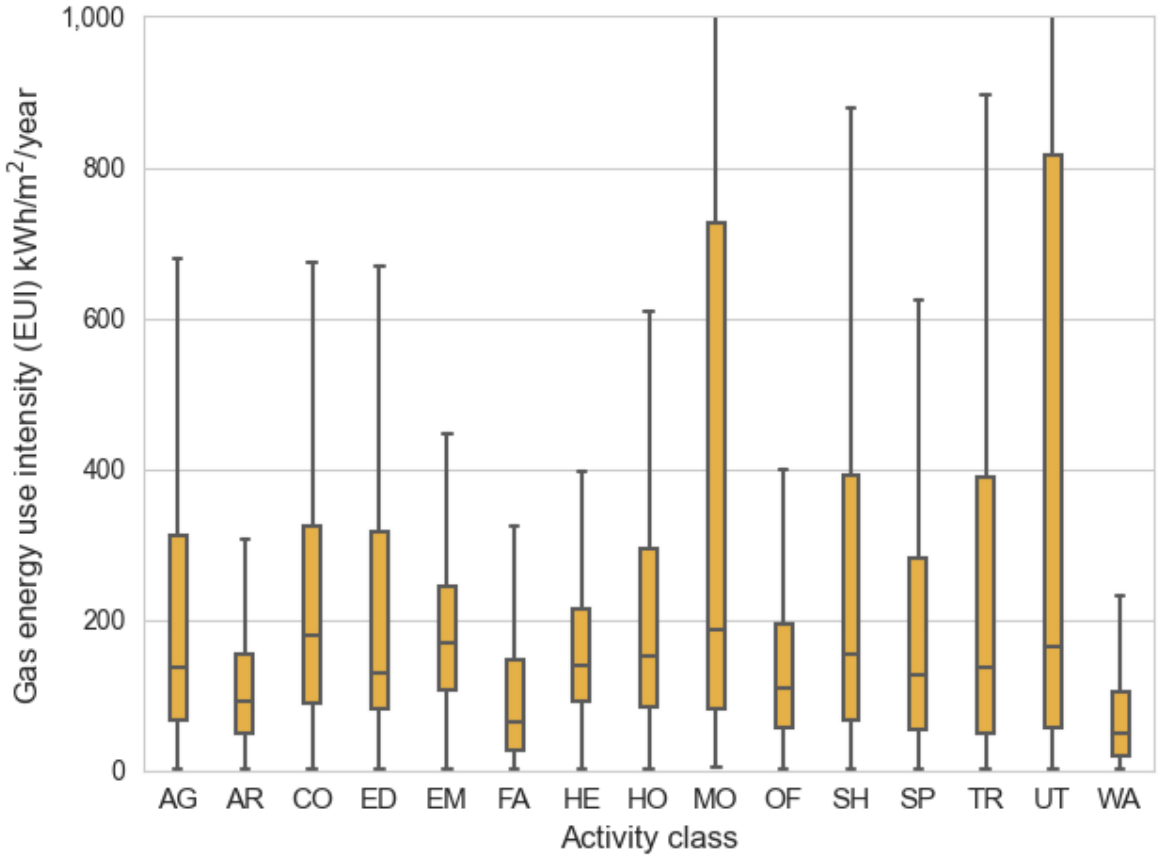
CO = Community	FA = Factory	MO = MoD	SP = Sport	WA = Warehouse

The vertical axis has been cropped at 1,000 kWh/m^2/year which makes the chart more legible but obscures the 'whiskers' for Transport (TR) and Utilities (UT).

Figure 2-4: Box and whisker plot of electricity Energy Use Intensity (kWh/m^2/year) for each activity class.



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The vertical axis has been cropped at 1,000 kWh/m^2/year which makes the chart more legible but obscures the 'whiskers' for MoD (MO) and Utilities (UT).

Figure 2-5: Box and whisker plot of mains gas Energy Use Intensity (kWh/m^2/year) for each activity class.

2.5 Energy Certification

Energy Performance Certificates (EPCs) and Display Energy Certificates (DECs) can provide information on premises in NBD when they can be linked to the records. Around 25% of NBD premises link to a non-domestic EPC and 1% link to a DEC. The presence of EPCs is very much lower for non-domestic premises than for domestic premises, mostly due to lower levels of occupier churn.

Whilst this report focusses on non-domestic, NBD does include all domestic addresses and 63% of these link to a domestic EPC. However, it is important to note that some non-domestic premises link to domestic EPCs (around 7%) with the majority of these matching to premises in the Hospitality class, especially the “Holiday Home (Self Catering)” activity.

The non-domestic matched energy certificate ratings are shown as box and whisker plots in Figure 2-4. The overall median non-domestic asset rating is 76 (D) and for a DEC the operational rating 82 (D). The median lodgement date for these certificates was July 2019.

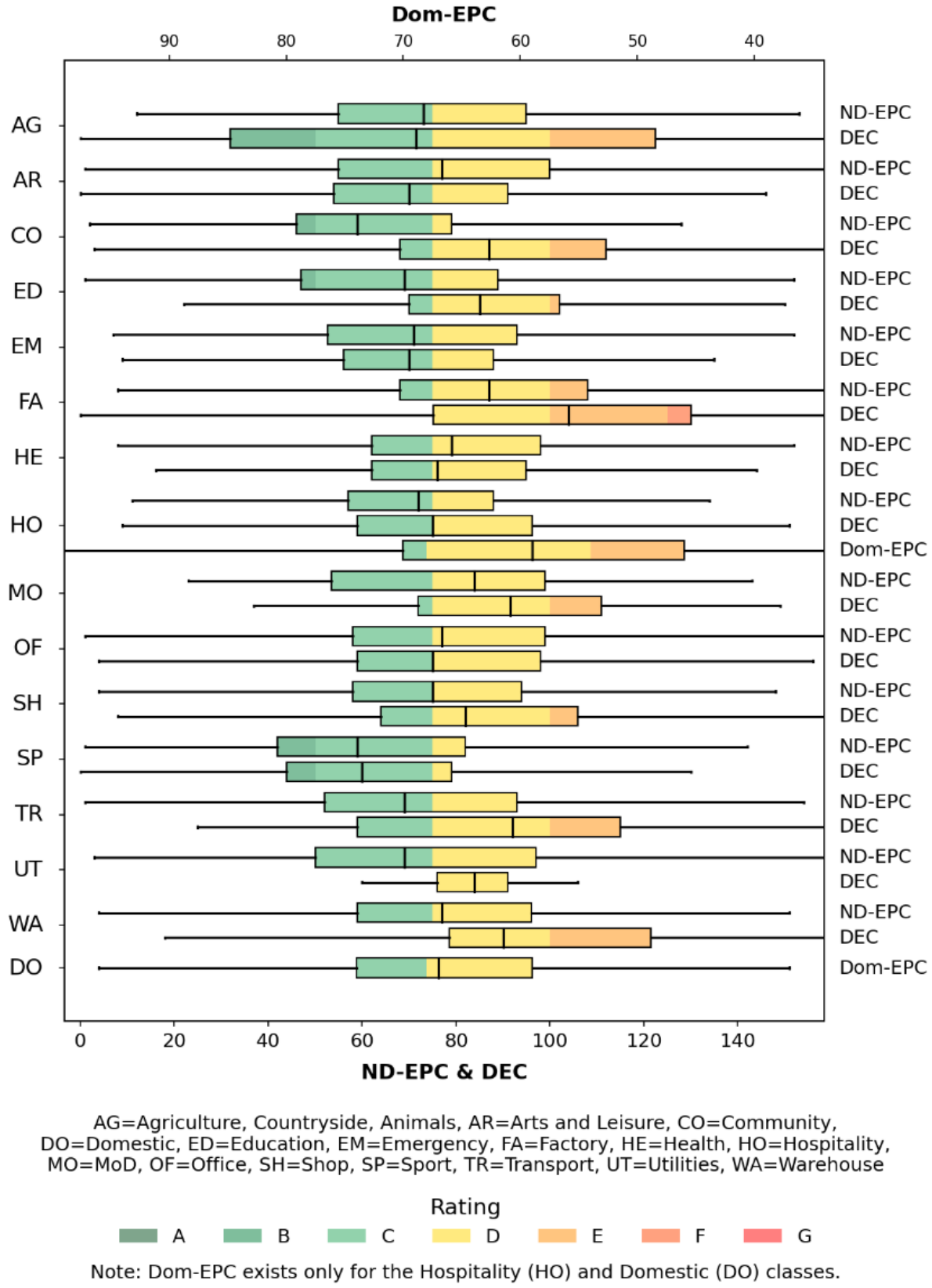

Figure 2-6 Box and whisker plots of non-domestic EPCs, DECs and domestic EPCs for the 15 activity classes in NBD. The scale for domestic EPCs is shown at the top.

At the activity class level 'Sport' and 'Community' have the lowest (best performing) median non-domestic EPC asset ratings (59, on a scale from 1 to 100) whilst 'Factory' and 'MoD' have the highest (poorly performing) asset ratings (87 and 84 respectively). For DECs, 'Sport', 'Emergency' and 'Arts and Leisure' have the lowest (best performing) operational rating (60, 70 and 70 respectively). For 'Hospitality', where several activity types have a large number of matches to domestic EPCs (for example, 'self-catering Holiday Homes'), the median current energy efficiency (domestic EPC) is 59 (D).

The median lodgement date is most recent for Education (May 2021) and is least recent for 'Agriculture, Countryside, Animals' (January 2017).

Although the NBD does not include the 3D representations of the domestic stock as its primary objective, some of the domestic stock is fully represented where the SCU includes both domestic and non-domestic premises, see Section 4.7. The full population of the domestic stock is recorded by UPRN, along with a copy of the EPC and energy-use data. Figure 2-6 shows the distribution of domestic EPC numeric scores compared to the DEC and non-domestic EPC ratings, allowing comparison of the A-G ratings. Note that both the sample size and coverage differ for domestic EPCs. At the NBD target date there were 30 million domestic UPRNs (63% with EPCs) compared to 2.2 million non-domestic UPRNS (25% with DEC or non-domestic EPC). Figure 2-6 shows that the non-domestic stock typically has more premises attracting higher (worse) EPC ratings compared to the domestic stock, where the inter-quartile range is EPC rating C-D.

2.6 Heritage and Rural / Urban

NBD has been linked to spatial data for Conservation areas and Listed buildings across the whole of GB. By applying these flags to NBD, it is possible to identify premises which might have one, or both of these heritage flags applied to them. The results show that 31%[8] of all non-domestic premises are either in a Conservation area (17%) or are part of a Listed building (5%) or both (8%). When measured by floor area these percentages are slightly different with Conservation area 9%, Listed building 5%, both 5%. This indicates that around 20% of the non-domestic floor area of GB has some form of heritage flag.

[8] Not all conservation areas have data available in England at the time of this report. The data reported is for premises in areas that are covered by the full data which excludes around 400,000 premises in and around 65 local authorities. Wales and Scotland are not affected by this.

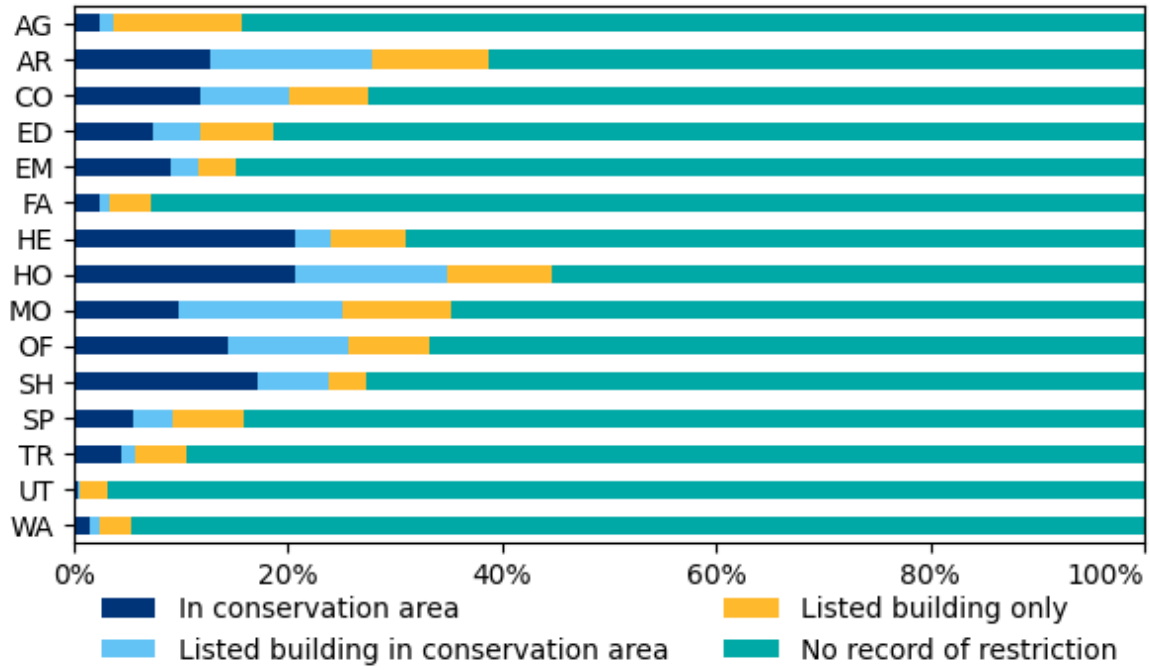

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Figure 2-7 Percentage of premises per activity class which are in a Conservation area, or are a Listed building or have both flags applied[8]

When this is viewed at the activity class level, as shown in Figure 2-7, 'Office' and 'Hospitality' both have over 40%[8] of their premises with some form of heritage flag. 'Utilities', 'Factory', 'Transport' and 'Warehouse' are least likely to have a heritage restriction with less than 15% of premises having some form of heritage flag.

The Office for National Statistics (ONS) allocate a 'rural / urban' flag at the output area (OA) level of geography, and the 2021 version of this has been applied to the premises in NBD (with the 2022 version for Scotland). Overall, 79% of premises and 81% of non-domestic floorspace is in an output area classified as 'Urban' whilst 21% of premises and 19% of floorspace is classified as 'Rural'.

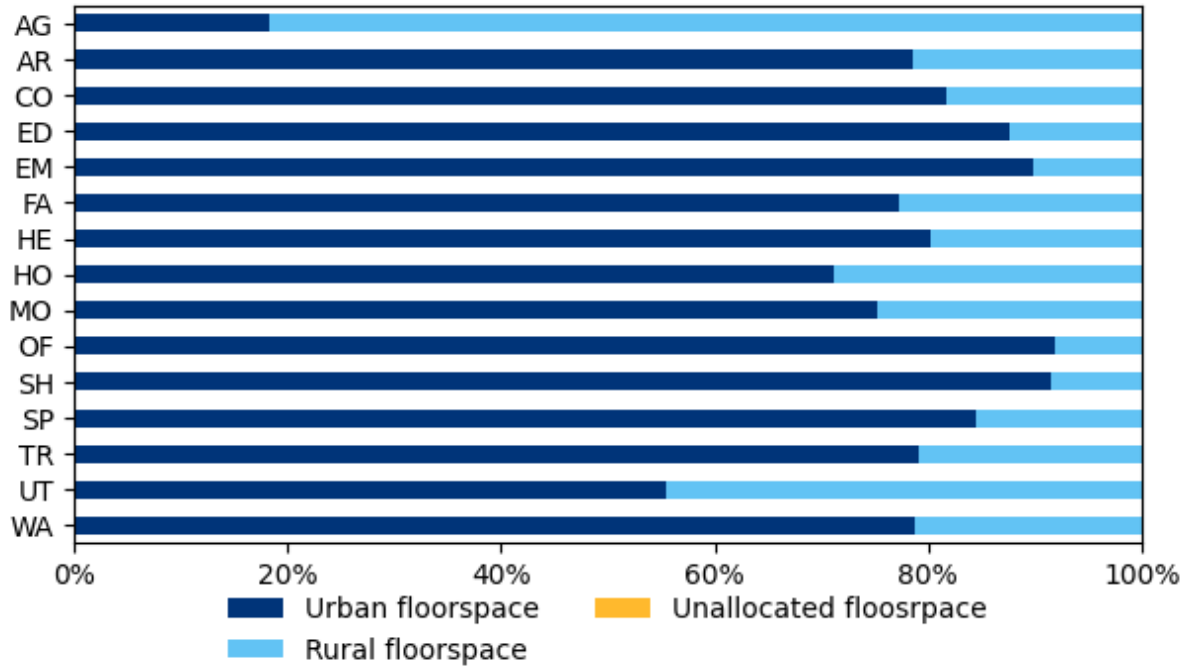

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Figure 2-8 Percentage of floorspace per activity class that are classified as Urban or Rural

At the activity class level, shown in Figure 2-8, there is some variation with 'Education', 'Shop', 'Office' and 'Health' having over 80% of their premises in urban areas whilst 'Agriculture, Countryside, Animals' and 'Utilities' have over 70% of their premises in rural areas.

2.7 Mixed use buildings

The relationship between premises and buildings can be complex, with some buildings containing multiple premises and others containing a mixture of non-domestic and domestic. Sometimes there are multiple non-domestic activities *and* domestic in the same building. Using NBD, it is possible to analyse the SCUs (analogous to buildings) to see whether they have sole occupiers or are mixed use. This analysis shows that of SCUs containing at least one non-domestic premises, 59% have sole occupiers of the building, whilst 14% share the SCU with one or more non-domestic premises and 27% share the SCU with one or more domestic address. This means that 41% of non-domestic building stock SCUs (buildings) are mixed use buildings / have multiple occupants. This fact is significant when it comes to coordinating any renovation or retrofit work in such a building, since there are multiple parties involved who need to be in agreement over such work.

Figure 2-9 shows the percentage of SCUs, containing at least one activity class with their mixed classification categorised. This shows that SCUs containing either 'Shop' or 'Office' premises occupy the highest numbers of mixed-use SCUs, with over 60% of 'Shop' or 'Office' premises sharing the SCU with either non-domestic premises or domestic addresses. SCUs containing 'Hospitality' (35%) or 'Shop' (49%) have the highest percentages of SCUs where there is also a domestic address. 'Office' (41%), 'Warehouse' (32%) and 'Transport' (26%) have the highest percentages of SCUs where they share the SCU with at least one other non-domestic premises. 'Emergency' (87%), 'Community' (79%) and 'Arts and Leisure'

(78%) have the largest percentages of SCUs where they are the sole occupier of the SCU. Whilst it might seem strange that some premises (for example 'Factory', or 'Transport') share buildings with domestic uses, NBD demonstrates how premises come in all sorts of shapes, sizes and configurations, and that shared buildings form a proportion of the building stock for *all* activity classes. 'Factory', for example, includes jewellery workshops, and it is quite common for such premises to have a flat above or a shop beneath them.

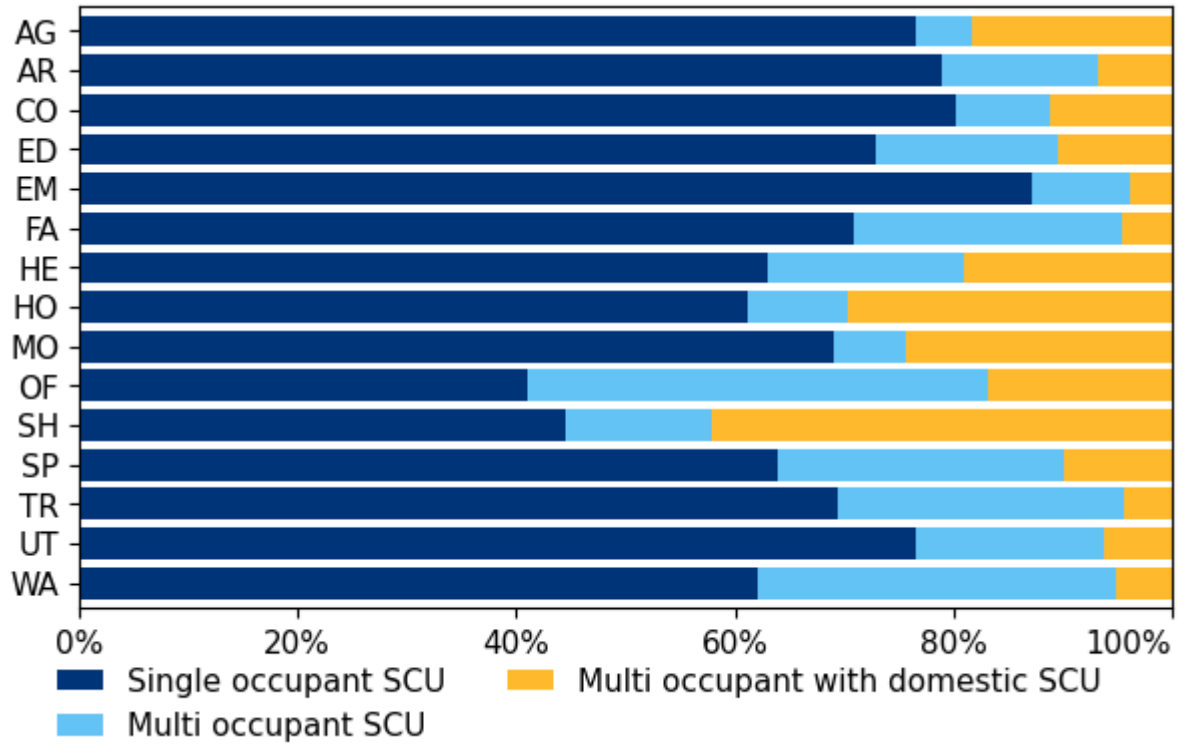

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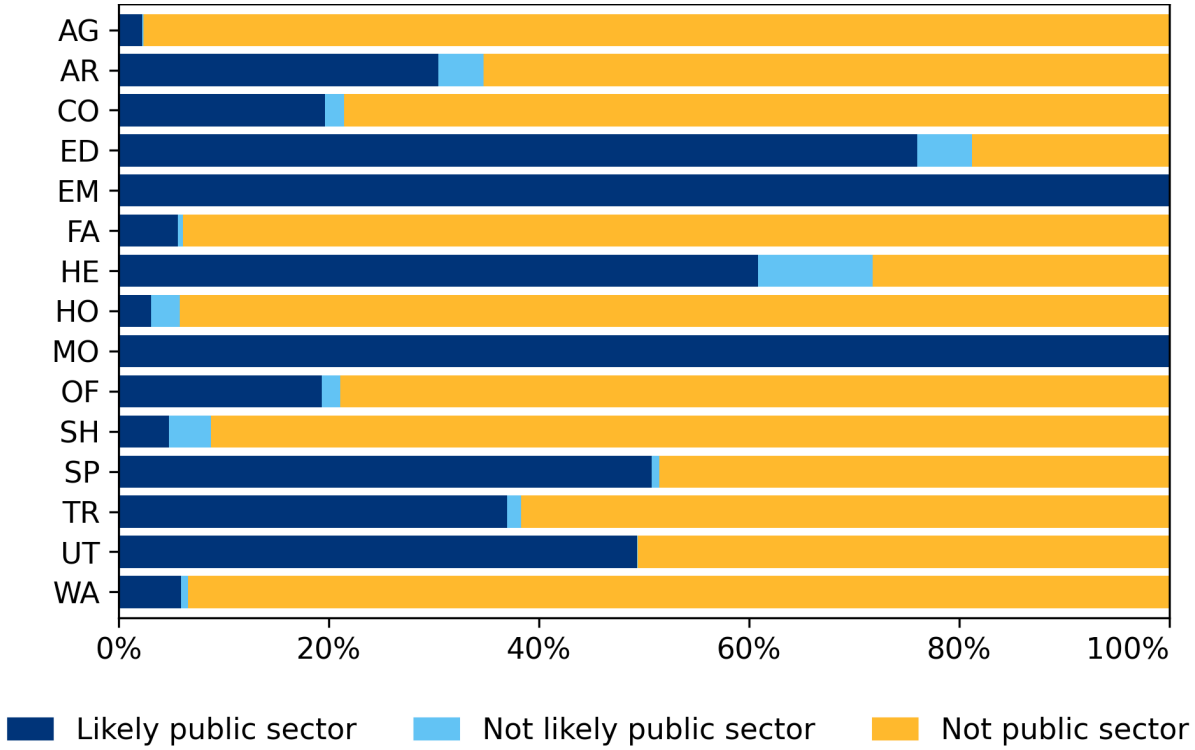
Figure 2-9 Percentage of premises in each activity class that are occupying SCUs classified as sole occupiers or sharing with other non-domestic premises or sharing with domestic addresses

2.8 Public Sector

NBD has developed a flag which indicates whether a premises is likely to be owned, managed or occupied by a Public Sector organisation. This suggests that 9% of non-domestic premises and 18% of non-domestic floor area is 'likely to be Public Sector', whilst 1% of premises and 2% of floorspace was 'not likely to be Public Sector' with 91% of premises and 79% of floorspace flagged as 'Not Public Sector'. ('Not Public Sector' indicates there is more certainty about the ownership and management, whereas 'Not likely public sector' indicates there is no definitive data about public-sector status.)



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CO = Community	FA = Factory	MO = MoD	SP = Sport	WA = Warehouse

Figure 2-10 Percentage of floorspace per activity class that is flagged as Public Sector

The data is shown in more detail in Figure 2-10 where the percentage of floorspace flagged as each of the three categories of Public Sector likelihood are shown. At the activity class level both 'Emergency' and 'MoD' stand out as being flagged as 100% likely to be Public Sector whilst 'Education' (76%) and 'Health' (61%) have the next highest floorspace percentages assigned as Public Sector followed by 'Sport' (51%) and 'Utilities' (49%). The lowest levels of Public Sector floorspace appear in 'Agriculture, Countryside, Animals' (2%), 'Hospitality' (3%) and 'Shop' (5%). 'Office' is an important activity class since it includes Central Government Offices and Local Authority Offices, and it shows 19% of floorspace as being flagged as 'likely to be Public Sector'.

2.9 Age and Materials

Using a variety of data sources for building age it was possible to allocate an age band to around 97% of premises in NBD. The breakdown of age bands for the whole non-domestic stock is shown in Table 2-2.

Table 2-2: Premises and floorspace aggregated by building age band for all non-domestic premises in NBD

Age period	Percentage non-domestic premises	Percentage non-domestic floorspace
pre-1919	35	18
1919-1939	8	6
1940-1975	20	22
1976-1990	13	17
1991-2006	12	19
2007-2021	11	16
2022 onwards	<1	<1
No available data	2	2

The period pre-1919 has the largest percentage of premises (35%), but the second largest percentage of floorspace (18%), showing these premises tend to be smaller, whilst the largest floorspace percentage is for the period 1940-1975 (22%).

At the activity class level shown in Figure 2-11, it is clear that 'Hospitality' has the largest percentage of floorspace built in the pre-1919 age bracket (47% of all 'Hospitality' floorspace), followed by 'Agriculture, Countryside, Animals' (38%), 'Arts and Leisure' (31%) and 'Community' (30%), whilst 'Health' has the highest percentage of floorspace built in the 2007-2021 bracket (28%) along with 'Education' (23%) and 'Warehouse' (22%).

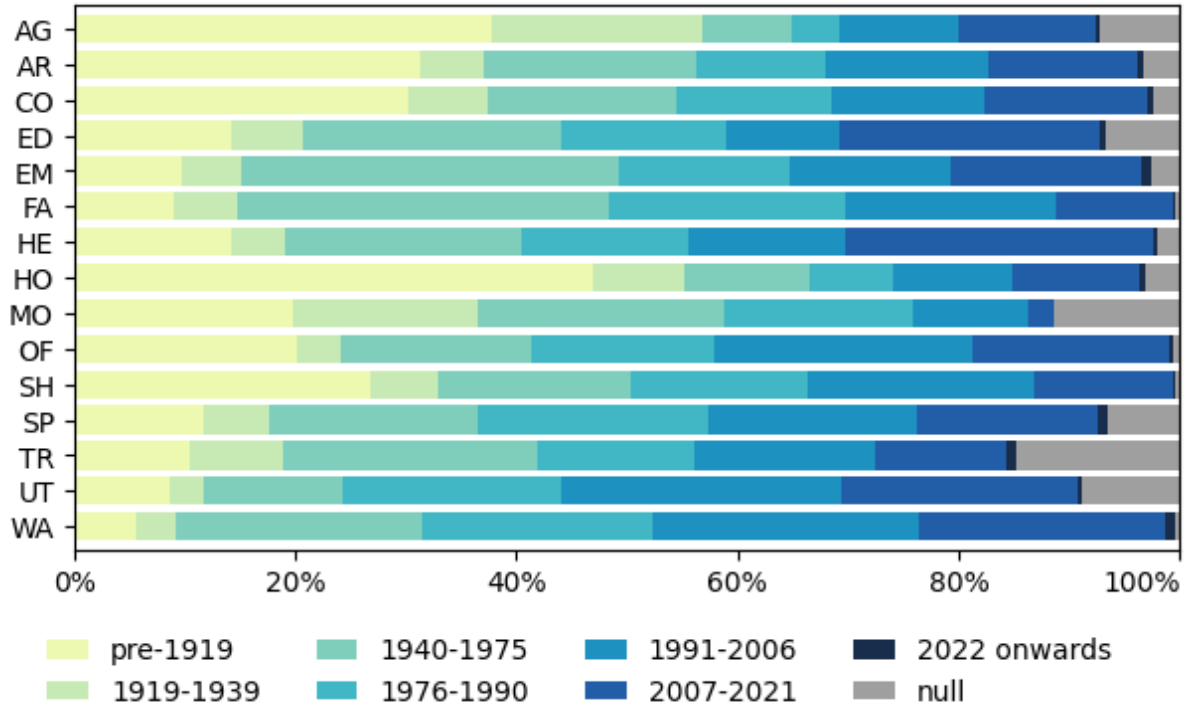

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Figure 2-11 Floorspace of premises in different age brackets for NBD by activity class

NBD has been linked to the Ordnance Survey National Geographic Database (OS NGD), which includes data on materials. Using the 3D model generated for NBD it is possible to

calculate the exposed wall areas for each SCU and match this to OS NGD to attribute materials to these wall areas. The results show that masonry is by far the largest percentage of exposed wall area in SCUs occupied by at least one non-domestic premises (74%), while 11% use some form of rainscreen cladding, 9% are classified as 'mixed', 2% are concrete and around 2% have no data.

At the activity class level shown in Figure 2-12, this breakdown clearly indicates the dominance of masonry as the largest percentage classification for all the activity classes. Notably, 'Factory' has a large percentage of mixed materials (33%) and rainscreen cladding (20%), whilst 'Warehouse' has 59% masonry and 30% rainscreen cladding.

AG = Agriculture, Countryside, Animals	ED = Education	HE = Health	OF = Office	TR = Transport
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Figure 2-12 Wall materials (sourced from OS NGD) as a percentage of wall area of SCUs containing activity classes

2.10 Regional differences

When NBD is aggregated by region using International Territorial Level (ITL) 1 (2021), which represents the UK in 12 statistical regions (previously known as NUTS 1) it is possible to identify regional differences in the data, as shown in Figure 2-13.

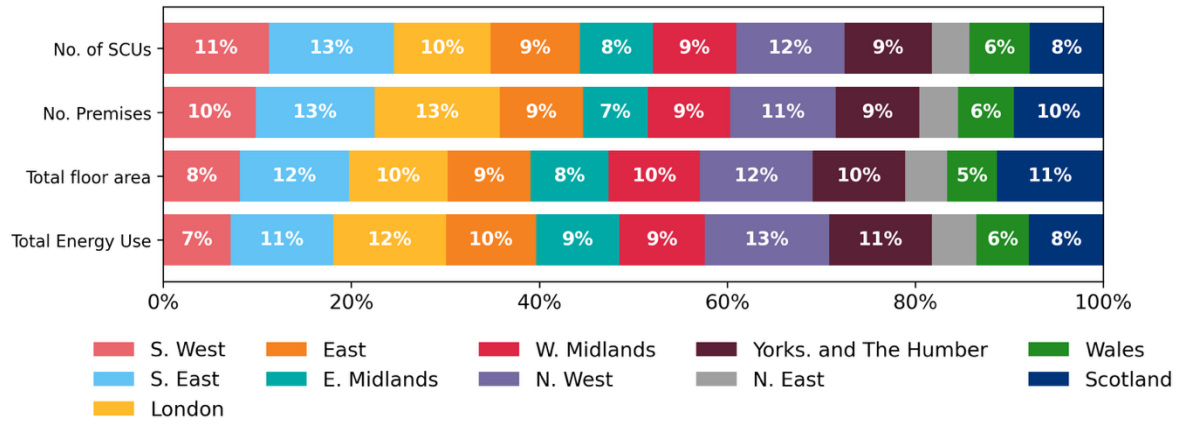


Figure 2-13 Regional variations of the key variables in NBD

For the percentages of SCUs, the largest is the South East (of England) (13%) followed by the North West (12%), South West (11%) and London (10%). The smallest is the North East (4%).

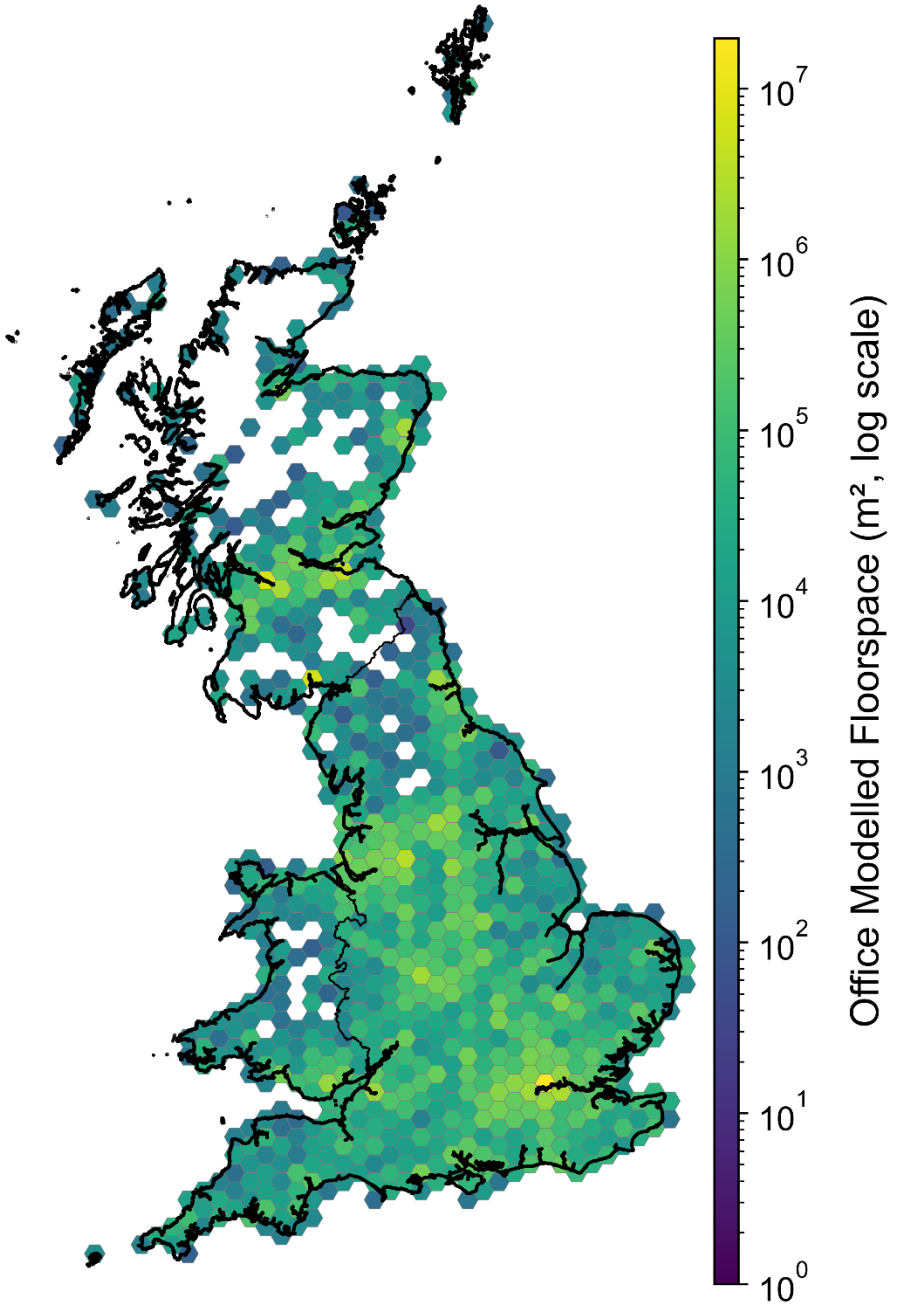
The largest percentage of all GB non-domestic premises is in London (13%), followed by the South East (13%) and the North West (11%). The smallest percentage of premises is in North East (4%).

For floor area, NBD suggests that the largest total floorspace is in the North West (12%) followed by the South East (12%) and London (10%). The smallest is again the North East (4%).

For total energy, the largest total energy is for the North West region (13%), followed by London (12%), Yorkshire and The Humber (11%) and the South East (11%). The smallest is North East (5%).

The spatial data in NBD can be reported at a range of different spatial aggregations (not just ITL regions). One such method is to use hexagonal polygons which tesselate (i.e. fit together without gaps) across GB. Each hexagon on the map represents an equal-area slice of GB and can be used to aggregate many of the different data points that exist in NBD. Figure 2-14 shows an example of this for the activity class ‘Office’ which has been coloured to show the total amount of ‘Office’ floorspace within each hexagonal cell. Because the raw values span tiny local offices to sprawling business parks and warehouses, the colour legend is scaled logarithmically: each band (from purple through green to yellow) marks a ten-fold increase in cumulative floorspace. In practical terms, a yellow hexagon might contain ten times as much office space as a green one, and a hundred times more than a purple one. The black outlines delineate coastlines and major administrative boundaries, helping to orient population centres and regional clusters of office activity. All other activity class hexmaps are included in Appendix C.

As shown in Figure 2-14, Great Britain’s primary business hubs are immediately evident: London and the Thames Valley exhibit the highest floorspace densities, with Manchester, Birmingham, and Edinburgh also standing out. Conversely, rural upland zones in Wales, Scotland, and the Pennines fall into the lowest bands, indicating minimal ’Office’ floorspace in these areas.



This chart uses a base-10 colour scale because modelled floorspace values range over several orders of magnitude—from small local shops up to massive warehouses. Equal colour steps correspond to equal multiplicative changes in floorspace.

Figure 2-14: Hexagonal bin map of modelled floorspace (m², log scale) for the Office activity class.

3 Activity-class summaries

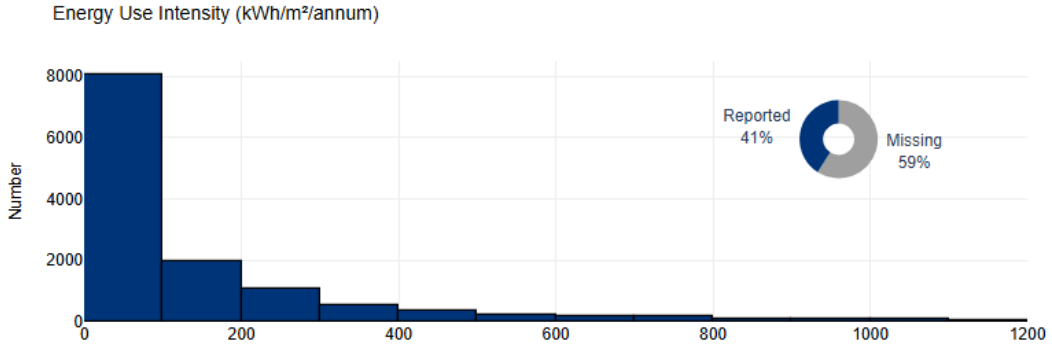
3.1 Agriculture, Countryside, Animals

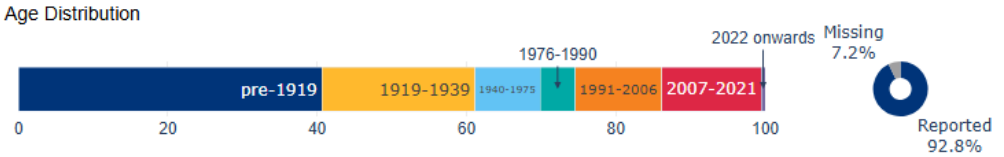
Overview

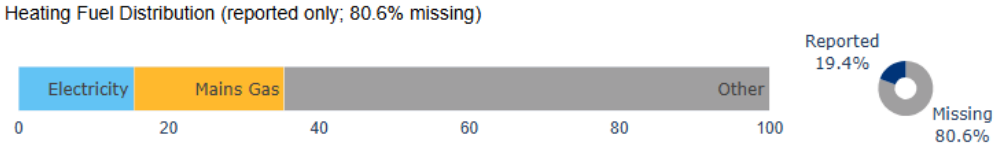
In the Agriculture, Countryside, Animals activity class, the analysis covers 35,211 premises. The average Energy Use Intensity (EUI) is 348 kWh/m²/annum. The dominant building age group is pre-1919 (38%), and the predominant heating fuel is District & Community Heating (9%).

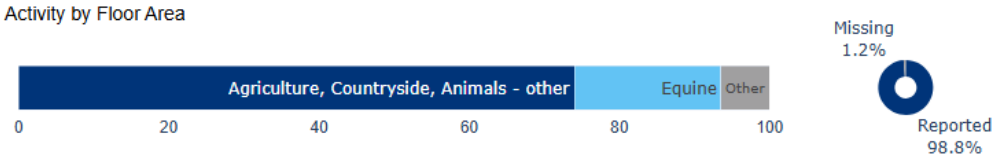
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Equine	12.0	2.65
Animal Boarding	4.8	0.41
Animals, medical	1.7	0.47
Agriculture, Countryside, Animals - other	16.7	10.06









3.1.1 Overview

The 'Agriculture, Countryside, Animals' class has a total of 35,211 premises and 13.59 million m² of floorspace. This makes it the ninth largest activity class by premises, with 9% of all non-domestic premises and the eleventh largest class by floorspace: 2% of all non-domestic floorspace. This class contains 17 activities, which have been grouped into four activity groups. The largest activity by count is 'Agriculture, Countryside, Animals NEC' with 15,806 premises. The largest by total floorspace is 'Agriculture, Countryside, Animals NEC' with 9.41 million m² of floorspace. In total NBD reports 31,616 SCUs (which roughly equate to buildings) for 'Agriculture, Countryside, Animals'.

For ‘Agriculture, Countryside, Animals’ as a whole, there is no equivalent grouping of data in either ND-NEED (2023) or BEES (2014) with which to make comparisons.

Figure 3.1-1 below shows all activities in the 'Agriculture, Countryside, Animals' class aggregated into four activity groups. 'Agriculture, Countryside, Animals - other' has the largest number of premises but these have a relatively small median floorspace (251 m²), making it the first largest activity group in terms of floorspace within 'Agriculture, Countryside, Animals'. The activity group with the largest total floorspace is 'Agriculture, Countryside, Animals - other' where the median floor area is 251 m² and the total floor area is 10.06 million m². The largest share of matched energy demand is for the group ‘Agriculture, Countryside, Animals – other’.

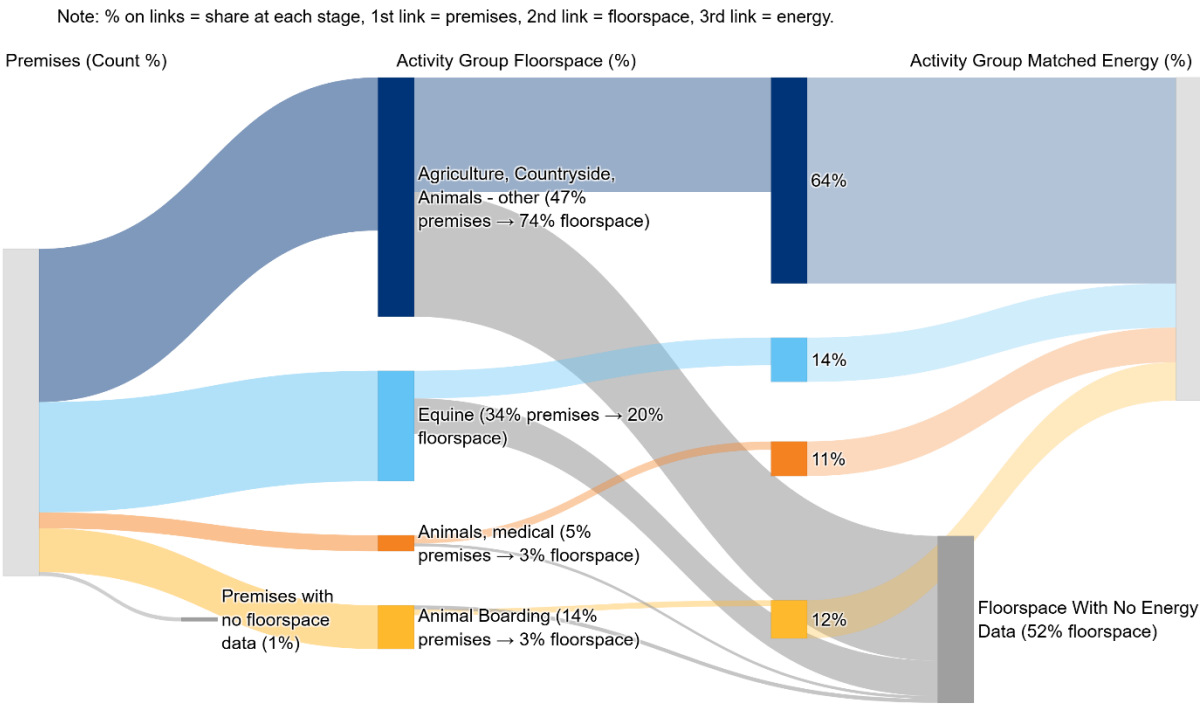


Figure 3.1-1: Share of activity group by number of premises, floorspace and total energy demand

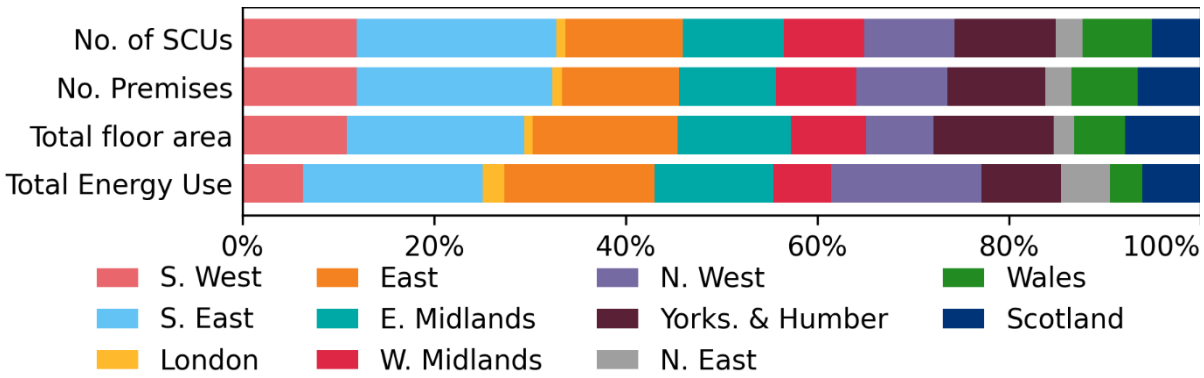


Figure 3.1-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.1-2), for England these are comparable with the NUTS regions. For 'Agriculture, Countryside, Animals' the South East has the largest percentage of premises (20%) and SCUs (21%). The largest percentage of floorspace is in South East (19%). For the regional share of total energy demand, South East has the largest percentage (19%).

3.1.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Agriculture, Countryside, Animals - other' (251 m²) and the smallest is 'Animal Boarding' (19 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.1-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

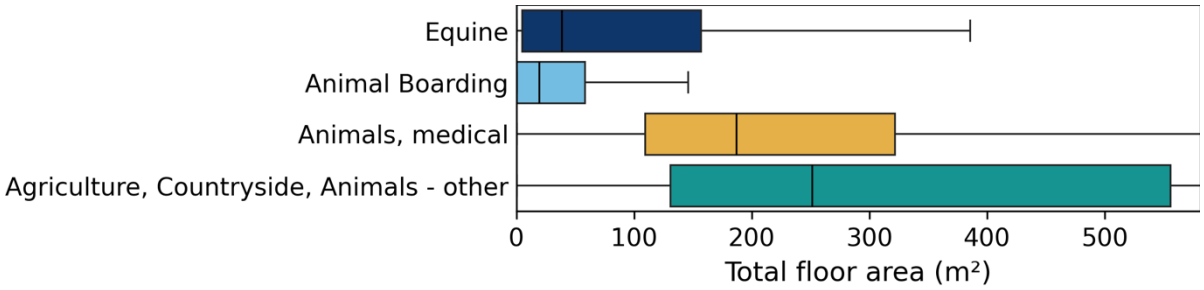


Figure 3.1-3: Distribution of total floor area by activity group

3.1.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 44% of 'Agriculture, Countryside, Animals' premises have at least one matched electricity meter and 9% have at least one matched gas meter. The total matched energy use for 'Agriculture, Countryside, Animals' is 642 GWh per year, which consists of 470 GWh for electricity and 172 GWh for gas per year.

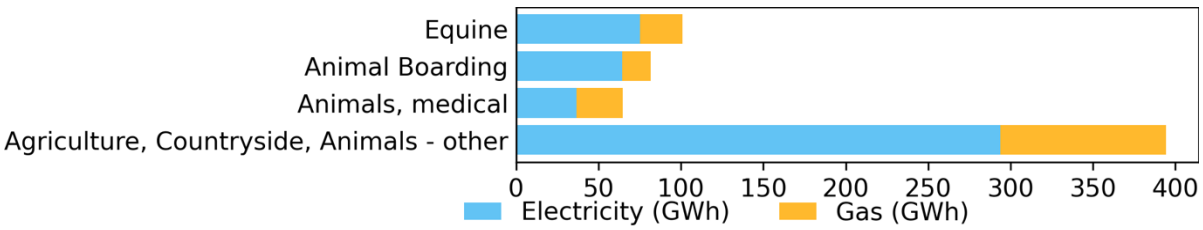


Figure 3.1-4: Total energy demand (GWh) for 'Agriculture, Countryside, Animals' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in 'Agriculture, Countryside, Animals' is Profile Class 1, which represents 36% of all electricity meters in the activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where domestic classes are re-categorised. Pa is where very high domestic meter usage (>100,000 kWh) means that they are considered to be non-domestic, with Profile Class Pb representing cases where high consumption (between 50,000 and 100,000 kWh) is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

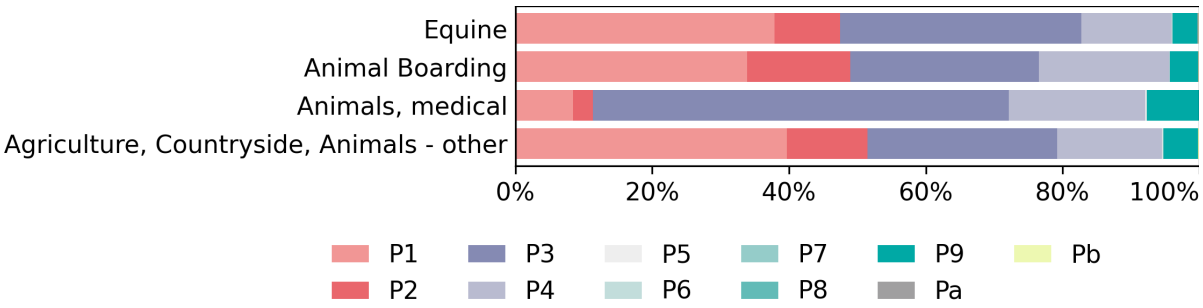


Figure 3.1-5: Percentage of meter profile classes for electricity meters by activity group

Around 41% of all 'Agriculture, Countryside, Animals' premises (46% of 'Agriculture, Countryside, Animals' floorspace) are located in postcodes classified as off the gas grid (based on Xoserve data). Figure 3.1-6 below shows that 'Agriculture, Countryside, Animals - other' is the activity group that has the largest share (51% by floorspace) of off the gas grid postcodes and 'Animals, medical' have the lowest share (11%). This partially explains the low matching to gas meter data (9%) described above. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

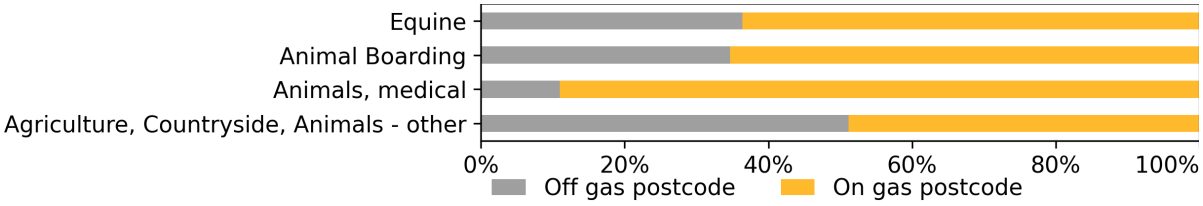
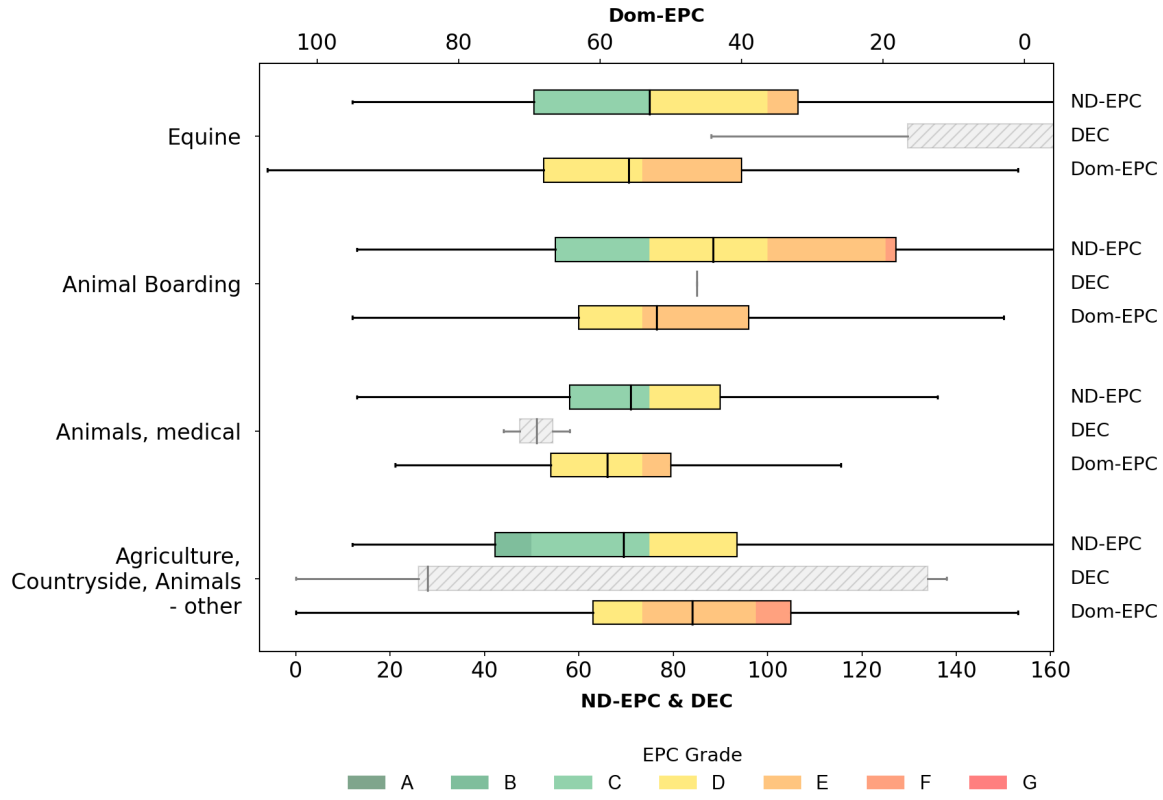


Figure 3.1-6: Percentage of floorspace on or off gas grid by activity group

3.1.4 Energy certification

Around 4% of all 'Agriculture, Countryside, Animals' premises have an energy certificate with around 4% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Agriculture, Countryside, Animals' was April 2017.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.1-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that numerous domestic EPCs match to the `Agriculture, Countryside, Animals - other` group which may be 'Farm' premises, and have a median current energy efficiency value of 47 (E). Animals, medical has the best performing non-domestic EPCs with a median asset rating of 71 (C).

3.1.5 Energy use detailed insights

Within 'Agriculture, Countryside, Animals', the activity group with the highest median energy use intensity (EUI) for electricity is 'Animal Boarding' (275 kWh/m² per year) and for gas it is 'Animal Boarding' (672 kWh/m² per year). For total EUI (gas and electricity combined) 'Animal Boarding' have the highest value (355 kWh/m² per year), see Figure 3.1-8 below (chart values truncated to 76th percentile of highest activity group).

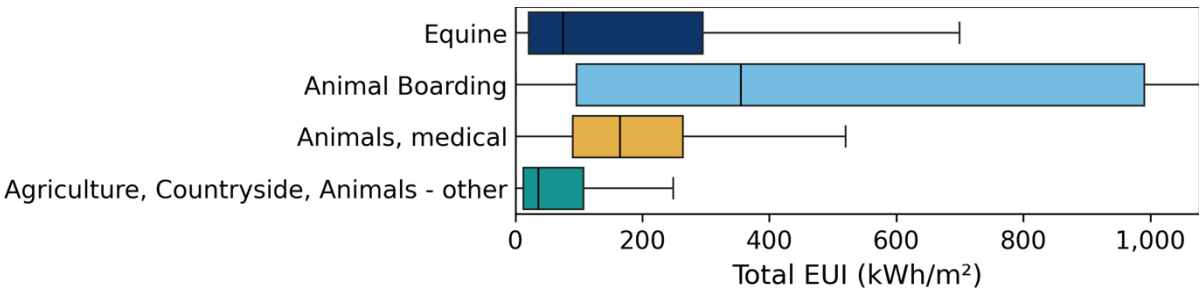


Figure 3.1-8: Distribution of total Energy Use Intensity (EUI) by activity group

As shown in Figure 3.1-9 below, much of the floorspace in the 'Agriculture, Countryside, Animals' class does not have an energy certificate ('No EC'). 'Animals, medical' floorspace is predominantly heated by 'Mains Gas', with 'Electricity' also being important. 'Oil & Liquid Fuels' occur in each group, probably reflecting rural locations that are not on the mains gas grid.

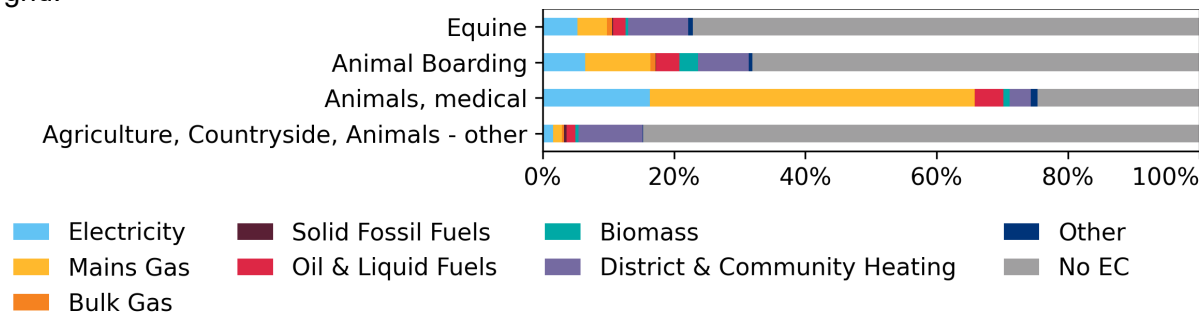


Figure 3.1-9: Heating fuels as percentage of total floorspace by activity group

Figure 3.1-10 below, shows a mix of heating equipment in the activity groups. Where an energy certificate has been matched to premises, 'Animals, medical' and 'Animals, boarding' are shown to be mostly 'Heating and Ventilation' but with significant floorspace treated by 'Air Conditioning'. The floorspace of the two remaining groups is mostly treated using 'Boilers and Radiators'.

Note that in some cases we know the heating fuel, but consumption data is not available. This happens for bottled gas, for example.

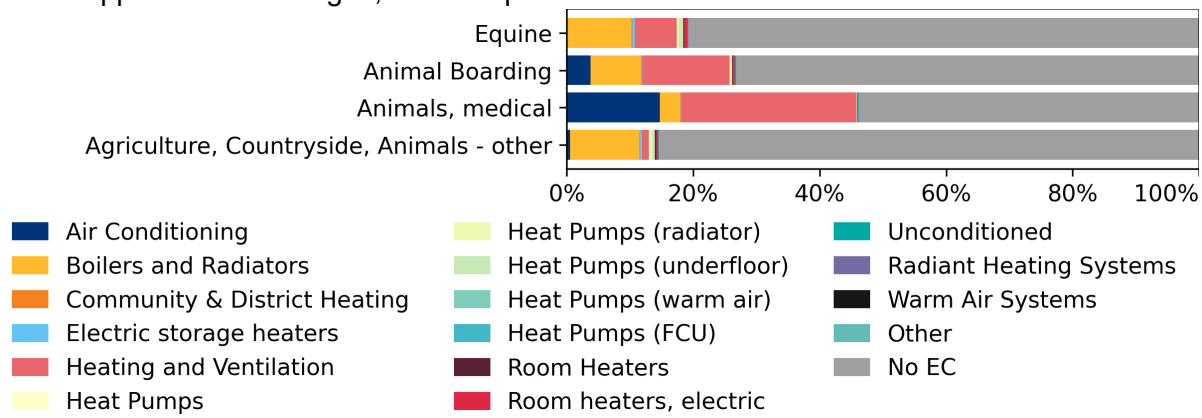


Figure 3.1-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is

'Animals, medical' (37%) whilst the lowest percentage is for 'Equine' (< 1%), as shown in Figure 3.1-11 below.

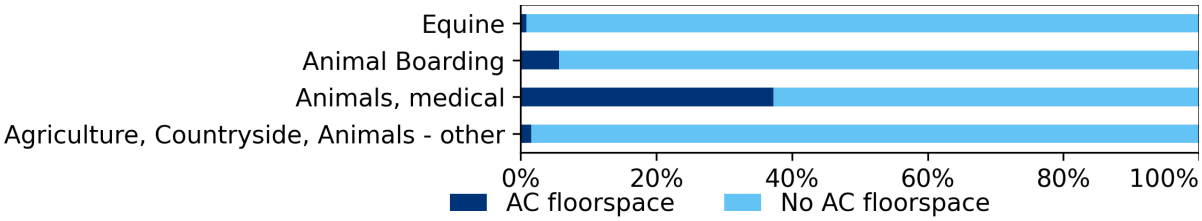


Figure 3.1-11: Air-conditioned floorspace by activity group

3.1.6 Heritage and Rural Urban

84% of all 'Agriculture, Countryside, Animals' premises are in an area with no Conservation area or Listed building restrictions whilst 16% are either in a Conservation area, or are a Listed building or both. 'Animals, medical' has the largest amount of their floorspace in heritage restricted areas (19%). More details can be seen in Figure 3.1-12 below.

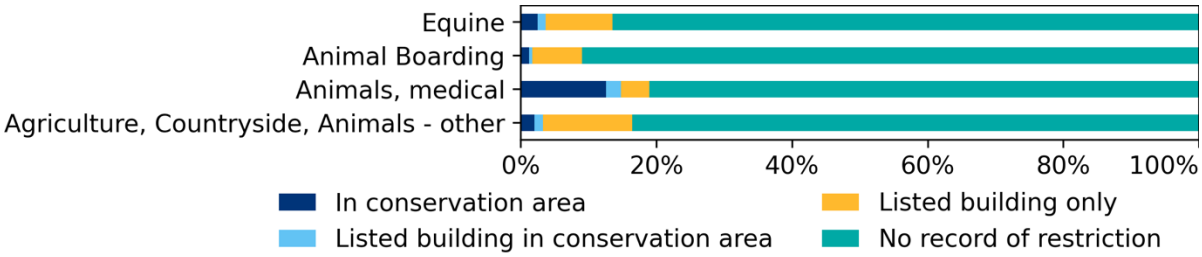


Figure 3.1-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 22% of premises and 18% of floorspace in the 'Agriculture, Countryside, Animals' activity class may be found in an urban area. The largest activity group is 'Animals, medical' where 68% of its floorspace is in an urban area, whilst 'Agriculture, Countryside, Animals - other' has the largest percentage of its floorspace in rural areas (85%), as shown in Figure 3.1-13 below.

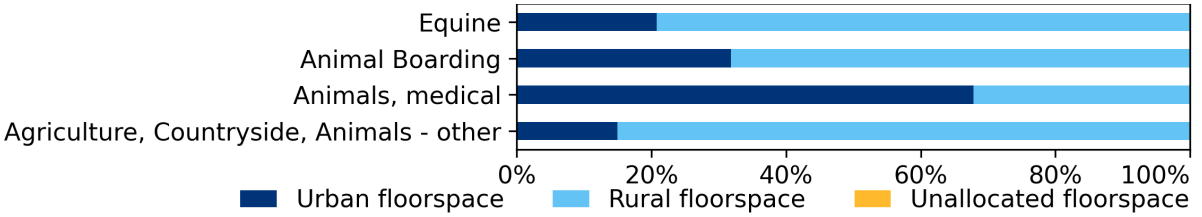


Figure 3.1-13: Floorspace by ONS Urban / rural classification by activity group

3.1.7 Mixed-use buildings

Within the 'Agriculture, Countryside, Animals' class, 74% of SCUs are occupied by a single 'Agriculture, Countryside, Animals' premises, whilst 5% share the SCU with other non-domestic premises and 21% share the SCU with domestic premises.

Figure 3.1-14 below shows 'Equine' is the activity group with the highest percentage of cases where they are the sole occupier of the building (80%) whilst 'Animals, medical' has the highest percentage of SCUs shared with other non-domestic premises (9%) and

'Animals, medical' has the highest percentage of SCUs shared with domestic residential uses (34%).

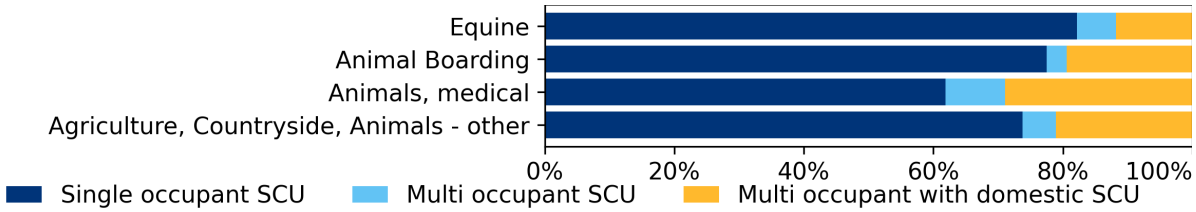


Figure 3.1-14: Percentage of premises by mixed-use SCU classification by activity group

3.1.8 Public sector

Around < 1% of 'Agriculture, Countryside, Animals' premises and < 1% of 'Agriculture, Countryside, Animals' floorspace is likely to be Public Sector. This is as would be expected since very few 'Agriculture, Countryside, Animals' premises are expected to be owned or managed by Local or Central Government.

'Agriculture, Countryside, Animals - other' is the activity group with the highest percentage of premises likely to be Public Sector (< 1%) and this represents < 1% of their activity group floorspace. 'Agriculture, Countryside, Animals - other' is the activity group with the lowest percentage of premises (< 1%) and floorspace (< 1%) likely to be Public Sector. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled 'Likely public sector' in NBD.

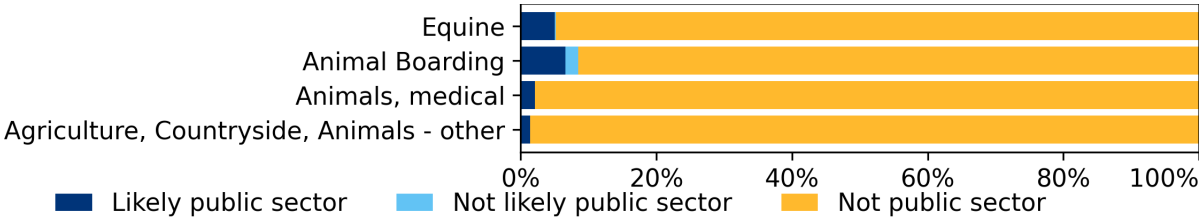


Figure 3.1-15: Percentage of floor area assigned 'Public sector' by activity group

3.1.9 Age and materials

40% of 'Agriculture, Countryside, Animals' premises and 38% of Agriculture, Countryside, Animals floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1976-1990' for premises (5%), which represents 4% of floorspace.

The details at the activity group level are shown in Figure 3.1-16 below.

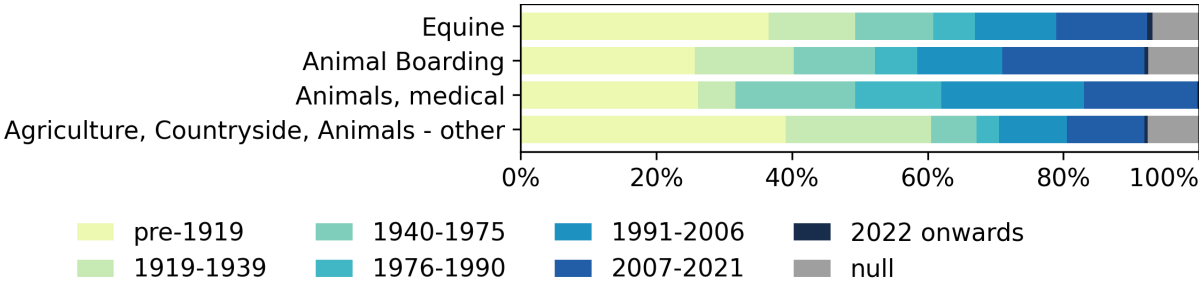


Figure 3.1-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Agriculture, Countryside, Animals' activity class (measured by wall area). The 'Agriculture, Countryside, Animals - other' activity group has the largest wall area (6.0 million m²) when measured from the 3D geometry in the database, and 85% of this is masonry (see Figure 3.1-17) which represents 56% of the total wall area in 'Agriculture, Countryside, Animals'.

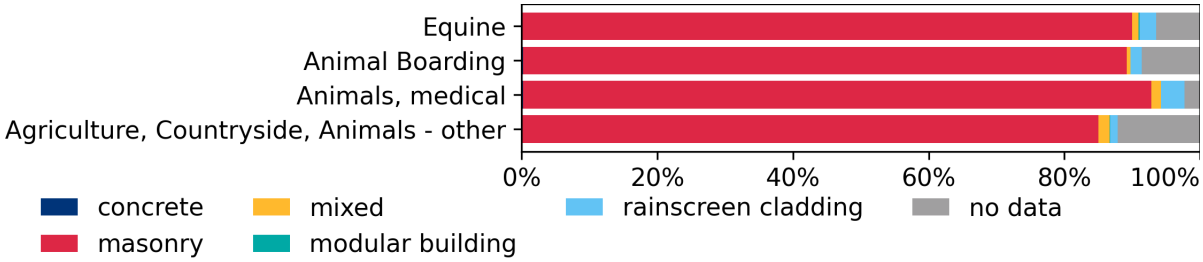


Figure 3.1-17: Distribution of total wall area by NGD material and activity group

Table 3.1-1: Summary statistics for Agriculture, Countryside, Animals by activity group

Activity group	No. of premises	No. of SCUs	total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Equine	12,017	9,716	2.65	222	34.1	19.5
Animal Boarding	4,759	4,274	0.41	87	13.5	3.0
Animals, medical	1,738	1,640	0.47	268	4.9	3.4
Agriculture, Countryside, Animals - other	16,697	16,134	10.06	614	47.4	74.0

Table 3.1-2: Summary energy statistics for Agriculture, Countryside, Animals by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
Equine	75	101.05	15.7
Animal Boarding	355	81.73	12.7
Animals, medical	164	64.67	10.1
Agriculture, Countryside, Animals - other	36	394.39	61.4

3.2 Arts and Leisure

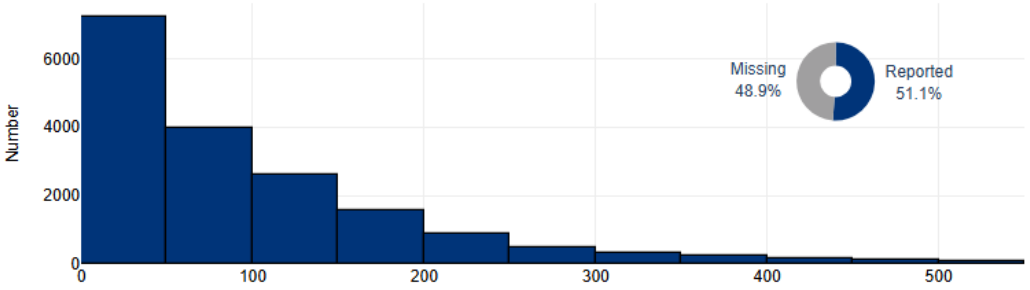
Overview

In the Arts and Leisure activity class, the analysis covers 38,429 premises. The average Energy Use Intensity (EUI) is 282 kWh/m²/annum. The dominant building age group is pre-1919 (31%), and the predominant heating fuel is Mains Gas (29%).

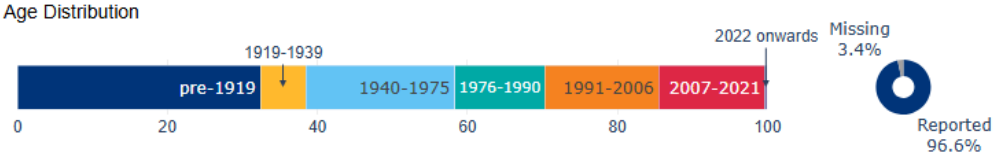
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Halls/huts	21.3	7.34
Clubhouses etc	5.0	2.21
Museums etc	6.1	5.57
Auditoria etc	2.0	5.13
Tourist attractions etc	1.0	0.79
Arts and Leisure, other	3.0	1.61

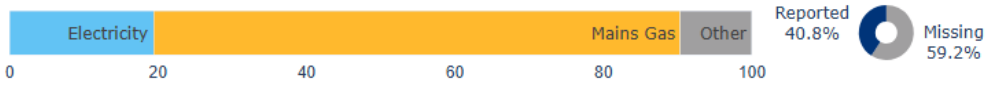
Energy Use Intensity (kWh/m²/annum)



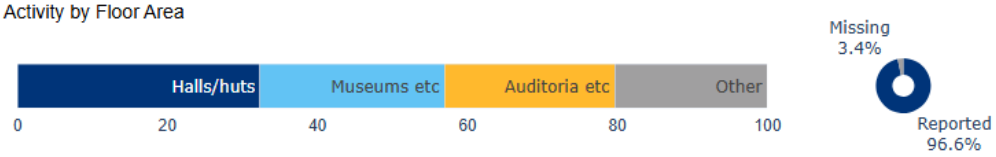
Age Distribution



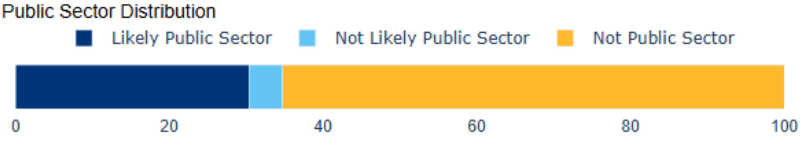
Heating Fuel Distribution (reported only; 59.2% missing)



Activity by Floor Area



Public Sector Distribution



3.2.1 Overview

The 'Arts and Leisure' class has a total of 38,429 premises and 22.66 million m² of floorspace. This makes it the eighth largest class by premises count with 2% of all non-domestic premises and the nineth largest class by floorspace with 3% of all non-domestic floorspace. This class contains 30 activities, which have been grouped into six activity groups. The largest activity by count is 'Village hall, Scout/Guide hut, Cadet hut/centre, Youth club' with 18,213 premises. The largest by total floorspace is 'Village hall, Scout/Guide hut, Cadet hut/centre, Youth club' with 4.41 million m² of floorspace. In total NBD reports 31,588 SCUs (which roughly equate to buildings) for 'Arts and Leisure'.

For 'Arts and Leisure' as a whole, ND-NEED (2023) combines Community along with Arts and Leisure and reports 0.05 million buildings (165% of NBD SCUs) and 15.30 million m² of floorspace (68% of NBD). BEES (2014) also combined Community with Arts and Leisure and reported 78,500 premises (204% of NBD premises) and 52 million m2 of floorspace (229% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, mean these comparisons should be treated with caution.

Figure 3.2-1 below shows all activities in the 'Arts and Leisure' class aggregated into six activity groups. 'Halls/huts' has the largest number of premises but these have a relatively small median floorspace (189 m²), making it the first largest activity group in terms of floorspace within 'Arts and Leisure'. The activity group with the largest total floorspace is 'Halls/huts' where the median floor area is 189 m² and the total floor area is 7.34 million m². The largest share of matched energy demand is for the activity group ‘Auditoria etc’ with 28% of the total energy demand.

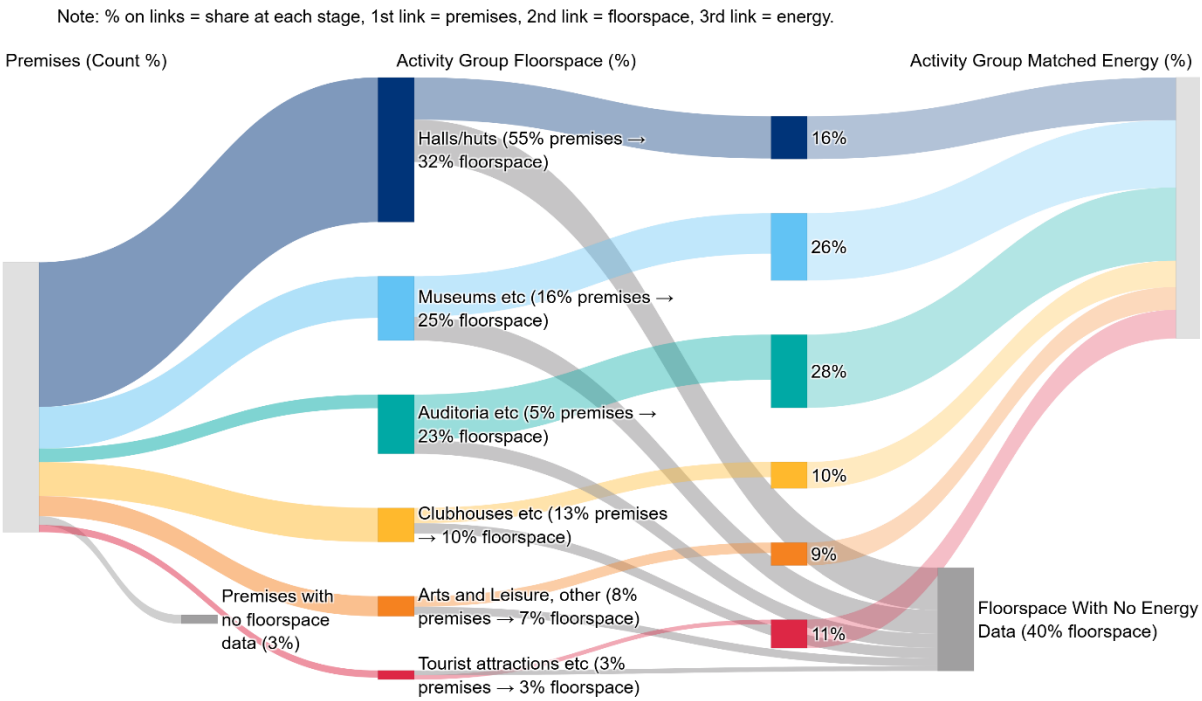


Figure 3.2-1: Share of activity group by number of premises, floorspace and total energy demand

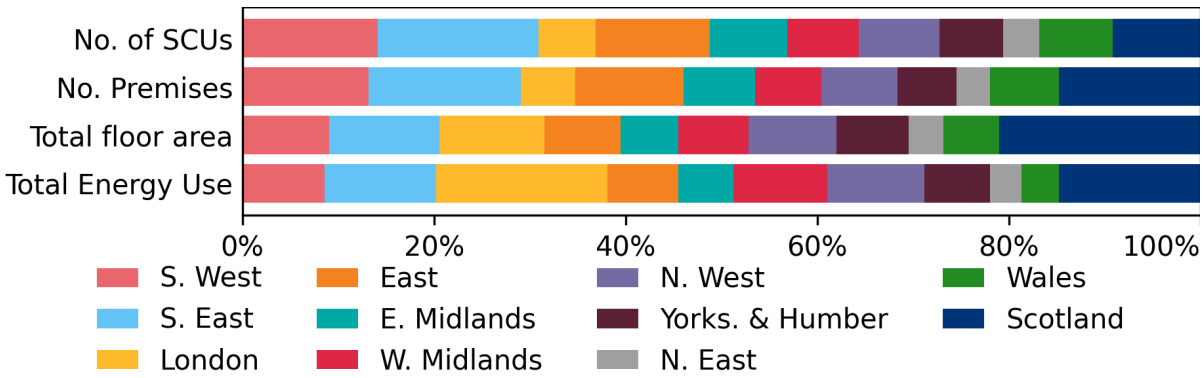


Figure 3.2-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.2-2), for England these are comparable with the NUTS regions. For 'Arts and Leisure' the South East has the largest percentage of premises (16%) and SCUs (17%). The largest percentage of floorspace is in Scotland (21%). For the regional share of total energy demand, London has the largest percentage (18%).

3.2.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Auditoria etc' (1,469 m²) and the smallest is 'Arts and Leisure, other' (142 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.2-3, where the dotted line indicates the distribution of floorspace beyond the 75th percentile, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

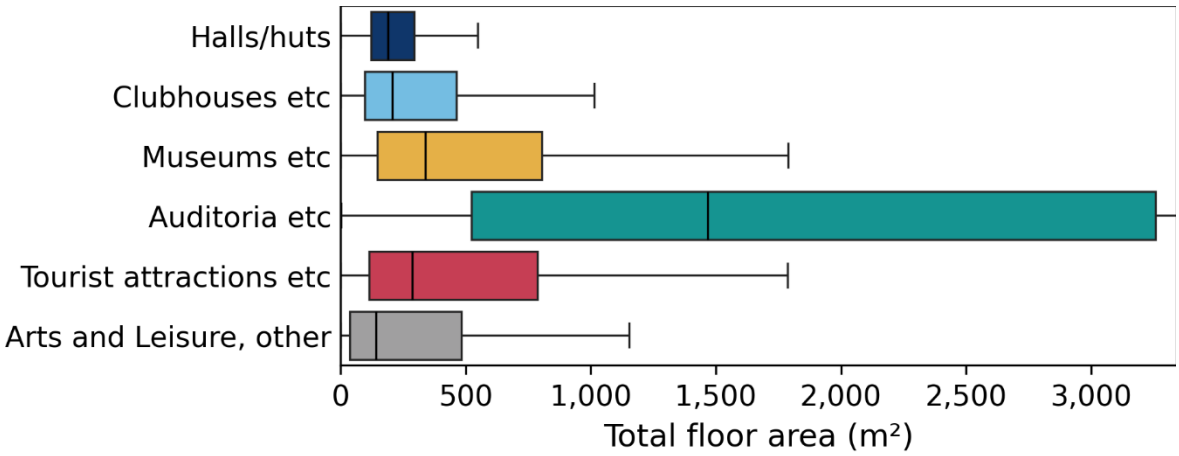


Figure 3.2-3: Distribution of premises total floor area by activity group

3.2.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 47% of ‘Arts and Leisure’ premises have at least one matched electricity meter and 23% have at least one matched gas meter. The total matched energy use for 'Arts and Leisure' is 2,001 GWh per year, which consists of 1,065 GWh for electricity and 936 GWh for gas per year.

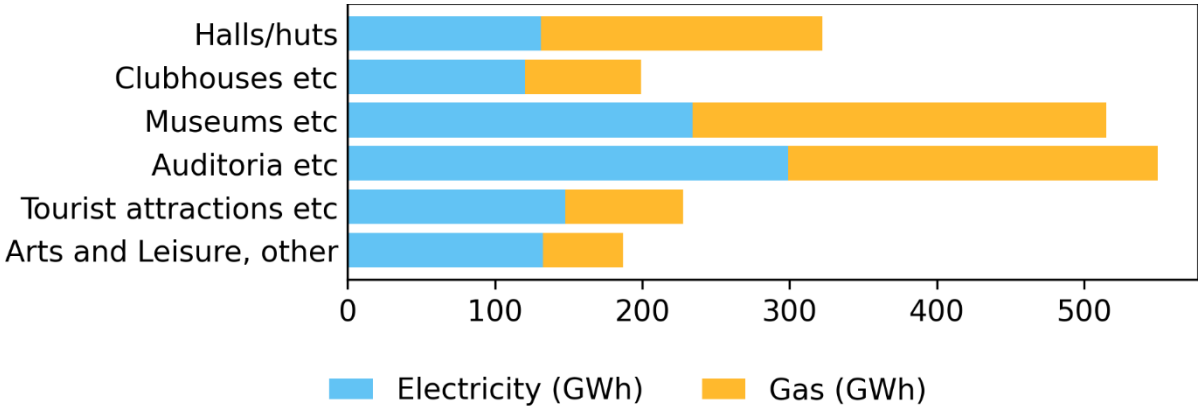


Figure 3.2-4: Total energy demand (GWh) for 'Arts and Leisure' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Arts and Leisure’ is Profile Class 3, which represents 58% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where domestic classes are re-categorised. Pa is where very high domestic meter usage (>100,000 kWh) means that they are considered to be non-domestic, with Profile Class Pb representing cases where high consumption (between 50,000 and 100,000 kWh) is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

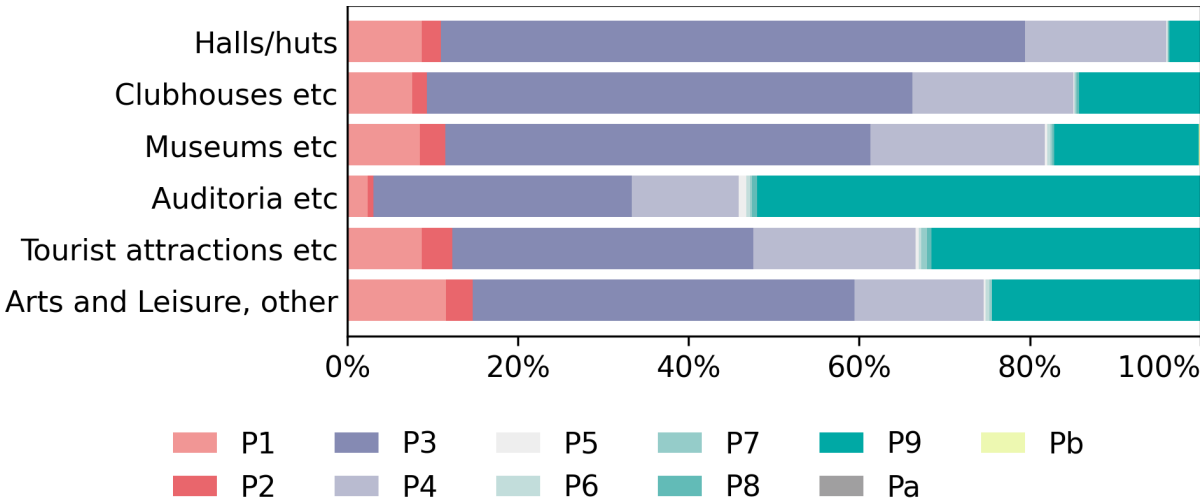


Figure 3.2-5: Percentage of meter profile classes for electricity meters by activity group

Around 18% of all 'Arts and Leisure' premises (10% of 'Arts and Leisure' floorspace) are located in postcodes classified as off the gas grid. Figure 3.2-6 below shows that 'Tourist attractions etc' is the activity group that has the largest share (23% by floorspace) of off the gas grid postcodes and 'Auditoria etc' have the lowest share (3%). This is to be expected since ‘Auditoria etc’ are more likely to be located in towns and cities which in turn are more likely to have access to mains gas connections. For premises off the gas grid, bulk fuels may

account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

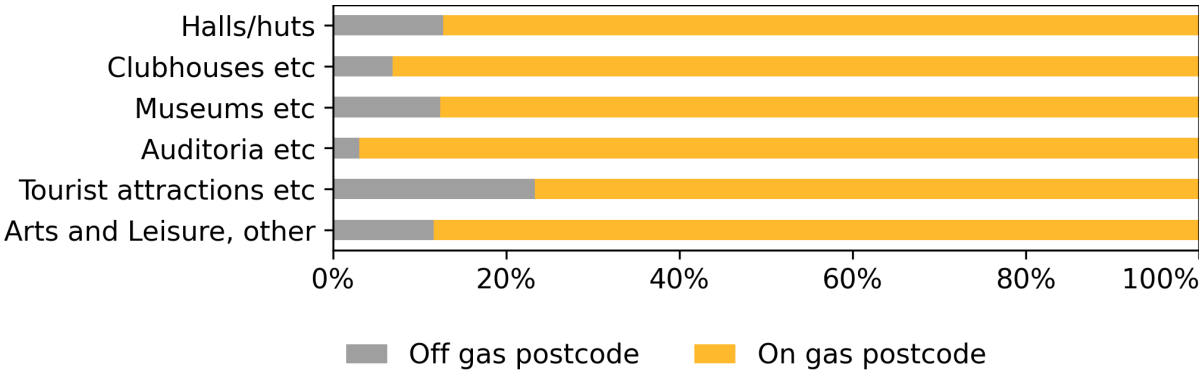
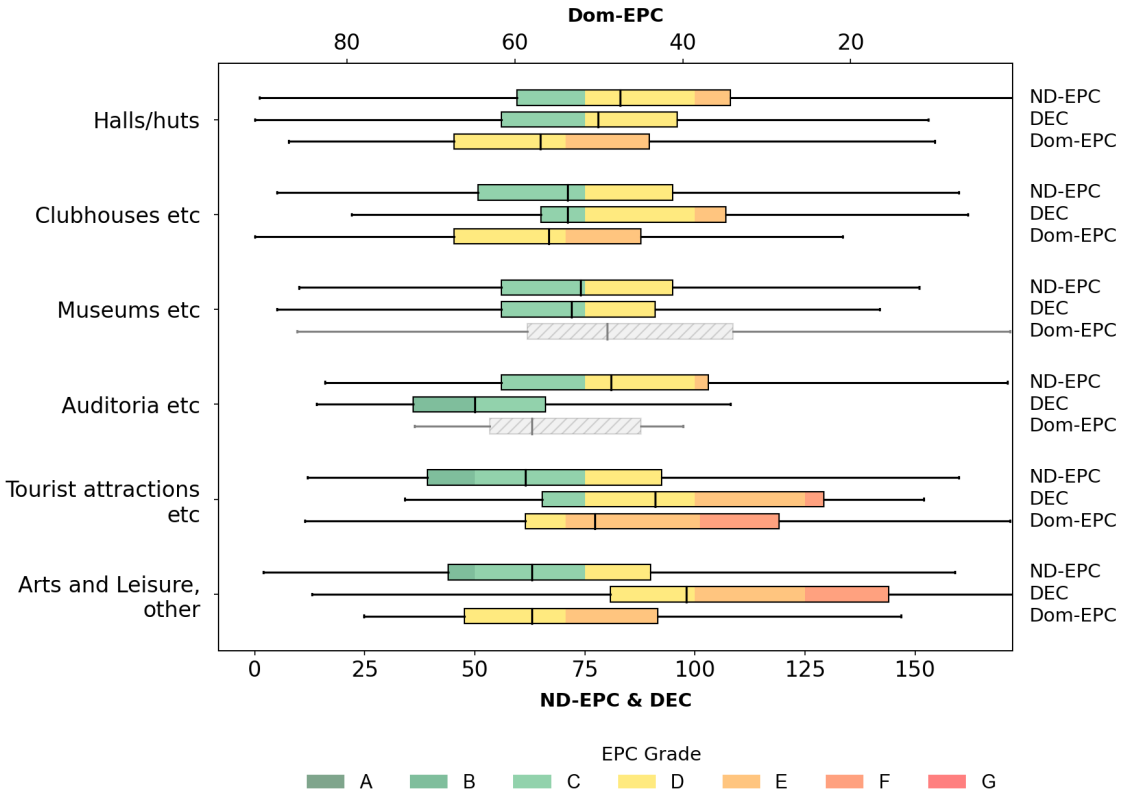


Figure 3.2-6: Percentage of floorspace on or off gas grid by activity group

3.2.4 Energy certification

Around 15% of all 'Arts and Leisure' premises have an energy certificate, with around 11% of these being non-domestic EPCs and 4% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Arts and Leisure' was February 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.2-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level, it is clear that the median asset rating for ‘Tourist attractions etc’ and ‘Arts and Leisure, other’ show the best performance (62 and 63 or ‘C’ rating) whilst

‘Halls/huts’ have a median of 83 (D). The largest number of DECs are present for ‘Museums etc’ where the median operational rating is 72 (C).

3.2.5 Energy use detailed insights

Within 'Arts and Leisure', the activity group with the highest median energy use intensity (EUI) for electricity is 'Tourist attractions etc' (172 kWh/m² per year) and for gas it is 'Tourist attractions etc' (204 kWh/m² per year). For total EUI (gas and electricity combined) 'Tourist attractions etc' have the highest value (201 kWh/m² per year), see Figure 3.2-8 below (chart values truncated to 76th percentile of highest activity group).

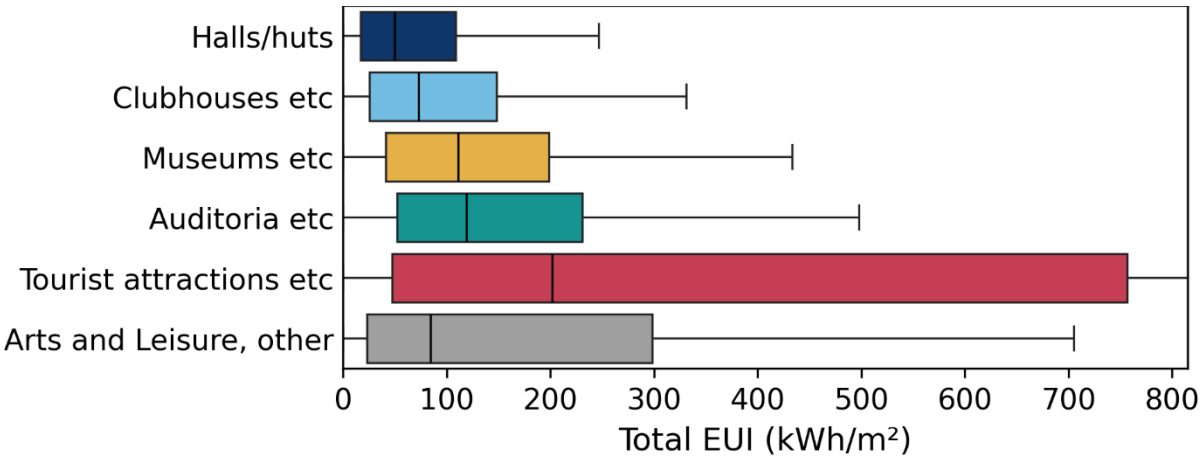


Figure 3.2-8: Distribution of total Energy Use Intensity (EUI) by activity group

Figure 3.2-9 below, shows that more than 50% of Arts and Leisure floorspace has no matched energy certificate (‘No EC’). The fuel mix across each activity group is largely consistent, except for ‘Museums etc’ and ‘Auditoria etc’, which tend to have large internal spaces, requiring a lot of heating. Electricity use for heating is present in all groups, with ‘Clubhouses etc’ using this more than other groups.

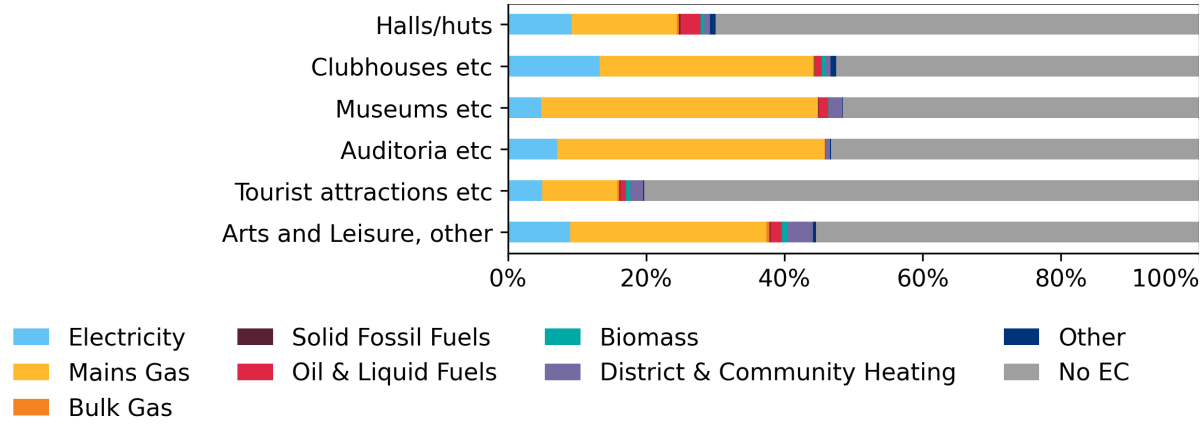


Figure 3.2-9: Heating fuels as percentage of total floorspace by activity group

Figure 3.2-10 below, indicates that ‘Heating and Ventilation’ is generally used for the largest percentages of floorspace in each group, except ‘Auditoria etc’, suggesting that for this group the gas burnt for heating is transported to spaces via ‘Air Conditioning’. Very limited floorspace is treated using ‘Boilers & Radiators’, possibly due to this method being less suitable for large volume spaces.

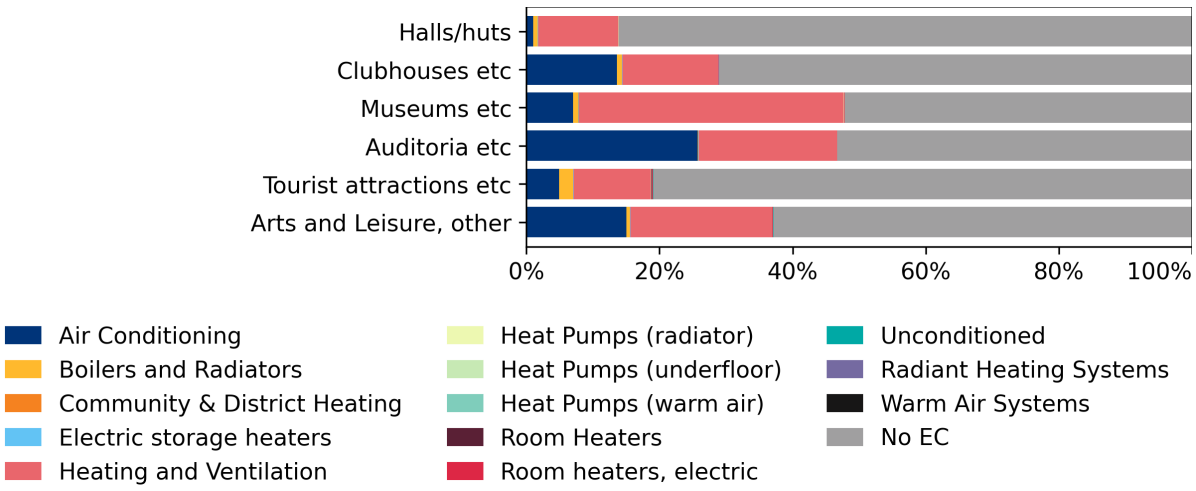


Figure 3.2-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Clubhouses etc' (33%) whilst the lowest percentage is for 'Halls/huts' (2%), as shown in Figure 3.2-11 below.

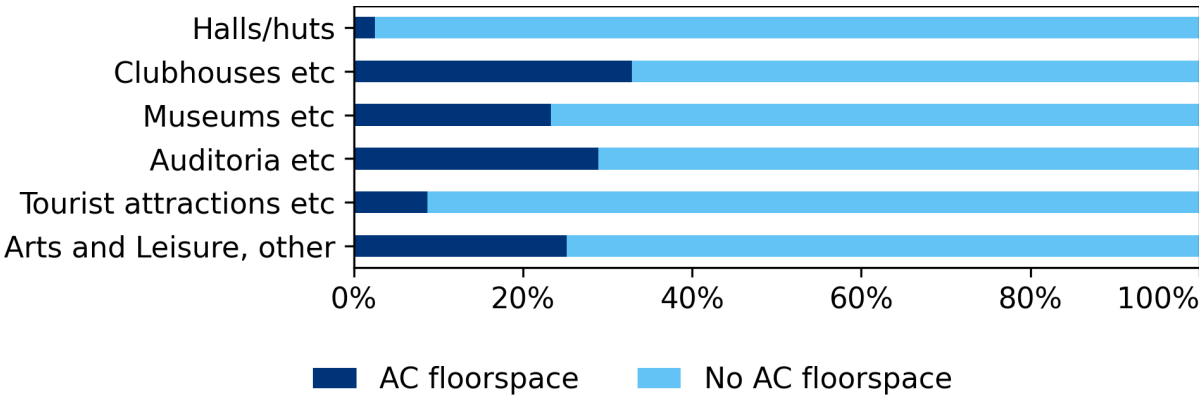


Figure 3.2-11: Air-conditioned floorspace by activity group

3.2.6 Heritage and Rural Urban

64% of all 'Arts and Leisure' premises are in an area with no Conservation area or Listed building restrictions whilst 36% are either in a Conservation area, or are a Listed building or both. 'Museums etc' has the largest amount of their floorspace in heritage restricted areas (61%). More details can be seen in Figure 3.2-12 below.

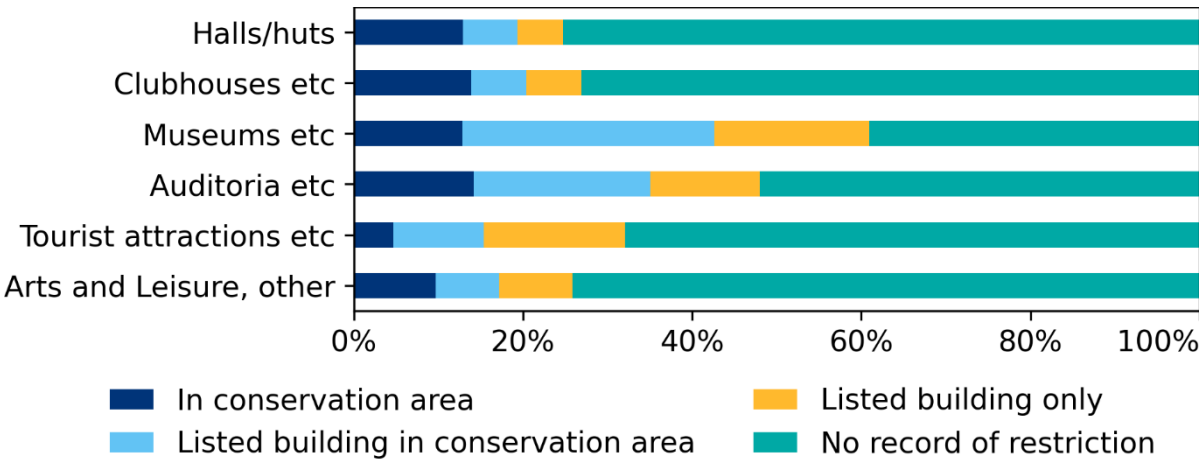


Figure 3.2-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 56% of premises and 79% of floorspace in the 'Arts and Leisure' activity class may be found in an urban area. The largest activity group is 'Auditoria etc' where 98% of its floorspace is in an urban area, whilst 'Tourist attractions etc' has the largest percentage of its floorspace in rural areas (40%), as shown in Figure 3.2-13 below.

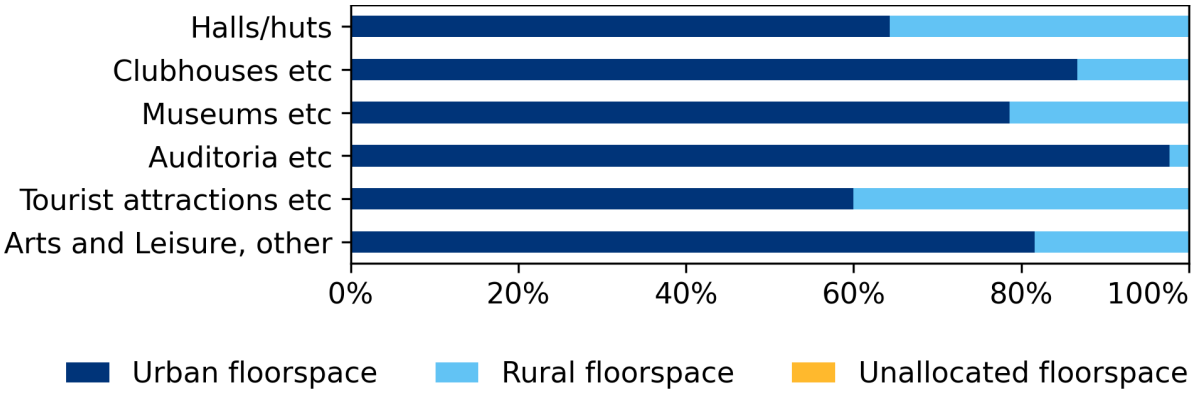


Figure 3.2-13: Floorspace by ONS Urban / rural classification by activity group

3.2.7 Mixed-use buildings

Within the 'Arts and Leisure' class, 78% of SCUs are occupied by a single 'Arts and Leisure' premises, whilst 14% share the SCU with other non-domestic premises and 8% share the SCU with domestic premises.

Figure 3.2-14 below shows 'Halls/huts' is the activity group with the highest percentage of cases where they are the sole occupier of the building (86%) whilst 'Auditoria etc' has the highest percentage of SCUs shared with other non-domestic premises (31%) and 'Tourist attractions etc' has the highest percentage of SCUs shared with domestic residential uses (20%).

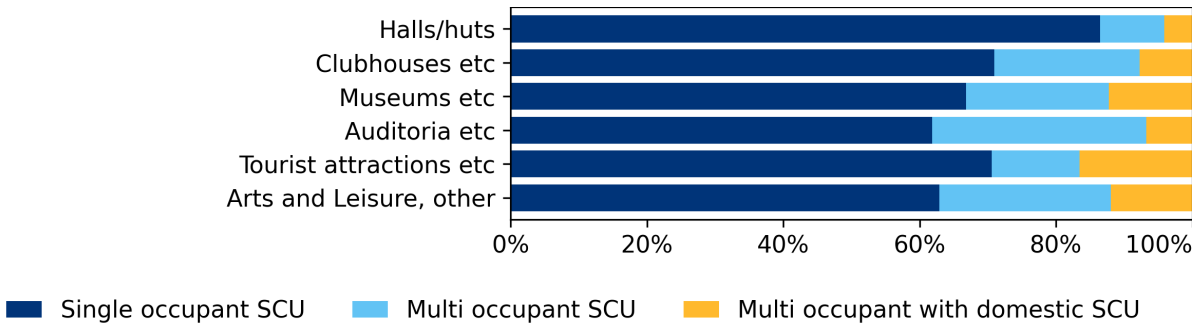


Figure 3.2-14: Percentage of premises by mixed-use SCU classification by activity group

3.2.8 Public sector

Around 22% of Arts and Leisure premises and 30% of Arts and Leisure floorspace is likely to be Public Sector. 'Museums etc' is the activity group with the highest percentage of premises likely to be Public Sector (51%) and this represents 58% of their activity group floorspace. 'Halls/huts' is the activity group with the lowest percentage of premises (14%) and floorspace (18%) likely to be Public Sector.

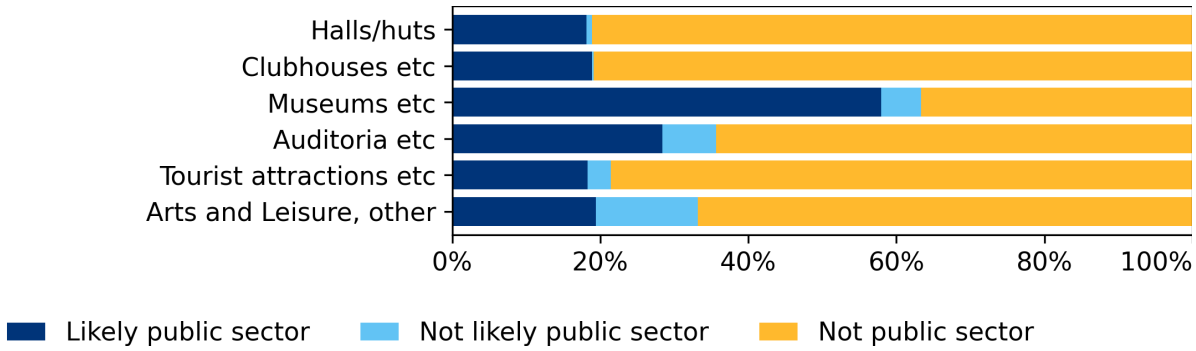


Figure 3.2-15: Percentage of floor area assigned 'Public sector' by activity group

3.2.9 Age and materials

30% of 'Arts and Leisure' premises and 31% of Arts and Leisure floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '2007-2021' for premises (8%), which represents 14% of floorspace.

The details at the activity group level are shown in Figure 3.2-16 below which confirms that over 50% of ‘Museums etc’ are in buildings older than 1939.

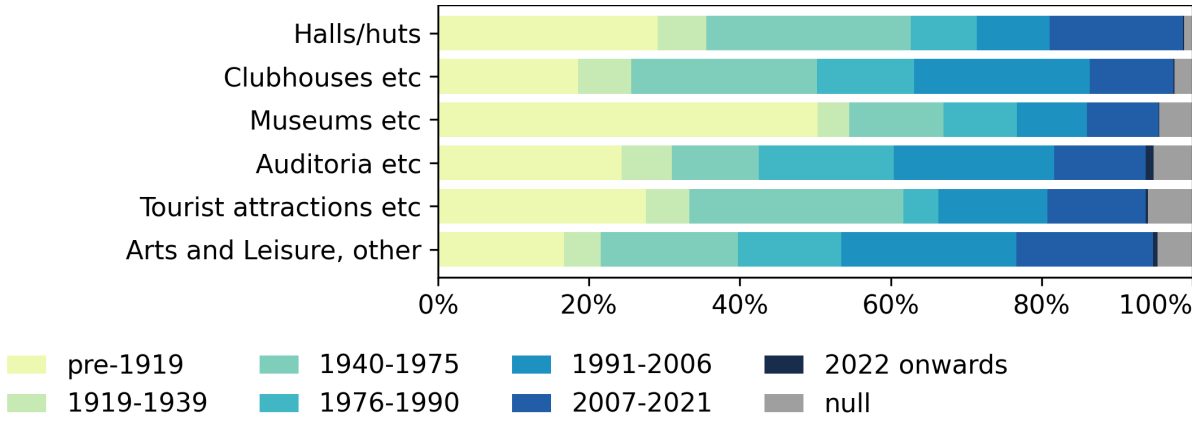


Figure 3.2-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Arts and Leisure' activity class (measured by wall area). The 'Halls/huts' activity group has the largest wall area (5.7 million m²) when measured from the 3D geometry in the database, and 95% of this is masonry, which represents 49% of the total wall area in 'Arts and Leisure' (see Figure 3.2-17).

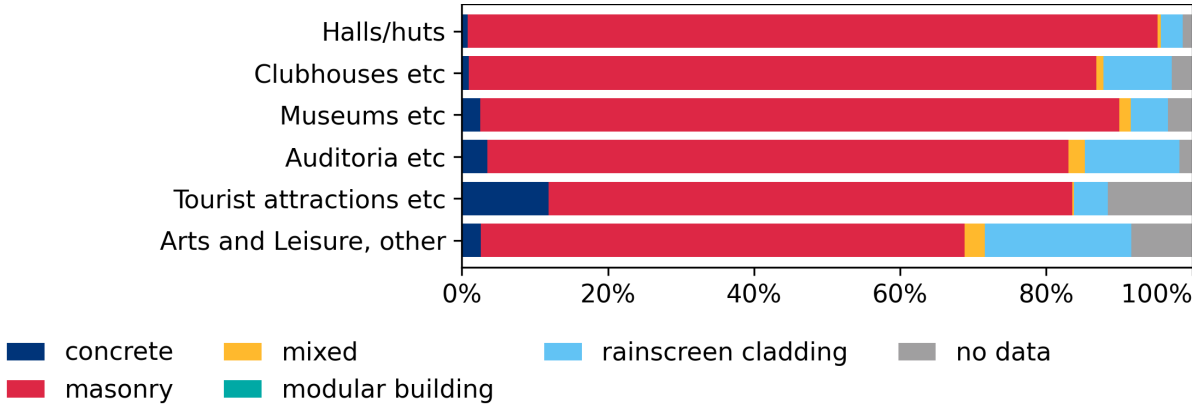


Figure 3.2-17: Distribution of total wall area by NGD material and activity group

Table 3.2-1: Summary statistics for Arts and Leisure by activity group

Activity group	No. of premises	No. of SCUs	total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Halls/huts	21,297	18,311	7.35	347	55.4	32.4
Clubhouses etc	5,005	4,036	2.21	445	13.0	9.8
Museums etc	6,126	5,226	5.57	940	15.9	24.6
Auditoria etc	1,995	1,796	5.13	2,636	5.2	22.6
Tourist attractions etc	1,046	696	0.79	1,034	2.7	3.5
Arts and Leisure, other	2,960	1,777	1.61	691	7.7	7.1

Table 3.2-2: Summary energy statistics for Arts and Leisure by activity group

Activity group	median total EUI (kWh/m^2/year)	total GWh	% by total energy
Halls/huts	50	322.20	16.1
Clubhouses etc	73	199.26	10.0
Museums etc	111	515.32	25.7
Auditoria etc	119	550.04	27.5
Tourist attractions etc	201	227.69	11.4
Arts and Leisure, other	84	186.95	9.3

3.3 Community

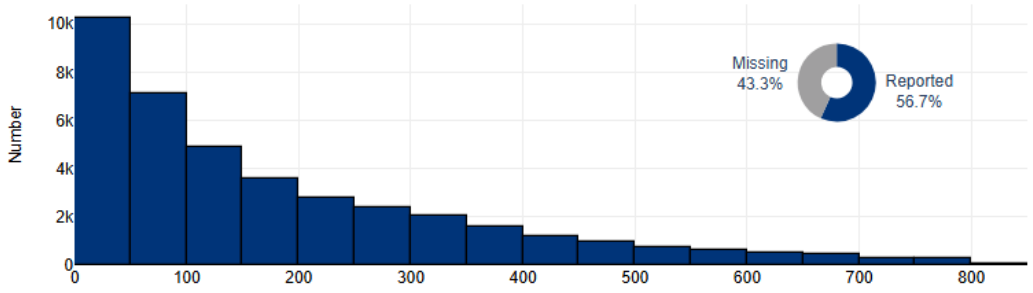
Overview

In the Community activity class, the analysis covers 77,920 premises. The average Energy Use Intensity (EUI) is 311 kWh/m²/annum. The dominant building age group is pre-1919 (30%), and the predominant heating fuel is Mains Gas (42%).

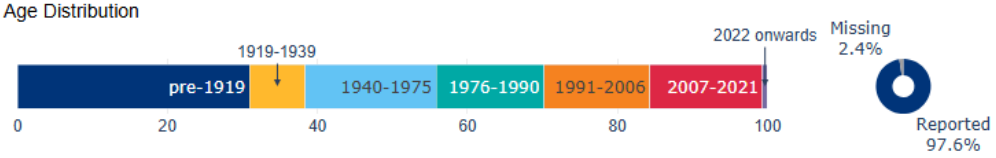
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Church halls etc	13.8	5.27
Places of Worship	25.3	8.6
Undertakers etc	2.2	0.68
Residential care / institution	29.7	16.32
Law courts	0.4	1.27
Prisons etc	0.2	0.66
Community, other	6.3	1.02

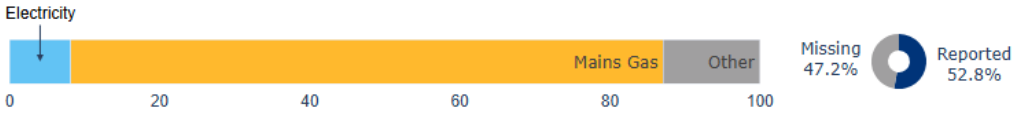
Energy Use Intensity (kWh/m²/annum)



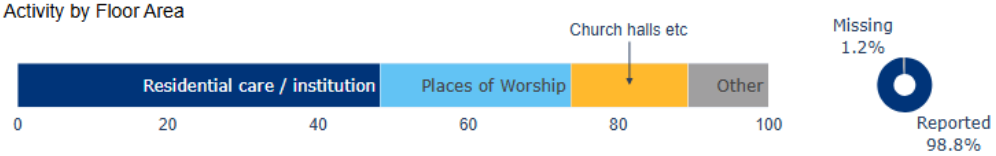
Age Distribution



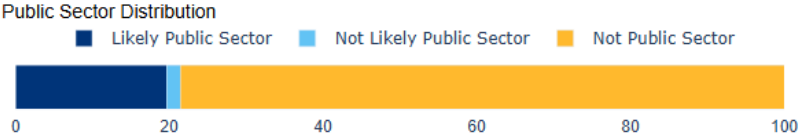
Heating Fuel Distribution (reported only; 47.2% missing)



Activity by Floor Area



Public Sector Distribution



3.3.1 Overview

The 'Community' class has a total of 77,920 premises and 33.82 million m² of floorspace which makes it the seventh largest class by the count of both premises and floorspace, with a 4% share of all non-domestic premises and a 4% share of total non-domestic floorspace. This class contains 15 activities, which have been grouped into seven activity groups. The largest activity by count is 'Nursing/Care/Childrens Home' with 29,668 premises. The largest by total floorspace is 'Nursing/Care/Childrens Home' with 16.30 million m² of floorspace. In total NBD reports 64,207 SCUs (which roughly equate to buildings) for 'Community'.

For Community as a whole, ND-NEED (2023) combines Community along with Arts and Leisure and reports 0.05 million buildings (78% of NBD SCUs) and 15.30 million m² of floorspace (45 % of NBD). BEES (2014) also combined Community with Arts and Leisure and reported 78,500 premises (101% of NBD premises) and 52 million m² of floorspace (154% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult. For example prisons and law courts were placed into the ‘Emergency Services’ classification in BEES.

Figure 3.3-1 below shows all activities in the 'Community' class aggregated into seven activity groups. 'Residential care / institution' has the largest number of premises but these have a relatively small median floorspace (201 m²), making it the first largest activity group in terms of floorspace within 'Community'. The activity group with the largest total floorspace is 'Residential care / institution' where the median floor area is 201 m² and the total floor area is 16.32 million m². 'Residential care / institution' also represents the largest share of matched energy with around 60% of the total matched energy for Community as a whole.

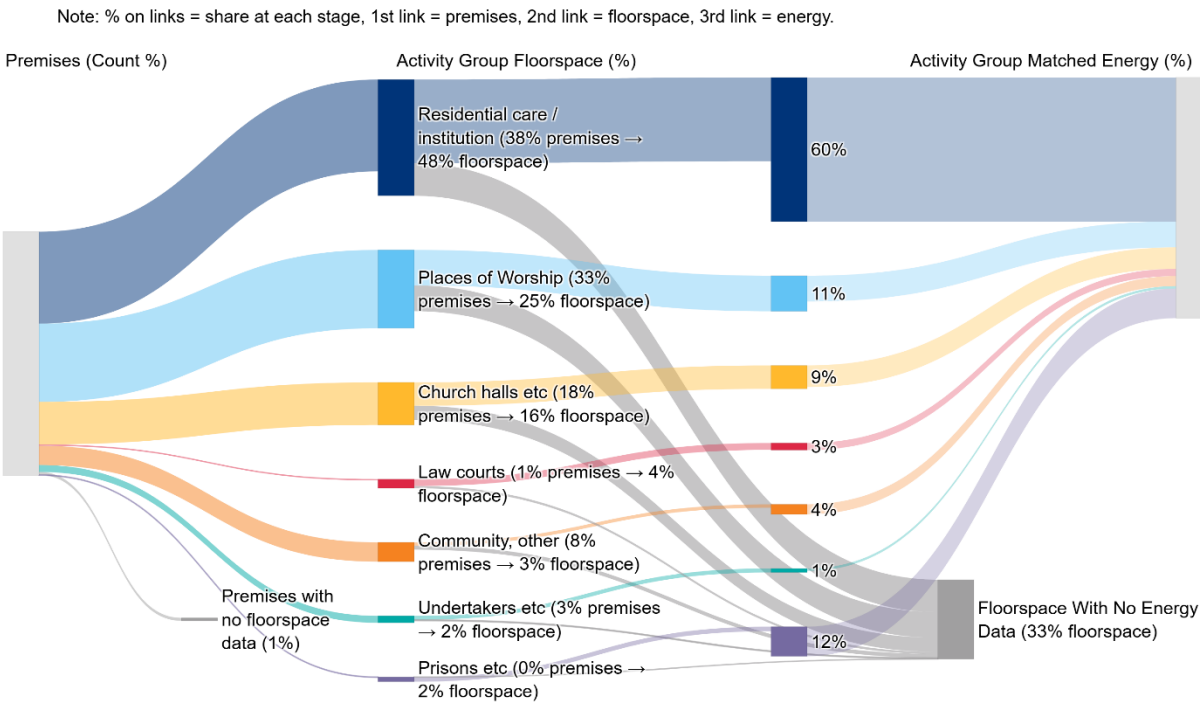


Figure 3.3-1: Share of activity group by number of premises, floorspace and total energy demand

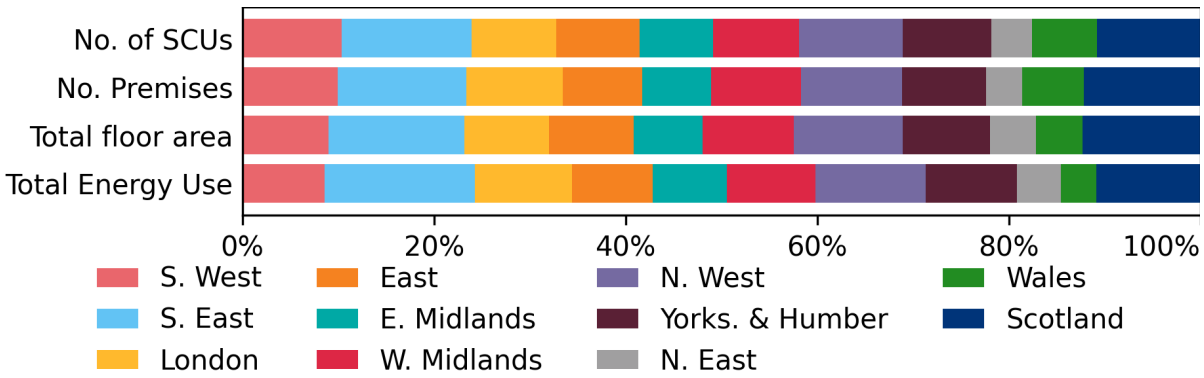


Figure 3.3-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.3-2), for England these are comparable with the NUTS regions. For 'Community' the South East has the largest percentage of premises (13%) and SCUs (14%). The largest percentage of floorspace is in South East (14%). For the regional share of total energy demand, the South East has the largest percentage (16%).

3.3.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Law courts' (1,514 m²) and the smallest is 'Community, other' (36 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.3-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

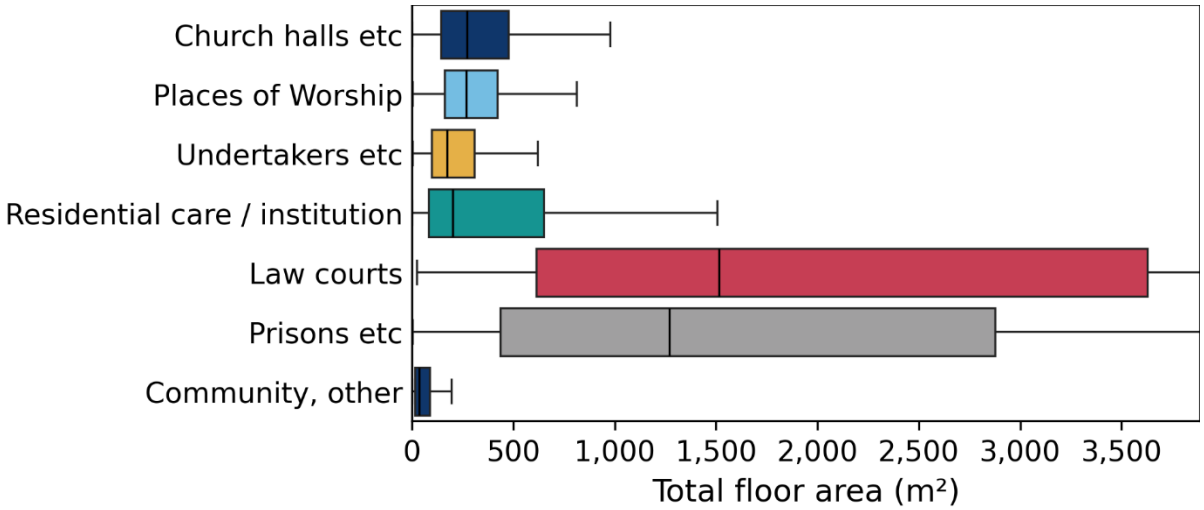


Figure 3.3-3: Distribution of premises total floor area by activity group

3.3.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 56% of ‘Community’ premises have at least one matched electricity meter and 39% have at least one matched gas meter. The total matched energy use for 'Community' is 5,788 GWh per year, which consists of 1,686 GWh for electricity and 4,102 GWh for gas per year.

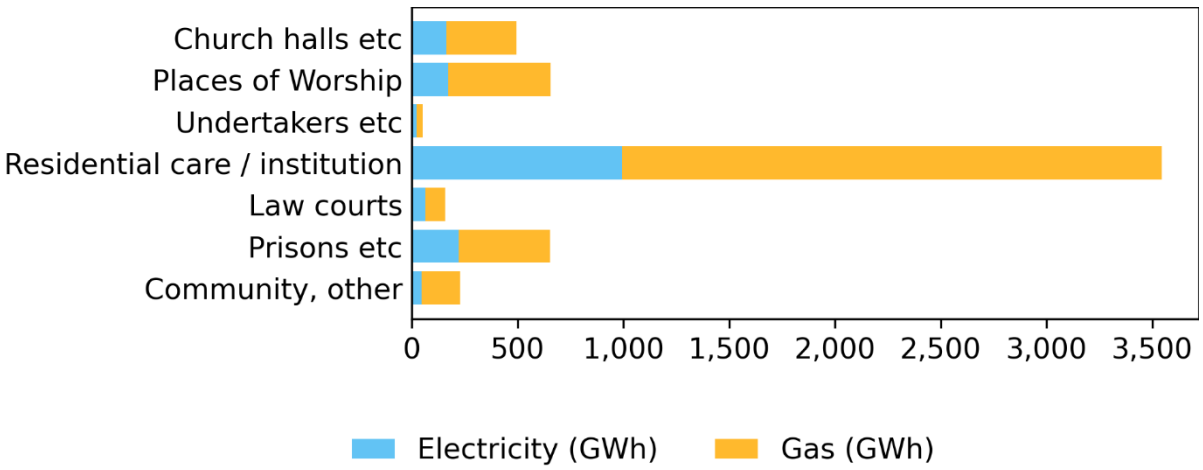


Figure 3.3-4: Total energy demand (GWh) for 'Community' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Community is Profile Class 3, which represents 48% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

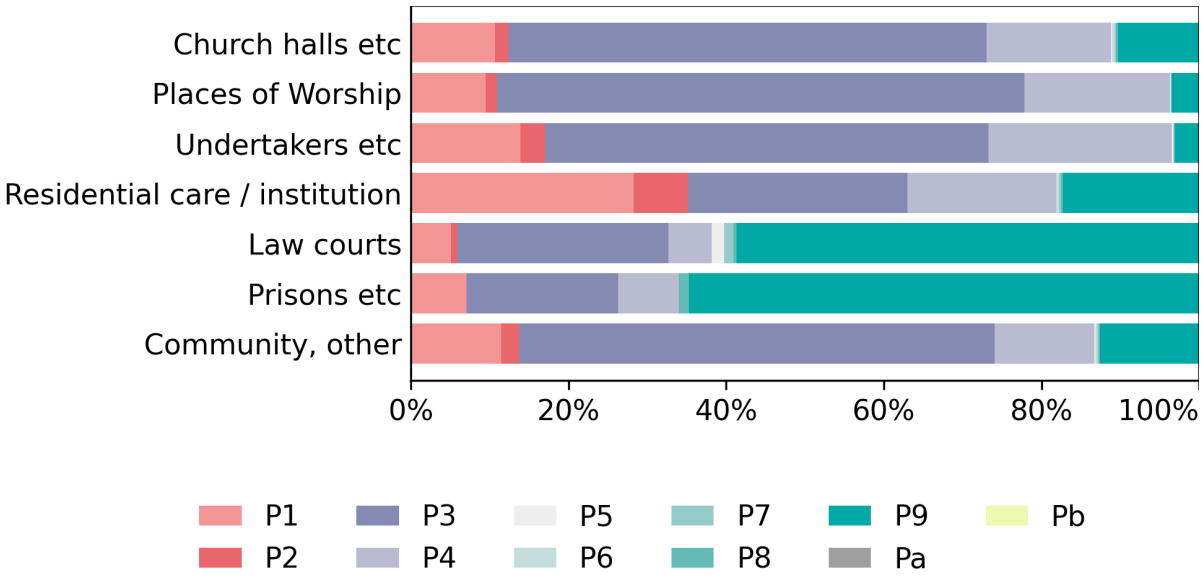


Figure 3.3-5: Percentage of meter profile classes for electricity meters by activity group

Around 10% of all 'Community' premises (7% of 'Community' floorspace) are located in postcodes classified as off the gas grid. Figure 3.3-6 below shows that 'Community, other' is the activity group that has the largest share (17% by floorspace) of off the gas grid postcodes and 'Undertakers etc' have the lowest share (2%). For premises off the gas grid,

bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

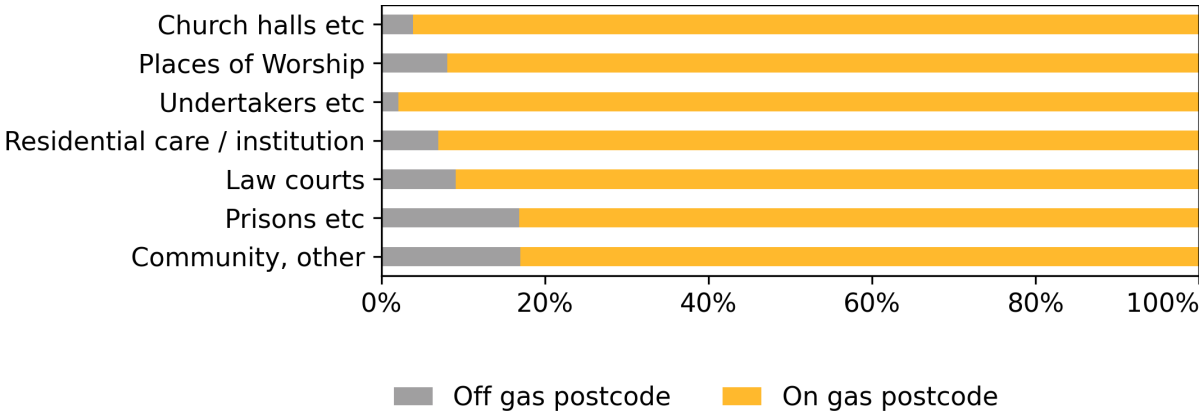
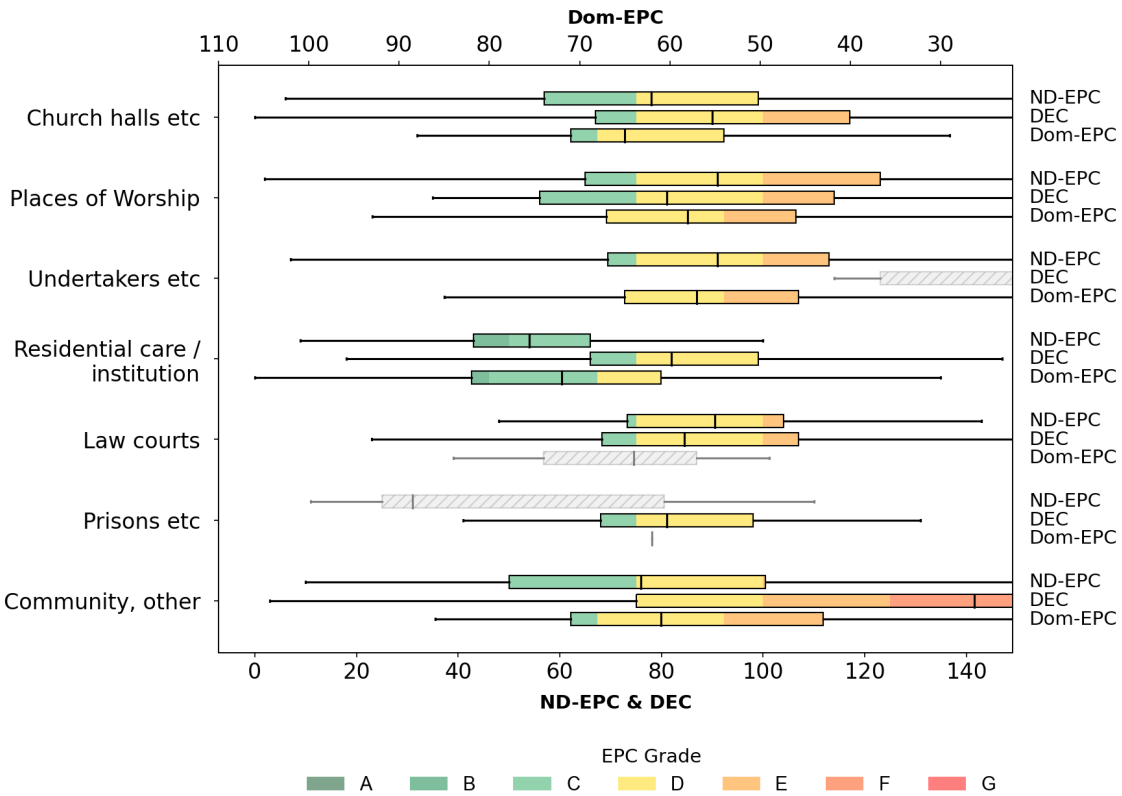


Figure 3.3-6: Percentage of floorspace on or off gas grid by activity group

3.3.4 Energy certification

Around 18% of all 'Community' premises have an energy certificate, with around 16% of these being non-domestic EPCs and 2% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Community' was August 2018.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.3-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear ‘Residential care / institutions’ link to a large number of domestic EPCs as well as non-domestic EPCs. These have the best performing median asset rating for non-domestic EPCs (54 or ‘C’ rating) and a median current energy efficiency of 72 (C) for domestic EPCs. ‘Places of Worship’, ‘Undertakers etc’ and ‘Law courts’ all have the lowest performing non-domestic EPCs with a median asset rating of 91 for all three of them (D). ‘Church halls etc’ link to a reasonable number of DECs which have a median current operation rating of 90 (D).

3.3.5 Energy use detailed insights

Within 'Community', the activity group with the highest median energy use intensity (EUI) for electricity is 'Prisons etc' (1,262 kWh/m² per year) and for gas it is 'Prisons etc' (3,004 kWh/m² per year). For total EUI (gas and electricity combined) 'Prisons etc' have the highest value (2,884 kWh/m² per year), see Figure 3.3-8 below (chart values truncated to 76th percentile of highest activity group).

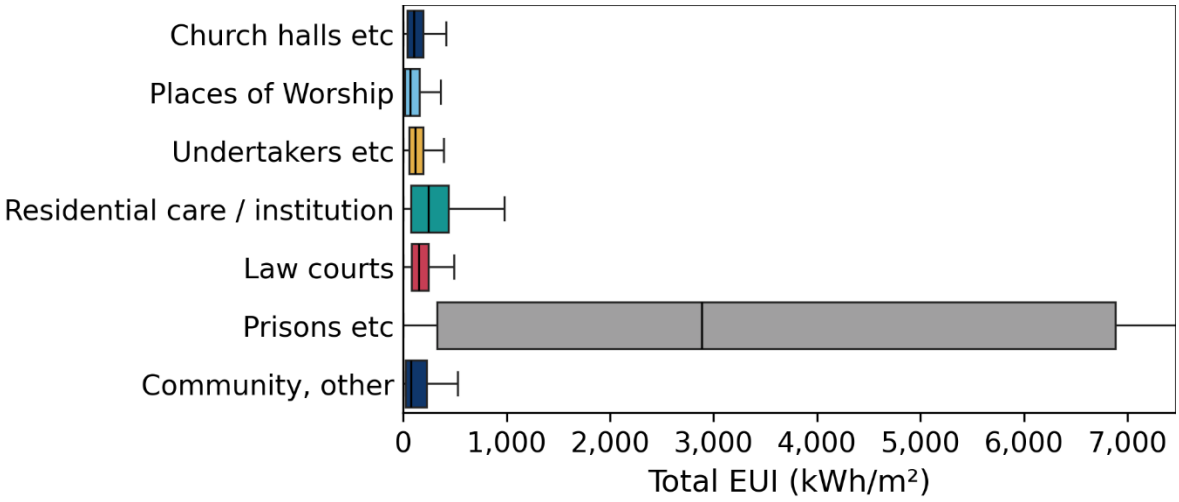


Figure 3.3-8: Distribution of total Energy Use Intensity (EUI) by activity group

Figure 3.3-9 below, clearly shows that a high percentage of ‘Places of Worship’ floorspace has no associated energy certificate (No EC), as in most cases they are not mandated. However, significant areas of ‘Church halls etc’ and ‘Community, other’ also have no matched certificate. Overall, though, the Community class is dominated by ‘Mains Gas’, with small percentages heated using ‘Electricity’. Where ‘Oil & Liquid Fuels’ are present, this is likely to be where premises are not on the mains gas grid.

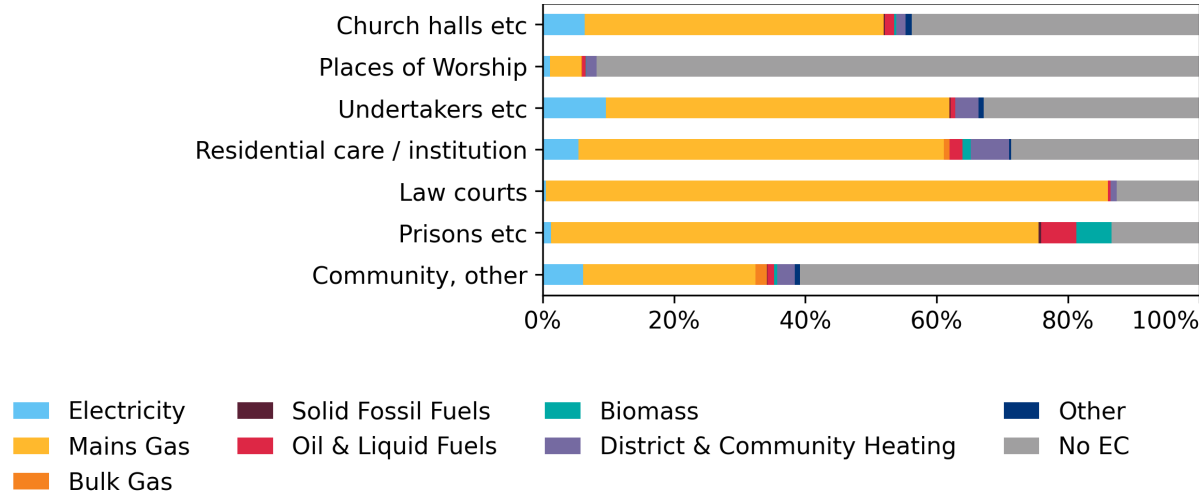


Figure 3.3-9: Heating fuels as percentage of total floorspace by activity group

Of the floorspace shown in 3.3-10 below, much has ‘No EC’ and thus no heating system data. Where data exist, ‘Heating and Ventilation’ is dominant, though ‘Law courts’ have significant areas of ‘Air Conditioning’, likely due to the need to cool trial spaces etc.

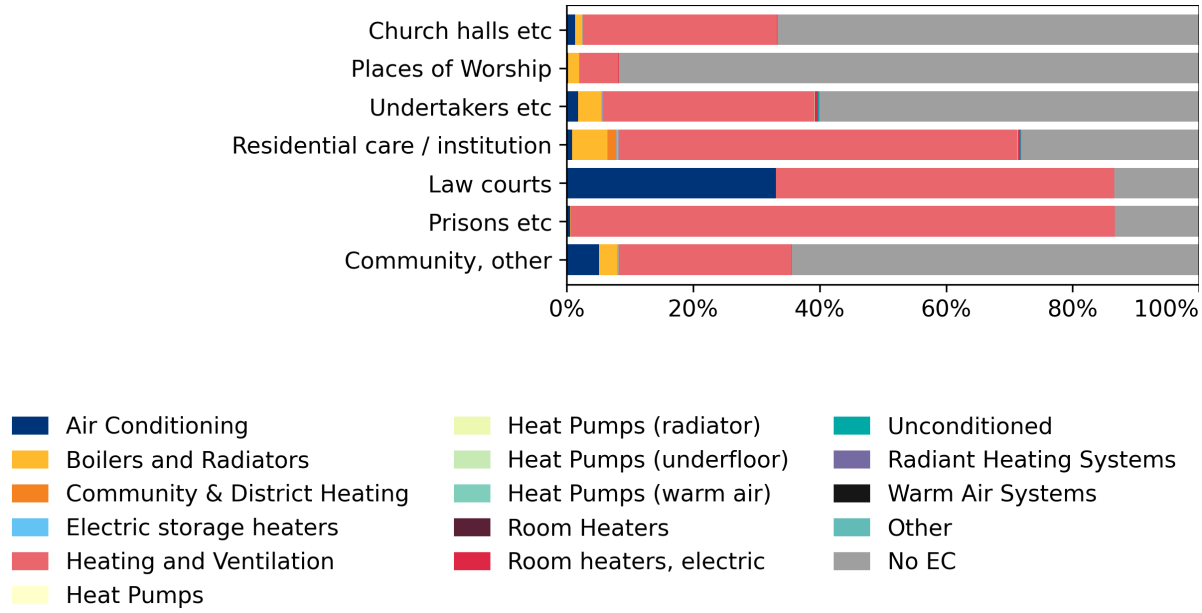


Figure 3.3-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Law courts' (82%) whilst the lowest percentage is for 'Places of Worship' (< 1%), as shown in Figure 3.3-11 below.

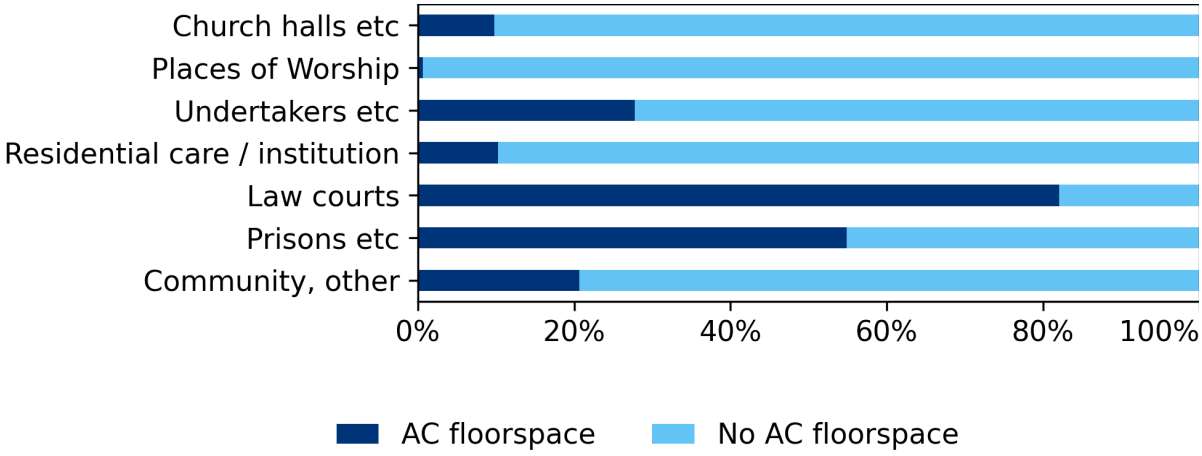


Figure 3.3-11: Air-conditioned floorspace by activity group

3.3.6 Heritage and Rural Urban

70% of all 'Community' premises are in an area with no Conservation area or Listed building restrictions whilst 30% are either in a Conservation area, or are a Listed building or both. 'Law courts' has the largest amount of their floorspace in heritage restricted areas (46%). More details can be seen in Figure 3.3-12 below.

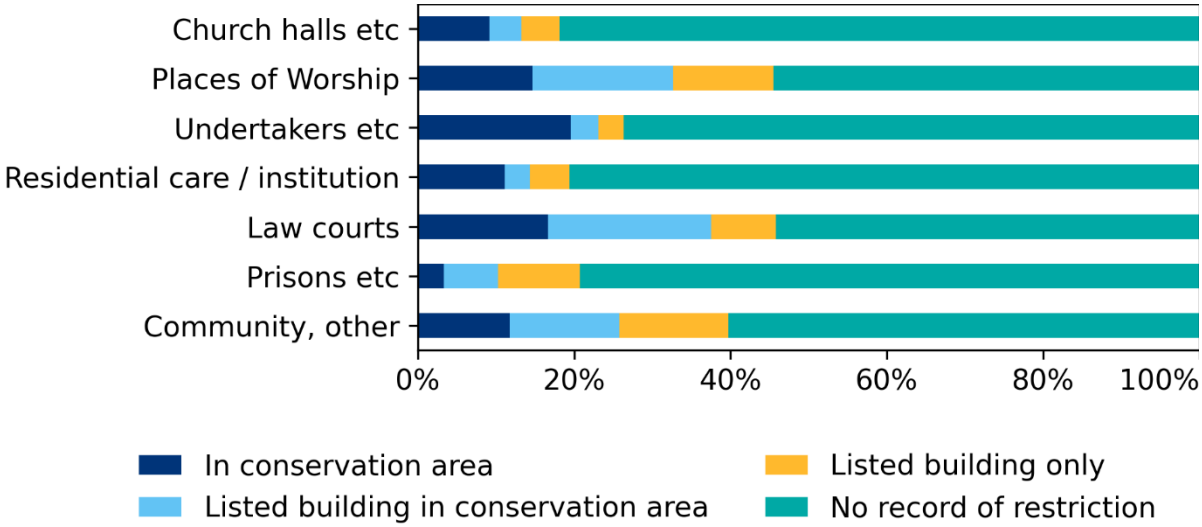


Figure 3.3-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 77% of premises and 82% of floorspace in the 'Community' activity class may be found in an urban area. The largest activity group is 'Law courts' where 100% of its floorspace is in an urban area, whilst 'Prisons etc' has the largest percentage of its floorspace in rural areas (44%), as shown in Figure 3.3-13 below.

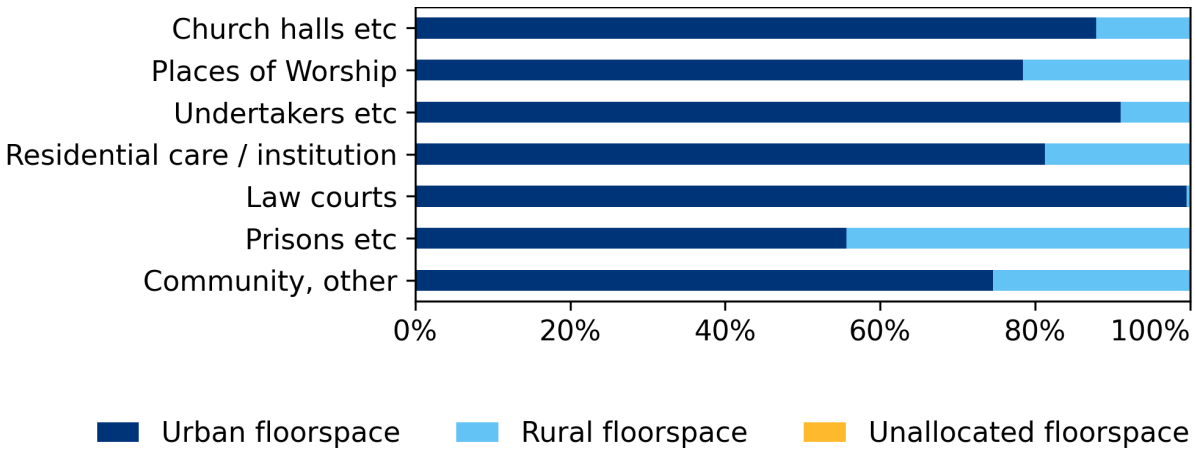


Figure 3.3-13: Floorspace by ONS Urban / rural classification by activity group

3.3.7 Mixed-use buildings

Within the 'Community' class, 79% of SCUs are occupied by a single 'Community' premises, whilst 9% share the SCU with other non-domestic premises and 12% share the SCU with domestic premises.

Figure 3.3-14 below shows 'Places of Worship' is the activity group with the highest percentage of cases where they are the sole occupier of the building (85%) whilst 'Law courts' has the highest percentage of SCUs shared with other non-domestic premises (26%) and 'Undertakers etc' has the highest percentage of SCUs shared with domestic residential uses (31%).

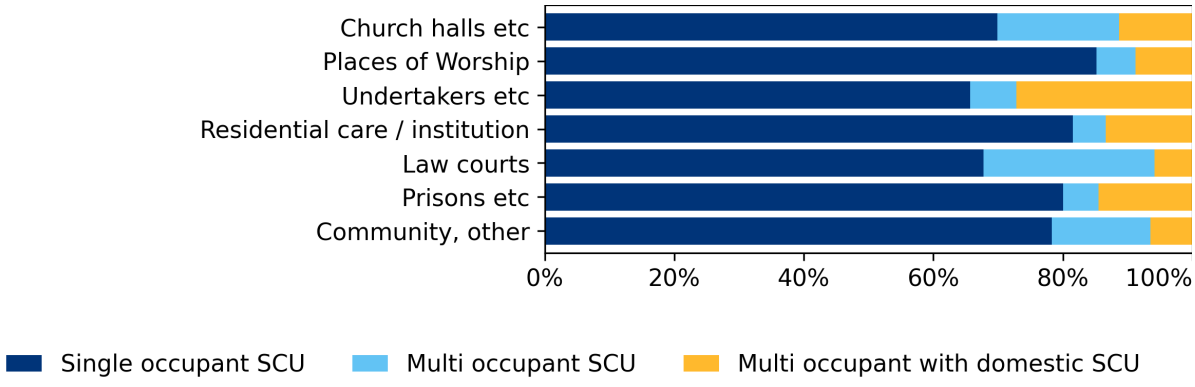


Figure 3.3-14: Percentage of premises by mixed-use SCU classification by activity group

3.3.8 Public sector

Around 17% of Community premises and 20% of Community floorspace is likely to be Public Sector. This represents a mixture when viewed at the activity group level in Figure 3.3-15 where 'Law courts' is the activity group with the highest percentage of premises likely to be Public Sector (100%) and likewise ‘Prisons etc’ are also considered to be 100% Public Sector. 'Undertakers etc' is the activity group with the lowest percentage of premises (2%) and floorspace (20%) likely to be Public Sector.

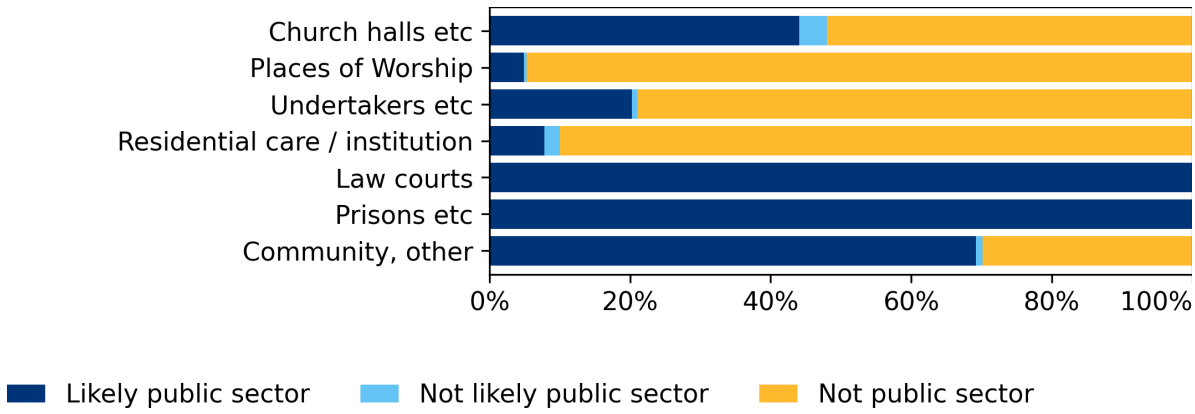


Figure 3.3-15: Percentage of floor area assigned 'Public sector' by activity group

3.3.9 Age and materials

35% of 'Community' premises and 30% of Community floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (9%), which represents 7% of floorspace.

The details at the activity group level are shown in Figure 3.3-16 below shows that more than 60% of ‘Places of Worship’ premises are located in buildings built before 1940.

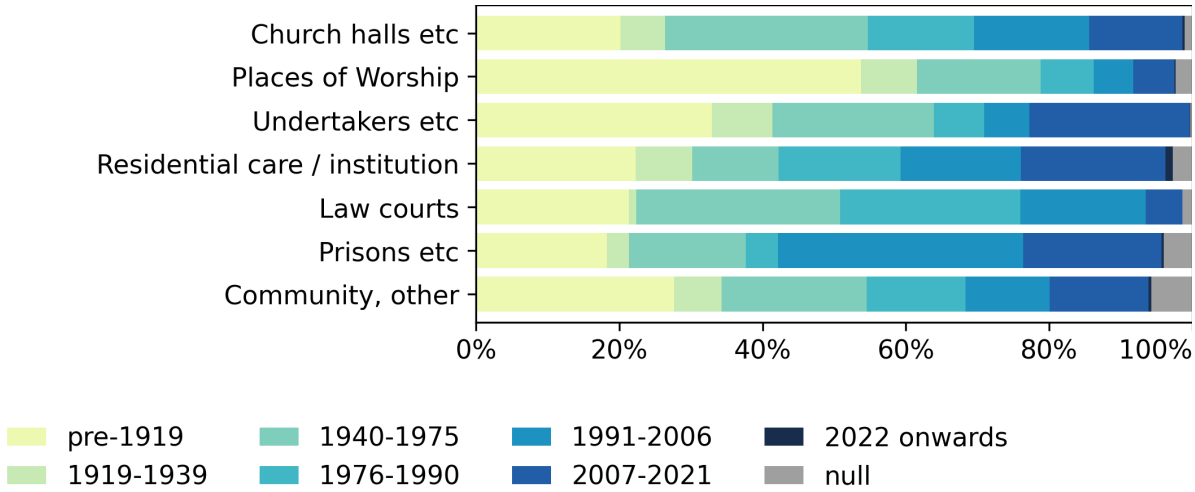


Figure 3.3-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Community' activity class (measured by wall area). The 'Residential care / institution' activity group has the largest wall area (27.1 million m²) when measured from the 3D geometry in the database, and 97% of this is masonry, which represents 50% of the total wall area in 'Community' (see Figure 3.3-17).

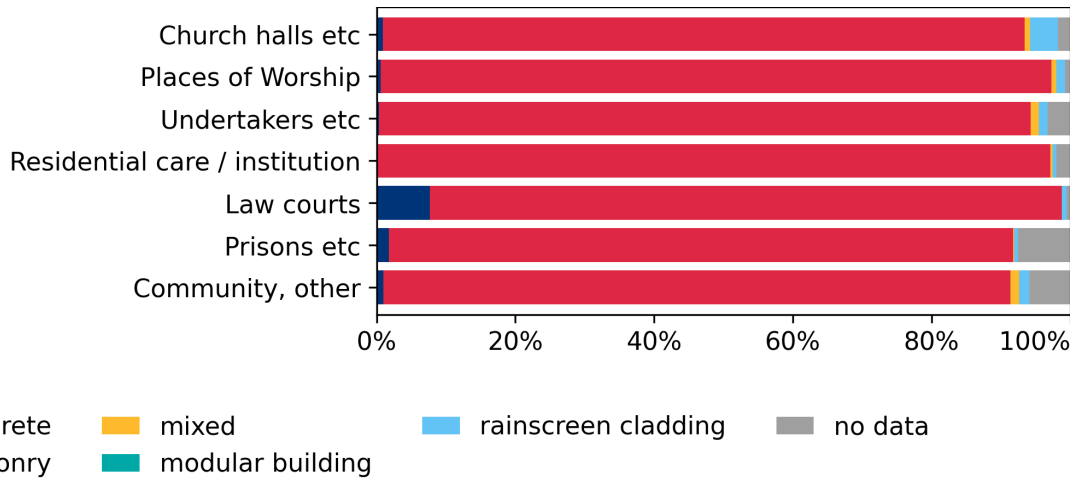


Figure 3.3-17: Distribution of total wall area by NGD material and activity group

Table 3.3-1: Summary statistics for Community by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Church halls etc	13,786	12,114	5.27	383	17.7	15.6
Places of Worship	25,339	24,074	8.6	341	32.5	25.4
Undertakers etc	2,248	2,101	0.68	302	2.9	2.0
Residential care / institution	29,727	21,261	16.32	550	38.2	48.3
Law courts	409	360	1.27	3,180	0.5	3.7
Prisons etc	157	145	0.66	4,365	0.2	2.0
Community, other	6,254	4,392	1.02	186	8.0	3.0

Table 3.3-2: Summary energy statistics for Community by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
Church halls etc	104	494.79	8.5
Places of Worship	70	655.67	11.3
Undertakers etc	116	52.76	0.9
Residential care / institution	248	3,544.67	61.2
Law courts	150	156.94	2.7
Prisons etc	2,884	654.43	11.3
Community, other	78	229.11	4.0

3.4 Education

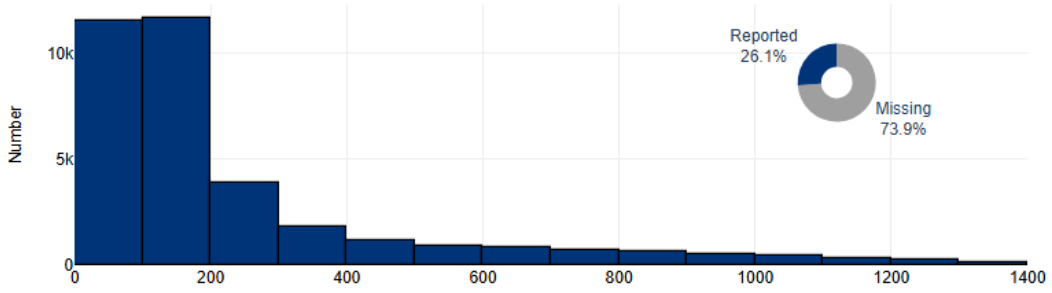
Overview

In the Education activity class, the analysis covers 148,931 premises. The average Energy Use Intensity (EUI) is 556 kWh/m²/annum. The dominant building age group is 2007-2021 (23%), and the predominant heating fuel is Mains Gas (57%).

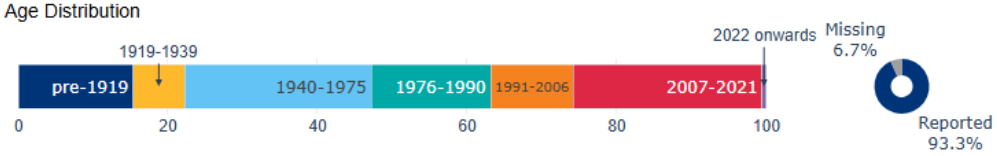
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
State Schools	22.7	46.21
Childcare etc	18.2	5.53
Private schools etc	2.7	4.6
Schools NEC	3.1	9.13
Further education etc	4.0	12.32
Education, residential	95.9	7.89
Education, other	2.3	1.3

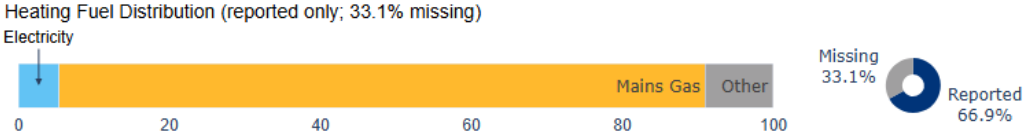
Energy Use Intensity (kWh/m²/annum)



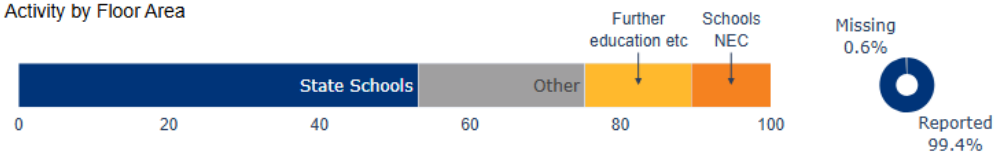
Age Distribution



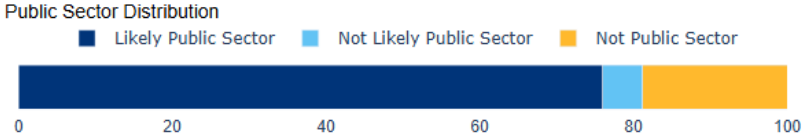
Heating Fuel Distribution (reported only; 33.1% missing)



Activity by Floor Area



Public Sector Distribution



3.4.1 Overview

The 'Education' class has a total of 148,931 premises and 86.98 million m² of floorspace This is the sixth largest non-domestic class by premises count with 7% of all non-domestic premises and the fifth largest non-domestic class by floorspace with 10% of all non-domestic floorspace. This class contains 22 activities, which have been grouped into seven activity groups. The largest activity by count is 'Residential Education' with 95,889 premises. The largest by total floorspace is 'State school' with 46.21 million m² of floorspace. In total NBD reports 50,445 SCUs (which roughly equate to buildings) for 'Education'.

For 'Education' as a whole, ND-NEED (2023) reports 0.04 million buildings (79% of NBD SCUs) and 3.85 million m² of floorspace (4% of NBD). BEES (2014) reported 47,400 premises (32% of NBD premises) and 80 million m² of floorspace (92% of NBD) for the year 2014. The allocation of premises to ‘Education’ largely matches the classifications used in ND-NEED and BEES.

Figure 3.4-1 below shows all activities in the 'Education' class aggregated into seven activity groups. 'Education, residential' has the largest number of premises but these have a relatively small median floorspace (26 m²), making it the second largest activity group in terms of floorspace within 'Education'. The activity group with the largest total floorspace is 'State Schools' where the median floor area is 1,398 m² and the total floor area is 46.21 million m². ‘State Schools’ also represent the largest group of matched energy demand.

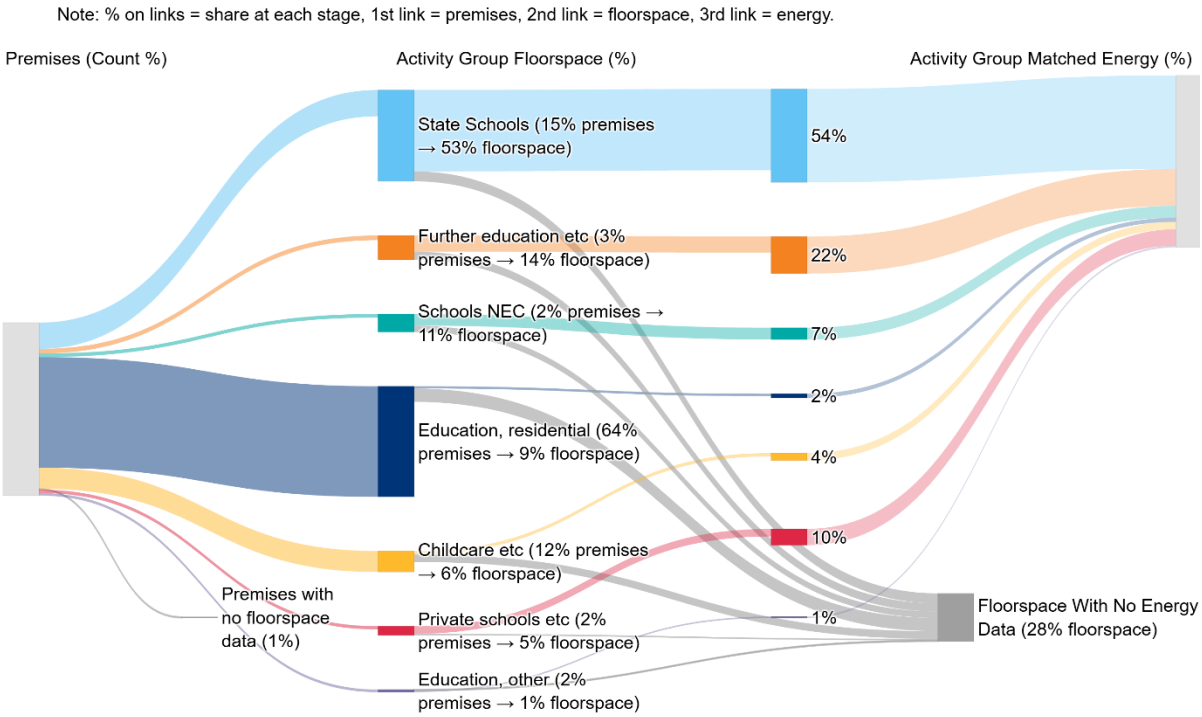


Figure 3.4-1: Share of activity group by number of premises, floorspace and total energy demand

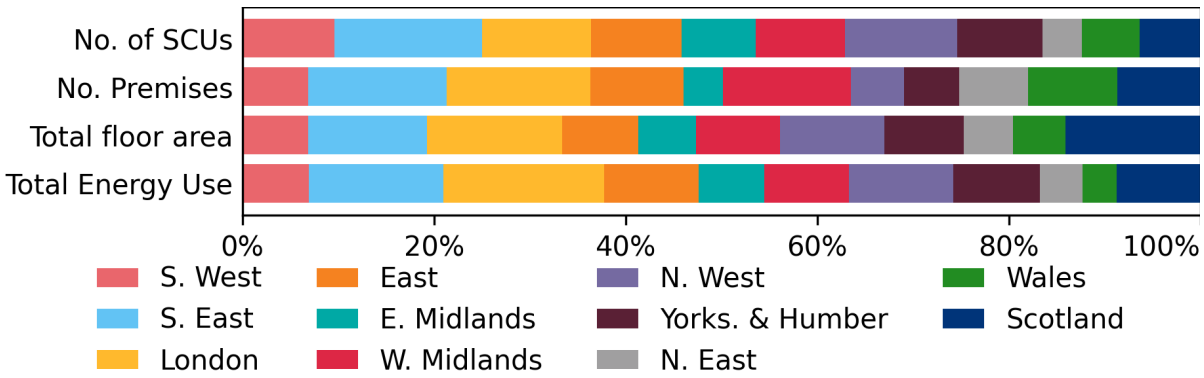


Figure 3.4-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.4-2), for England these are comparable with the NUTS regions. For 'Education' the London has the largest percentage of premises (15%) and SCUs (15%). The largest percentage of floorspace is in Scotland (14%). For the regional share of total energy demand, London has the largest percentage (17%).

3.4.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'State Schools' (1,398 m²) and the smallest is 'Education, residential' (26 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.4-3, where the dotted line indicates the distribution of floorspace beyond the 75th percentile, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

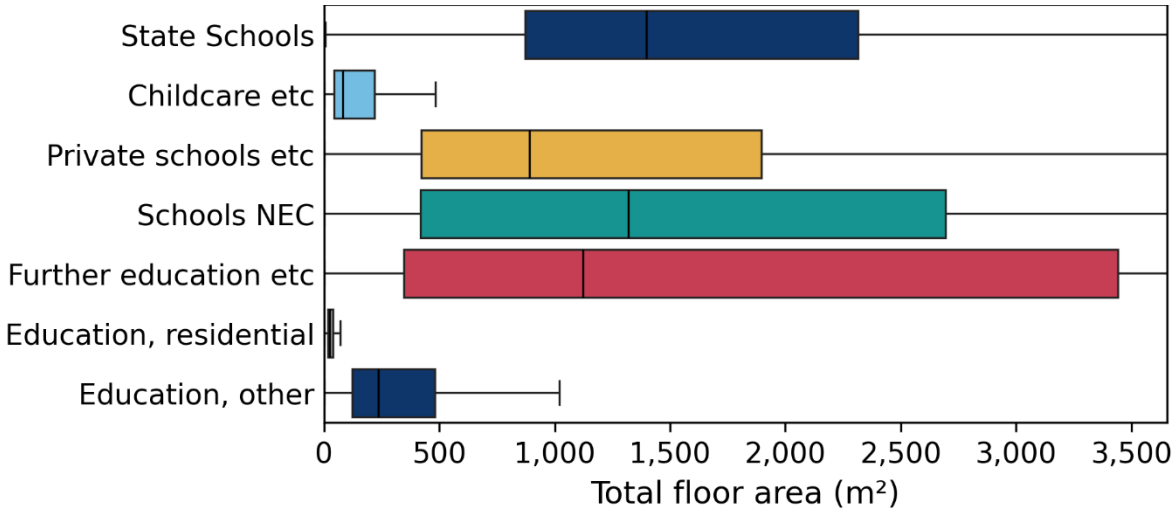


Figure 3.4-3: Distribution of premises total floor area by activity group

3.4.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 24% of ‘Education’ premises have at least one matched electricity meter and 18% have at least one matched gas meter. The total matched energy use for 'Education' is 11,764 GWh per year, which consists of 4,332 GWh for electricity and 7,432 GWh for gas per year.

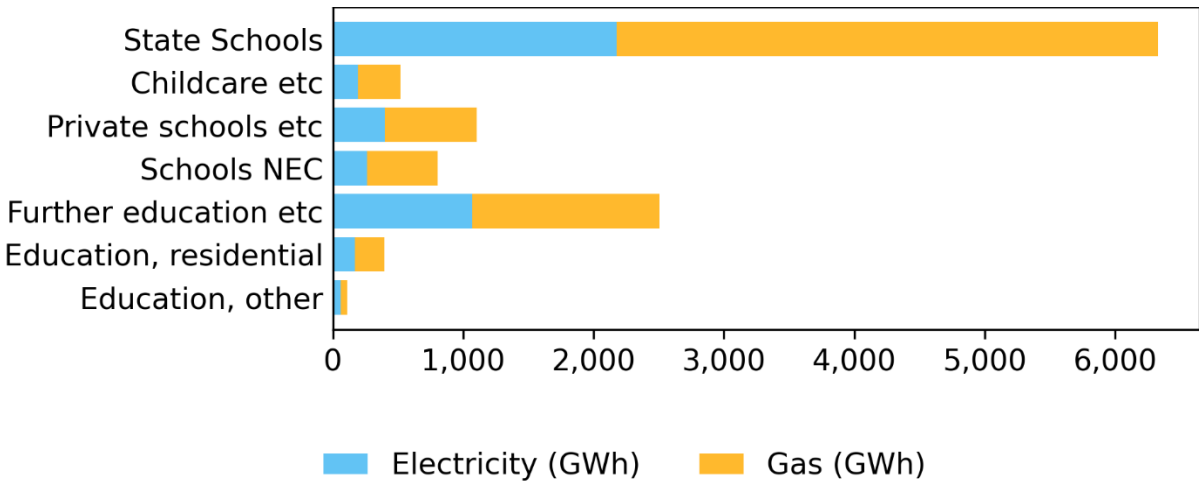


Figure 3.4-4: Total energy demand (GWh) for 'Education' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Education’ is Profile Class 3, which represents 43% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

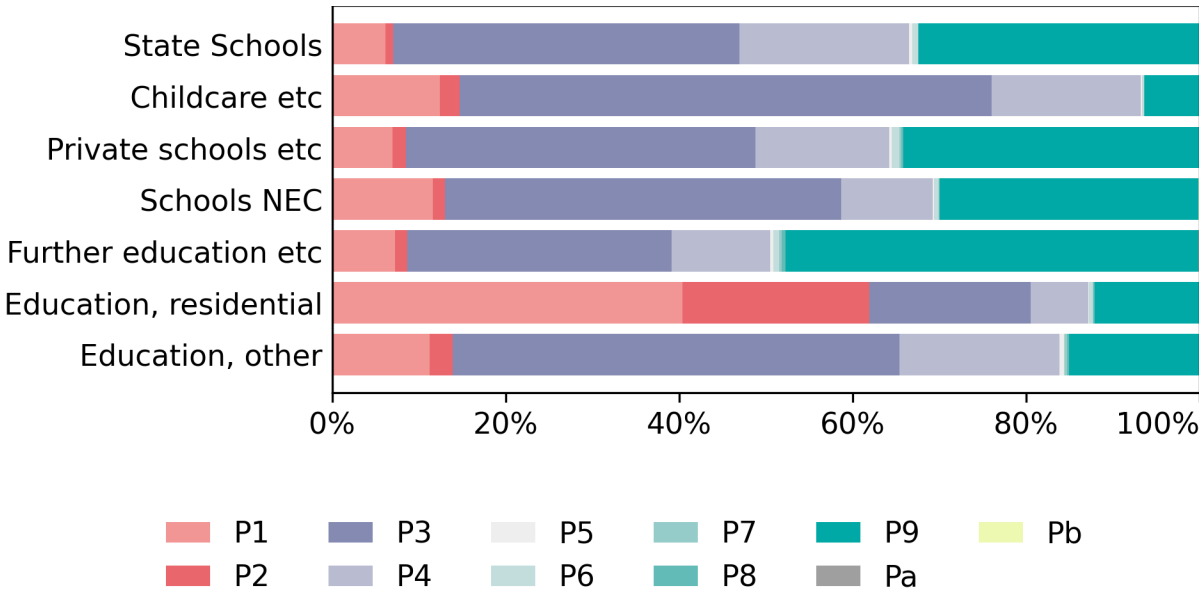


Figure 3.4-5: Percentage of meter profile classes for electricity meters by activity group

Around 14% of all 'Education' premises (8% of 'Education' floorspace) are located in postcodes classified as off the gas grid. Figure 3.4-6 below shows that 'Schools NEC' is the activity group that has the largest share (27% by floorspace) of off the gas grid postcodes

and 'Childcare etc' have the lowest share (4%). For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

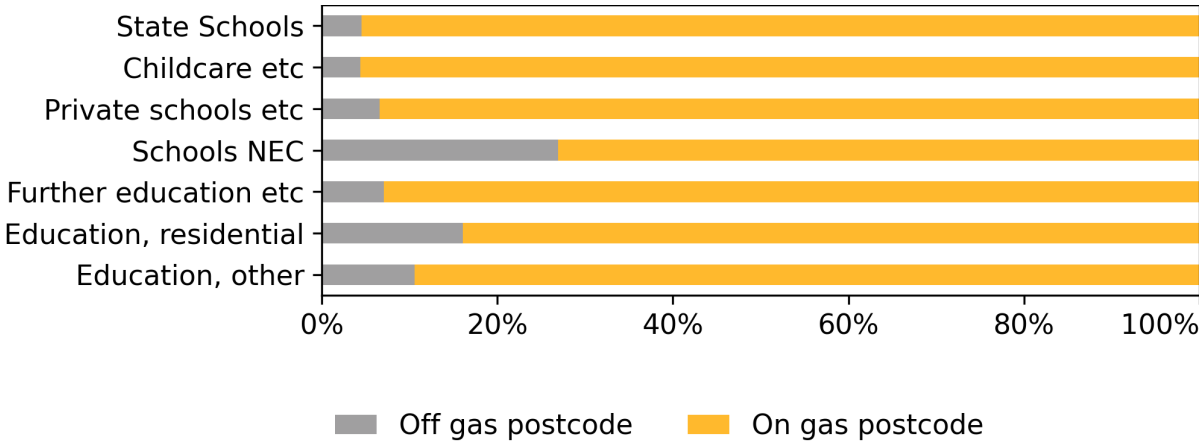
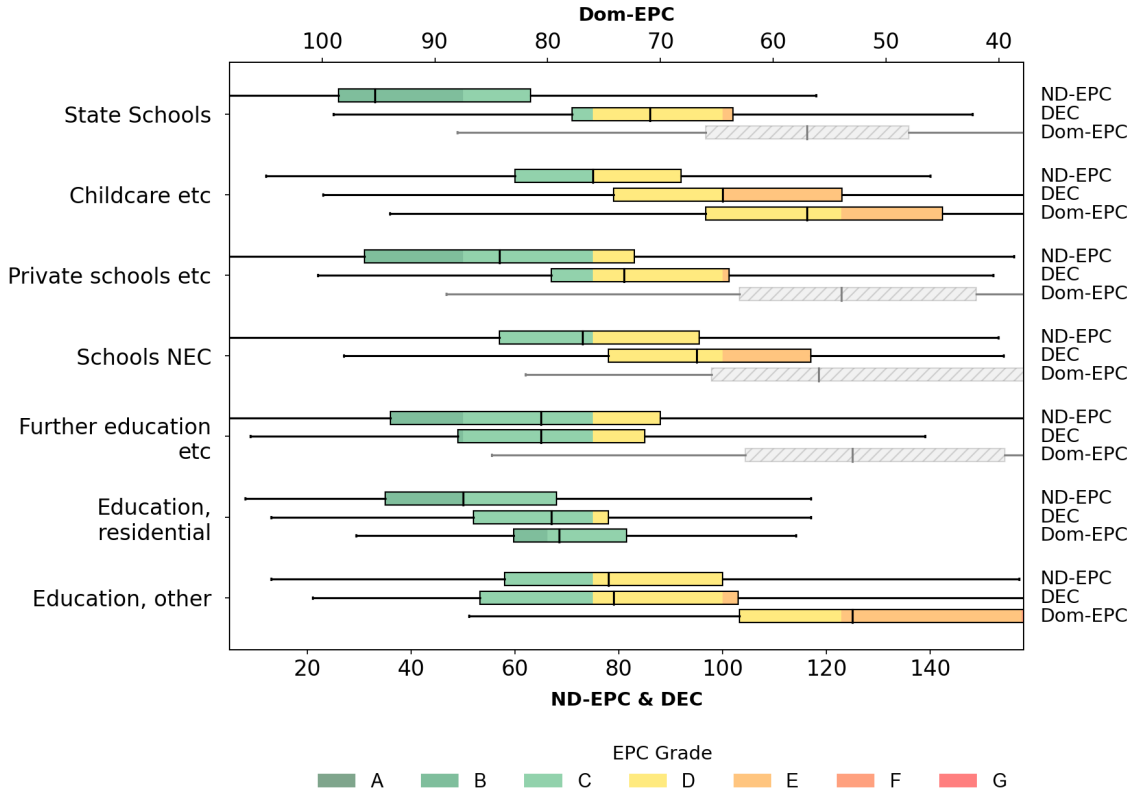


Figure 3.4-6: Percentage of floorspace on or off gas grid by activity group

3.4.4 Energy certification

Around 19% of all 'Education' premises have an energy certificate, with around 6% of these being non-domestic EPCs and 13% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Education' was March 2020.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.4-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that ’State Schools’ have the largest share of DECs with over 16,500 matches to a DEC. The median current operational rating of these is 86 (D) for ‘State Schools’. For non-domestic EPCs, the highest performing are for ‘State Schools’ with a median asset rating of 33 (B) whilst ‘Childcare etc’, ‘Schools NEC’ and ‘Education, other’ have the poorest performing median EPC values of 75 (C), 73 (C) and 78 (D) respectively. ‘Education, residential’ has the largest number of domestic EPCs (over 5,000) with a median current energy efficiency of 79 (C).

3.4.5 Energy use detailed insights

Within 'Education', the activity group with the highest median energy use intensity (EUI) for electricity is 'Childcare etc' (148 kWh/m² per year) and for gas it is 'Childcare etc' (436 kWh/m² per year). For total EUI (gas and electricity combined) 'Childcare etc' have the highest value (362 kWh/m² per year), see Figure 3.4-8 below (chart values truncated to 76th percentile of highest activity group).

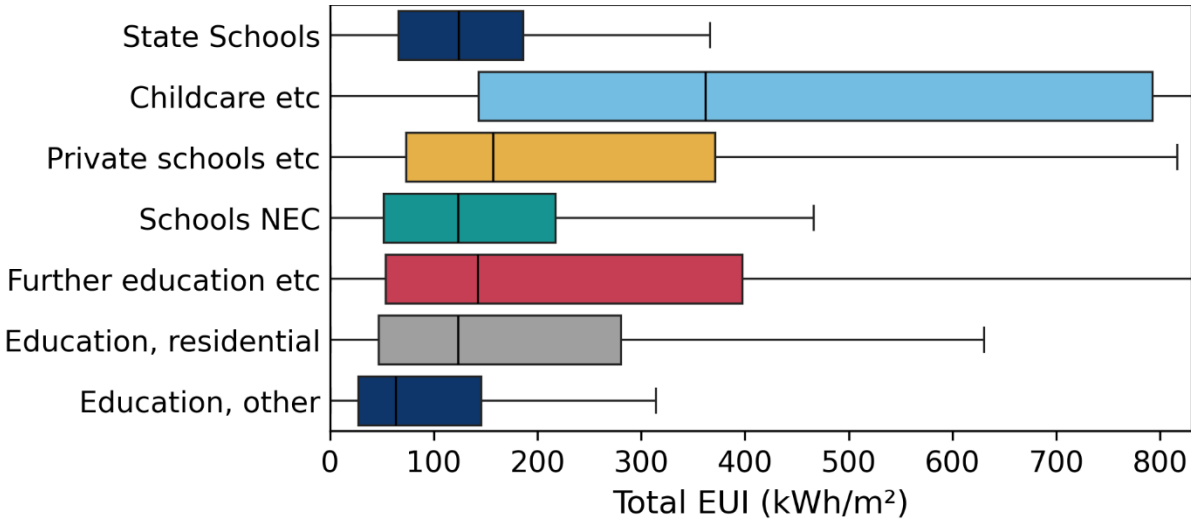


Figure 3.4-8: Distribution of total Energy Use Intensity (EUI) by activity group

Where an energy certificate (EC) has been matched to premises, ‘Mains Gas’ is the dominant fuel used for heating, as shown in Figure 3.4-9 below. However, significant floorspace of the groups ‘Education, residential’ and ‘Education, other’ are treated using ‘Electricity’. ‘District and Community Heating’ energy is also significant in ‘Education, residential’ and ‘Further education etc’, possibly due to these premises being largely associated with student halls of residence linked to university district heating networks.

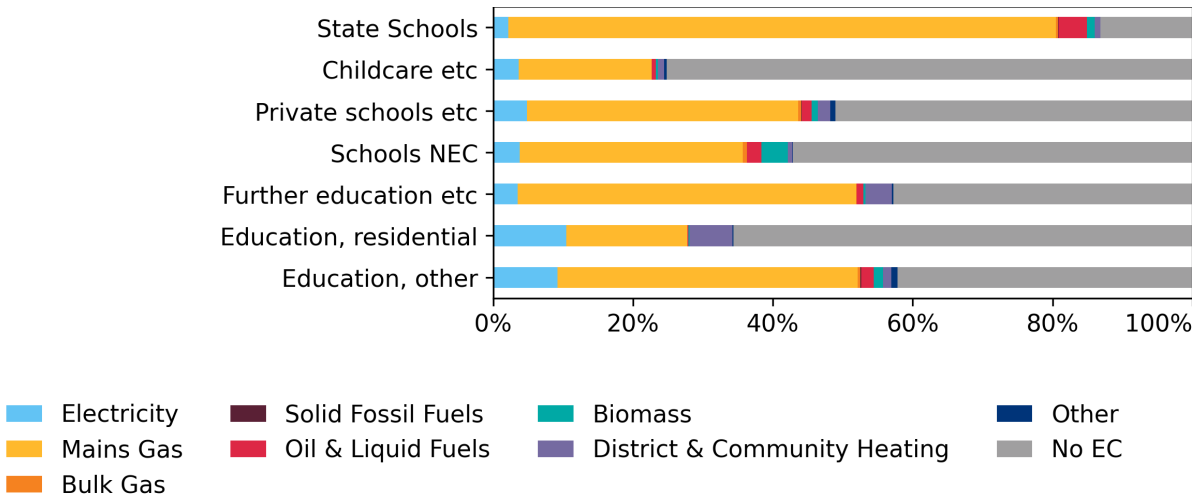


Figure 3.4-9: Heating fuels as percentage of total floorspace by activity group

Figure 3.4-10 below, indicates that ‘Heating and Ventilation’ dominates the Education class, but that ‘Air conditioning’ is also significant, particularly in ‘Education, other’, ‘Further education etc’ and ‘Private schools etc’. ‘Oil & Liquid Fuels’ treat more floorspace than ‘Air Conditioning’ in the ‘Education, residential’ group.

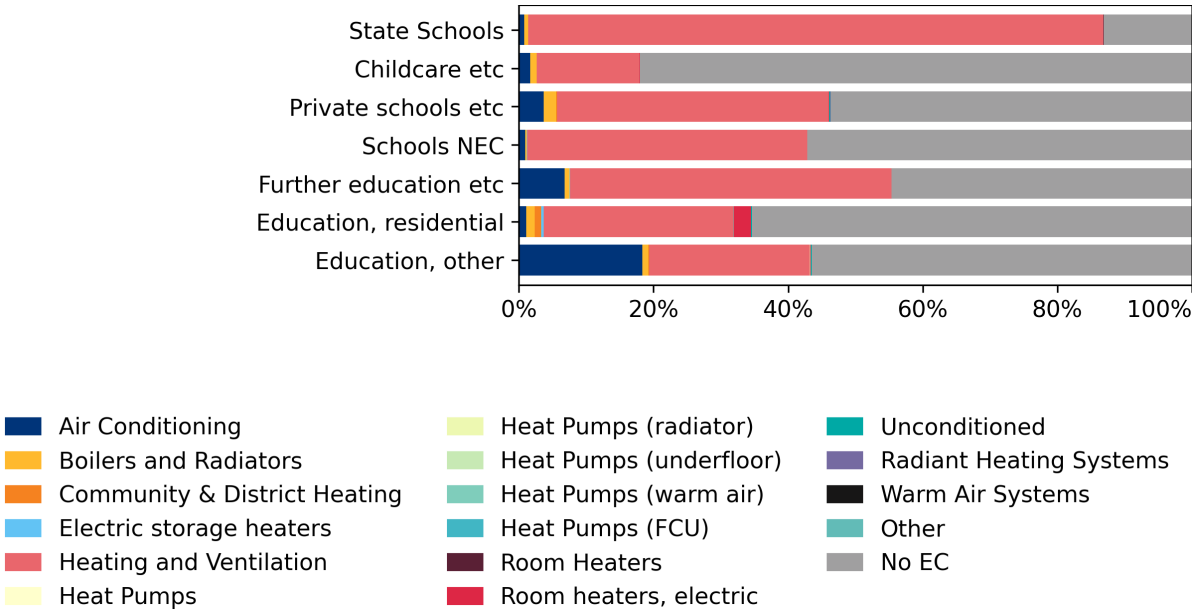


Figure 3.4-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'State Schools' (44%) whilst the lowest percentage is for 'Schools NEC' (4%), as shown in Figure 3.4-11 below.

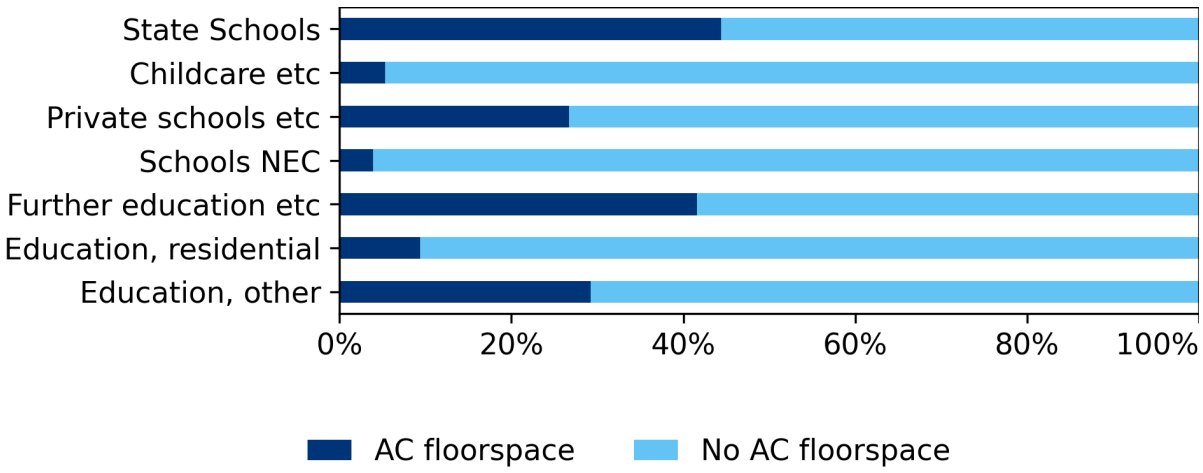


Figure 3.4-11: Air-conditioned floorspace by activity group

3.4.6 Heritage and Rural Urban

69% of all 'Education' premises are in an area with no Conservation area or Listed building restrictions whilst 31% are either in a Conservation area, or are a Listed building or both. 'Private schools etc' has the largest amount of their floorspace in heritage restricted areas (45%). More details can be seen in Figure 3.4-12 below.

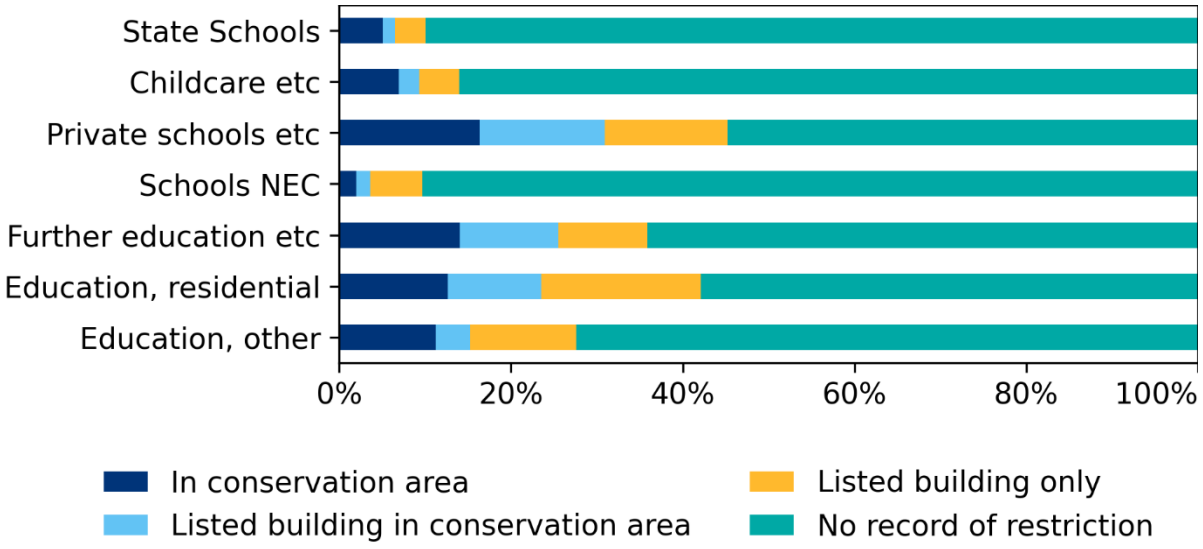


Figure 3.4-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 90% of premises and 88% of floorspace in the 'Education' activity class may be found in an urban area. The largest activity group is 'Further education etc' where 93% of its floorspace is in an urban area, whilst 'Education, other' has the largest percentage of its floorspace in rural areas (22%), as shown in Figure 3.4-13 below.

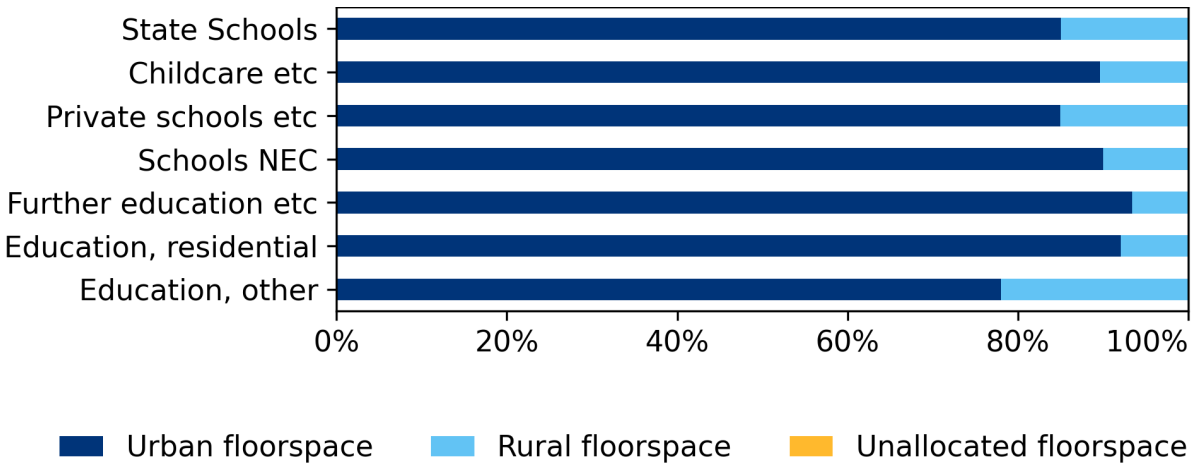


Figure 3.4-13: Floorspace by ONS Urban / rural classification by activity group

3.4.7 Mixed-use buildings

Within the 'Education' class, 72% of SCUs are occupied by a single 'Education' premises, whilst 16% share the SCU with other non-domestic premises and 12% share the SCU with domestic premises.

Figure 3.4-14 below shows 'State Schools' is the activity group with the highest percentage of cases where they are the sole occupier of the building (85%) whilst 'Education, other' has the highest percentage of SCUs shared with other non-domestic premises (30%) and 'Education, residential' has the highest percentage of SCUs shared with domestic residential uses (38%).

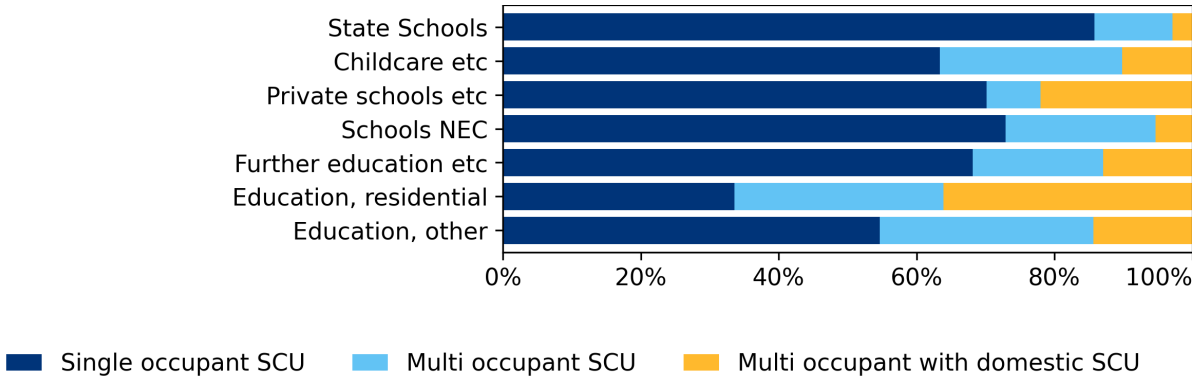


Figure 3.4-14: Percentage of premises by mixed-use SCU classification by activity group

3.4.8 Public sector

Around 23% of Education premises and 76% of Education floorspace is likely to be Public Sector. This is to be expected given the large amount of State School floorspace which can be seen in Figure 3.4-15 where 'State Schools' is the activity group with the highest percentage of premises likely to be Public Sector (100%) and this represents 100% of their activity group floorspace. 'Education, residential' is the activity group with the lowest percentage of premises (3%) and floorspace (5%) likely to be Public Sector.

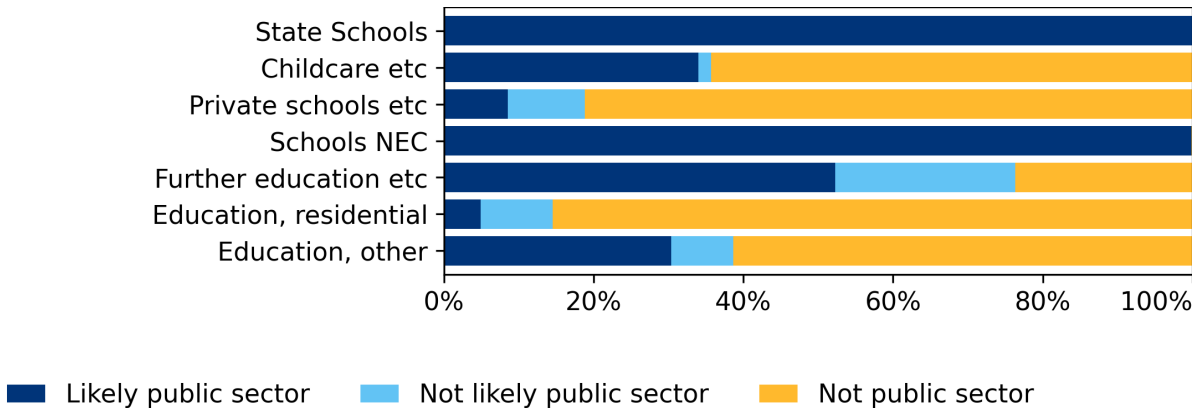


Figure 3.4-15: Percentage of floor area assigned 'Public sector' by activity group

3.4.9 Age and materials

29% of 'Education' premises and 23% of Education floorspace is classified in the '2007-2021' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (4%), which represents 6% of floorspace.

The details at the activity group level are shown in Figure 3.4-16 below, where ‘Private schools etc’ stand out as the activity group with the largest percentage of premises in buildings older than 1940 (around 40%) whilst ‘State Schools’ appear to have a large percentage of their premises in buildings built in 1940-1975.

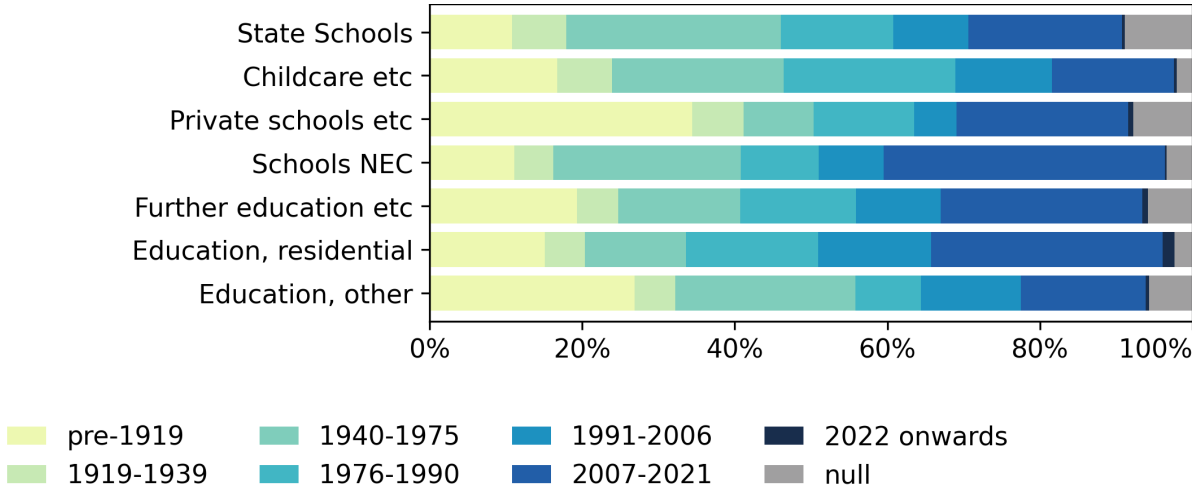


Figure 3.4-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Education' activity class (measured by wall area). The 'State Schools' activity group has the largest wall area (23.7 million m²) when measured from the 3D geometry in the database, and 89% of this is masonry, which represents 51% of the total wall area in 'Education' (see Figure 3.4-17).

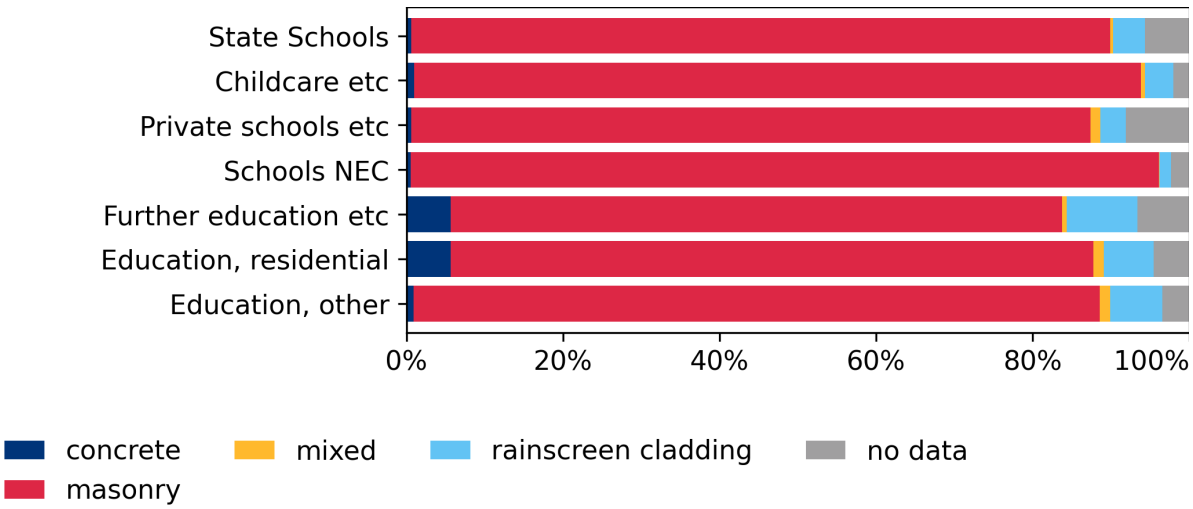


Figure 3.4-17: Distribution of total wall area by NGD material and activity group

Table 3.4-1: Summary statistics for Education by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
State Schools	22,717	20,811	46.22	2,081	15.3	53.1
Childcare etc	18,202	16,676	5.53	304	12.2	6.4
Private schools etc	2,726	2,537	4.60	1,718	1.8	5.3
Schools NEC	3,113	2,178	9.13	3,001	2.1	10.5
Further education etc	3,998	3,309	12.32	3,196	2.7	14.2
Education, residential	95,889	5,075	7.89	82	64.4	9.1
Education, other	2,286	1,920	1.30	585	1.5	1.5

Table 3.4-2: Summary energy statistics for Education by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
State Schools	124	6,329.80	53.8
Childcare etc	362	518.50	4.4
Private schools etc	157	1,101.73	9.4
Schools NEC	123	802.92	6.8
Further education etc	143	2,508.36	21.3
Education, residential	124	393.67	3.3
Education, other	63	109.49	0.9

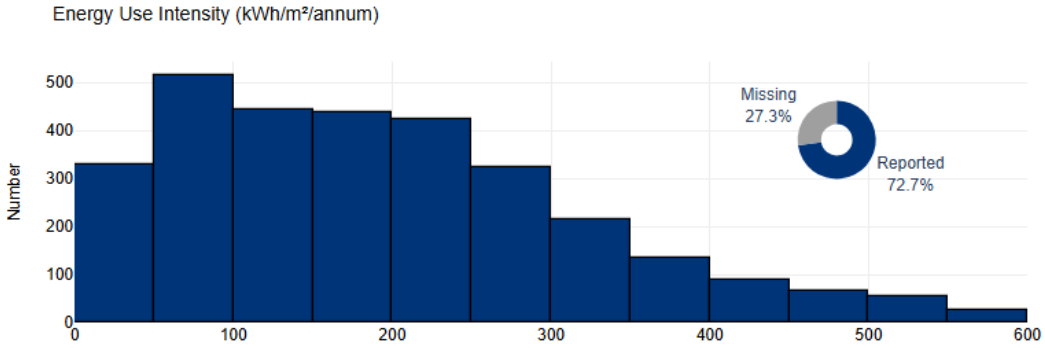
3.5 Emergency

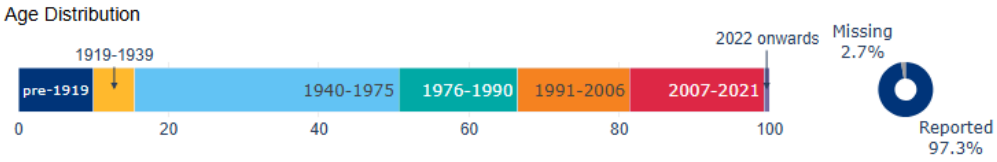
Overview

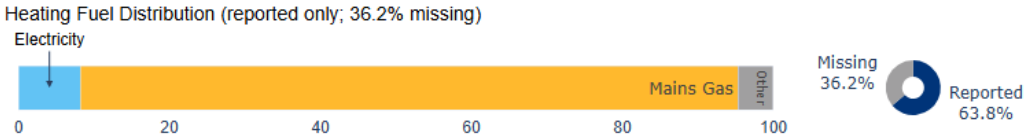
In the Emergency activity class, the analysis covers 4,668 premises. The average Energy Use Intensity (EUI) is 282 kWh/m²/annum. The dominant building age group is 1940-1975 (34%), and the predominant heating fuel is Mains Gas (56%).

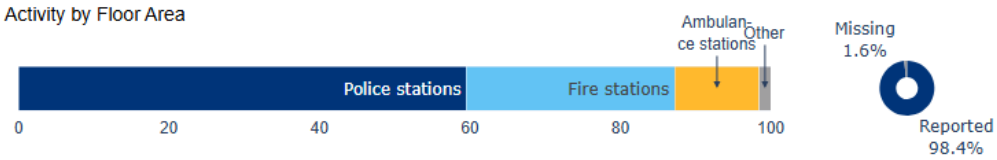
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

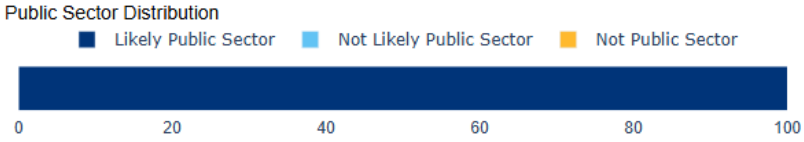
Activity Group	Premises (thousands)	Floorspace (millions m²)
Fire stations	1.9	1.14
Police stations	1.7	2.46
Ambulance stations	0.8	0.46
Coastguard/Lifeboat stations	0.3	0.06











3.5.1 Overview

The 'Emergency' class has a total of 4,668 premises and 4.13 million m² of floorspace. This makes Emergency the second smallest activity class with less than 1% of all non-domestic premises and less than 1% of all non-domestic floorspace. This class contains five activities, which have been grouped into four activity groups. The largest activity by count is 'Fire station' with 1,920 premises. The largest by total floorspace is 'Police station' with 2.46 million m² of floorspace. In total NBD reports 4,076 SCUs (which roughly equate to buildings) for 'Emergency'.

For 'Emergency' as a whole, ND-NEED (2023) reports 0.00 million buildings (98% of NBD SCUs) and 0.15 million m² of floorspace (4% of NBD). BEES (2014) reported 5,100 premises (109% of NBD premises) and 14 million m² of floorspace (339% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult. For example, BEES included prisons and law courts in its 'Emergency Services' category, which fall within the 'Community' class in NBD.

Figure 3.5-1 below shows all activities in the 'Emergency' class aggregated into four activity groups. 'Fire stations' has the largest number of premises but these have a relatively small median floorspace (320 m²), making it the second largest activity group in terms of floorspace within 'Emergency'. The activity group with the largest total floorspace is 'Police stations' where the median floor area is 457 m² and the total floor area is 2.46 million m². 'Police stations' also represents the largest share of the matched energy demand (57%).

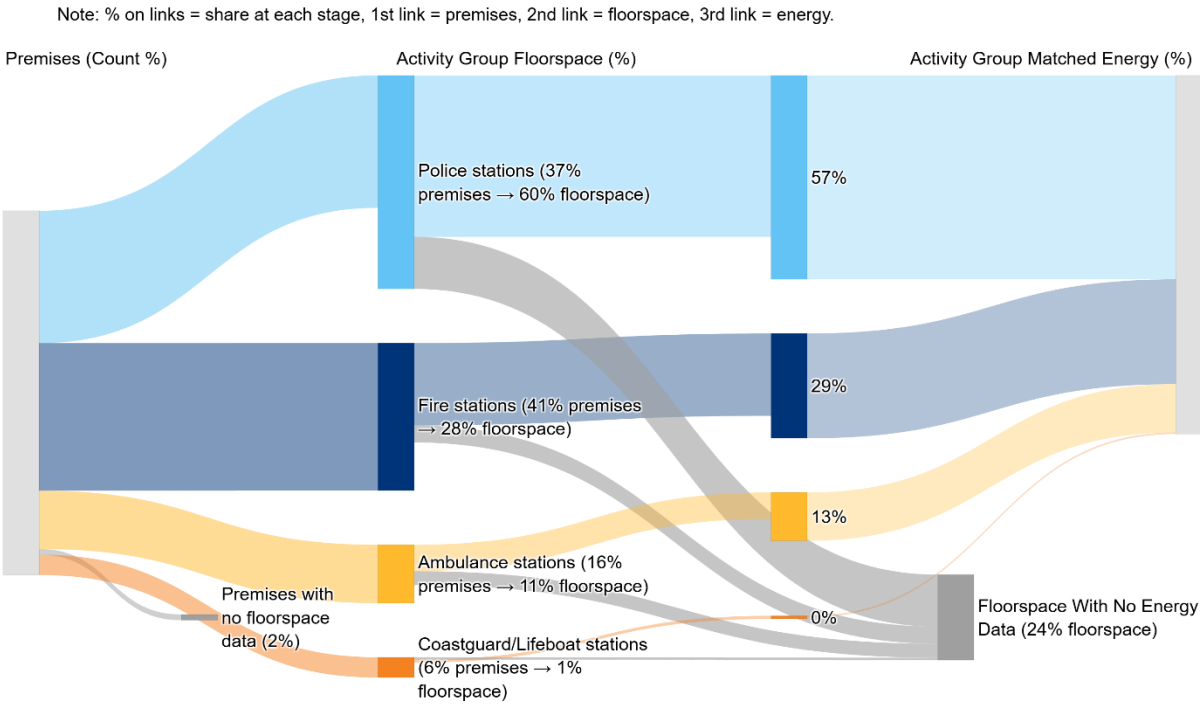


Figure 3.5-1: Share of activity group by number of premises, floorspace and total energy demand

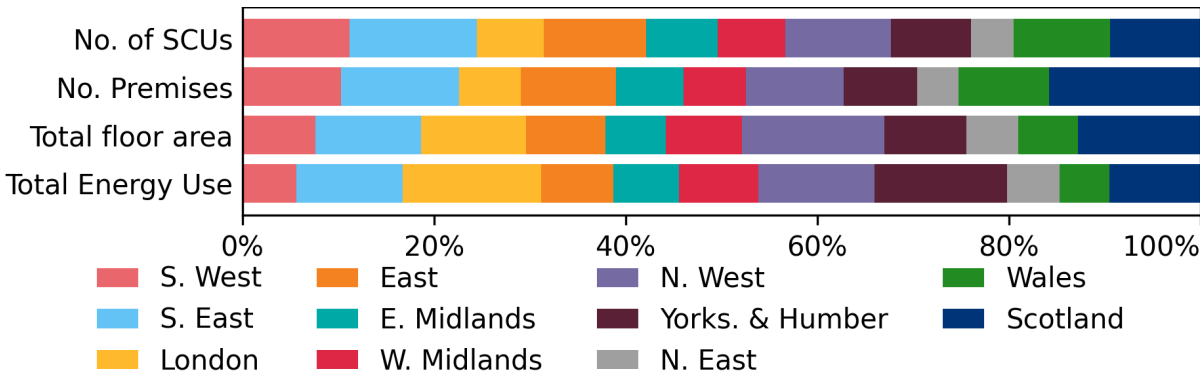


Figure 3.5-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.5-2), for England these are comparable with the NUTS regions. For 'Emergency' the Scotland has the largest percentage of premises (16%) and SCUs (13%). The largest percentage of floorspace is in North West (15%). For the regional share of total energy demand, London has the largest percentage (15%).

3.5.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Police stations' (457 m²) and the smallest is 'Coastguard/Lifeboat stations' (133 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.5-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

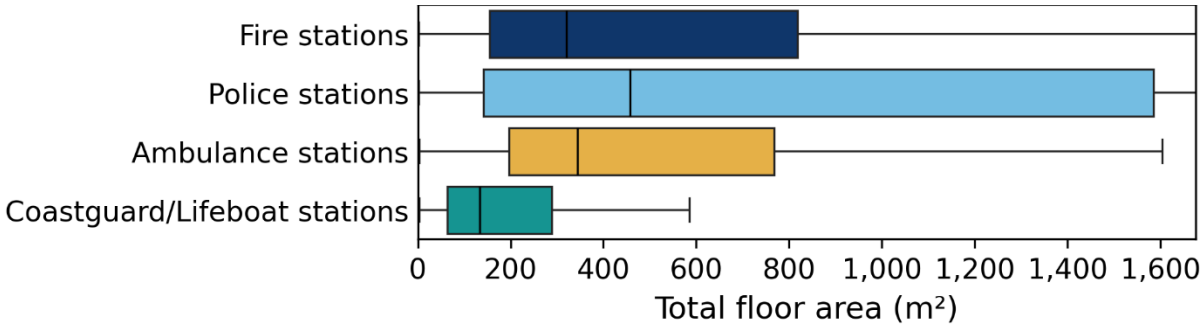


Figure 3.5-3: Distribution of premises total floor area by activity group

3.5.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 66% of ‘Emergency’ premises have at least one matched electricity meter and 43% have at least one matched gas meter. The total matched energy use for 'Emergency' is 651 GWh per year, which consists of 292 GWh for electricity and 359 GWh for gas per year.

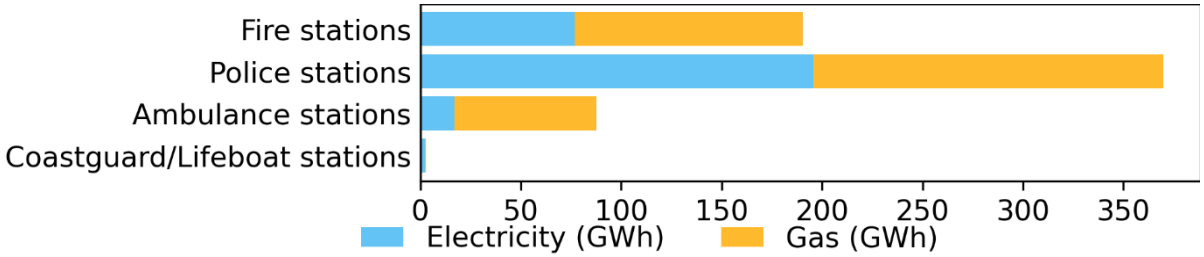


Figure 3.5-4: Total energy demand (GWh) for 'Emergency' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Emergency’ is Profile Class 3, which represents 41% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

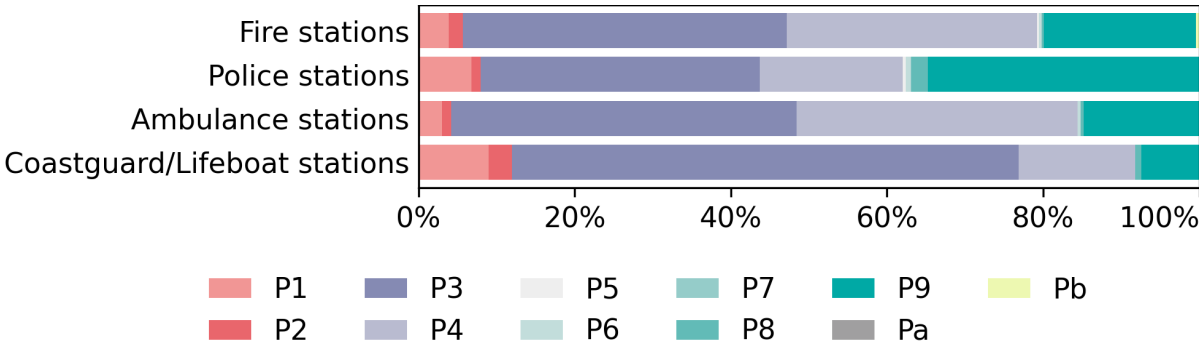


Figure 3.5-5: Percentage of meter profile classes for electricity meters by activity group

Around 11% of all 'Emergency' premises (7% of 'Emergency' floorspace) are located in postcodes classified as off the gas grid. Figure 3.5-6 below shows that 'Coastguard/Lifeboat stations' is the activity group that has the largest share (21% by floorspace) of off the gas grid postcodes and 'Ambulance stations' have the lowest share (3%). For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

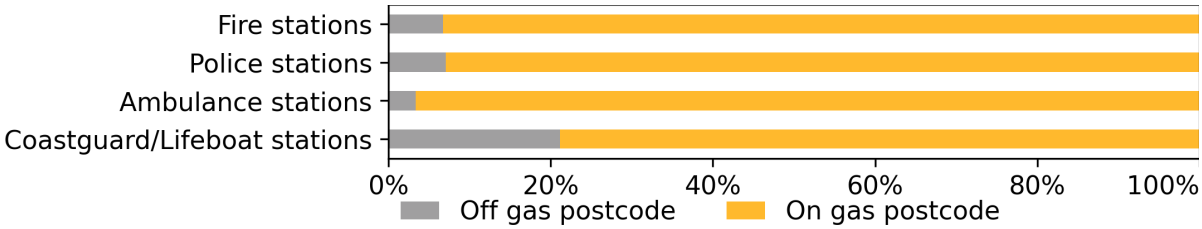
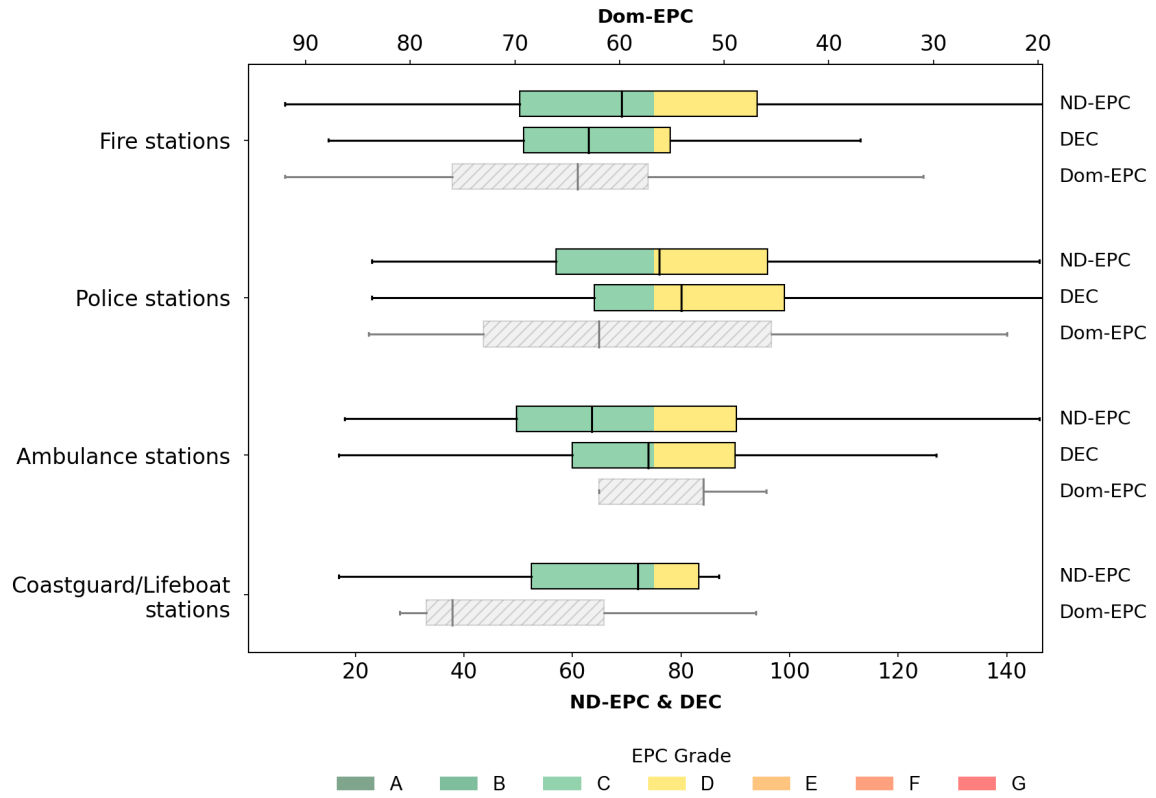


Figure 3.5-6: Percentage of floorspace on or off gas grid by activity group

3.5.4 Energy certification

Around 37% of all 'Emergency' premises have an energy certificate, with around 15% of these being non-domestic EPCs and 22% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Emergency' was September 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.5-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that ‘Fire stations’ and ‘Police stations’ have more DECs that match to them than non-domestic EPCs and the median current operational rating for these DECs is 63 (C), and 80 (D) respectively. Ambulance stations have more non-domestic EPCs than DECs matching to them and the median asset rating for these is 64 (C). For ‘Coastguard/Lifeboat stations’ the median non-domestic EPC is 72 (C).

3.5.5 Energy use detailed insights

Within 'Emergency', the activity group with the highest median energy use intensity (EUI) for electricity is 'Coastguard/Lifeboat stations' (85 kWh/m² per year) and for gas it is 'Police stations' (180 kWh/m² per year). For total EUI (gas and electricity combined) 'Fire stations' have the highest value (190 kWh/m² per year), see Figure 3.5-8 below (chart values truncated to 76th percentile of highest activity group).

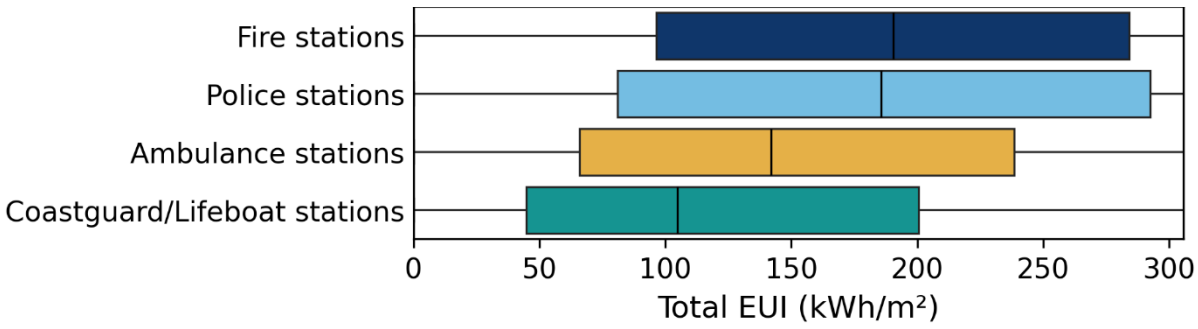


Figure 3.5-8: Distribution of total Energy Use Intensity (EUI) by activity group

‘Coastguard/Lifeboat stations’ and ‘Ambulance stations’ have the lowest percentage of floorspace captured by energy certificates, as shown in Figure 3.5-9 below, because these are not generally open to the public, and do not change hands frequently.
’Coastguard/Lifeboat stations’ have the largest percentage of their floor area heated by ‘Electricity’, possibly reflecting remote locations. However, most of the Emergency class is heated by ‘Mains Ga’s and the amount of floorspace using ‘Oil & Liquid Fuels’ is negligible, as are the remaining non-electric/non-mains gas elements.

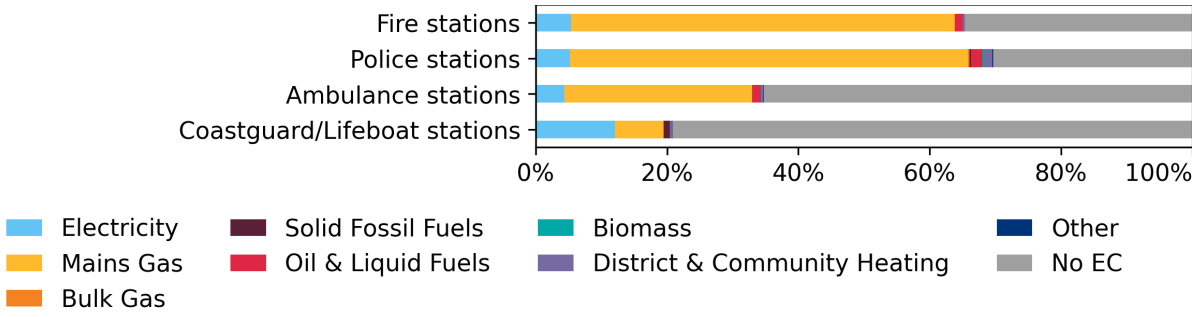


Figure 3.5-9: Heating fuels as percentage of total floorspace by activity group

’Heating and Ventilation’ is the dominant method of treating spaces in Emergency, with limited use of ‘Air Conditioning’, except in ‘Ambulance stations’ where the latter is largely non-existent, as demonstrated in Figure 3.5-10 below.

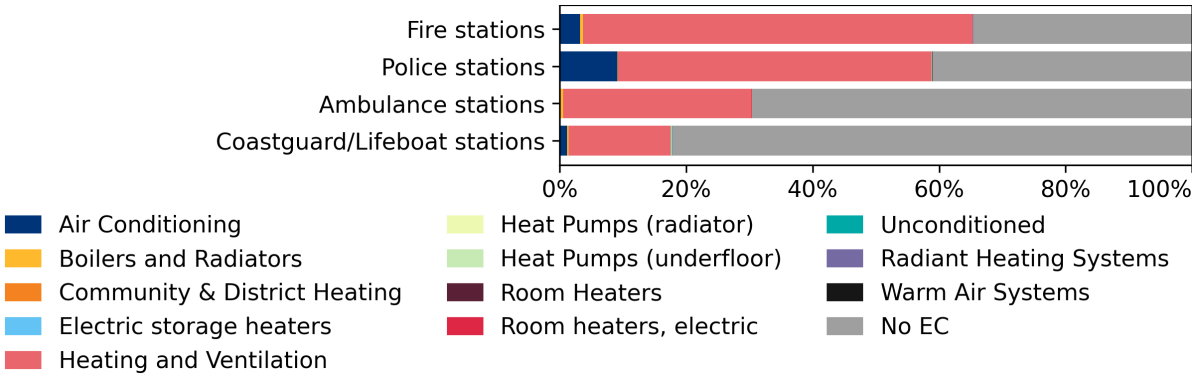


Figure 3.5-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Police stations' (47%) whilst the lowest percentage is for 'Coastguard/Lifeboat stations' (3%), as shown in Figure 3.5-11 below.

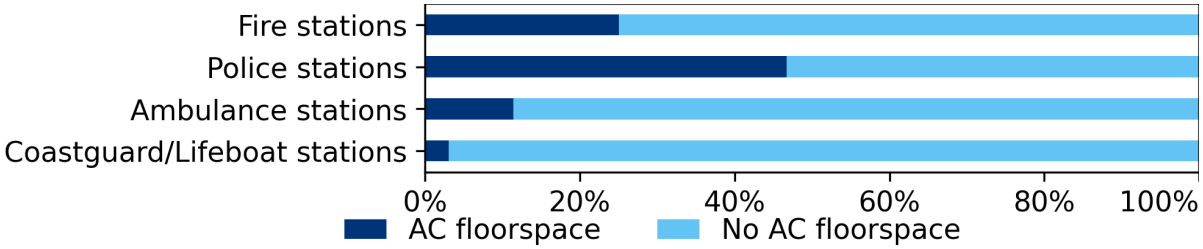


Figure 3.5-11: Air-conditioned floorspace by activity group

3.5.6 Heritage and Rural Urban

82% of all 'Emergency' premises are in an area with no Conservation area or Listed building restrictions whilst 18% are either in a Conservation area, or are a Listed building or both. 'Coastguard/Lifeboat stations' has the largest amount of their floorspace in heritage restricted areas (46%). More details can be seen in Figure 3.5-12 below.

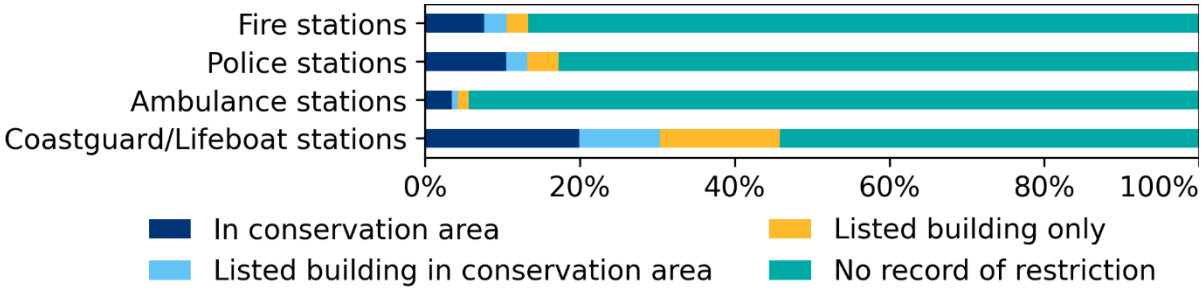


Figure 3.5-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 70% of premises and 90% of floorspace in the 'Emergency' activity class may be found in an urban area. The largest activity group is 'Police stations' where 93% of its floorspace is in an urban area, whilst 'Coastguard/Lifeboat stations' has the largest percentage of its floorspace in rural areas (40%), as shown in Figure 3.5-13 below.

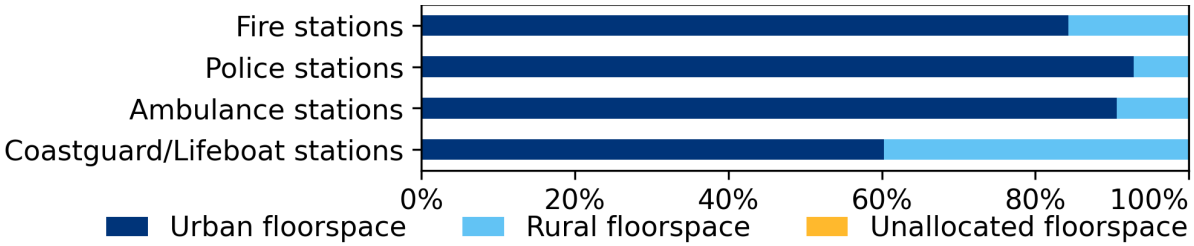


Figure 3.5-13: Floorspace by ONS Urban / rural classification by activity group

3.5.7 Mixed-use buildings

Within the 'Emergency' class, 87% of SCUs are occupied by a single 'Emergency' premises, whilst 9% share the SCU with other non-domestic premises and 5% share the SCU with domestic premises.

Figure 3.5-14 below shows 'Fire stations' is the activity group with the highest percentage of cases where they are the sole occupier of the building (91%) whilst 'Coastguard/Lifeboat stations' has the highest percentage of SCUs shared with other non-domestic premises (17%) and 'Police stations' has the highest percentage of SCUs shared with domestic residential uses (9%).

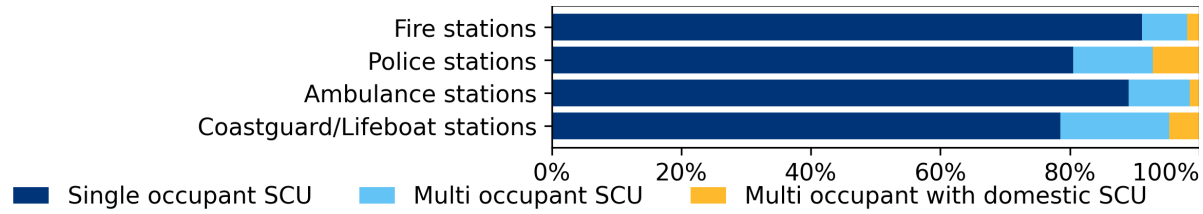


Figure 3.5-14: Percentage of premises by mixed-use SCU classification by activity group

3.5.8 Public sector

NBD has classified 100% of Emergency premises as likely to be Public Sector as can be seen in Figure 3.5-15 below. This shows the challenge of classifying public sector premises, where the coastguard is a public sector body but lifeboat stations are run by private charities – in this instance we would expect some of the activity group 'Coastguard/Lifeboat stations' to be 'Not likely public sector'.

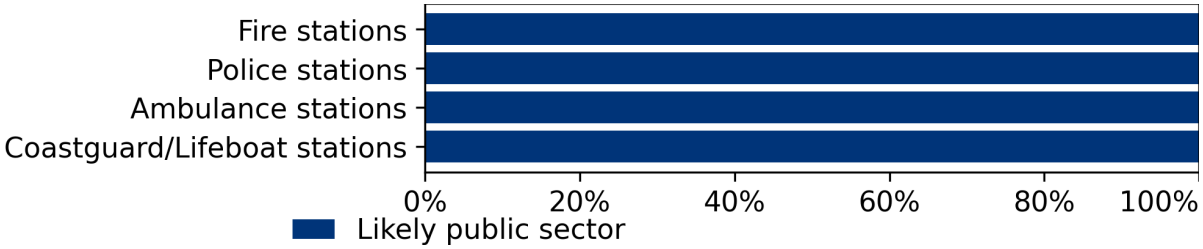


Figure 3.5-15: Percentage of floor area assigned 'Public sector' by activity group

3.5.9 Age and materials

33% of 'Emergency' premises and 34% of Emergency floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (7%), which represents 5% of floorspace.

The details at the activity group level are shown in Figure 3.5-16 below where it shows that around 30% of all 'Coastguard/Lifeboat stations' premises are in buildings built before 1940.

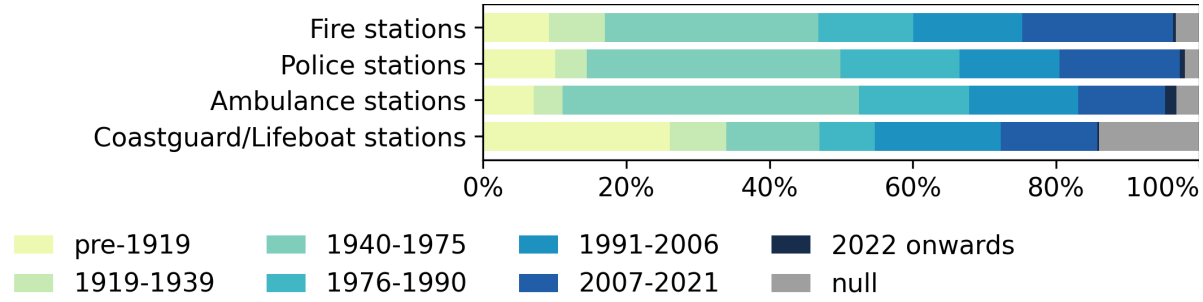


Figure 3.5-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Emergency' activity class (measured by wall area). The 'Police stations' activity group has the largest wall area (1.0 million m²) when measured from the 3D geometry in the database, and 85% of this is masonry, which represents 43% of the total wall area in 'Emergency' (see Figure 3.5-17).

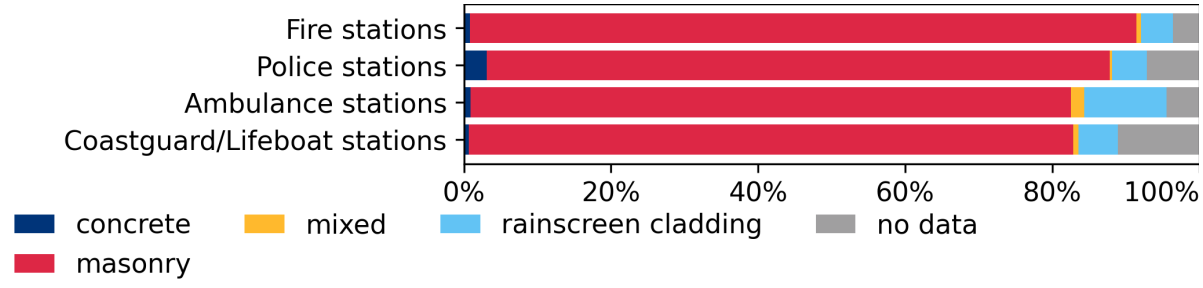


Figure 3.5-17: Distribution of total wall area by NGD material and activity group

Table 3.5-1: Summary statistics for Emergency by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Fire stations	1,920	1,694	1.14	606	41.1	27.7
Police stations	1,724	1,520	2.46	1,443	36.9	59.5
Ambulance stations	760	686	0.46	622	16.3	11.3
Coastguard/ Lifeboat stations	264	214	0.06	240	5.7	1.5

Table 3.5-2: Summary energy statistics for Emergency by activity group

Activity group	median total EUI ($kWh/m^2/year$)	total GWh	% by total energy
Fire stations	190	190.46	29.3
Police stations	186	369.85	56.8
Ambulance stations	142	87.56	13.5
Coastguard/Lifeboat stations	105	2.90	0.4

3.6 Factory

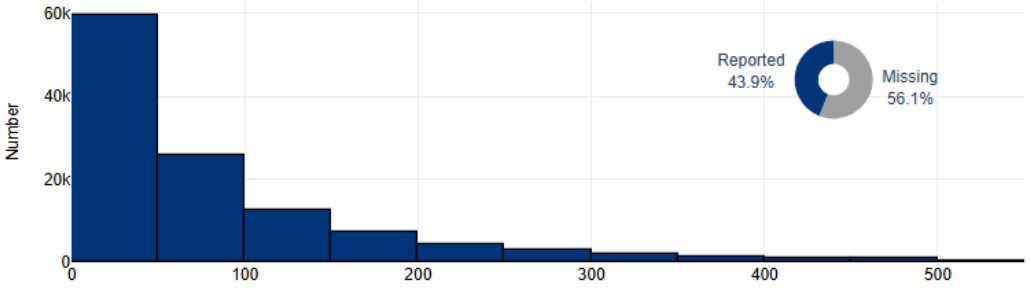
Overview

In the Factory activity class, the analysis covers 300,173 premises. The average Energy Use Intensity (EUI) is 377 kWh/m²/annum. The dominant building age group is 1940-1975 (33%), and the predominant heating fuel is Mains Gas (35%).

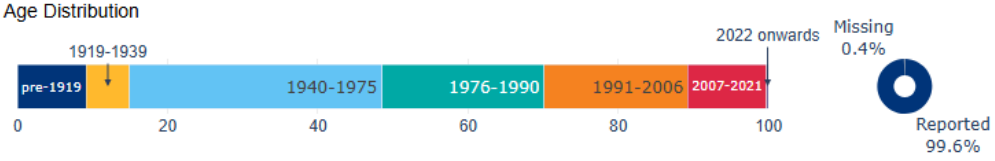
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Workshops etc	230.2	68.71
Factories etc	31.9	88.57
Vehicle repair etc	30.9	8.99
Mineral production etc	3.0	1.36
High Energy Industries	1.5	9.06
Food & Drink Production	1.4	3.54
Factory, other	1.4	0.98

Energy Use Intensity (kWh/m²/annum)

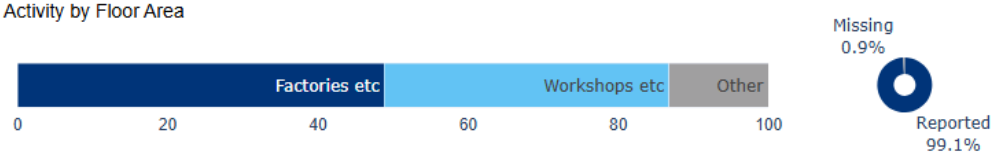


Age Distribution

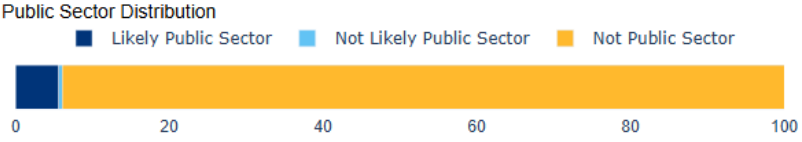


Heating Fuel Distribution (reported only; 48.2% missing)

Activity by Floor Area



Public Sector Distribution



3.6.1 Overview

The 'Factory' class has a total of 300,173 premises and 181.21 million m² of floorspace. This makes it the third-largest class by premises count, with 14% of all non-domestic premises, and the largest class by floorspace accounting for 20% of all non-domestic floorspace. This class contains 58 activities, which have been grouped into seven activity groups. The largest activity by count is 'Workshop' with 229,476 premises. The largest by total floorspace is 'Factory' with 86.63 million m² of floorspace. In total NBD reports 192,493 SCUs (which roughly equate to buildings) for 'Factory'.

For 'Factory' as a whole, ND-NEED (2023) reports 0.24 million buildings (125% of NBD SCUs) and 150.04 million m² of floorspace (83% of NBD). BEES (2014) reported 252,800 premises (84% of NBD premises) and 175 million m² of floorspace (97% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.6-1 below shows all activities in the 'Factory' class aggregated into seven activity groups. 'Workshops etc' has the largest number of premises but these have a relatively small median floorspace (136 m²), making it the second largest activity group in terms of floorspace within 'Factory'. The activity group with the largest total floorspace is 'Factories etc' where the median floor area is 784 m² and the total floor area is 88.57 million m². ’Factories etc’ also represents the largest share of matched energy.

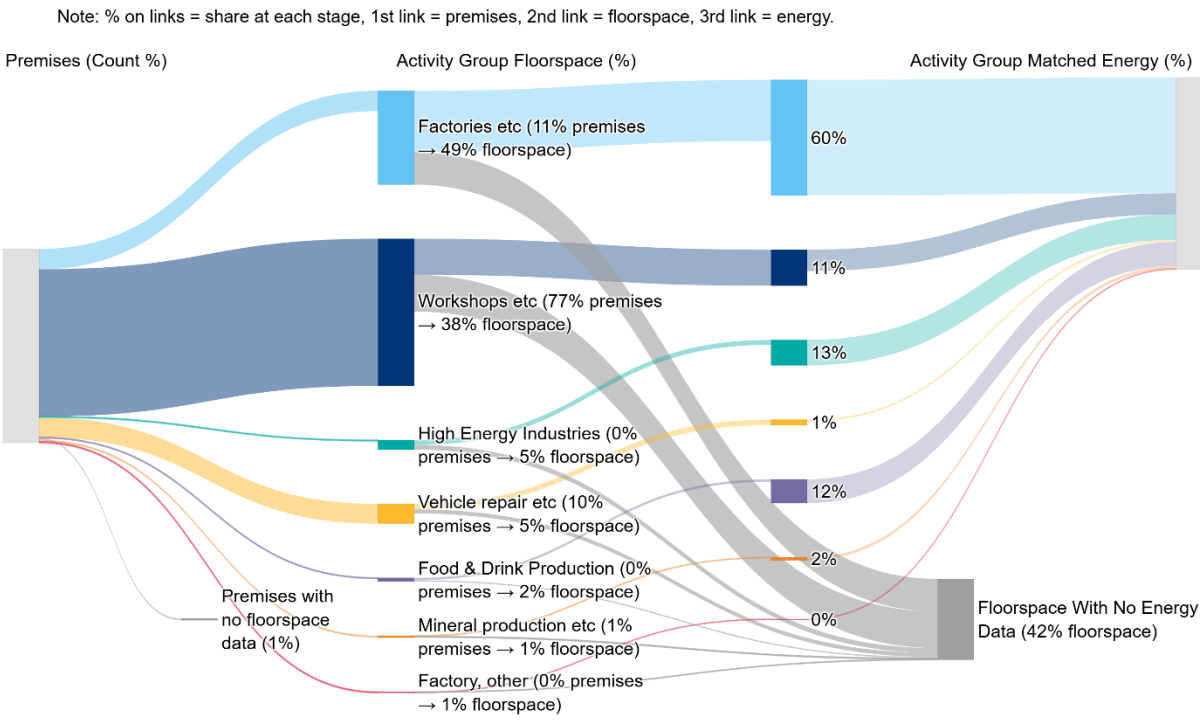


Figure 3.6-1: Share of activity group by number of premises, floorspace and total energy demand

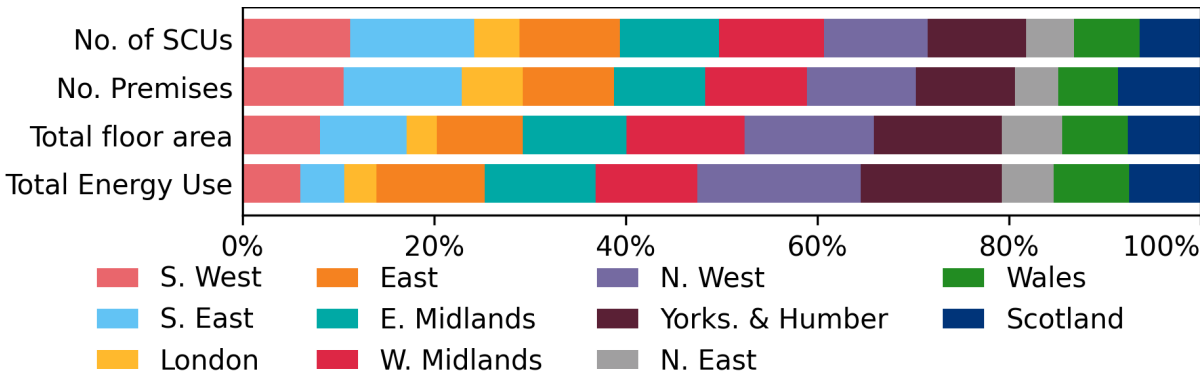


Figure 3.6-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.6-2), for England these are comparable with the NUTS regions. For 'Factory', the South East has the largest percentage of premises (12%) and SCUs (13%). The largest percentage of floorspace is in North West (14%). For the regional share of total energy demand, North West has the largest percentage (17%).

3.6.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Factories etc' (784 m²) and the smallest is 'Factory, other' (99 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.6-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

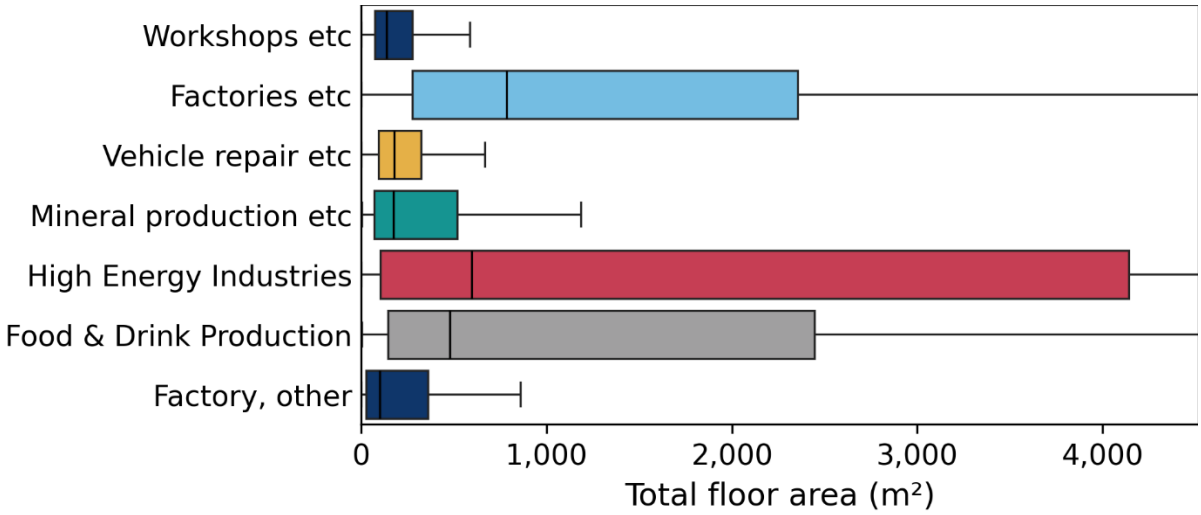


Figure 3.6-3: Distribution of premises total floor area by activity group

3.6.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 42% of ‘Factory’ premises have at least one matched electricity meter and 14% have at least one matched gas meter. The total matched energy use for 'Factory' is 48,534 GWh per year, which consists of 17,802 GWh for electricity and 30,731 GWh for gas per year. See Figure 3.6-4 for a breakdown of energy use per activity group.

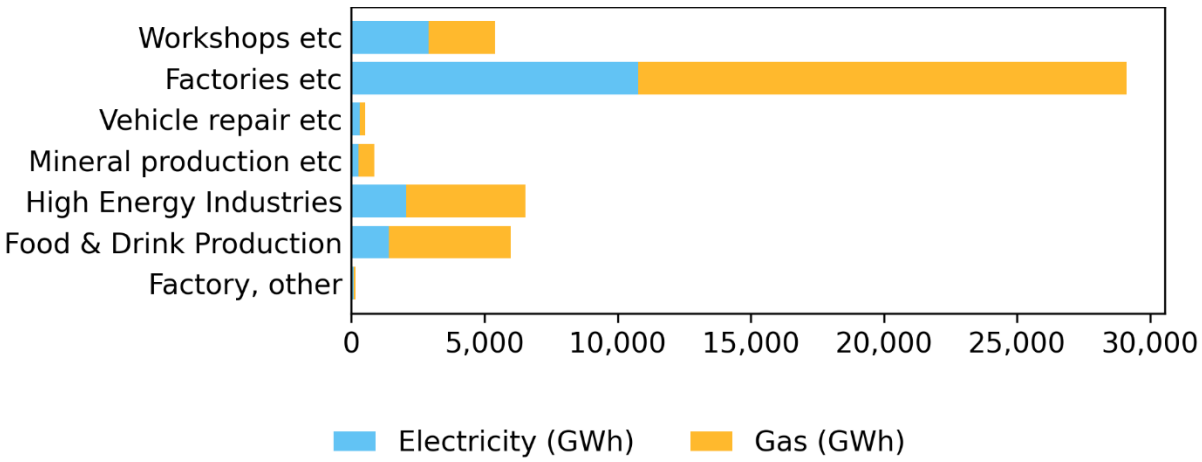


Figure 3.6-4: Total energy demand (GWh) for 'Factory' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Factory’ is Profile Class 3, which represents 64% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

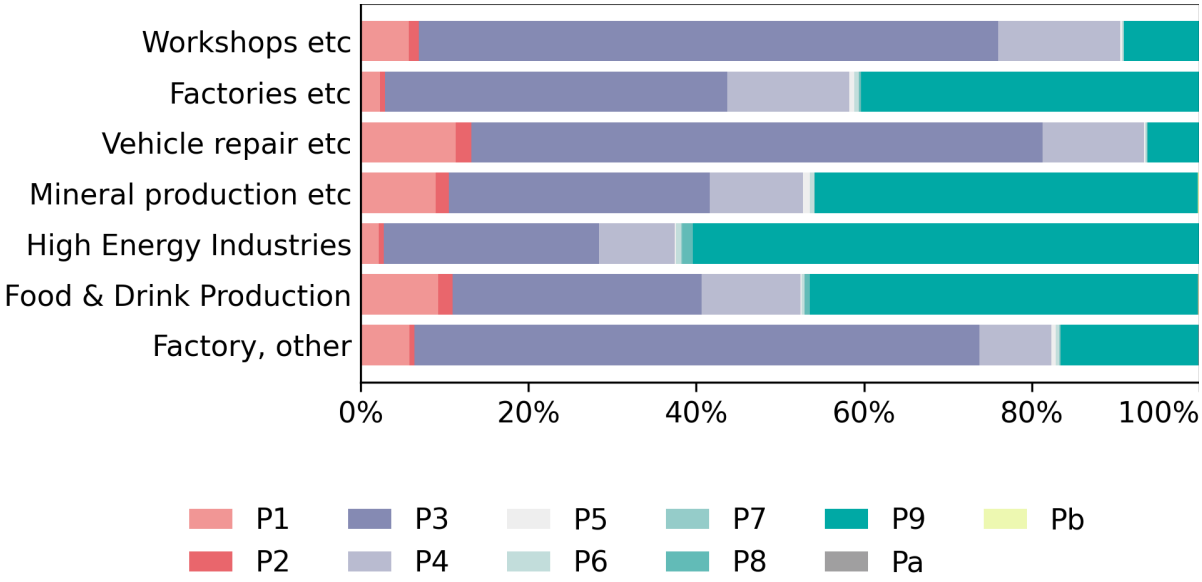


Figure 3.6-5: Percentage of meter profile classes for electricity meters by activity group

Around 14% of all 'Factory' premises (9% of 'Factory' floorspace) are located in postcodes classified as off the gas grid. Figure 3.6-6 below shows that 'Mineral production etc' is the activity group that has the largest share (28% by floorspace) of off the gas grid postcodes and 'Factories etc' have the lowest share (6%). This indicates that energy-intensive activities

like 'Mineral production etc' are more commonly situated in remote or rural areas with limited gas infrastructure, while general 'Factories etc' tend to cluster in urban, gas grid-connected industrial zones. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

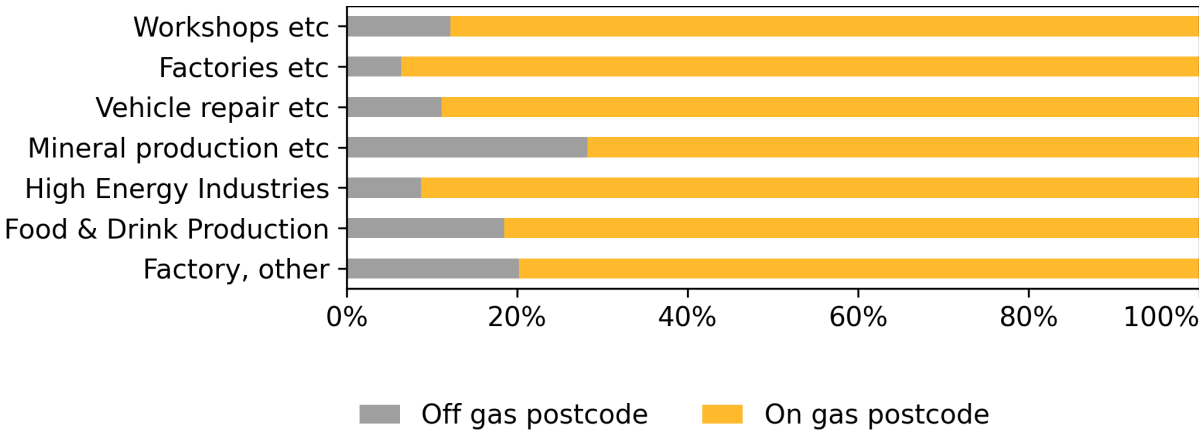
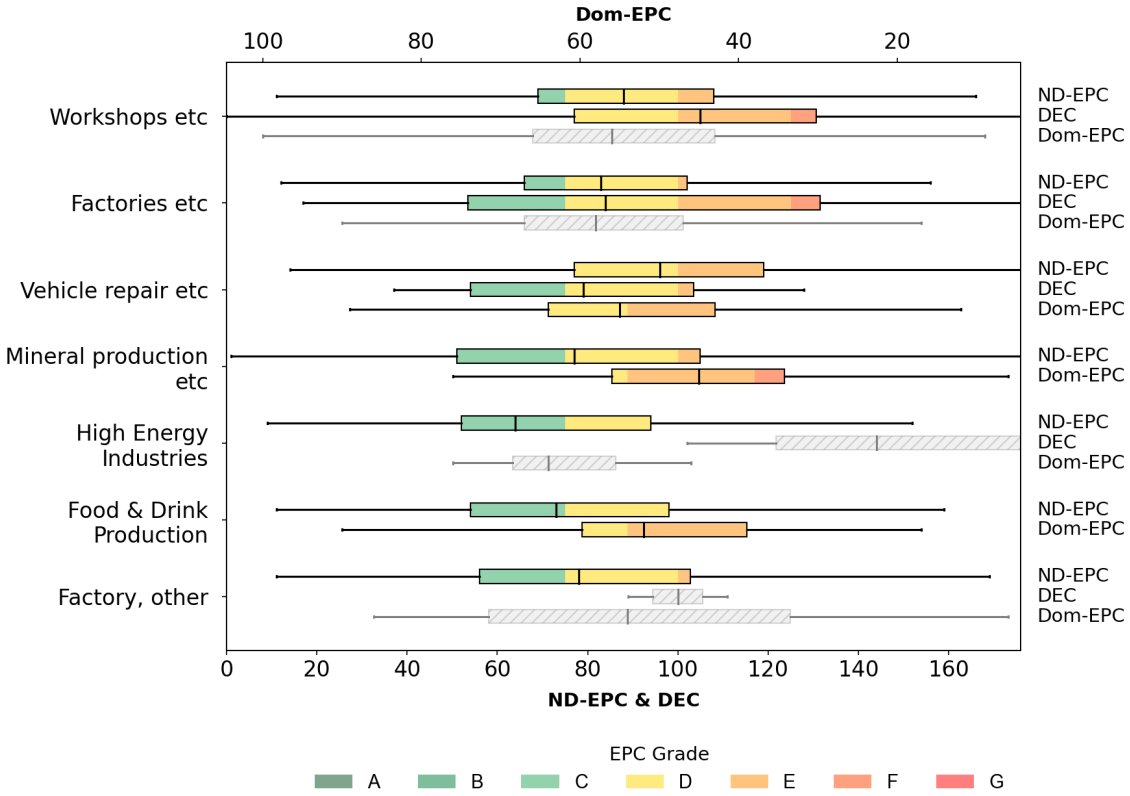


Figure 3.6-6: Percentage of floorspace on or off gas grid by activity group

3.6.4 Energy certification

Around 23% of all 'Factory' premises have an energy certificate, with around 23% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Factory' was May 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.6-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that 'Factories etc' have a larger percentage of premises matched to a non-domestic EPC (31%) than the other activity groups. Relatively few premises in any of the categories match to DECs. The lowest performing median non-domestic EPCs are for 'Vehicle repair etc' with a median asset rating of 96 (D) followed by 'Workshops etc' (88, D) and 'Factories etc' (83, D). The best performing median non-domestic EPCs are for the 'High Energy Industries' (64, C).

3.6.5 Energy use detailed insights

Within 'Factory', the activity group with the highest median energy use intensity (EUI) for electricity is 'Mineral production etc' (224 kWh/m² per year) and for gas it is 'Food & Drink Production' (292 kWh/m² per year). For total EUI (gas and electricity combined) 'Food & Drink Production' have the highest value (293 kWh/m² per year), see Figure 3.6-8 below (chart values truncated to 76th percentile of highest activity group).

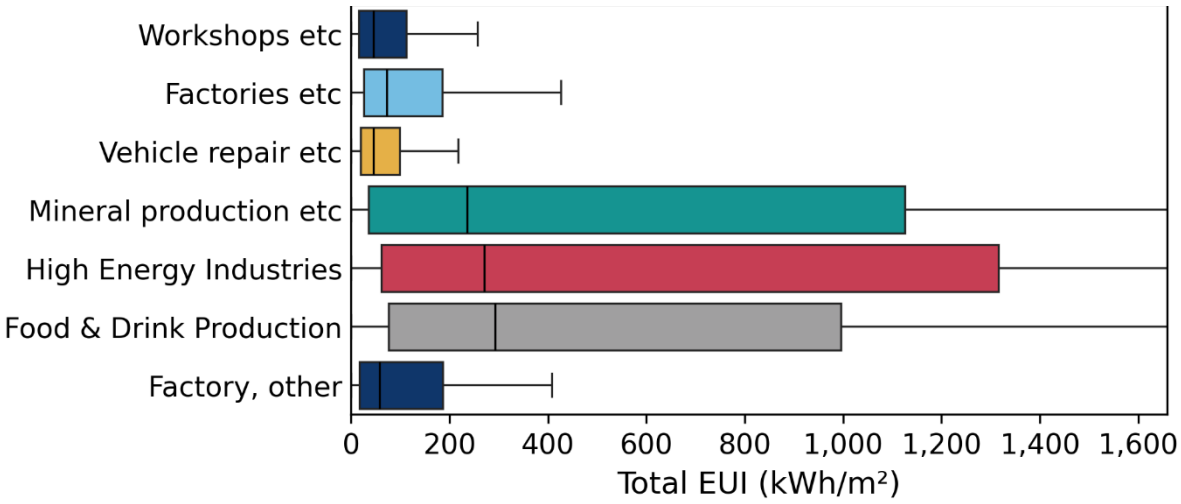


Figure 3.6-8: Distribution of total Energy Use Intensity (EUI) by activity group

Many premises and therefore their floorspace in the Factory class do not have an energy certificate ('No EC'), likely due to low occupier churn. This also applies to 'Factory' floorspace. There is a substantial mix of heating fuels used, as shown in Figure 3.6-9 below. 'Mains Gas' is the main source of energy, but electricity is also very significant. There is also a noticeable percentage of floorspace treated using 'Oil & Liquid Fuels'. 'Mineral production' premises have very little area with an energy certificate, possibly reflecting the nature of the buildings, but also that such premises have very low occupier churn.

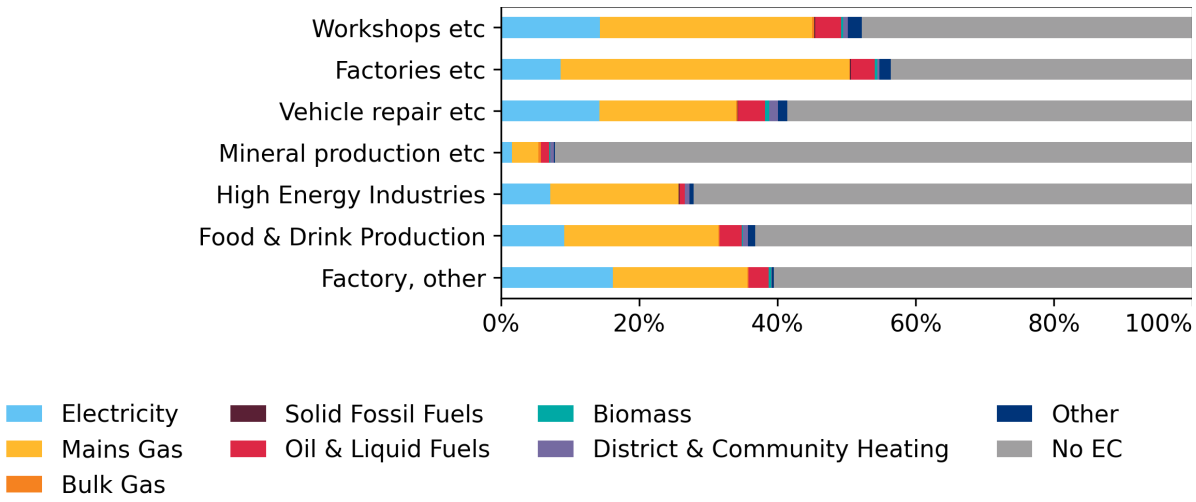


Figure 3.6-9: Heating fuels as percentage of total floorspace by activity group

In the Factory class, the principal HVAC system is ‘Heating and Ventilation’. However, there is also substantial use of ‘Air Conditioning’ as shown in 3.6-10, below. ‘Boilers and Radiators’ are also used, but to a very limited extent. Small percentages of floorspace are ‘Unconditioned’, with ‘Workshops etc’ being the most noticeable. Taking Figure 3.6-8 and 3.6-9 together suggests that very large areas (and volumes) of the Factory class are treated by burning mains gas and/or using electricity for air conditioning.

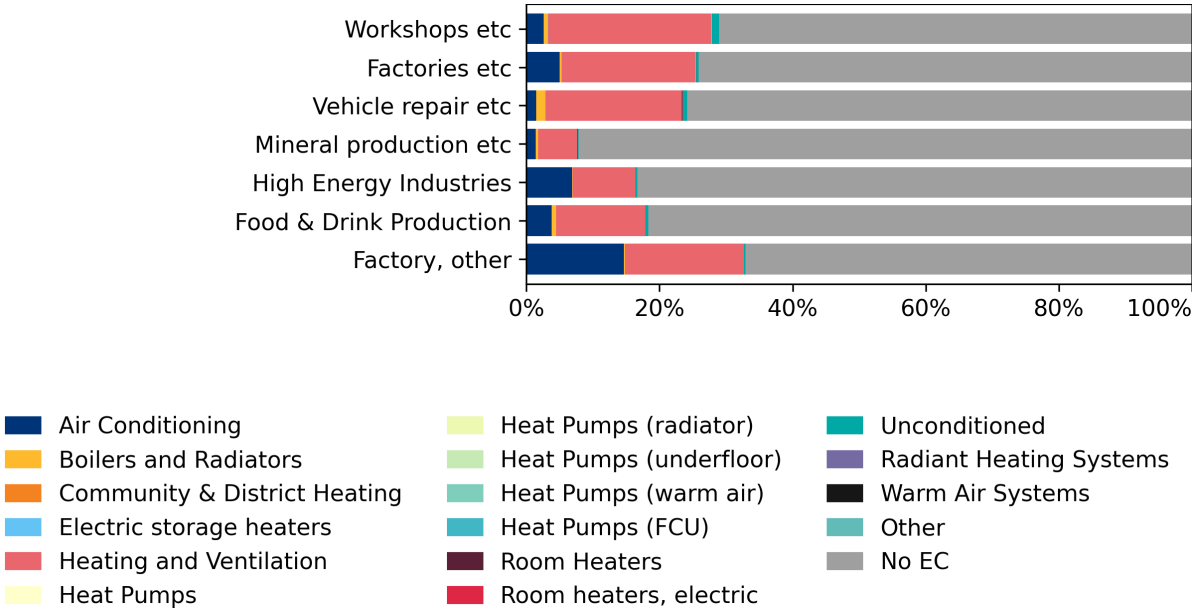


Figure 3.6-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Food & Drink Production' (24%) whilst the lowest percentage is for 'Mineral production etc' (1%), as shown in Figure 3.6-11 below.

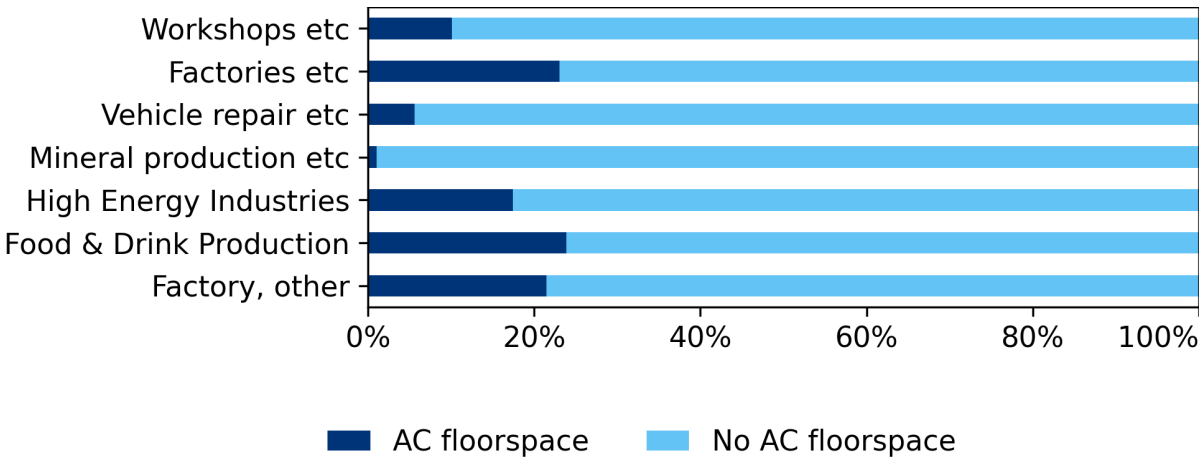


Figure 3.6-11: Air-conditioned floorspace by activity group

3.6.6 Heritage and Rural Urban

88% of all 'Factory' premises are in an area with no Conservation area or Listed building restrictions whilst 12% are either in a Conservation area, or are a Listed building or both. 'Factory, other' has the largest amount of their floorspace in heritage restricted areas (14%). More details can be seen in Figure 3.6-12 below.

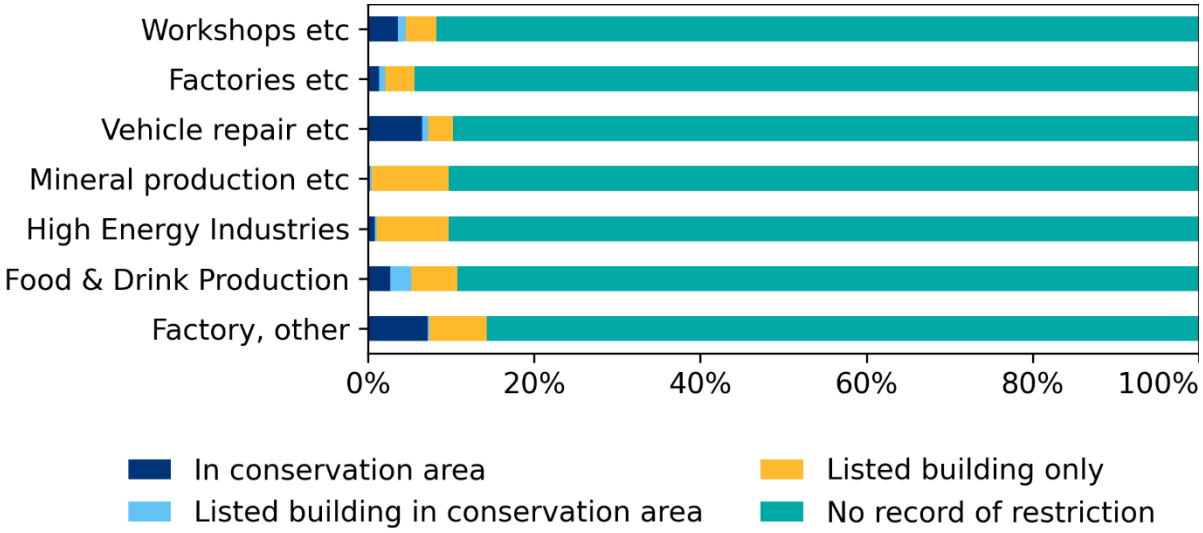


Figure 3.6-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 72% of premises and 77% of floorspace in the 'Factory' activity class may be found in an urban area. The largest activity group is 'Factories etc' where 81% of its floorspace is in an urban area, whilst 'Mineral production etc' has the largest percentage of its floorspace in rural areas (56%), as shown in Figure 3.6-13 below.

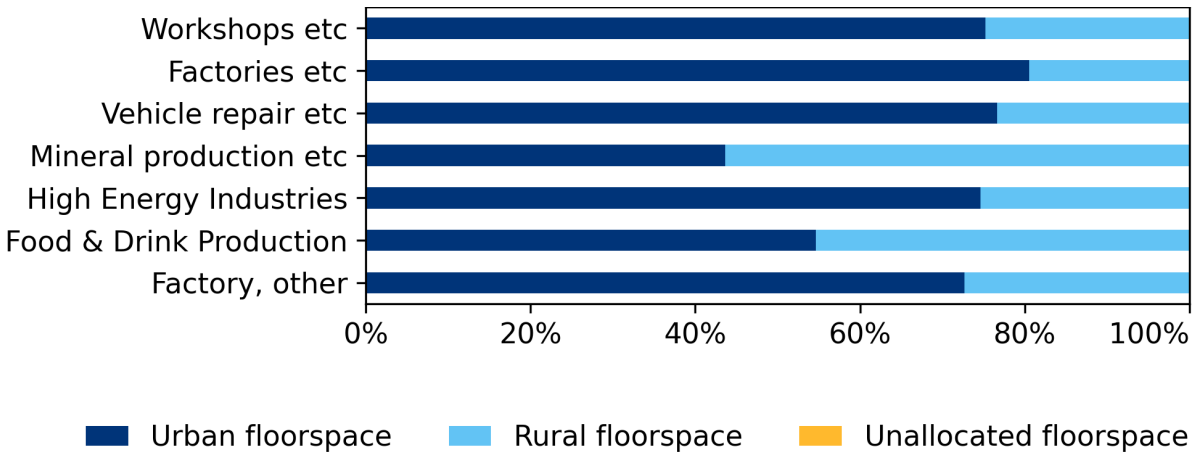


Figure 3.6-13: Floorspace by ONS Urban / rural classification by activity group

3.6.7 Mixed-use buildings

Within the 'Factory' class, 70% of SCUs are occupied by a single 'Factory' premises, whilst 24% share the SCU with other non-domestic premises and 6% share the SCU with domestic premises.

Figure 3.6-14 below shows Mineral Production etc' is the activity group with the highest percentage of cases where they are the sole occupier of the building (77%) whilst 'Factory, other' has the highest percentage of SCUs shared with other non-domestic premises (36%) and 'Vehicle repair etc' has the highest percentage of SCUs shared with domestic residential uses (9%).

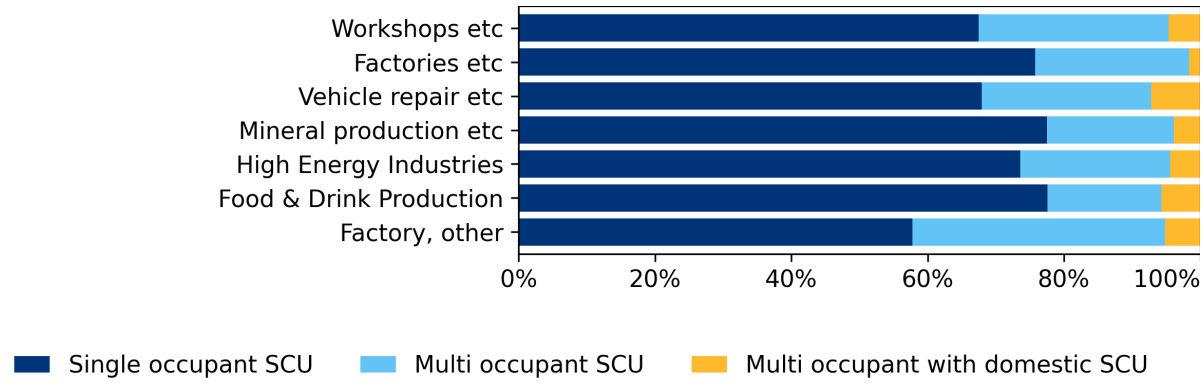


Figure 3.6-14: Percentage of premises by mixed-use SCU classification by activity group

3.6.8 Public sector

Around 7% of Factory premises and 6% of Factory floorspace is likely to be Public Sector. These low levels of the allocation of the Public Sector flag are to be expected given that relatively few premises in this activity class would be considered to be owned or managed by Local or Central Government. The breakdown by activity group can be seen in Figure 3.6-15 where 'High Energy Industries' is the activity group with the highest percentage of premises likely to be Public Sector (8%) and this represents 3% of their activity group floorspace. 'Mineral production etc' is the activity group with the lowest percentage of premises (1%) and floorspace (2%) likely to be Public Sector. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

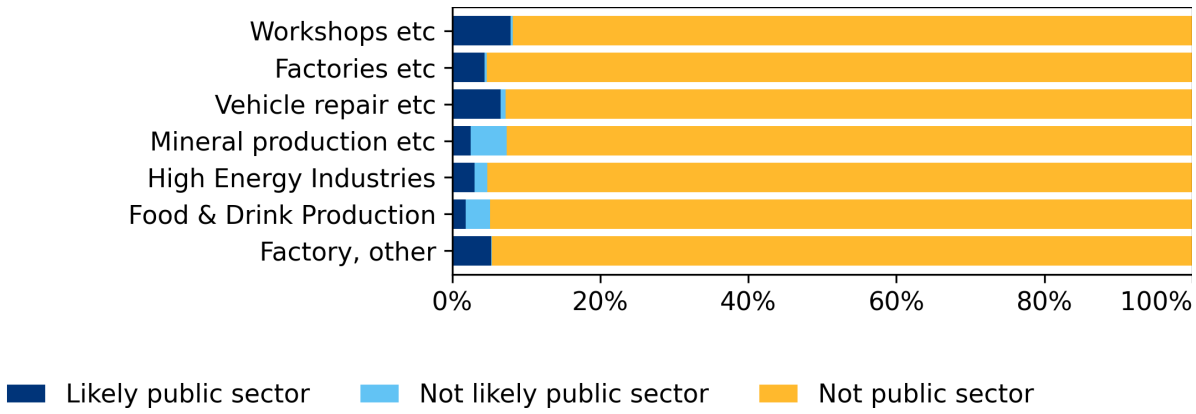


Figure 3.6-15: Percentage of floor area assigned 'Public sector' by activity group

3.6.9 Age and materials

30% of 'Factory' premises and 33% of Factory floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (8%), which represents 6% of floorspace.

The details at the activity group level are shown in Figure 3.6-16 below where it is apparent that over 60% of 'Vehicle repair etc' premises are in buildings built before 1975 whilst over 30% of 'Mineral production etc' premises are in buildings built before 1940.

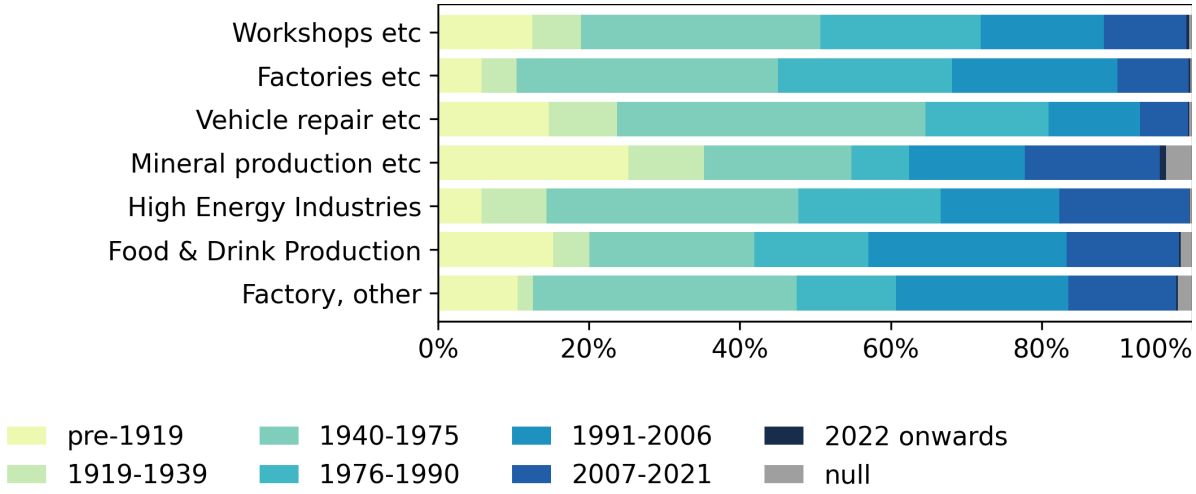


Figure 3.6-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Factory' activity class (measured by wall area). The 'Workshops etc' activity group has the largest wall area (17.2 million m²) when measured from the 3D geometry in the database, and 44% of this is masonry, which represents 23% of the total wall area in 'Factory' (see Figure 3.6-17).

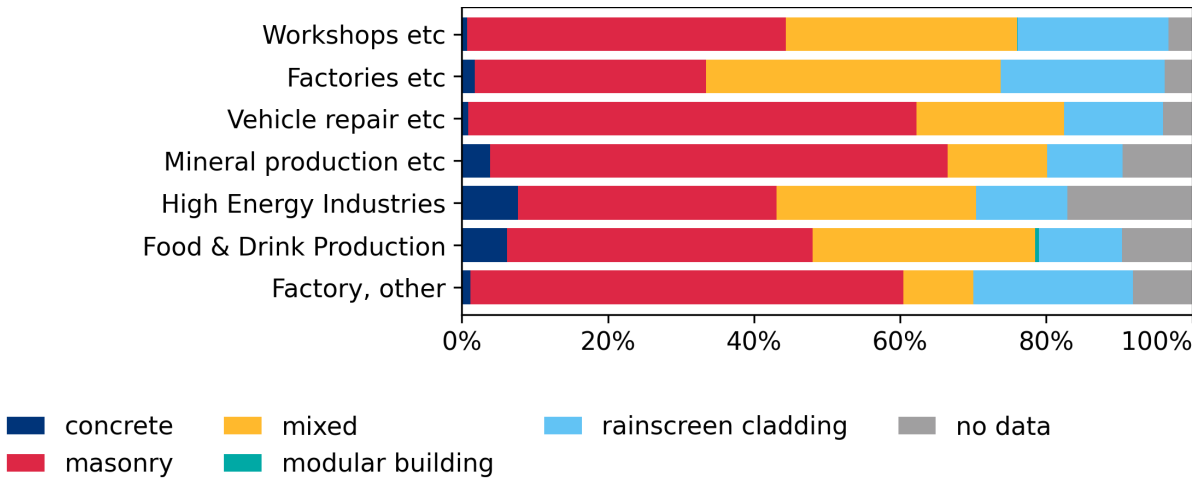


Figure 3.6-17: Distribution of total wall area by NGD material and activity group

Table 3.6-1: Summary statistics for Factory by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Workshops etc	230,177	142,602	68.71	300	76.7	37.9
Factories etc	31,855	26,336	88.57	2,796	10.6	48.9
Vehicle repair etc	30,886	25,148	8.99	293	10.3	5.0
Mineral production etc	2,967	1,402	1.36	778	1.0	0.7
High Energy Industries	1,476	925	9.06	6,596	0.5	5.0
Food & Drink Production	1,368	1,074	3.54	2,640	0.5	2.0
Factory, other	1,444	714	0.98	772	0.5	0.5

Table 3.6-2: Summary energy statistics for Factory by activity group

Activity group	median total EUI (kWh/m^2/year)	total GWh	% by total energy
Workshops etc	46	5,381.89	11.1
Factories etc	73	2,9105.61	60.0
Vehicle repair etc	46	515.19	1.1
Mineral production etc	236	851.48	1.8
High Energy Industries	271	6,534.86	13.5
Food & Drink Production	293	5,985.74	12.3
Factory, other	57	155.18	0.3

3.7 Health

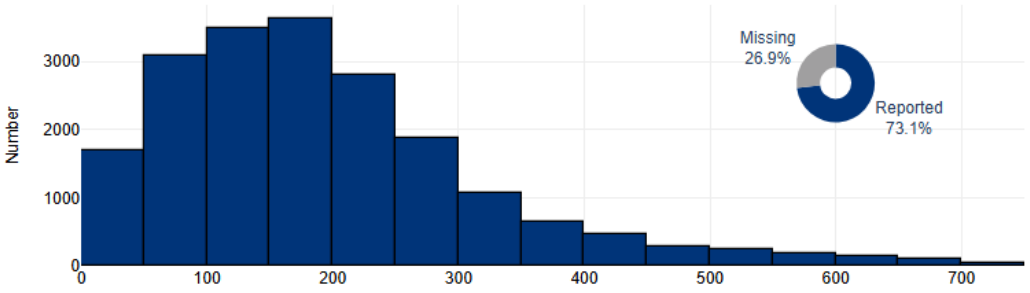
Overview

In the Health activity class, the analysis covers 30,058 premises. The average Energy Use Intensity (EUI) is 509 kWh/m²/annum. The dominant building age group is 2007-2021 (28%), and the predominant heating fuel is Mains Gas (60%).

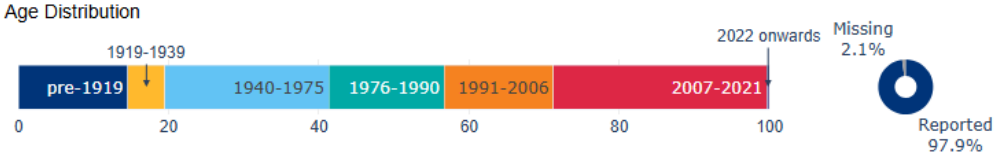
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Surgery / Clinic / Health Centre	27.6	9.27
Hospitals & Clinics (NHS)	1.7	12.67
Hospitals & Clinics (Private)	0.7	1.95
Hospices	0.02	0.03
Health, other	0.05	0.05

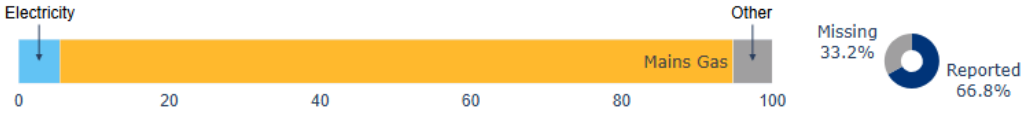
Energy Use Intensity (kWh/m²/annum)



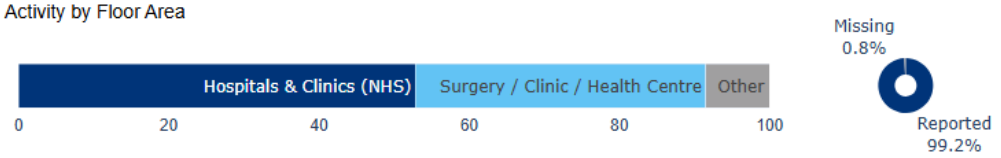
Age Distribution



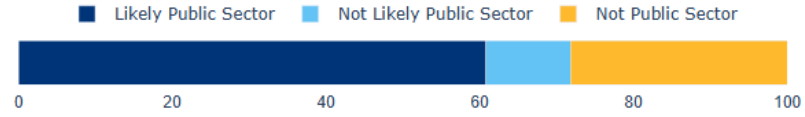
Heating Fuel Distribution (reported only; 33.2% missing)



Activity by Floor Area



Public Sector Distribution



3.7.1 Overview

The 'Health' class has a total of 30,058 premises and 23.97 million m² of floorspace. This means it is the tenth largest class in terms of premises counts with 1% of all non-domestic premises and the eighth largest class in terms of floorspace with 3% of all non-domestic floorspace. This class contains eight activities, which have been grouped into five activity groups. The largest activity by count is 'Surgery / Clinic / Health Centre' with 27,571 premises. The largest by total floorspace is 'Hospitals and Clinics (NHS)' with 9.38 million m² of floorspace. In total NBD reports 25,047 SCUs (which roughly equate to buildings) for 'Health'.

For 'Health' as a whole, ND-NEED (2023) reports 0.03 million buildings (104% of NBD SCUs) and 2.34 million m² of floorspace (10% of NBD). BEES (2014) reported 28,900 premises (96% of NBD premises) and 45 million m² of floorspace (188% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.7-1 below shows all activities in the 'Health' class aggregated into five activity groups. 'Surgery / Clinic / Health Centre' has the largest number of premises but these have a relatively small median floorspace (161 m²), making it the second largest activity group in terms of floorspace within 'Health'. The activity group with the largest total floorspace is 'Hospitals & Clinics (NHS)' where the median floor area is 1,884 m² and the total floor area is 12.67 million m². 'Hospitals & Clinics (NHS)' also represent the largest share of matched total energy demand.

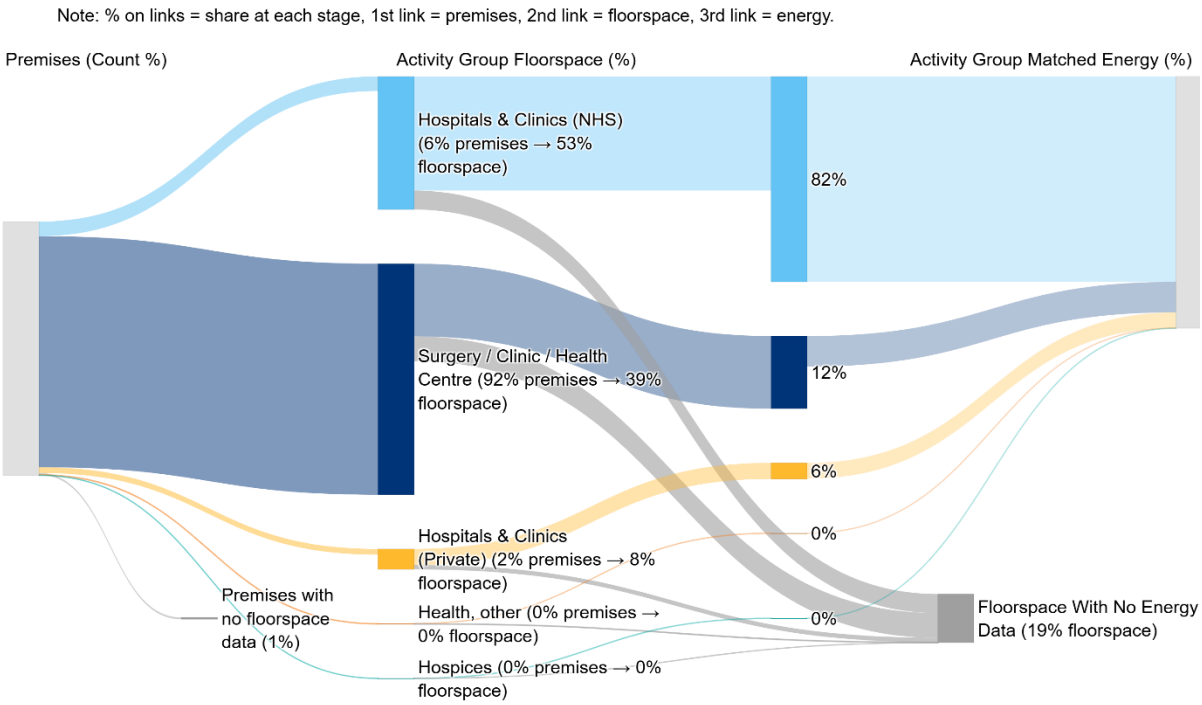


Figure 3.7-1: Share of activity group by number of premises, floorspace and total energy demand

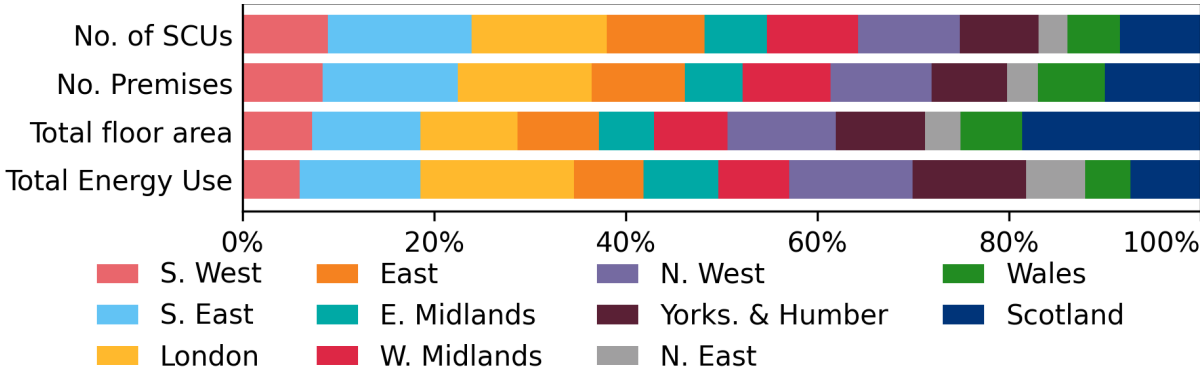


Figure 3.7-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.7-2), for England these are comparable with the NUTS regions. For 'Health' the South East has the largest percentage of premises (14%) and SCUs (15%). The largest percentage of floorspace is in Scotland (19%). For the regional share of total energy demand, London has the largest percentage (16%).

3.7.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Hospitals & Clinics (Private)' (2,035 m²) and the smallest is 'Surgery / Clinic / Health Centre' (161 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.7-3, where the dotted line indicates the distribution of floorspace beyond the 75th percentile, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

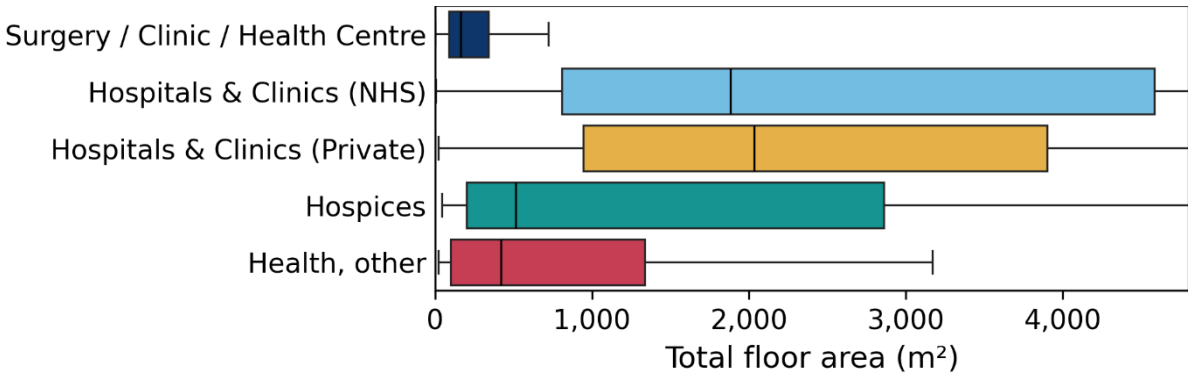


Figure 3.7-3: Distribution of premises total floor area by activity group

3.7.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data 67% of 'Health' premises have at least one matched electricity meter and 51% have at least one matched gas meter. The total matched energy use for 'Health' is 9,002 GWh per year, which consists of 2,434 GWh for electricity and 6,567 GWh for gas per year. Values for ‘Hospices’ and ‘Health, other’ are removed.

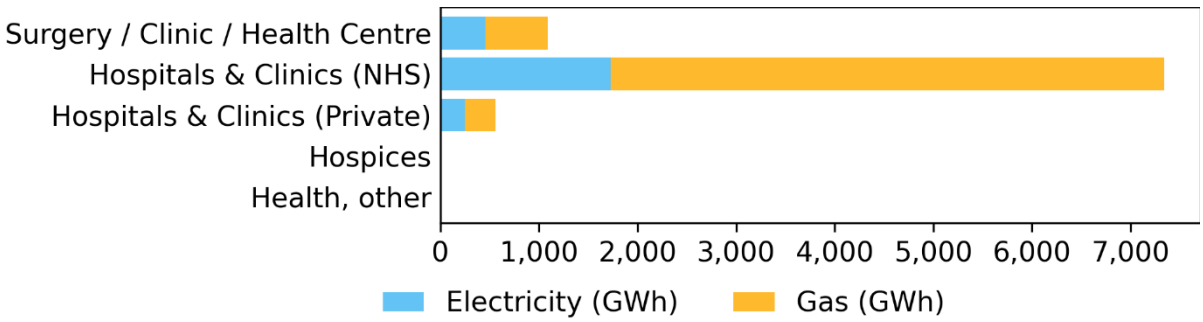


Figure 3.7-4: Total energy demand (GWh) for 'Health' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Health’ is Profile Class 3, which represents 60% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

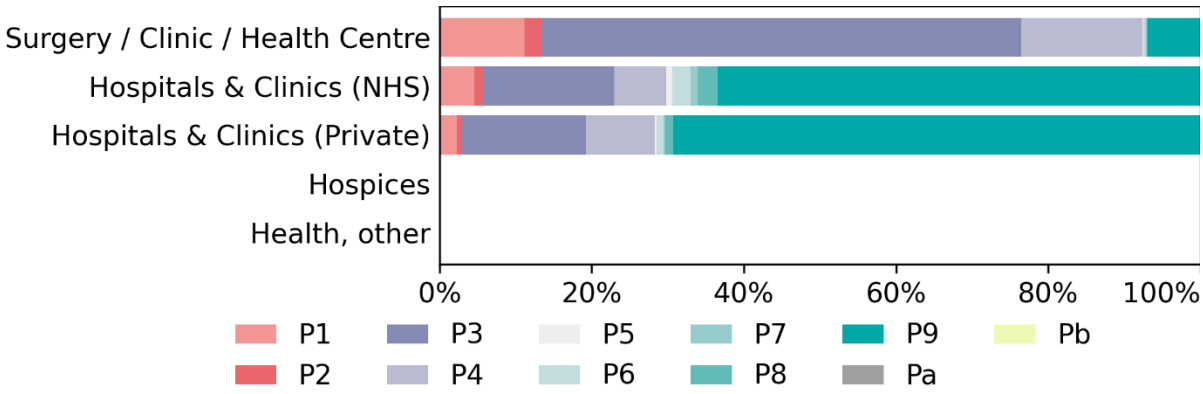


Figure 3.7-5: Percentage of meter profile classes for electricity meters by activity group

Around 5% of all 'Health' premises (4% of 'Health' floorspace) are located in postcodes classified as off the gas grid. Figure 3.7-6 below shows that 'Surgery / Clinic / Health Centre' is the activity group that has the largest share (6% by floorspace) of off the gas grid postcodes and 'Hospices' have the lowest share (2%). This suggests that most health facilities, especially energy-critical ones like hospices, are strategically located in well-connected, urban areas, while smaller services like surgeries or clinics are slightly more dispersed, occasionally serving rural or off-grid communities. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

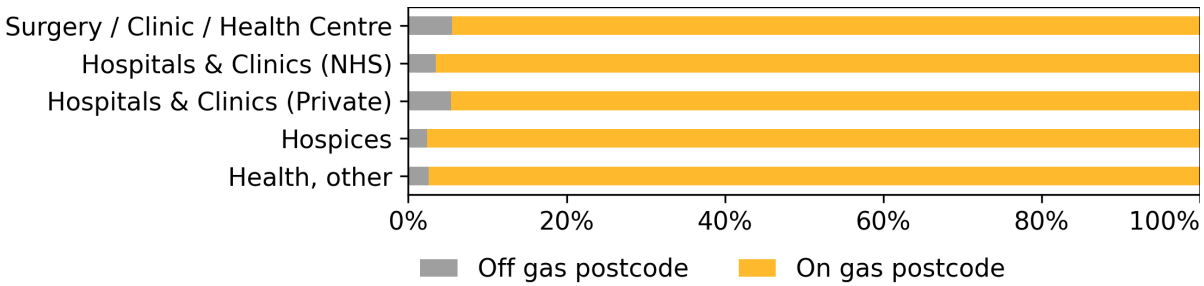
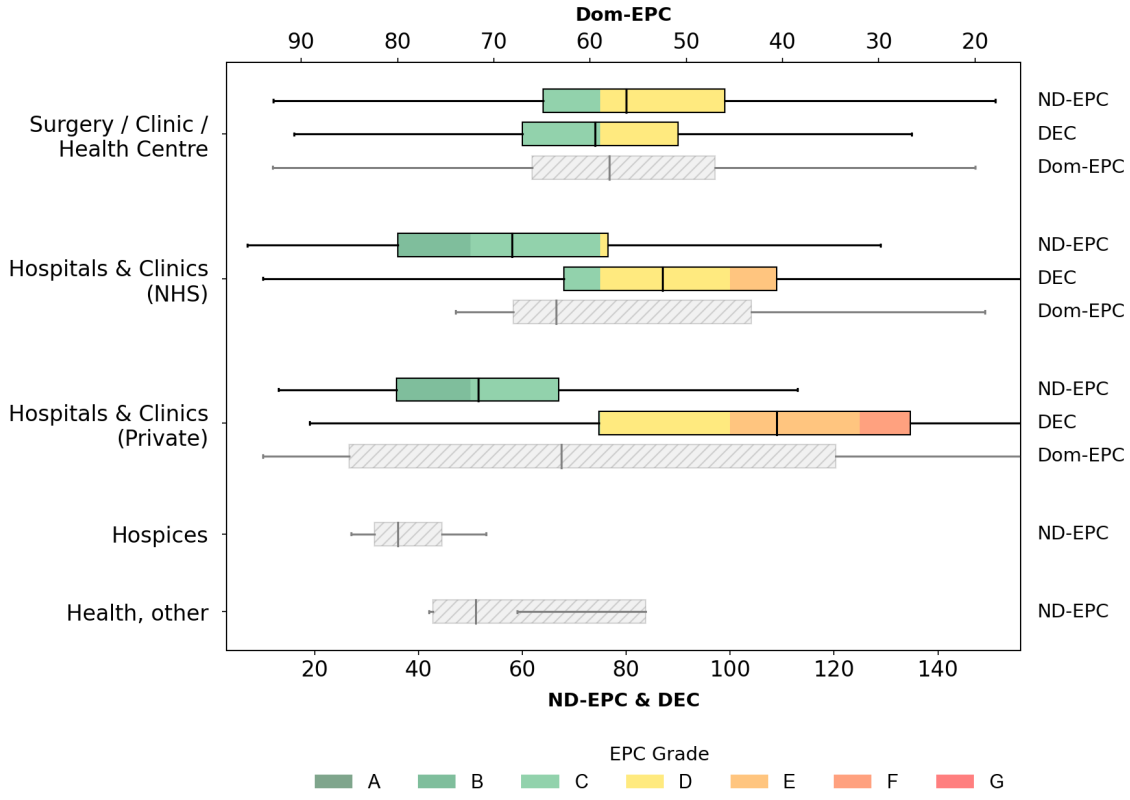


Figure 3.7-6: Percentage of floorspace on or off gas grid by activity group

3.7.4 Energy certification

Around 46% of all 'Health' premises have an energy certificate, with around 35% of these being non-domestic EPCs and 11% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Health' was March 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.7-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that there is around a 37% match rate for non-domestic EPCs to ‘Surgery / Clinic / Health Centre’ where the median non-domestic EPC asset rating is 80 (D). ‘Hospitals & Clinics (NHS)’ have around a 37% match rate to DECs on the other hand (and by contrast around a 14% match to non-domestic EPCs). The median asset rating for non-domestic EPCs for ‘Hospitals & Clinics (NHS)’ is 87 (D). The median non-domestic EPC for ‘Hospitals & Clinics (Private)’ is 52 (C).

3.7.5 Energy use detailed insights

Within 'Health', the activity group with the highest median energy use intensity (EUI) for electricity is 'Hospitals & Clinics (Private)' (121 kWh/m² per year) and for gas it is 'Hospitals & Clinics (NHS)' (308 kWh/m² per year). For total EUI (gas and electricity combined) 'Hospitals & Clinics (NHS)' have the highest value (317 kWh/m² per year), see Figure 3.7-8 below (chart values truncated to 76th percentile of highest activity group).

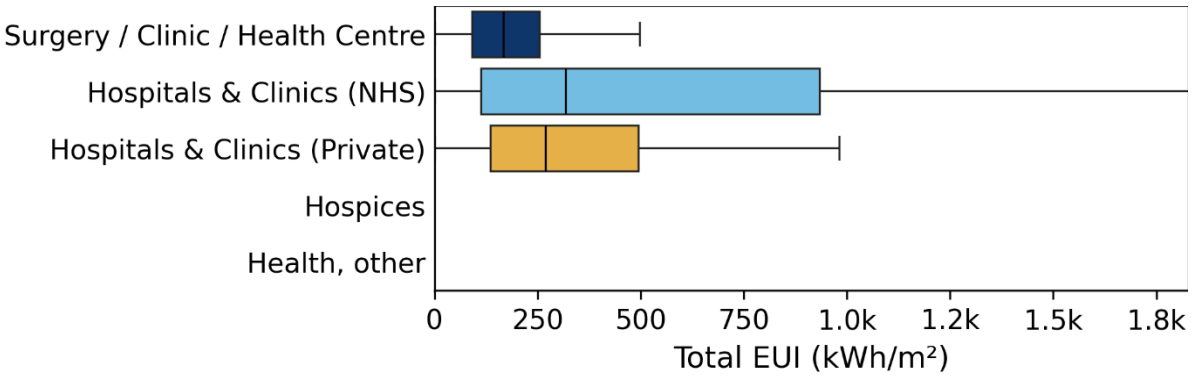


Figure 3.7-8: Distribution of total Energy Use Intensity (EUI) by activity group

In Figure 3.7-9 below, 'No EC' indicates that no energy certificate (EPC/DEC) has been matched to premises. For each activity group's remaining floorspace, 'Mains Gas' is the dominant heating fuel, with small percentages heated by 'Oil & Liquid Fuels'. The group 'Surgery / Clinic / Health Centre' has the highest percentage of its floorspace heated by 'Electricity'.

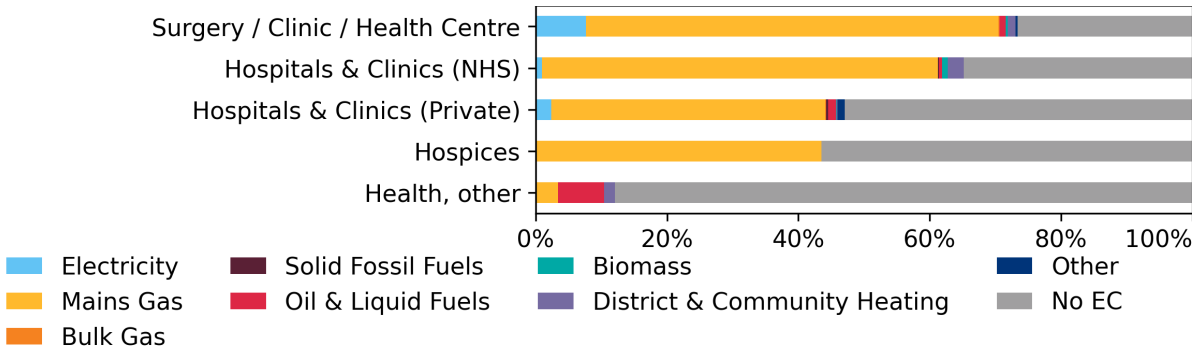


Figure 3.7-9: Heating fuels as percentage of total floorspace by activity group

Figure 3.7-10 below, shows the floorspace treated by heating systems recorded in energy certificates, where present, for each Health activity group. 'No EC' indicates that a significant percentage of floorspace in each group has no energy certificate. Where data are available, 'Heating and Ventilation' is dominant, followed by 'Air Conditioning'. Only a small percentage of the floorspace of 'Hospitals & Clinics (NHS)' is treated using 'Air Conditioning'.

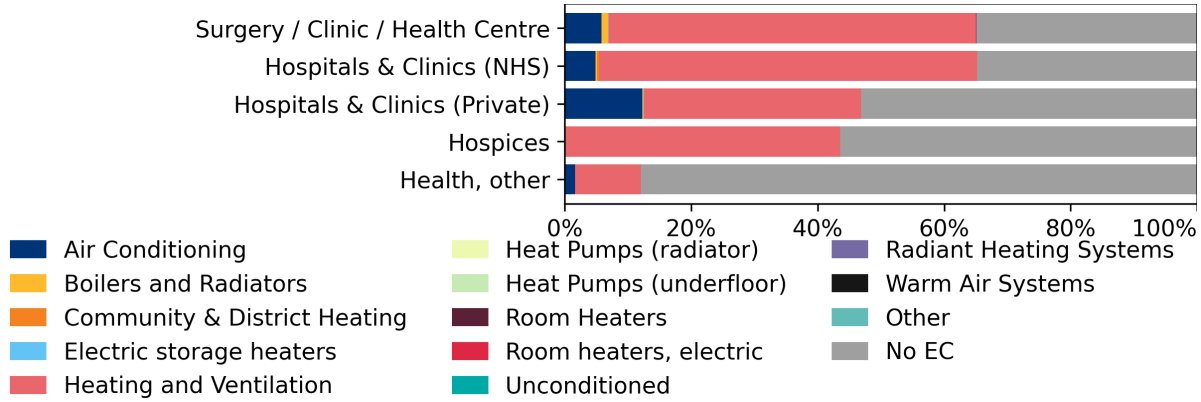


Figure 3.7-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Hospitals & Clinics (NHS)' (49%) whilst the lowest percentage is for 'Hospitals & Clinics (Private)' (33%), as shown in Figure 3.7-11 below.

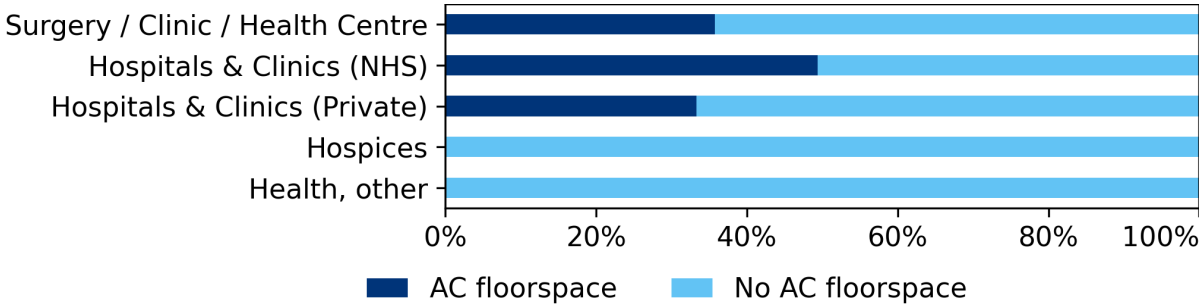


Figure 3.7-11: Air-conditioned floorspace by activity group

3.7.6 Heritage and Rural Urban

70% of all 'Health' premises are in an area with no Conservation area or Listed building restrictions whilst 30% are either in a Conservation area, or are a Listed building or both. 'Health, other' has the largest amount of their floorspace in heritage restricted areas (78%). More details can be seen in Figure 3.7-12 below.

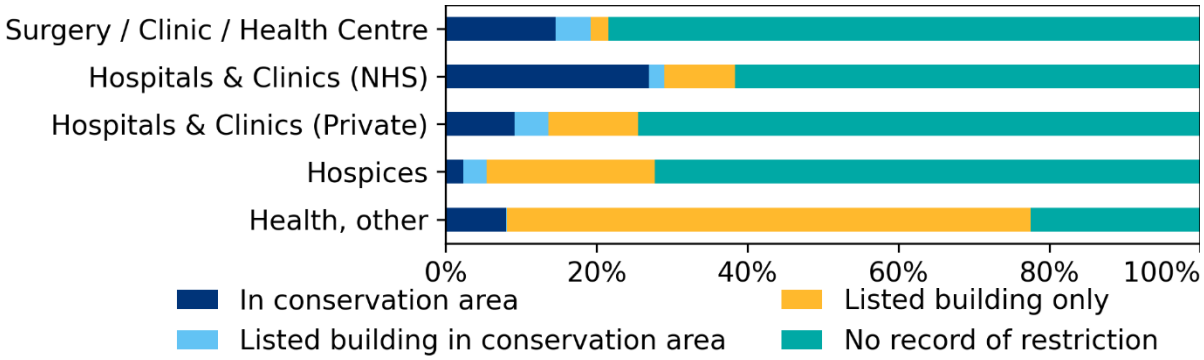


Figure 3.7-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 84% of premises and 80% of floorspace in the 'Health' activity class may be found in an urban area. The

largest activity group is 'Health, other' where 96% of its floorspace is in an urban area, whilst 'Hospitals & Clinics (NHS)' has the largest percentage of its floorspace in rural areas (26%), as shown in Figure 3.7-13 below.

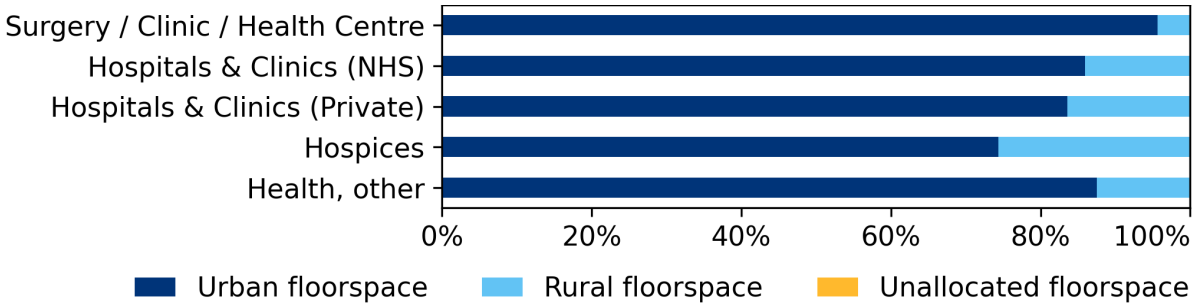


Figure 3.7-13: Floorspace by ONS Urban / rural classification by activity group

3.7.7 Mixed-use buildings

Within the 'Health' class, 60% of SCUs are occupied by a single 'Health' premises, whilst 17% share the SCU with other non-domestic premises and 23% share the SCU with domestic premises.

Figure 3.7-14 below shows 'Hospices' is the activity group with the highest percentage of cases where they are the sole occupier of the building (82%) whilst 'Hospitals & Clinics (NHS)' has the highest percentage of SCUs shared with other non-domestic premises (27%) and 'Health, other' has the highest percentage of SCUs shared with domestic residential uses (26%).

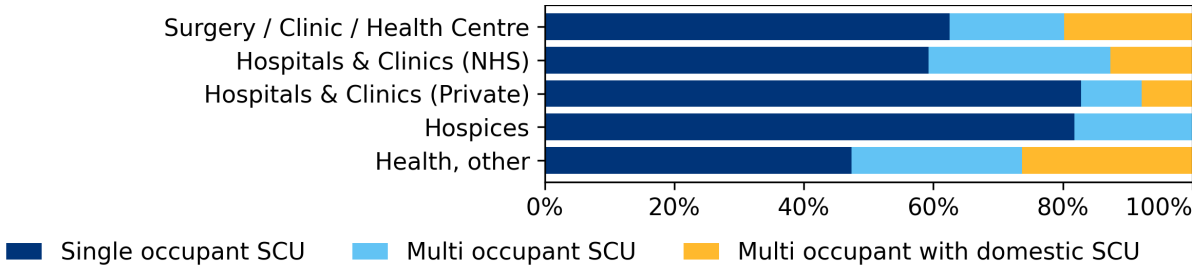


Figure 3.7-14: Percentage of premises by mixed-use SCU classification by activity group

3.7.8 Public sector

Around 14% of Health premises and 61% of Health floorspace is likely to be Public Sector. This is to be expected in an activity class like Health where there is a mixture of private and Public Sector premises. Figure 3.7-15 gives more details at the activity grouping level where 'Hospitals & Clinics (NHS)' is the activity group with the highest percentage of premises likely to be Public Sector (100%). 'Hospitals & Clinics (Private)' is the activity group with the lowest percentage of premises (3%) and floorspace (2%) likely to be Public Sector.

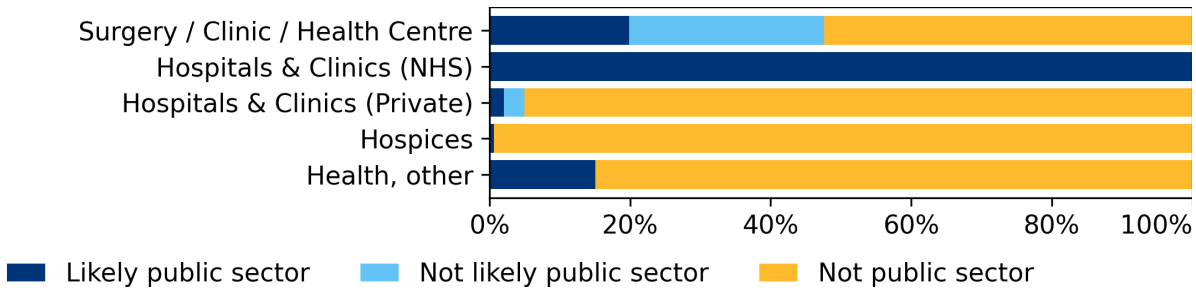


Figure 3.7-15: Percentage of floor area assigned 'Public sector' by activity group

3.7.9 Age and materials

36% of 'Health' premises and 14% of Health floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '2007-2021' for premises (10%), which represents 28% of floorspace.

The details at the activity group level are shown in Figure 3.7-16 below which shows around 30% of ‘Surgery / Clinic / Health Centre’ premises are in buildings built before 1940 and around half of all ‘Hospital & Clinics (NHS)’ premises are in buildings built before 1991. A larger percentage of ‘Hospital & Clinics (NHS)’ premises are in buildings built 2007-2021 than ‘Hospital & Clinics (Private)’.

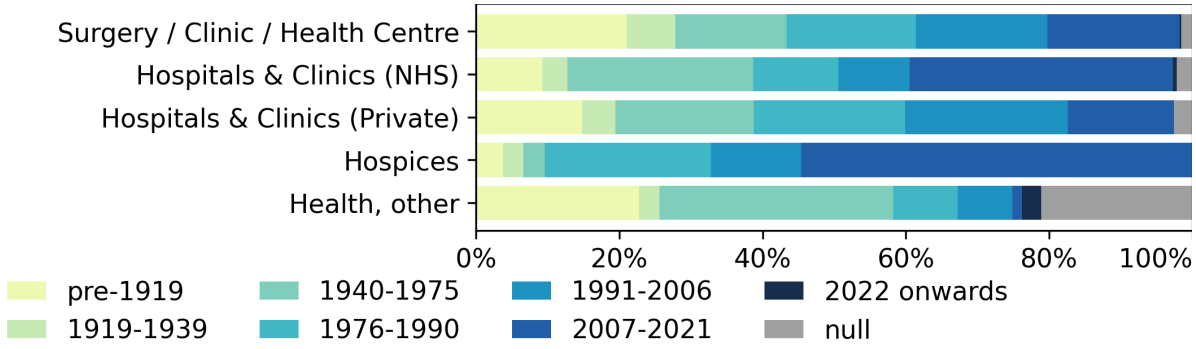


Figure 3.7-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Health' activity class (measured by wall area). The 'Surgery / Clinic / Health Centre' activity group has the largest wall area (5.5 million m²) when measured from the 3D geometry in the database, and 95% of this is masonry, which represents 56% of the total wall area in 'Health' (see Figure 3.7-17).

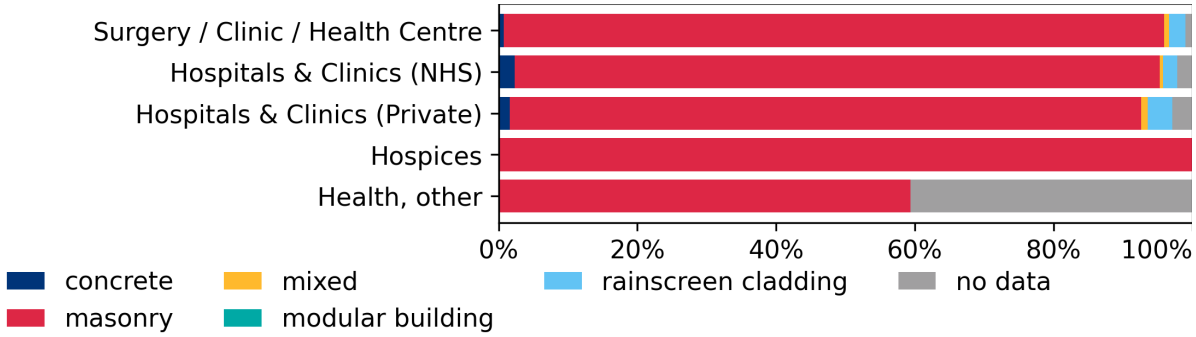


Figure 3.7-17: Distribution of total wall area by NGD material and activity group

Table 3.7-1: Summary statistics for Health by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Surgery / Clinic / Health Centre	27,571	23,140	9.27	338	91.7	38.7
Hospitals & Clinics (NHS)	1,742	1,287	12.67	7,502	5.8	52.9
Hospitals & Clinics (Private)	683	653	1.95	2,898	2.3	8.2
Hospices	16	11	0.03	1,794	0.1	0.1
Health, other	46	38	0.05	1,009	0.2	0.2

Table 3.7-2: Summary energy statistics for Health by activity group

Activity group	median total EUI ($kWh/m^2/year$)	total GWh	% by total energy
Surgery / Clinic / Health Centre	167	1,090.08	12.1
Hospitals & Clinics (NHS)	317	7,343.58	81.6
Hospitals & Clinics (Private)	268	561.56	6.2
Hospices	-	-	-
Health, other	-	-	-

3.8 Hospitality

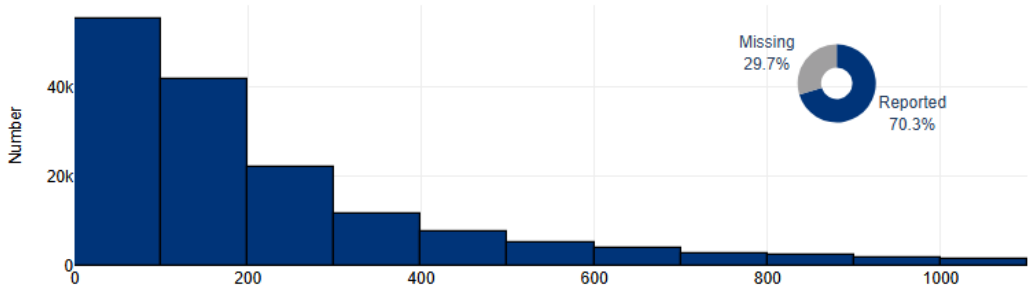
Overview

In the Hospitality activity class, the analysis covers 247,490 premises. The average Energy Use Intensity (EUI) is 348 kWh/m²/annum. The dominant building age group is pre-1919 (47%), and the predominant heating fuel is Mains Gas (36%).

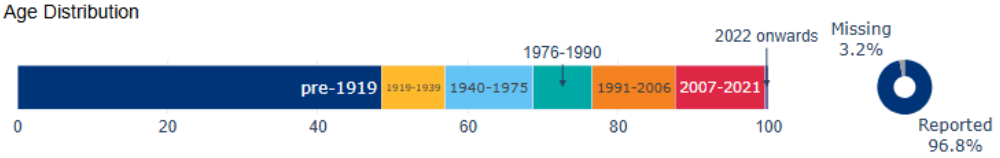
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Self-catering Accommodation	106.6	11.58
Pubs, Pub-restaurants, Bars, Night Clubs etc	46.6	18.67
Restaurants, Cafes & Takeaways	61.0	12.07
Clubs & Institutions	10.4	4.89
Hotels, Guesthouses etc.	21.9	27.55
Hospitality, other	1.1	0.23

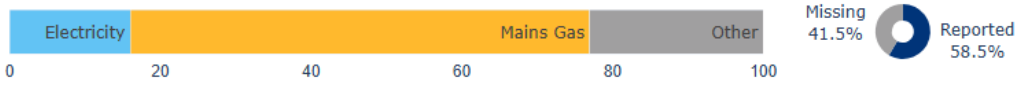
Energy Use Intensity (kWh/m²/annum)



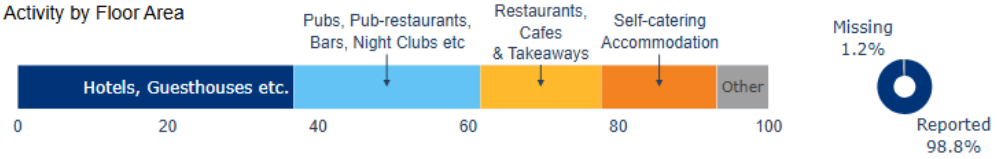
Age Distribution



Heating Fuel Distribution (reported only; 41.5% missing)



Activity by Floor Area



Public Sector Distribution

3.8.1 Overview

The 'Hospitality' class has a total of 247,490 premises and 74.98 million m² of floorspace This makes it the fourth largest class with 11% of all non-domestic premises and sixth largest class with 8% of all non-domestic floorspace. This class contains 29 activities, which have been grouped into six activity groups. The largest activity by count is 'Holiday Home (Self Catering)' with 103,774 premises. The largest by total floorspace is 'Public House/Pub Restaurant' with 17.68 million m² of floorspace. In total NBD reports 219,382 SCUs (which roughly equate to buildings) for 'Hospitality'.

For 'Hospitality' as a whole, ND-NEED (2023) reports 0.20 million buildings (91% of NBD SCUs) and 13.28 million m² of floorspace (18% of NBD). BEES (2014) reported 97,100 premises (39% of NBD premises) and 36 million m² of floorspace (48% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.8-1 below shows all activities in the 'Hospitality' class aggregated into six activity groups. 'Self-catering Accommodation' has the largest number of premises but these have a relatively small median floorspace (79 m²), making it the fourth largest activity group in terms of floorspace within 'Hospitality'. The activity group with the largest total floorspace is 'Hotels, Guesthouses etc.' where the median floor area is 356 m² and the total floor area is 27.55 million m². 'Hotels, Guesthouses etc.' show the largest share of total matched energy demand (34%).

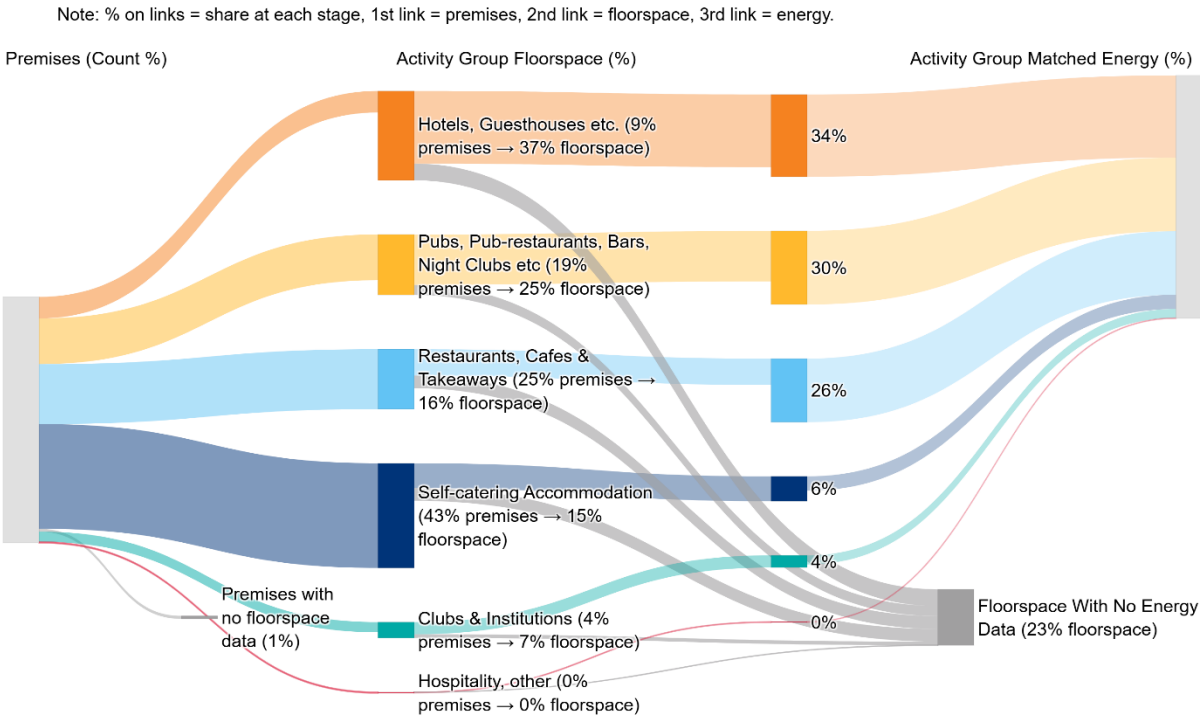


Figure 3.8-1: Share of activity group by number of premises, floorspace and total energy demand

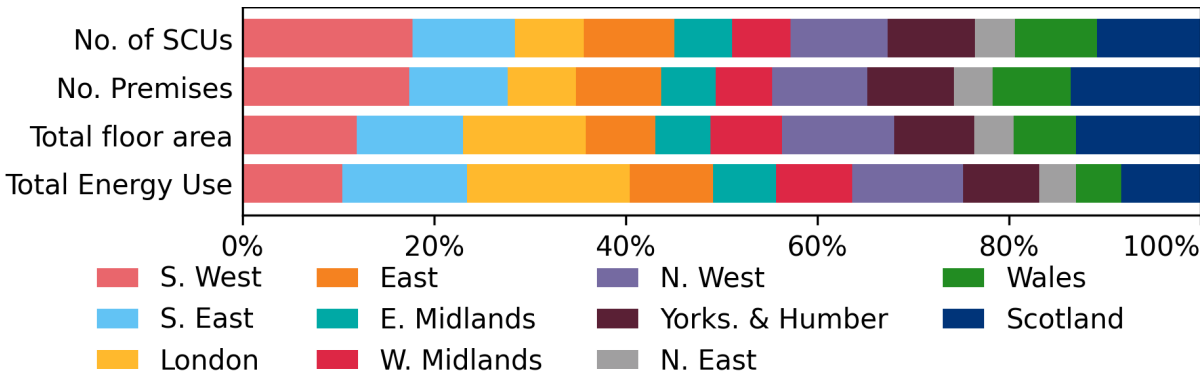


Figure 3.8-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.8-2), for England these are comparable with the NUTS regions. For 'Hospitality' the South West has the largest percentage of premises (17%) and SCUs (18%). The largest percentage of floorspace is in Scotland (13%). For the regional share of total energy demand, London has the largest percentage (17%).

3.8.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Clubs & Institutions' (384 m²) and the smallest is 'Hospitality, other' (50 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.8-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

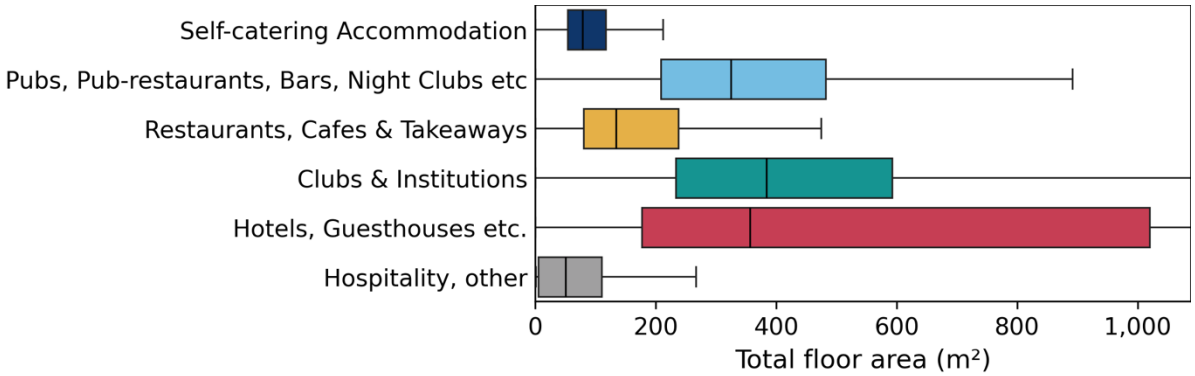


Figure 3.8-3: Distribution of premises total floor area by activity group

3.8.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 67% of ‘Hospitality’ premises have at least one matched electricity meter and 40% have at least one matched gas meter. The total matched energy use for 'Hospitality' is 15,101 GWh per year, which consists of 7,448 GWh for electricity and 7,653 GWh for gas per year.

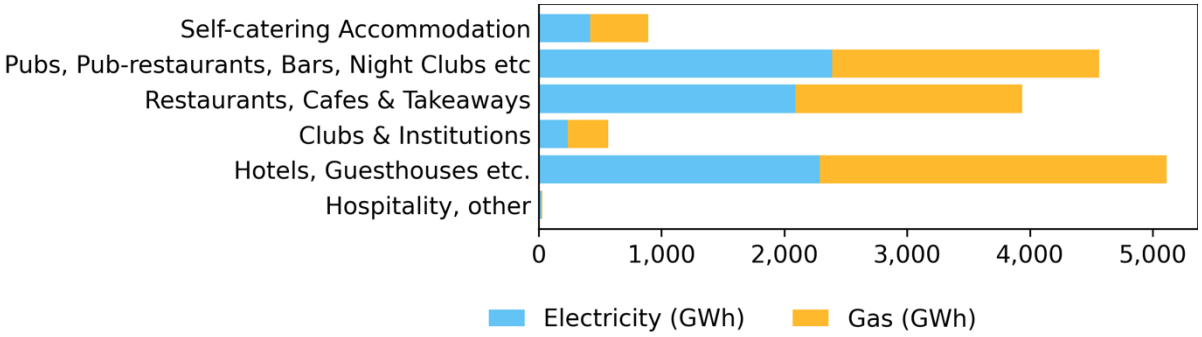


Figure 3.8-4: Total energy demand (GWh) for 'Hospitality' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Hospitality’ is Profile Class 1, which represents 32% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

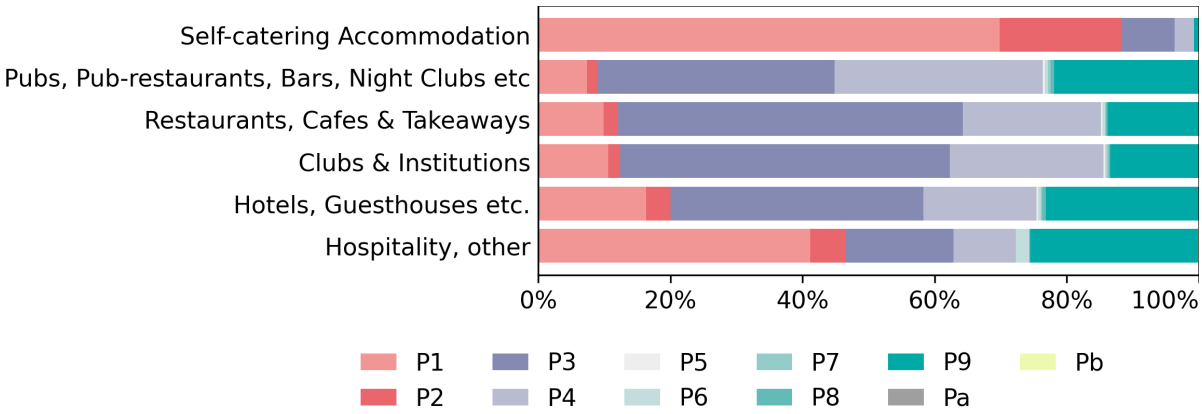


Figure 3.8-5: Percentage of meter profile classes for electricity meters by activity group

Around 22% of all 'Hospitality' premises (13% of 'Hospitality' floorspace) are located in postcodes classified as off the gas grid. Figure 3.8-6 below shows that 'Self-catering Accommodation' is the activity group that has the largest share (40% by floorspace) of off the gas grid postcodes and 'Clubs & Institutions' have the lowest share (4%). This suggests that 'Self-catering Accommodation' often operates in remote or rural areas, while 'Clubs & Institutions' are predominantly urban and thus more likely to have access to the gas grid. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

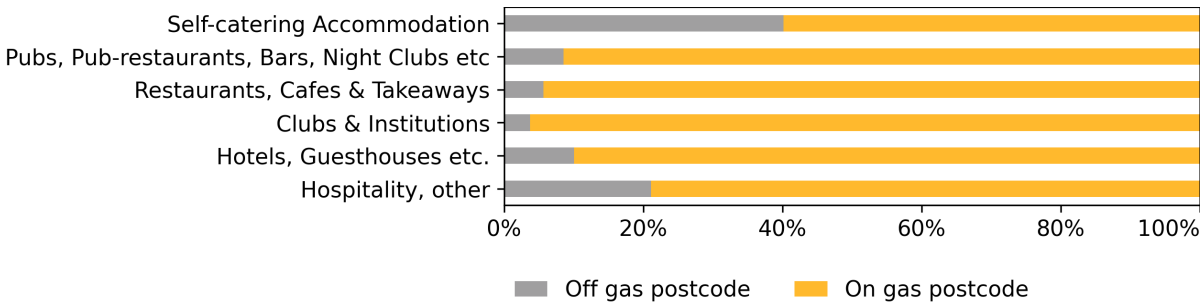
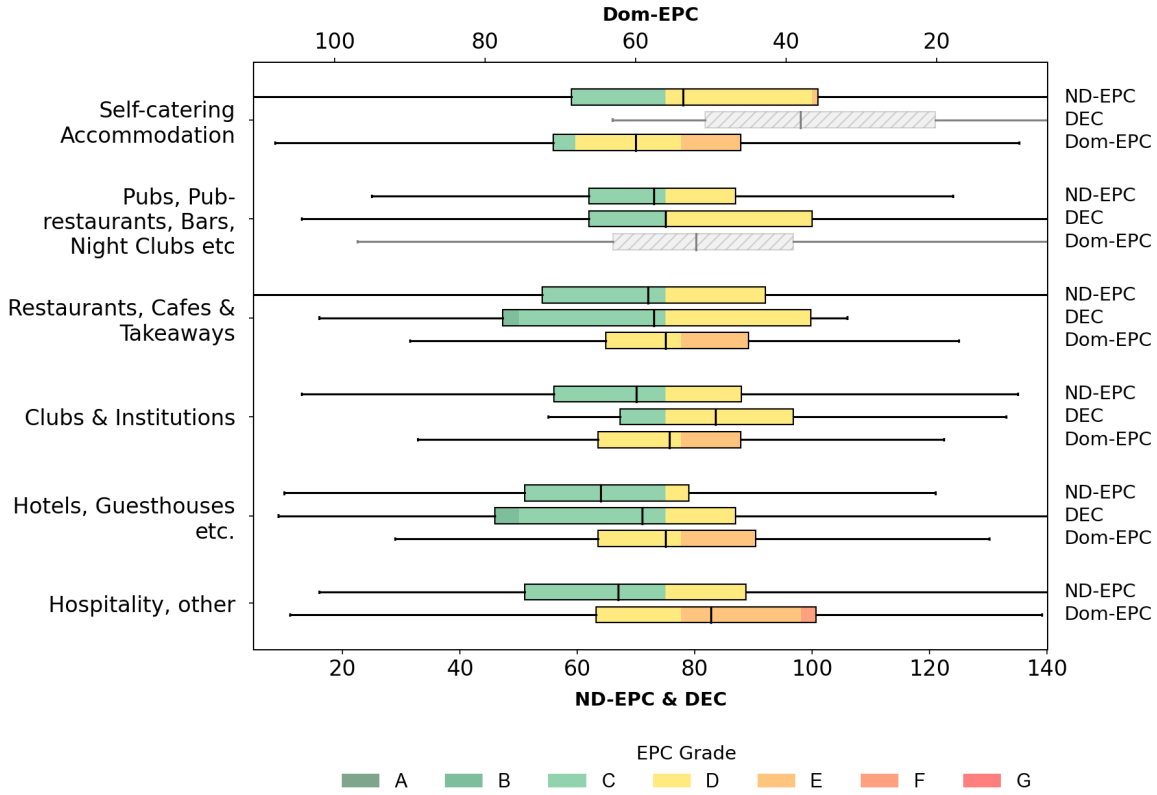


Figure 3.8-6: Percentage of floorspace on or off gas grid by activity group

3.8.4 Energy certification

Around 55% of all 'Hospitality' premises have an energy certificate, with around 26% of these being non-domestic EPCs and < 1% being DECs. 29% of Hospitality premises have a domestic EPC due to high numbers of holiday homes. The median non-domestic EPC grade is a C, the median DEC is a C grade and the median domestic EPC is C. The average 'lodgement date' for an EPC/DEC for 'Hospitality' was February 2018.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.8-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that most non-domestic EPCs have a median around the intersection of the C and the D rating with ‘Hotels, Guesthouses etc’ having a median of 64 (C) whilst ‘Pubs, Pub-restaurants, Bars, Night Clubs etc’ and ‘Restaurants, Cafes & Takeaways’ have medians of 73 (C) and 72 (C) respectively. Domestic EPCs are of particular importance for the ‘Self-catering Accommodation’ group where a median value of 60 is a D rating.

3.8.5 Energy use detailed insights

Within 'Hospitality', the activity group with the highest median energy use intensity (EUI) for electricity is 'Restaurants, Cafes & Takeaways' (184 kWh/m² per year) and for gas it is 'Restaurants, Cafes & Takeaways' (324 kWh/m² per year). For total EUI (gas and electricity combined) 'Restaurants, Cafes & Takeaways' have the highest value (366 kWh/m² per year), see Figure 3.8-8 below (chart values truncated to 76th percentile of highest activity group).

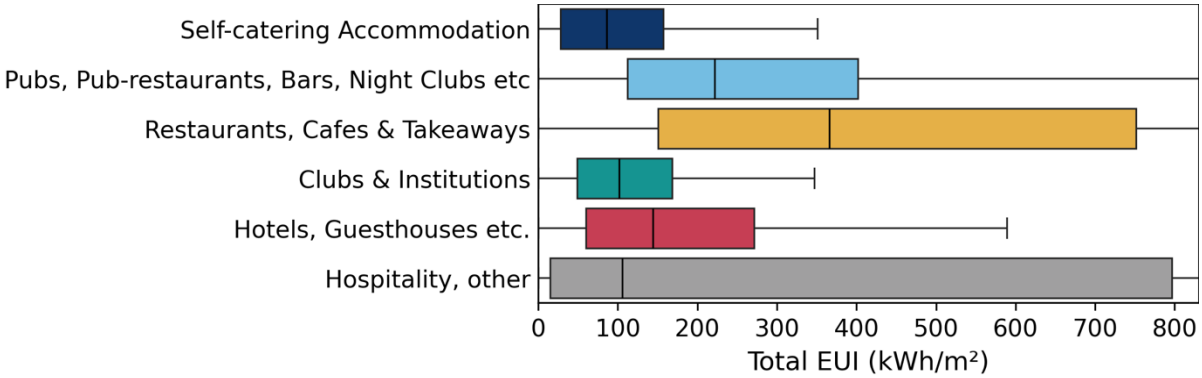


Figure 3.8-8: Distribution of total Energy Use Intensity (EUI) by activity group

For the matched energy certificate data, Figure 3.8-9, below, shows the main heating fuels by activity group. Most groups use ‘Mains Gas’ as their main heating fuel, whilst ‘Restaurants, Cafes & Takeaways’ appear to use ‘Electricity’ in around 20% of cases. ‘Self-catering Accommodation’ has a significant percentage of premises where ‘District & Community Heating’ is used.

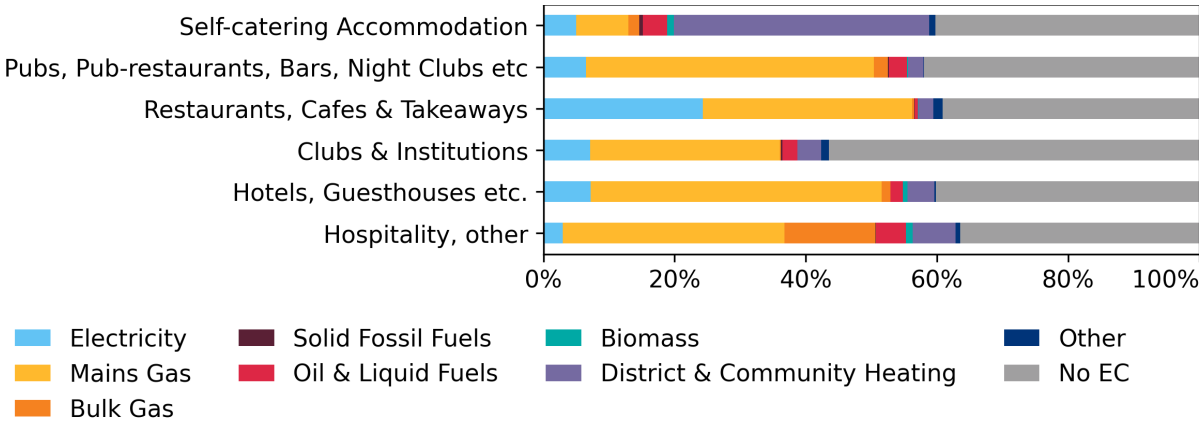


Figure 3.8-9: Heating fuels as percentage of total floorspace by activity group

Figure 3.8-10, below, shows the HVAC classifications as a percentage of floorspace by activity group. This shows that ‘Air Conditioning’ is more prevalent in ‘Hotels, Guesthouses etc.’ and ‘Restaurants, Cafes & Takeaways’ and is almost entirely absent in ‘Self-catering Accommodation’ where ‘Boilers and Radiators’ are the main HVAC system. Likewise, ‘Heating and Ventilation’ represents a significant percentage for most activity groups other than ‘Self-catering Accommodation’.

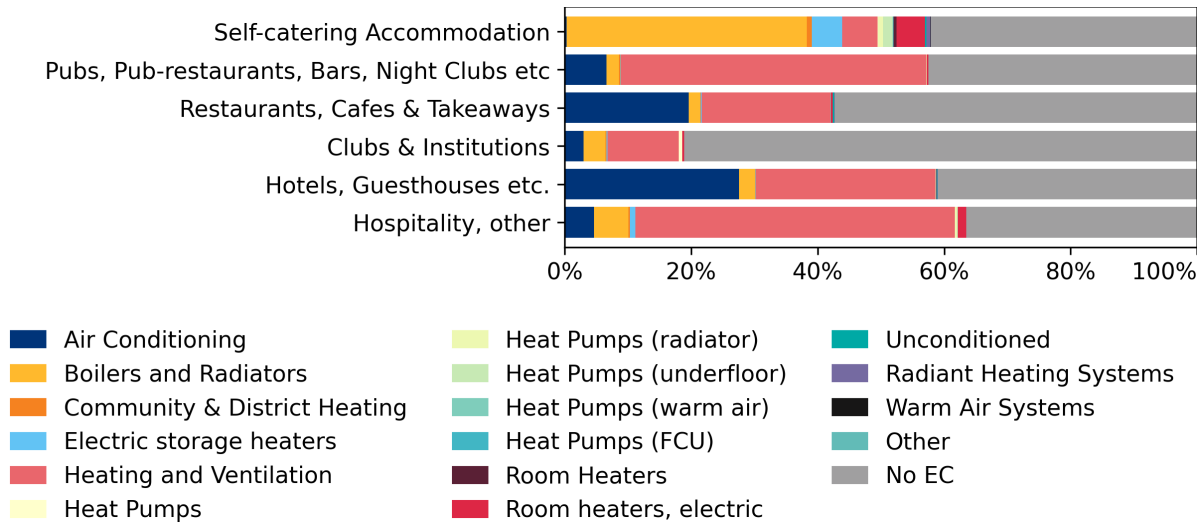


Figure 3.8-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Restaurants, Cafes & Takeaways' (43%) whilst the lowest percentage is for 'Self-catering Accommodation' (1%), as shown in Figure 3.8-11 below.

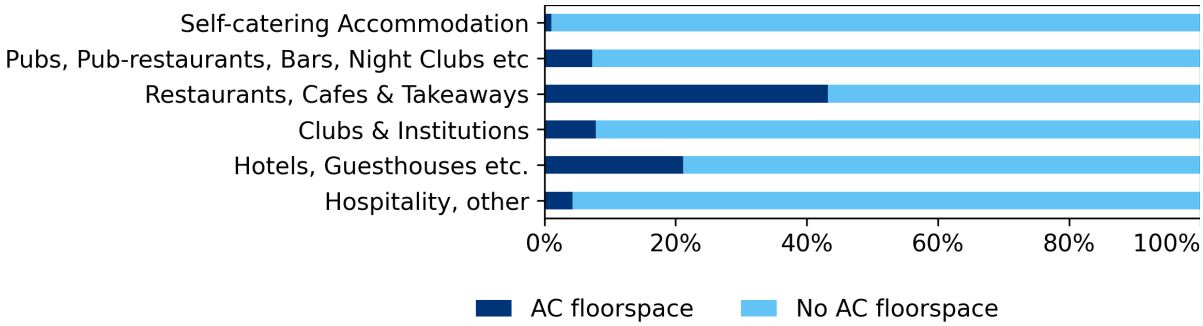


Figure 3.8-11: Air-conditioned floorspace by activity group

3.8.6 Heritage and Rural Urban

58% of all 'Hospitality' premises are in an area with no Conservation area or Listed building restrictions whilst 42% are either in a Conservation area, or are a Listed building or both. 'Pubs, Pub-restaurants, Bars, Night Clubs etc' has the largest amount of their floorspace in heritage restricted areas (49%). More details can be seen in Figure 3.8-12 below.

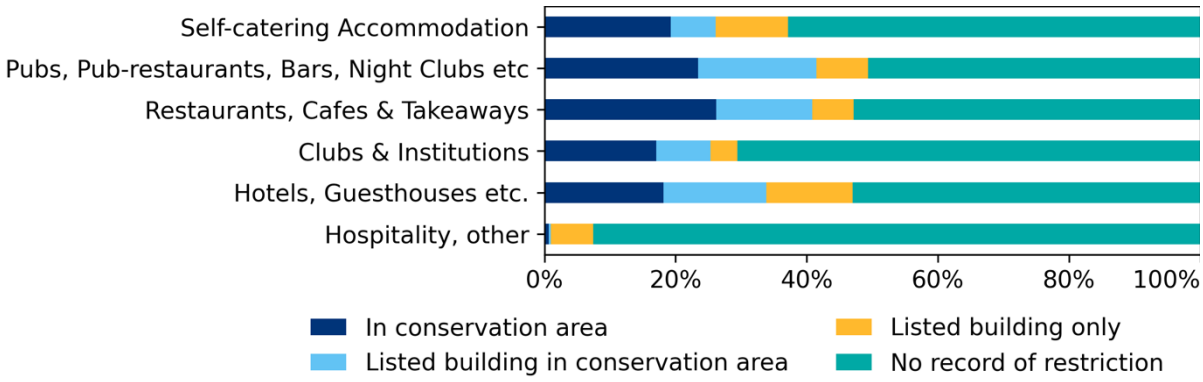


Figure 3.8-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 55% of premises and 71% of floorspace in the 'Hospitality' activity class may be found in an urban area. The largest activity group is 'Restaurants, Cafes & Takeaways' where 90% of its floorspace is in an urban area, whilst 'Hospitality, other' has the largest percentage of its floorspace in rural areas (93%), as shown in Figure 3.8-13 below.

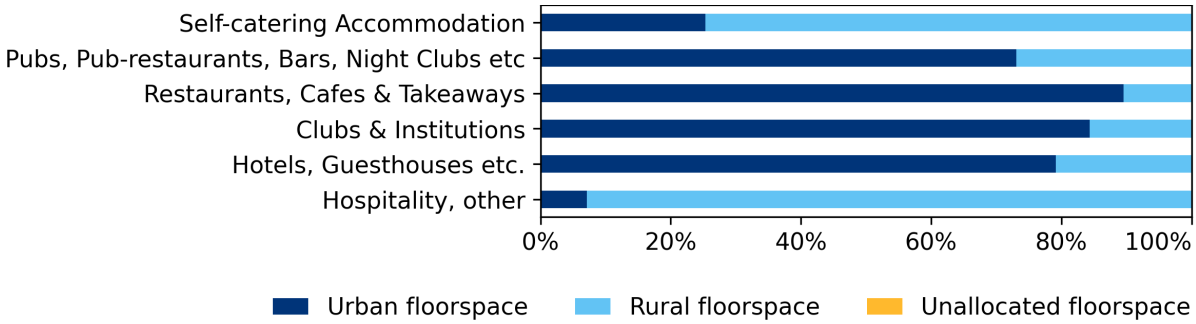


Figure 3.8-13: Floorspace by ONS Urban / rural classification by activity group

3.8.7 Mixed-use buildings

Within the 'Hospitality' class, 56% of SCUs are occupied by a single 'Hospitality' premises, whilst 8% share the SCU with other non-domestic premises and 35% share the SCU with domestic premises.

Figure 3.8-14 below shows 'Self-catering Accommodation' is the activity group with the highest percentage of cases where they are the sole occupier of the building (75%) whilst 'Restaurants, Cafes & Takeaways' has the highest percentage of SCUs shared with other non-domestic premises (19%) and 'Pubs, Pub-restaurants, Bars, Night Clubs etc' has the highest percentage of SCUs shared with domestic residential uses (57%).

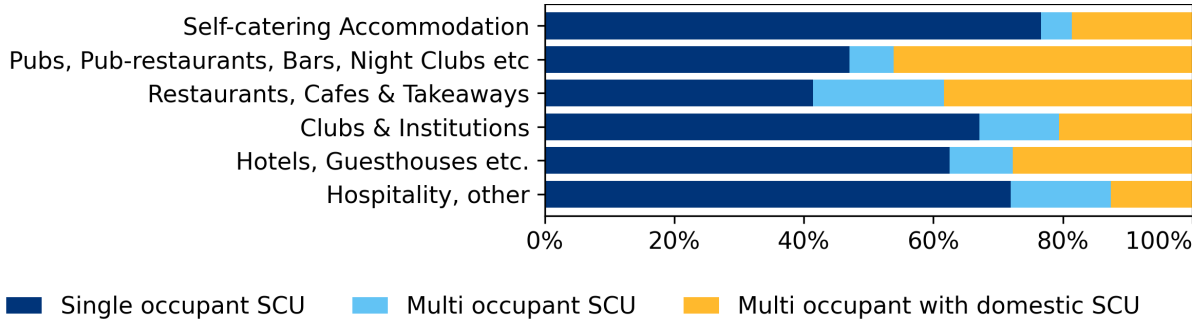


Figure 3.8-14: Percentage of premises by mixed-use SCU classification by activity group

3.8.8 Public sector

Around 2% of Hospitality premises and 3% of Hospitality floorspace is likely to be Public Sector. These low levels of Public Sector premises are to be expected given that relatively few premises in this activity class would be considered to be owned or managed by Local or Central Government.

'Clubs & Institutions' is the activity group with the highest percentage of premises likely to be Public Sector (9%) and this represents 8% of their activity group floorspace. 'Self-catering

Accommodation' is the activity group with the lowest percentage of premises (< 1%) and floorspace (< 1%) likely to be Public Sector.

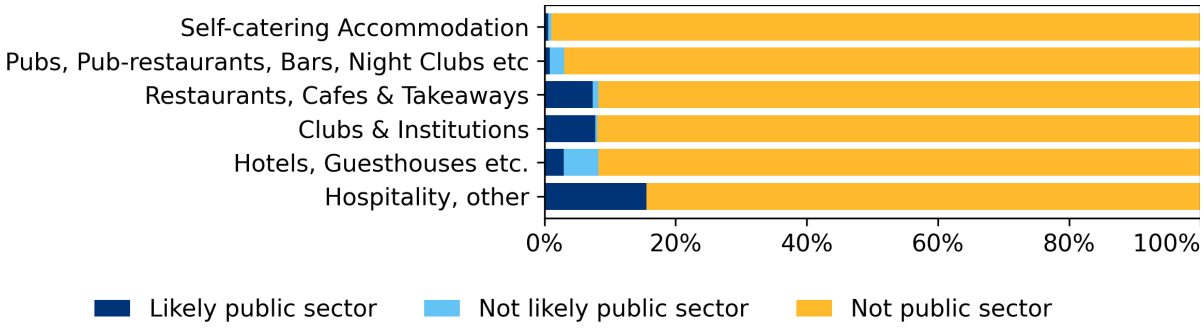


Figure 3.8-15: Percentage of floor area assigned 'Public sector' by activity group

3.8.9 Age and materials

54% of 'Hospitality' premises and 47% of Hospitality floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1976-1990' for premises (4%), which represents 8% of floorspace.

The details at the activity group level are shown in Figure 3.8-16 below where it appears that ‘Pubs, Pub-restaurants, Bars, Night Clubs etc’ and ‘Self-catering Accommodation’ have more premises in the older categories than the other groups.

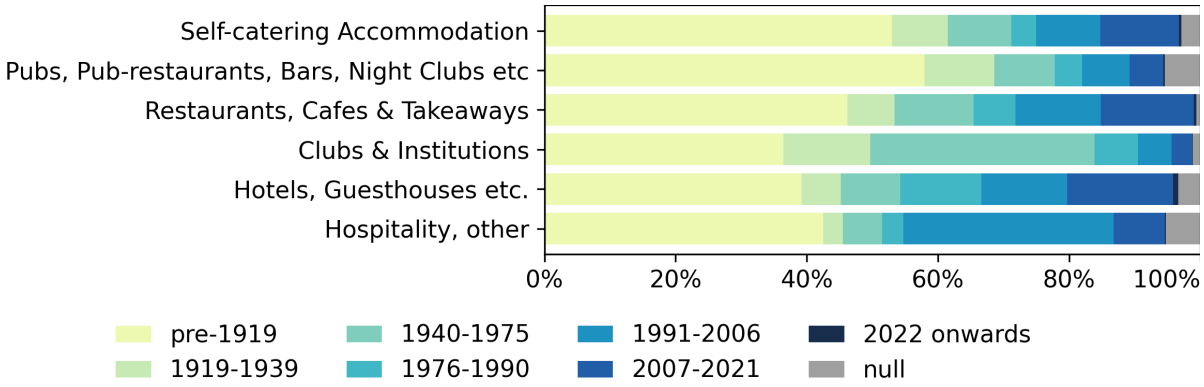


Figure 3.8-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Hospitality' activity class (measured by wall area). The 'Self-catering Accommodation' activity group has the largest wall area (11.4 million m²) when measured from the 3D geometry in the database, and 91% of this is masonry, which represents 27% of the total wall area in 'Hospitality' (see Figure 3.8-17).

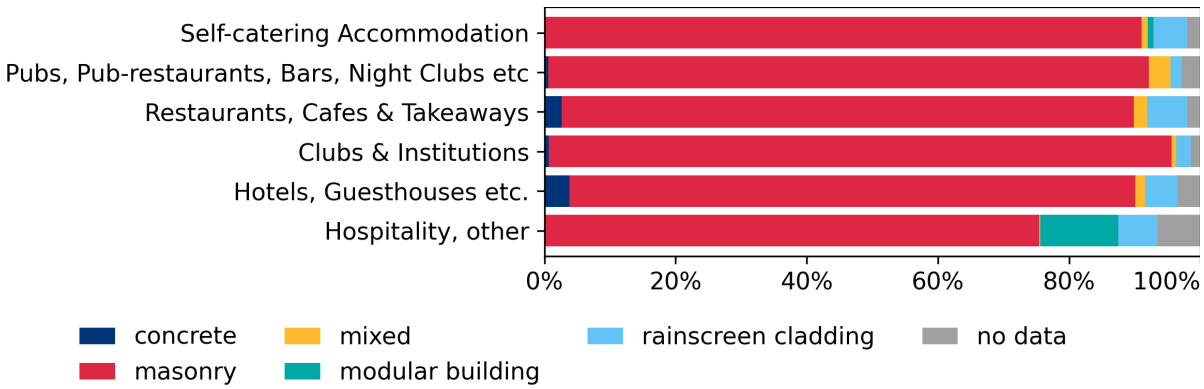


Figure 3.8-17: Distribution of total wall area by NGD material and activity group

Table 3.8-1: Summary statistics for Hospitality by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Self-catering Accommodation	106,563	90,629	11.58	110	43.1	15.4
Pubs, Pub-restaurants, Bars, Night Clubs etc	46,592	44,378	18.67	405	18.8	24.9
Restaurants, Cafes & Takeaways	61,015	53,114	12.07	198	24.7	16.1
Clubs & Institutions	10,373	9,441	4.89	474	4.2	6.5
Hotels, Guesthouses etc.	21,878	20,045	27.54	1,283	8.8	36.7
Hospitality, other	1,069	510	0.23	251	0.4	0.3

Table 3.8-2: Summary energy statistics for Hospitality by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
Self-catering Accommodation	86	890.99	5.9
Pubs, Pub-restaurants, Bars, Night Clubs etc	222	4,556.27	30.2
Restaurants, Cafes & Takeaways	366	3,938.65	26.1
Clubs & Institutions	102	566.25	3.7
Hotels, Guesthouses etc.	144	5,112.36	33.9
Hospitality, other	105	27.76	0.2

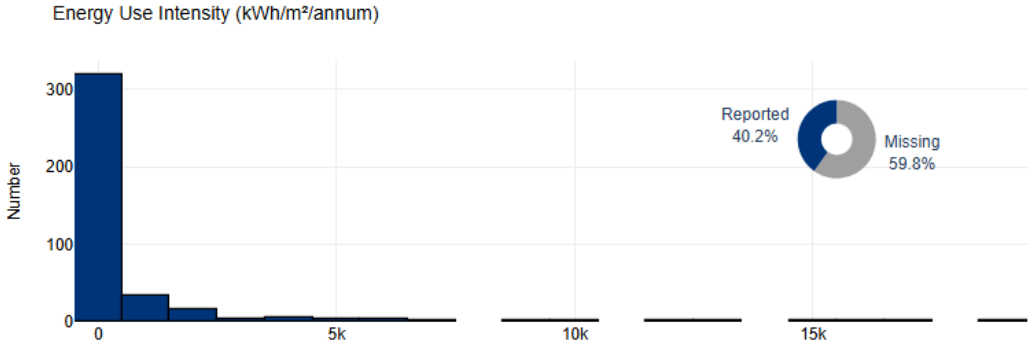
3.9 MoD

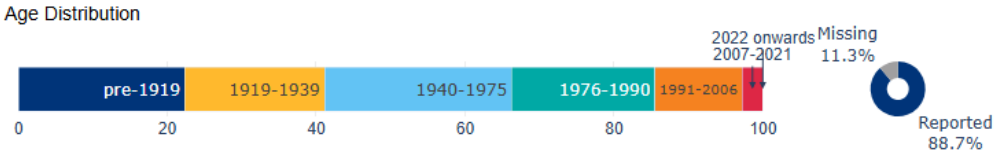
Overview

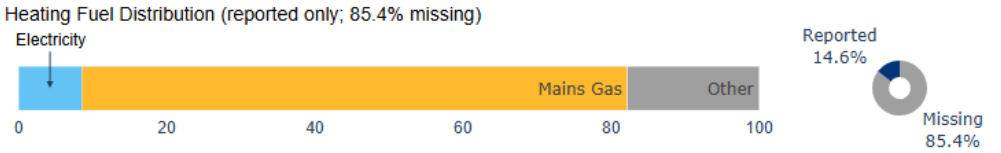
In the MoD activity class, the analysis covers 1,108 premises. The average Energy Use Intensity (EUI) is 11946 kWh/m²/annum. The dominant building age group is 1940-1975 (22%), and the predominant heating fuel is Mains Gas (11%).

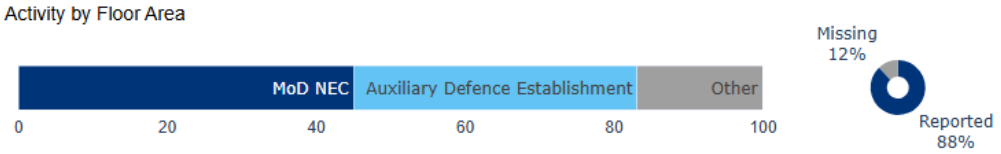
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

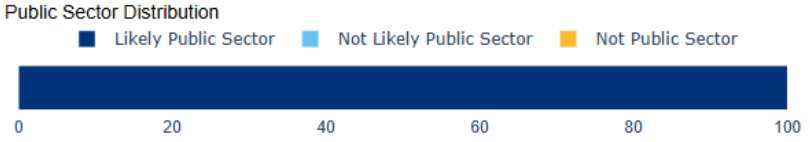
Activity Group	Premises (thousands)	Floorspace (millions m²)
Auxiliary Defence Establishment	0.6	0.57
MoD NEC	0.2	0.68
Army Hereditament	0.2	0.11
RAF Hereditament	0.1	0.1
Navy Hereditament	0.05	0.05











3.9.1 Overview

The 'MoD' class has a total of 1,108 premises and 1.50 million m² of floorspace. MoD is the smallest class in terms of both premises counts and floorspace with less than 1% of all non-domestic premises and less than 1% of all non-domestic. This class contains 13 activities, which have been grouped into five activity groups. The largest activity by count is 'Auxiliary Defence Establishment' with 422 premises. The largest by total floorspace is 'Auxiliary Defence Establishment' with 0.53 million m² of floorspace. In total NBD reports 928 SCUs (which roughly equate to buildings) for 'MoD'.

For 'MoD' as a whole, ND-NEED (2023) has no matches to make a comparison. BEES (2014) reported 12,400 premises (1,119% of NBD premises) and 18 million m² of floorspace (1,198% of NBD) for the year 2014. Differences in the data inputs and methods used in BEES and NBD, make direct comparisons difficult.

Figure 3.9-1 below shows all activities in the 'MoD' class aggregated into five activity groups. 'Auxiliary Defence Establishment' has the largest number of premises but these have a relatively small median floorspace (540 m²), making it the second largest activity group in terms of floorspace within 'MoD'. The activity group with the largest total floorspace is 'MoD NEC' where the median floor area is 389 m² and the total floor area is 0.68 million m². 'MoD NEC' also reports the largest share of the matched energy.

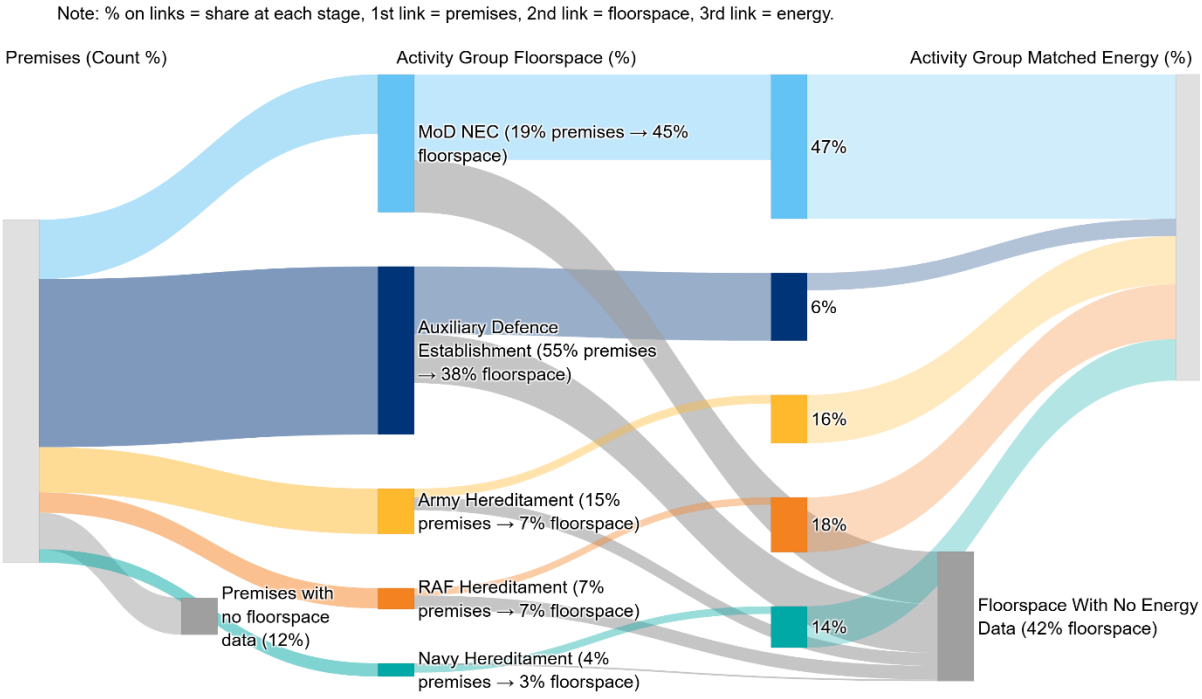


Figure 3.9-1: Share of activity group by number of premises, floorspace and total energy demand

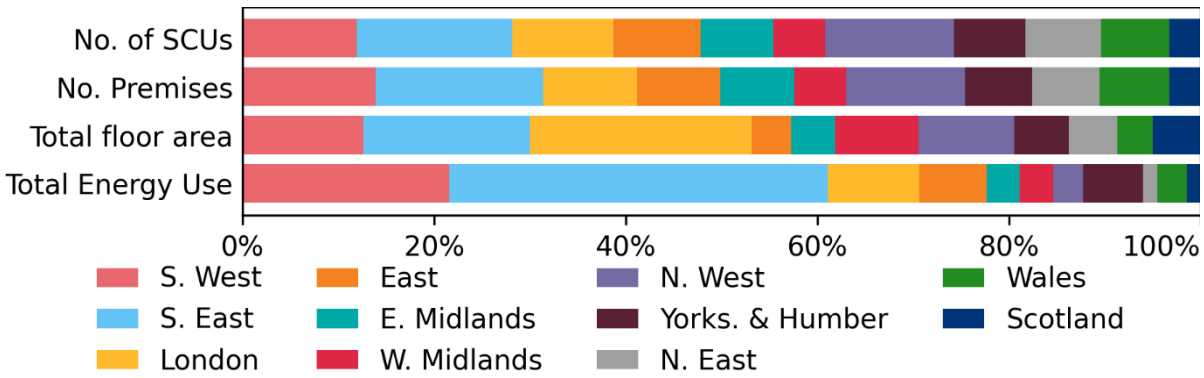


Figure 3.9-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.9-2), for England these are comparable with the NUTS regions. For 'MoD' the South East has the largest percentage of premises (18%) and SCUs (16%). The largest percentage of floorspace is in London (23%). For the regional share of total energy demand, South East has the largest percentage (40%).

3.9.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'RAF Hereditament' (683 m²) and the smallest is 'Navy Hereditament' (338 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.9-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

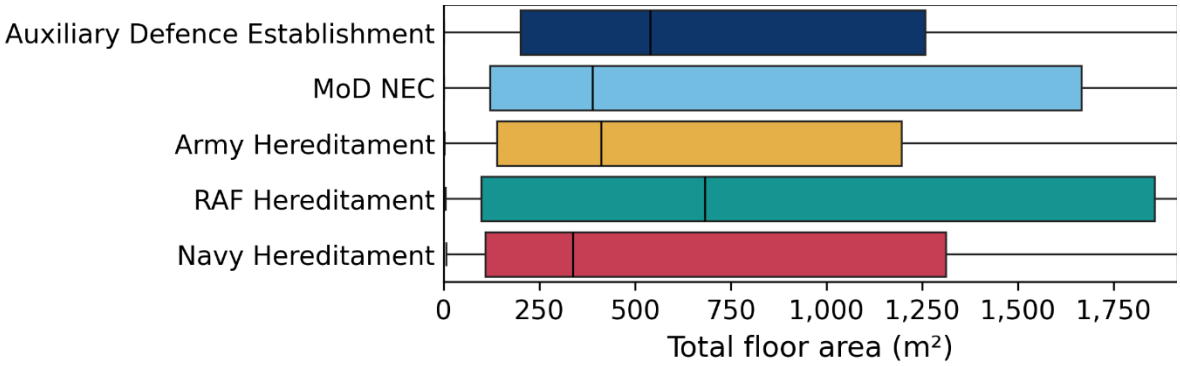


Figure 3.9-3: Distribution of premises total floor area by activity group

3.9.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 33% of ‘MoD’ premises have at least one matched electricity meter and 24% have at least one matched gas meter. The total matched energy use for 'MoD' is 950 GWh per year, which consists of 405 GWh for electricity and 545 GWh for gas per year.

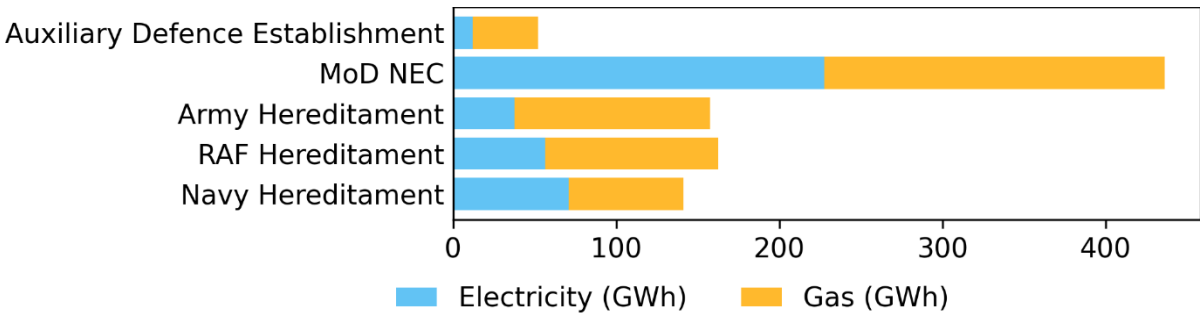


Figure 3.9-4: Total energy demand (GWh) for 'MoD' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘MoD’ is Profile Class 3, which represents 33% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

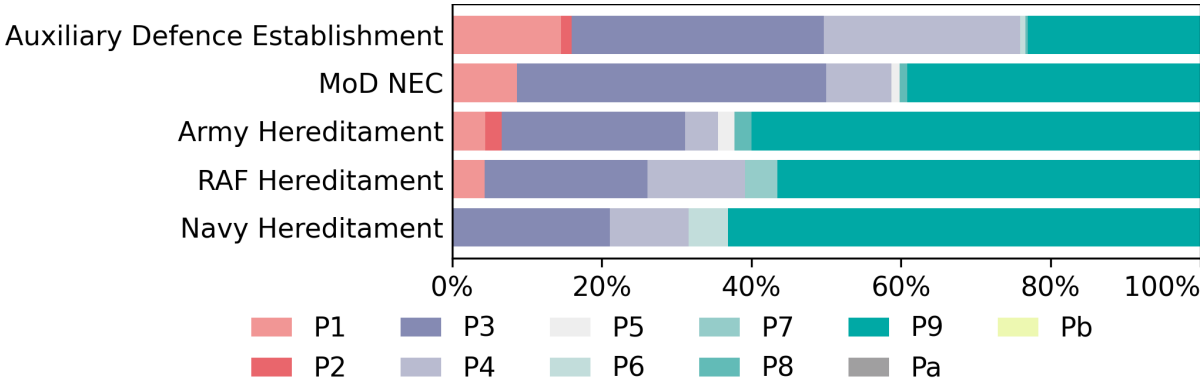


Figure 3.9-5: Percentage of meter profile classes for electricity meters by activity group

Around 13% of all 'MoD' premises (9% of 'MoD' floorspace) are located in postcodes classified as off the gas grid. Figure 3.9-6 below shows that 'RAF Hereditament' is the activity group that has the largest share (51% by floorspace) of off the gas grid postcodes and 'Navy Hereditament' have the lowest share (2%). This reflects the rural and often remote siting of RAF facilities—such as airfields and training grounds—compared to Navy premises, which are typically located in coastal urban areas with established gas infrastructure. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

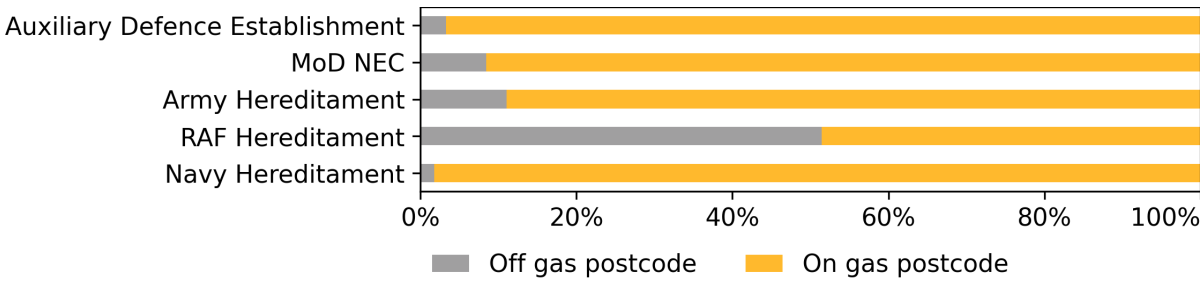
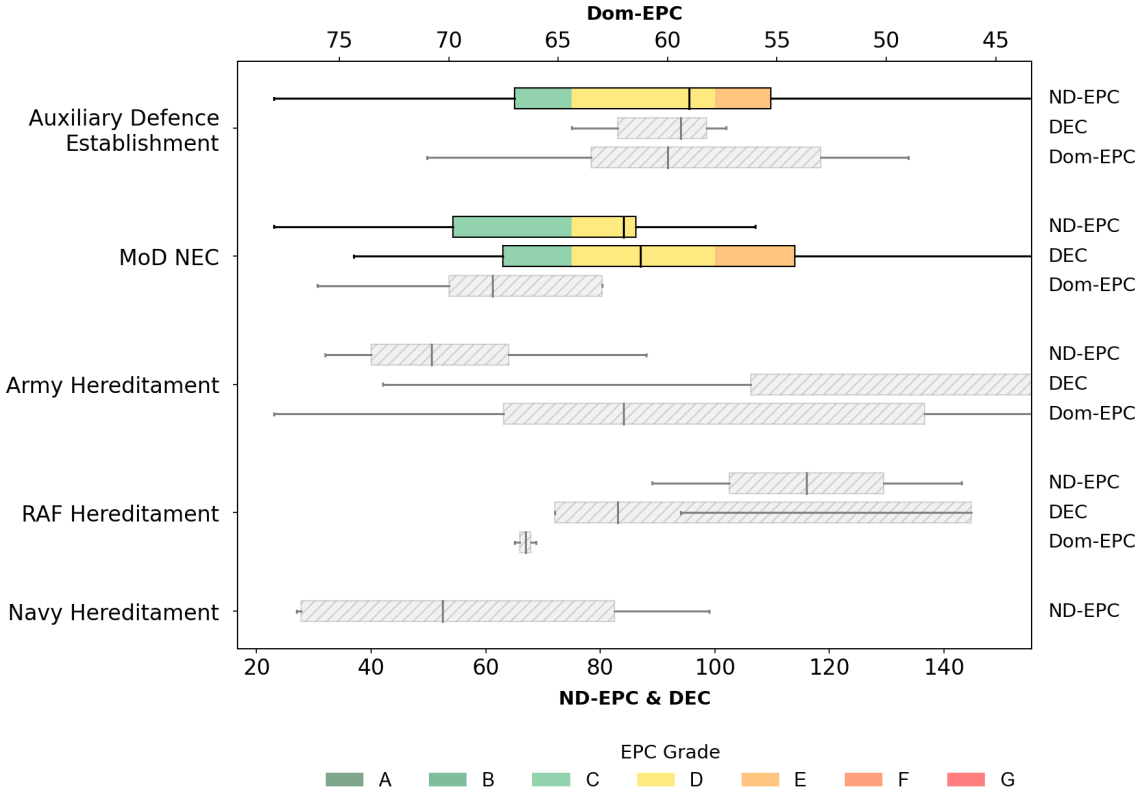


Figure 3.9-6: Percentage of floorspace on or off gas grid by activity group

3.9.4 Energy certification

The match rates between energy certificates and MoD are particularly low. Around 8% of all 'MoD' premises have an energy certificate, with around 6% of these being non-domestic EPCs and 2% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'MoD' was March 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.9-7: Distribution of energy certificate numeric rating by activity group

3.9.5 Energy use detailed insights

Within 'MoD', the activity group with the highest median energy use intensity (EUI) for electricity is 'Navy Hereditament' (3,447 kWh/m² per year) and for gas it is 'RAF Hereditament' (11,132 kWh/m² per year). For total EUI (gas and electricity combined) 'Navy Hereditament' have the highest value (3,322 kWh/m² per year), see Figure 3.9-8 below (chart values truncated to 76th percentile of highest activity group).

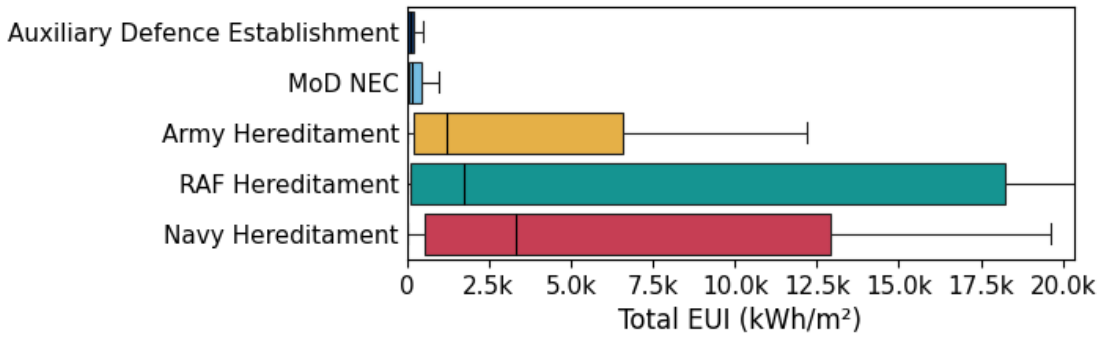


Figure 3.9-8: Distribution of total Energy Use Intensity (EUI) by activity group

Where energy certificates have been matched to MoD premises, most of the floorspace is treated using ‘Mains Gas’, as shown in Figure 3.9-9 below. Small percentages use ‘Electricity’, but it is interesting to note that ‘District & Community Heating’ is used in considerable percentages of floorspace across the MoD stock.

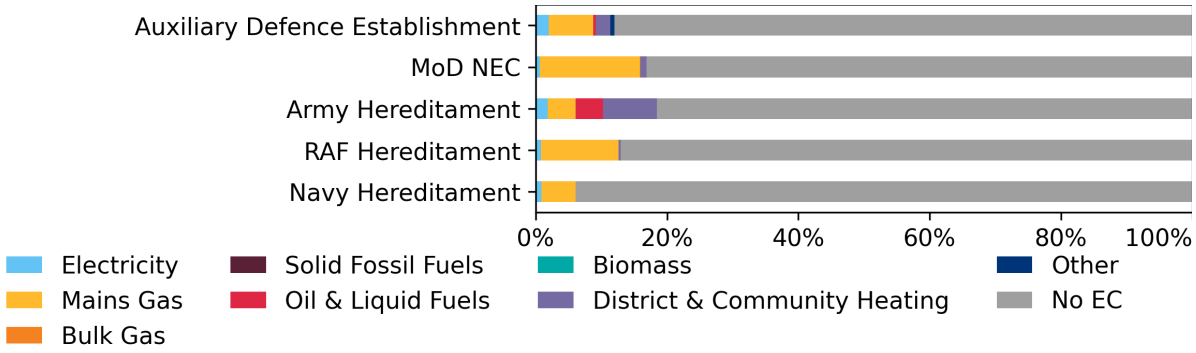


Figure 3.9-9: Heating fuels as percentage of total floorspace by activity group

Although the bulk of MoD floorspace (with an energy certificate) has ‘Heating and Ventilation’, there is some ‘Air Conditioning’ being used, as depicted in 3.9-10, below. A small percentage of floorspace is treated using ‘Electric storage heaters’, which is generally seen as an older technology. The remaining floorspace mostly uses ‘Boilers and Radiators’.

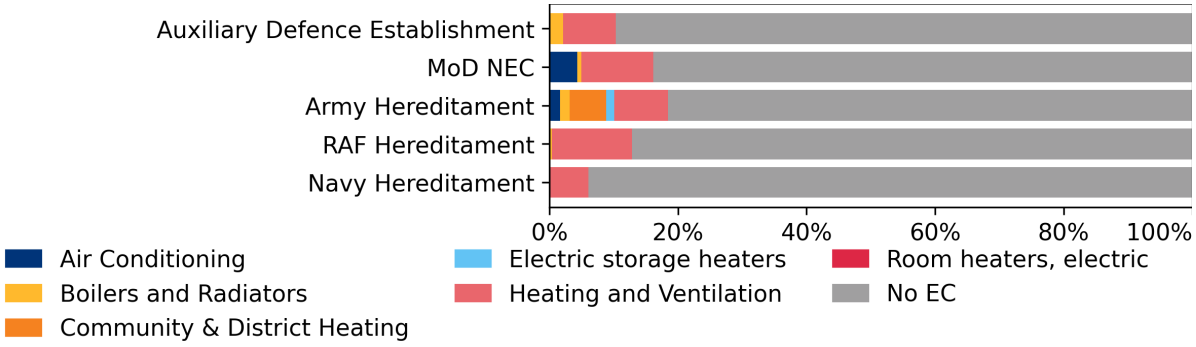


Figure 3.9-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'MoD NEC' (12%) whilst the lowest percentage is for 'Army Hereditament' (< 1%), as shown in Figure 3.9-11 below.

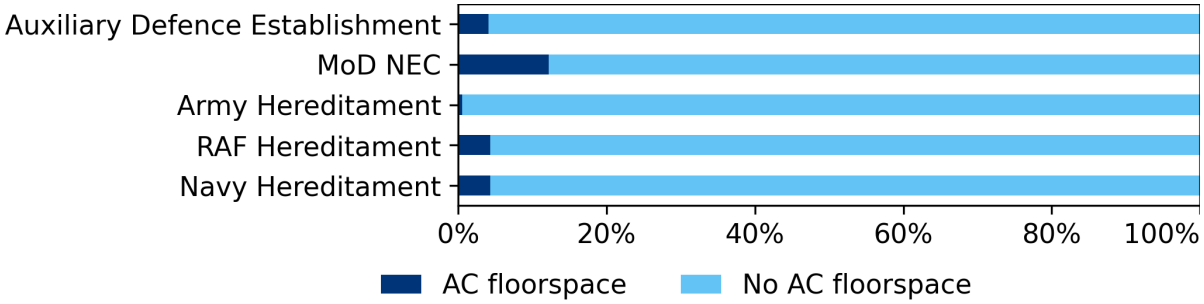


Figure 3.9-11: Air-conditioned floorspace by activity group

3.9.6 Heritage and Rural Urban

75% of all 'MoD' premises are in an area with no Conservation area or Listed building restrictions whilst 25% are either in a Conservation area, or are a Listed building or both. 'Army Hereditament' has the largest amount of their floorspace in heritage restricted areas (49%). More details can be seen in Figure 3.9-12 below.

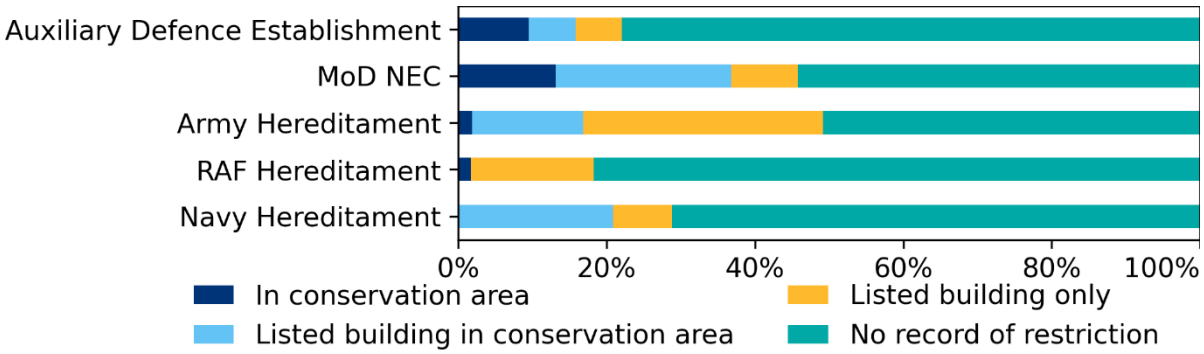


Figure 3.9-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 68% of premises and 75% of floorspace in the 'MoD' activity class may be found in an urban area. The largest activity group is 'Auxiliary Defence Establishment' where 92% of its floorspace is in an urban area, whilst 'Army Hereditament' has the largest percentage of its floorspace in rural areas (65%), as shown in Figure 3.9-13 below.

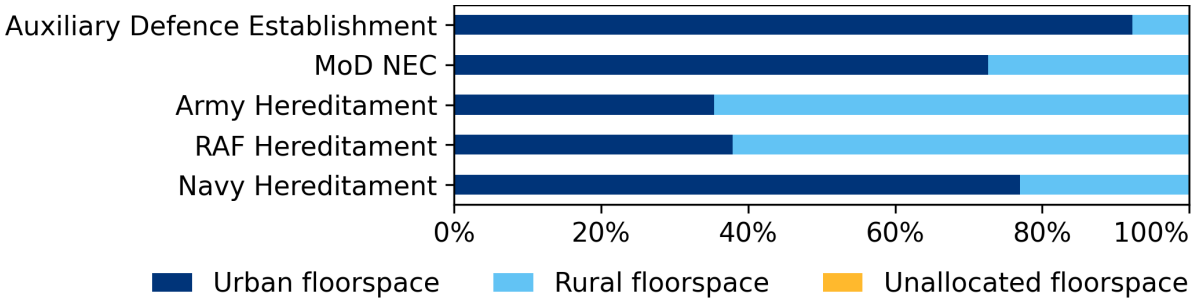


Figure 3.9-13: Floorspace by ONS Urban / rural classification by activity group

3.9.7 Mixed-use buildings

Within the 'MoD' class, 65% of SCUs are occupied by a single 'MoD' premises, whilst 6% share the SCU with other non-domestic premises and 29% share the SCU with domestic

premises.

Figure 3.9-14 below shows 'MoD NEC' is the activity group with the highest percentage of cases where they are the sole occupier of the building (79%) whilst 'Navy Hereditament' has the highest percentage of SCUs shared with other non-domestic premises (11%) and 'Auxiliary Defence Establishment' has the highest percentage of SCUs shared with domestic residential uses (35%).

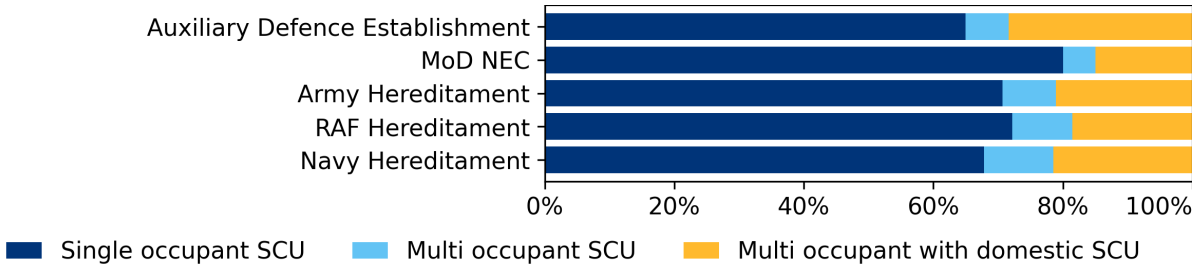


Figure 3.9-14: Percentage of premises by mixed-use SCU classification by activity group

3.9.8 Public sector

NBD predicts that the whole of MoD is likely to be Public Sector and this applies at all levels of activity grouping.

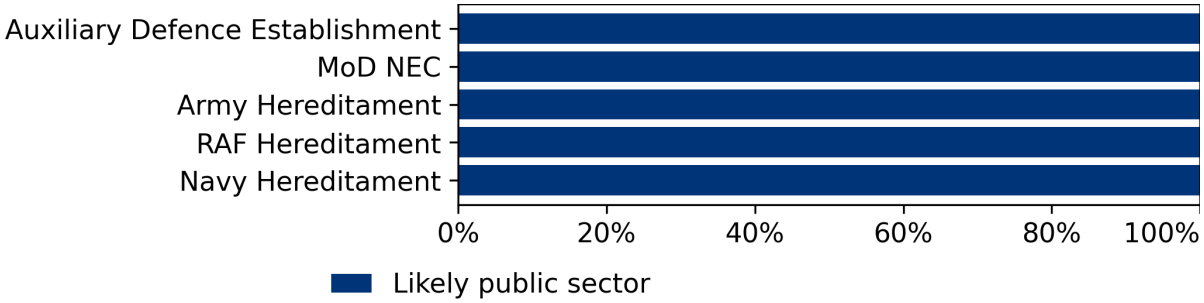


Figure 3.9-15: Percentage of floor area assigned 'Public sector' by activity group

3.9.9 Age and materials

25% of 'MoD' premises and 22% of MoD floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '2007-2021' for premises (4%), which represents 2% of floorspace. The details at the activity group level are shown in Figure 3.9-16 below.

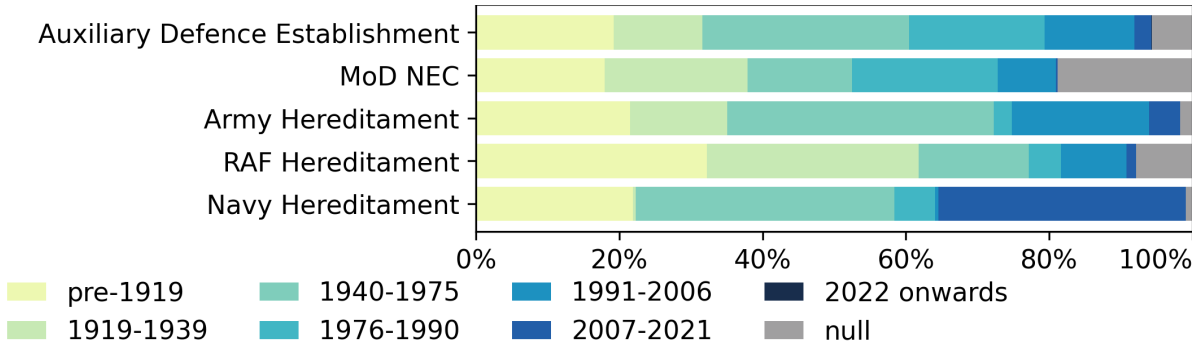


Figure 3.9-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'MoD' activity class (measured by wall area). The 'Auxiliary Defence Establishment' activity group has the largest wall area (0.3 million m²) when measured from the 3D geometry in the database, and 89% of this is masonry, which represents 43% of the total wall area in 'MoD' (see Figure 3.9-17).

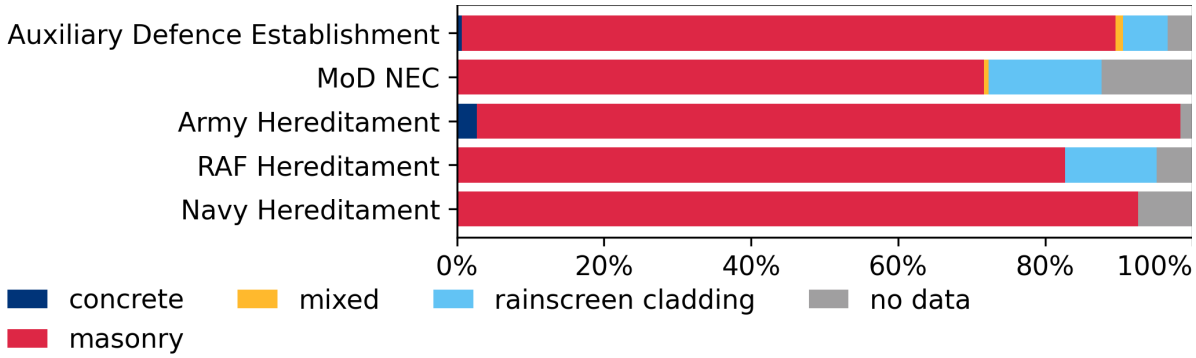


Figure 3.9-17: Distribution of total wall area by NGD material and activity group

Table 3.9-1: Summary statistics for MoD by activity group

Activity group	No. of premises	No. of SCUs	total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Auxiliary Defence Establishment	608	574	0.57	961	54.9	38.1
MoD NEC	215	160	0.68	3,801	19.4	45.0
Army Hereditament	164	109	0.11	950	14.8	7.0
RAF Hereditament	73	54	0.10	1,715	6.6	6.8
Navy Hereditament	48	28	0.05	1,469	4.3	3.0

Table 3.9-2: Summary energy statistics for MoD by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
Auxiliary Defence Establishment	98	52.21	5.5
MoD NEC	167	436.15	45.9
Army Hereditament	1,203	157.61	16.6
RAF Hereditament	1,760	162.63	17.1
Navy Hereditament	3,322	141.18	14.9

3.10 Office

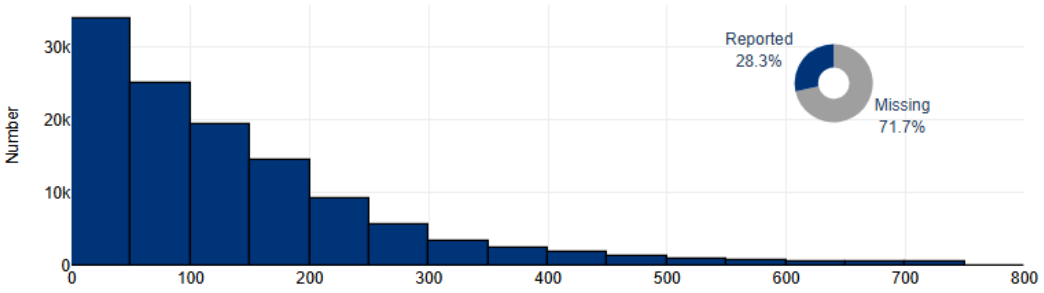
Overview

In the Office activity class, the analysis covers 470,455 premises. The average Energy Use Intensity (EUI) is 356 kWh/m²/annum. The dominant building age group is 1991-2006 (23%), and the predominant heating fuel is Mains Gas (44%).

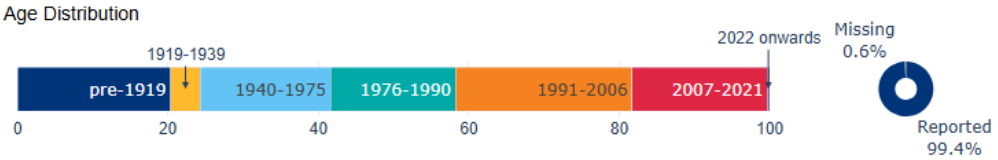
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
General Office	453.2	107.19
Business Units	11.0	0.98
Studios	2.8	0.82
Office, LA / Central Govnt	2.5	3.48
Film studios & Computer Centres	0.9	2.51

Energy Use Intensity (kWh/m²/annum)

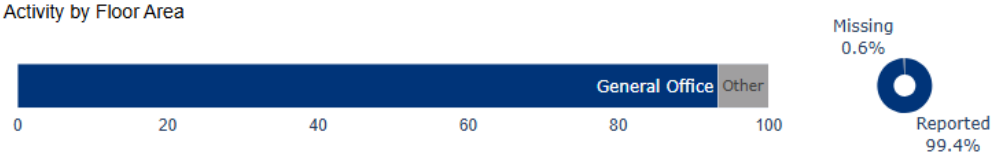


Age Distribution



Heating Fuel Distribution (reported only; 36.2% missing)

Activity by Floor Area



Public Sector Distribution

3.10.1 Overview

The 'Office' class has a total of 470,455 premises and 114.97 million m² of floorspace. Office is the second largest class in terms of premises counts with 21% of all non-domestic premises and it is fourth largest in terms of floorspace with 15% of all non-domestic floorspace. This class contains 11 activities, which have been grouped into five activity groups. The largest activity by count is 'Office' with 448,246 premises. The largest by total floorspace is 'Office' with 103.52 million m² of floorspace. In total NBD reports 163,131 SCUs (which roughly equate to buildings) for 'Office'.

For 'Office' as a whole, ND-NEED (2023) reports 0.36 million buildings (219% of NBD SCUs) and 73.29 million m² of floorspace (64% of NBD). BEES (2014) reported 366,200 premises (78% of NBD premises) and 118 million m² of floorspace (103% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.10-1 below shows all activities in the 'Office' class aggregated into five activity groups. 'General Office' has the largest number of premises but these have a relatively small median floorspace (64 m²), making it the first largest activity group in terms of floorspace within 'Office'. The activity group with the largest total floorspace is 'General Office' where the median floor area is 64 m² and the total floor area is 107.19 million m². ‘General Office’ also has the largest share of matched total energy demand.

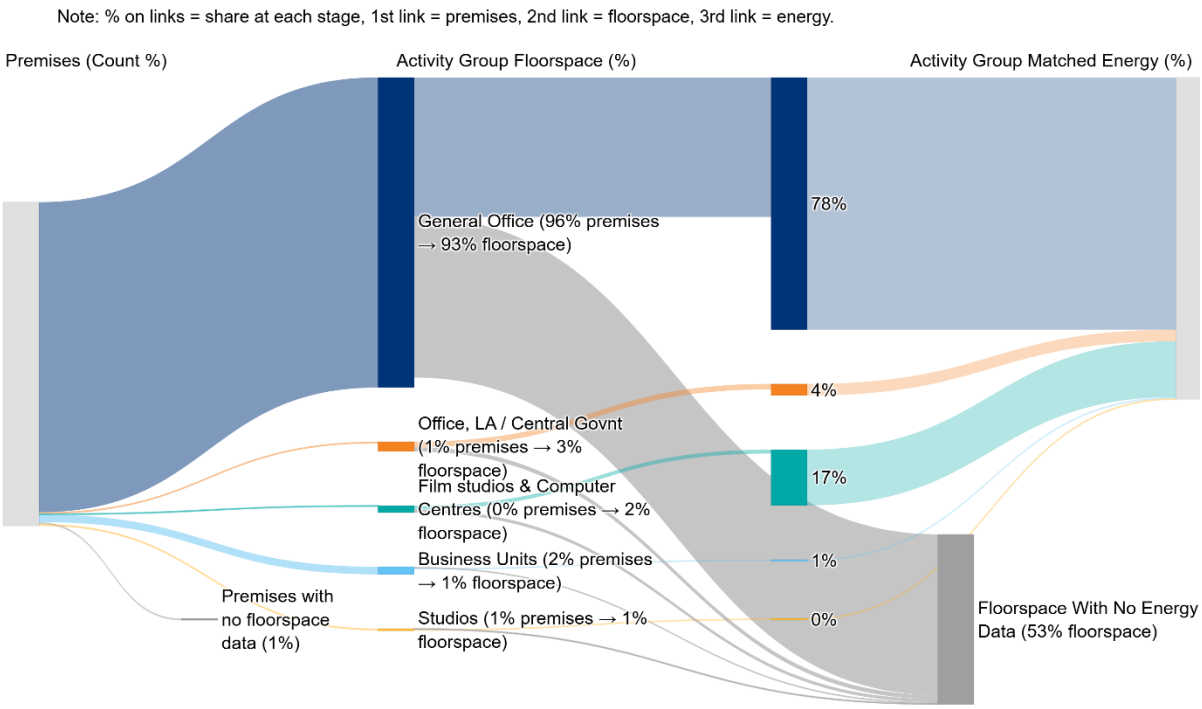


Figure 3.10-1: Share of activity group by number of premises, floorspace and total energy demand

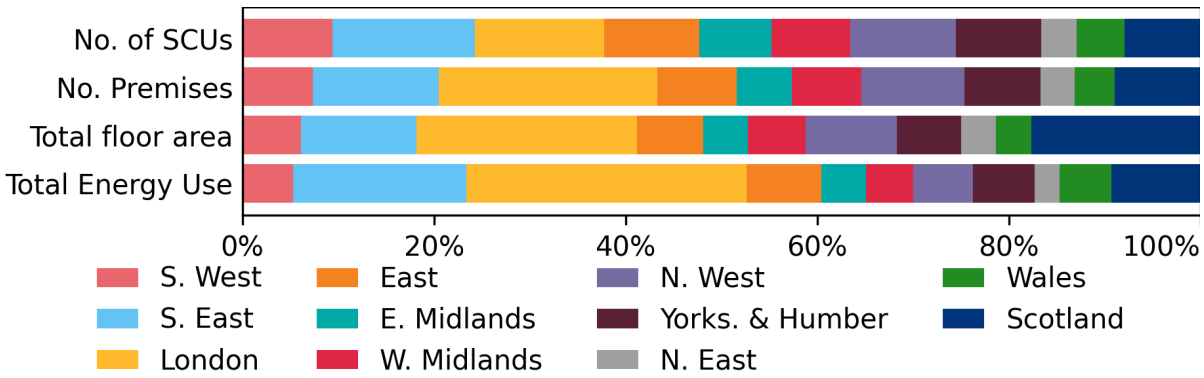


Figure 3.10-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.10-2), for England these are comparable with the NUTS regions. For 'Office' the London has the largest percentage of premises (23%) and SCUs (15%). The largest percentage of floorspace is in London (23%). For the regional share of total energy demand, London has the largest percentage (29%).

3.10.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Office, LA / Central Govnt' (276 m²) and the smallest is 'Business Units' (43 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.10-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

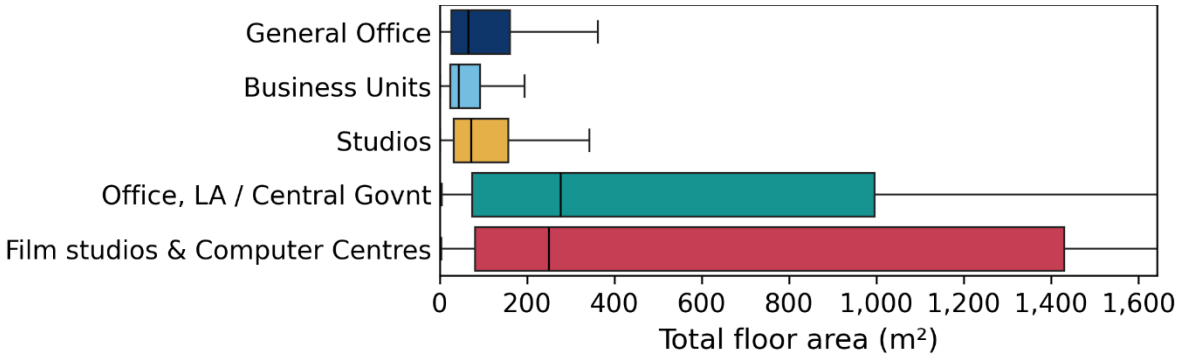


Figure 3.10-3: Distribution of premises total floor area by activity group

3.10.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 26% of ‘Office’ premises have at least one matched electricity meter and 12% have at least one matched gas meter. The total matched energy use for 'Office' is 10,656 GWh per year, which consists of 7,247 GWh for electricity and 3,408 GWh for gas per year.

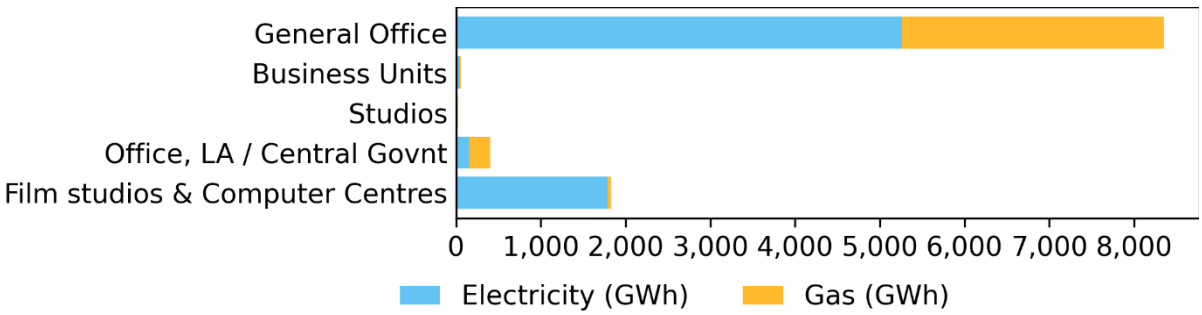


Figure 3.10-4: Total energy demand (GWh) for 'Office' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Office’ is Profile Class 3, which represents 57% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

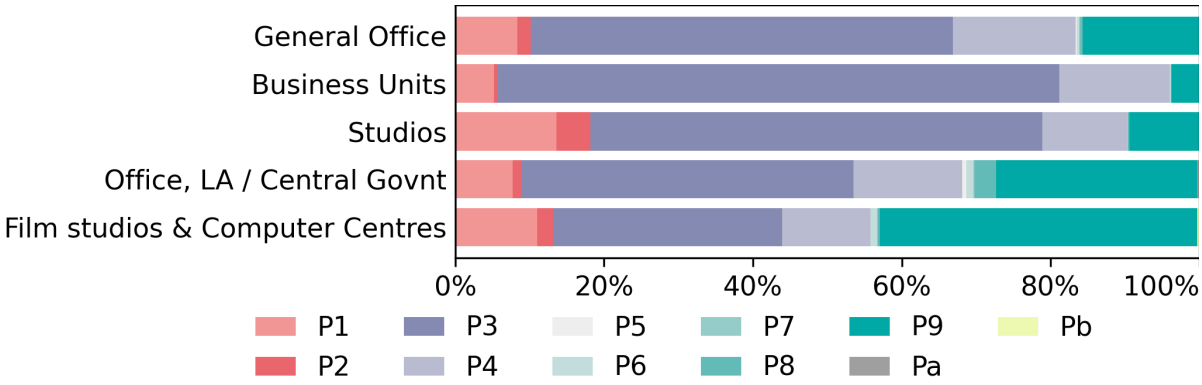


Figure 3.10-5: Percentage of meter profile classes for electricity meters by activity group

Around 9% of all 'Office' premises (9% of 'Office' floorspace) are located in postcodes classified as off the gas grid. Figure 3.10-6 below shows that 'Office, LA / Central Govnt' is the activity group that has the largest share (14% by floorspace) of off the gas grid postcodes and 'Studios' have the lowest share (7%). This suggests that government offices are more likely to be located in rural or remote areas to ensure local service provision, whereas studios tend to cluster in urban, grid-connected locations aligned with creative industry hubs. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

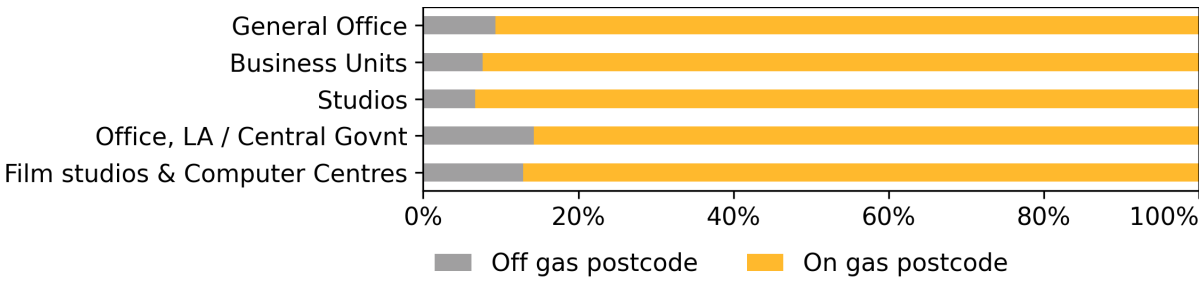
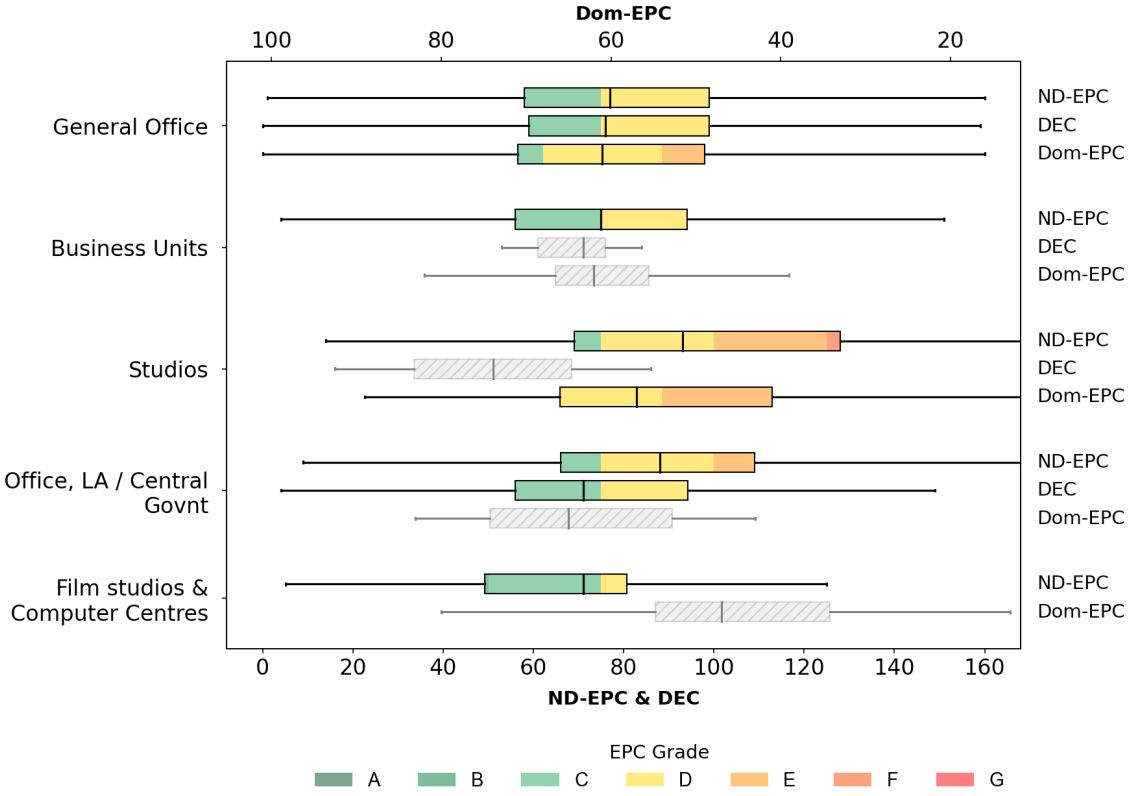


Figure 3.10-6: Percentage of floorspace on or off gas grid by activity group

3.10.4 Energy certification

Around 15% of all 'Office' premises have an energy certificate, with around 14% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Office' was June 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.10-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that ‘Office LA / Central Govnt.’ have around 16% matched to DECs, which have a median current operational rating of 71 (C). ‘General Office’ has a median non-domestic EPC asset rating of 77 (D) whilst ‘Studios’ have the lowest performing non-domestic EPCs, with a median asset rating of 93 (D).

3.10.5 Energy use detailed insights

Within 'Office', the activity group with the highest median energy use intensity (EUI) for electricity is 'Film studios & Computer Centres' (113 kWh/m² per year) and for gas it is

'Office, LA / Central Govnt' (137 kWh/m² per year). For total EUI (gas and electricity combined) 'Film studios & Computer Centres' have the highest value (131 kWh/m² per year), see Figure 3.10-8 below (chart values truncated to 76th percentile of highest activity group).

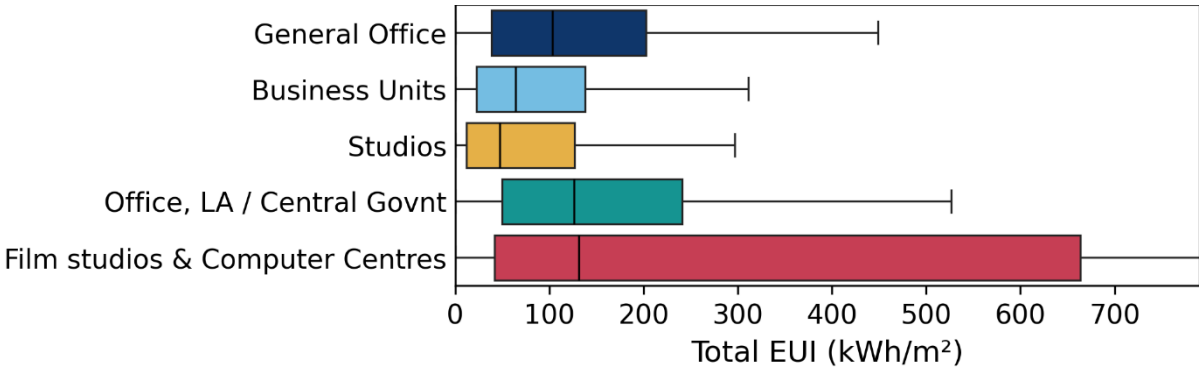


Figure 3.10-8: Distribution of total Energy Use Intensity (EUI) by activity group

In premises that have a matched energy certificate, Figure 3.10-9, below, clearly indicates that ‘Mains Gas’ is the dominant energy source used for heating floorspace in the Office class, especially in the ‘Office, LA / Central Govnt’ and ‘General Office’ groups, which constitute 96% of the class’s floorspace. ‘Business Units’, which tend to be more modern, have higher percentages of floorspace using ‘Electricity’, as do ‘Film studios & Computer Centres’.

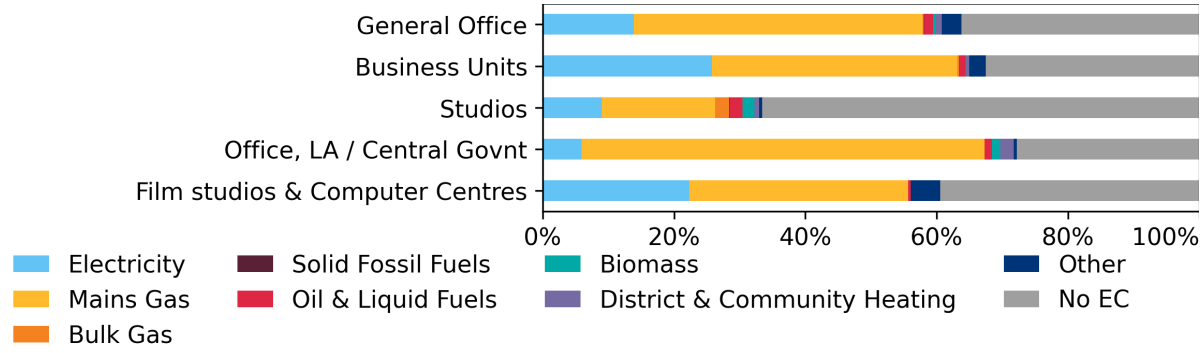


Figure 3.10-9: Heating fuels as percentage of total floorspace by activity group

Again, where an energy certificate has been matched to premises, Figure 3.10-10 below, shows that ‘Film studios & Computer Centres’ have substantial ‘Air Conditioning’, as they require a lot of cooling to maintain internal environments conducive to their activities. This group also has a small percentage of floorspace treated by ‘Other’ systems. The ‘General Office’ group treats almost half its floorspace using ‘Air conditioning’, but the remaining groups mostly use ’Heating and Ventilation’.

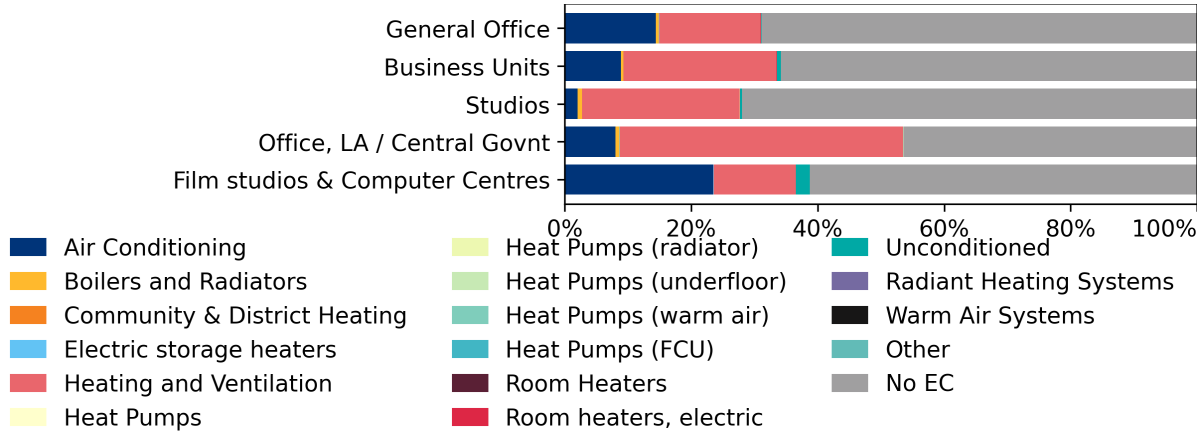


Figure 3.10-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Film studios & Computer Centres' (71%) whilst the lowest percentage is for 'Studios' (4%), as shown in Figure 3.10-11 below.

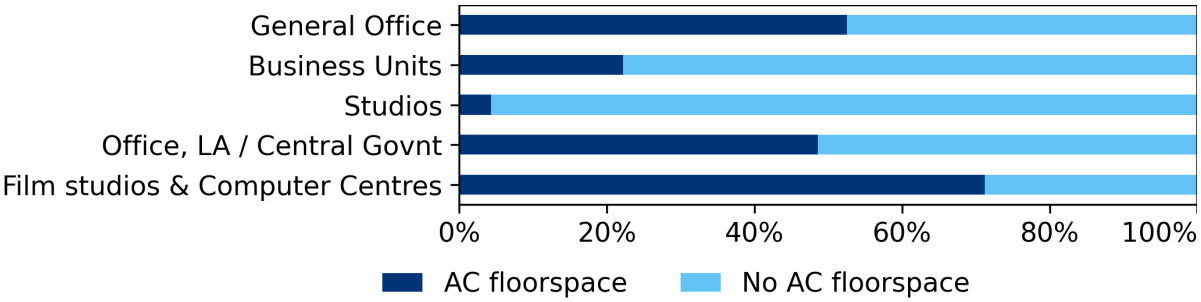


Figure 3.10-11: Air-conditioned floorspace by activity group

3.10.6 Heritage and Rural Urban

59% of all 'Office' premises are in an area with no Conservation area or Listed building restrictions whilst 41% are either in a Conservation area, or are a Listed building or both. 'Studios' has the largest amount of their floorspace in heritage restricted areas (61%). More details can be seen in Figure 3.10-12 below.

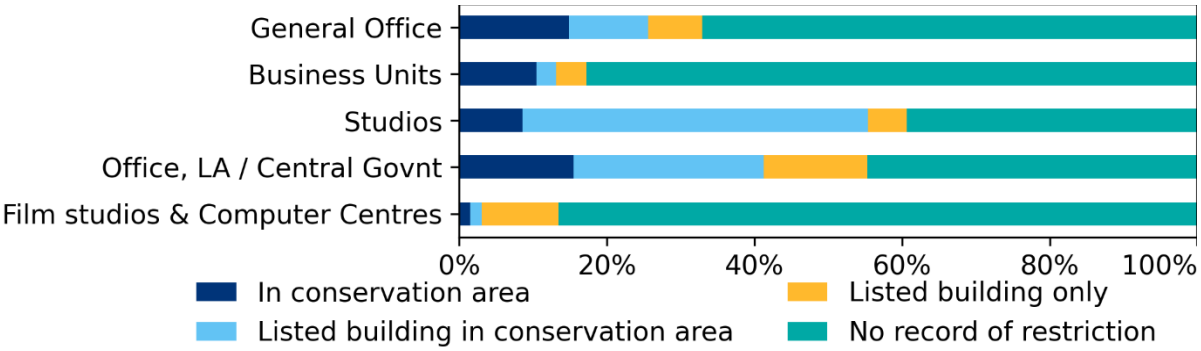


Figure 3.10-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 88% of premises

and 92% of floorspace in the 'Office' activity class may be found in an urban area. The largest activity group is 'Office, LA / Central Govnt' where 94% of its floorspace is in an urban area, whilst 'Studios' has the largest percentage of its floorspace in rural areas (12%), as shown in Figure 3.10-13 below.

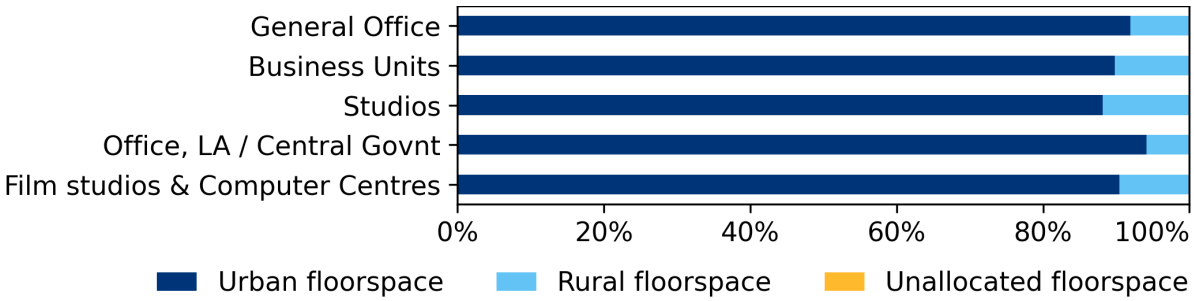


Figure 3.10-13: Floorspace by ONS Urban / rural classification by activity group

3.10.7 Mixed-use buildings

Within the 'Office' class, 40% of SCUs are occupied by a single 'Office' premises, whilst 41% share the SCU with other non-domestic premises and 20% share the SCU with domestic premises.

Figure 3.10-14 below shows 'Business Units' is the activity group with the highest percentage of cases where they are the sole occupier of the building (53%) whilst 'Studios' has the highest percentage of SCUs shared with other non-domestic premises (43%) and 'Studios' has the highest percentage of SCUs shared with domestic residential uses (25%).

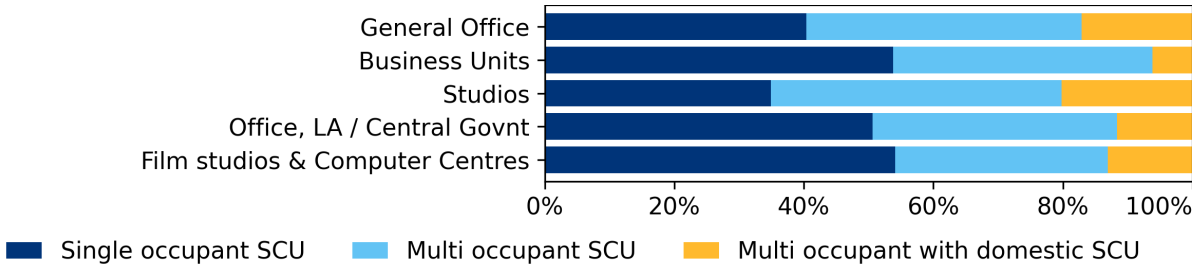


Figure 3.10-14: Percentage of premises by mixed-use SCU classification by activity group

3.10.8 Public sector

Around 10% of Office premises and 19% of Office floorspace is likely to be Public Sector. Figure 3.10-15 reveals that most activity groups are largely considered to be ‘not public sector’ whilst the activity group ‘Office, LA / Central Govnt.’ is 100% likely to be Public Sector.

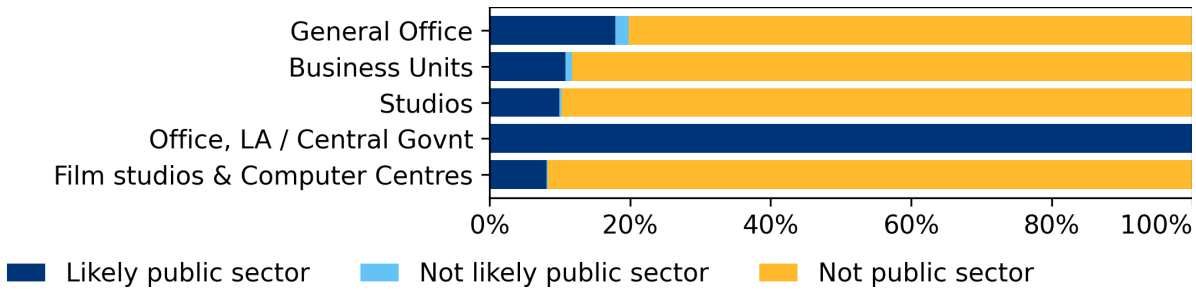


Figure 3.10-15: Percentage of floor area assigned 'Public sector' by activity group

3.10.9 Age and materials

34% of 'Office' premises and 20% of Office floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (6%), which represents 4% of floorspace.

The details at the activity group level are shown in Figure 3.10-16 below where it appears that nearly 70% of all ‘Studios’ are in buildings built before 1940 and nearly 40% of ‘Office, LA / Central Govnt.’ premises are in buildings built before 1940. In contrast, over 60% of ‘Film studios & Computer Centres’ premises are in buildings built after 1991.

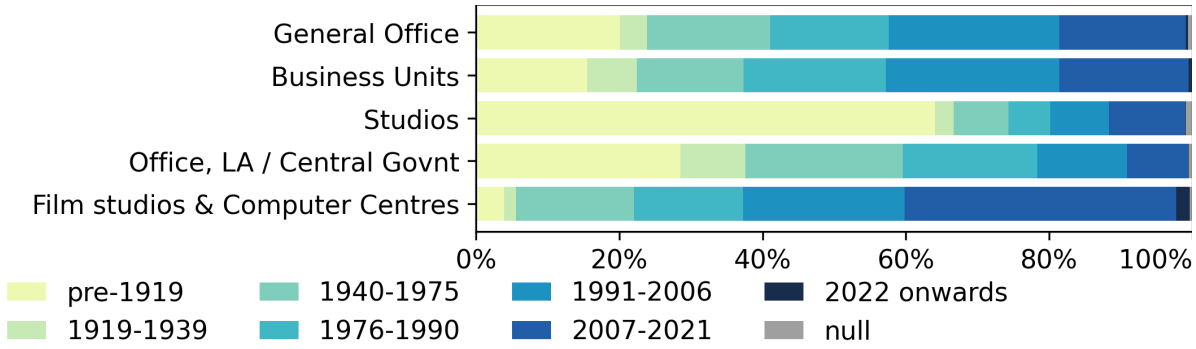


Figure 3.10-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Office' activity class (measured by wall area). The 'General Office' activity group has the largest wall area (44.1 million m²) when measured from the 3D geometry in the database, and 76% of this is masonry, which represents 73% of the total wall area in 'Office' (see Figure 3.10-17).

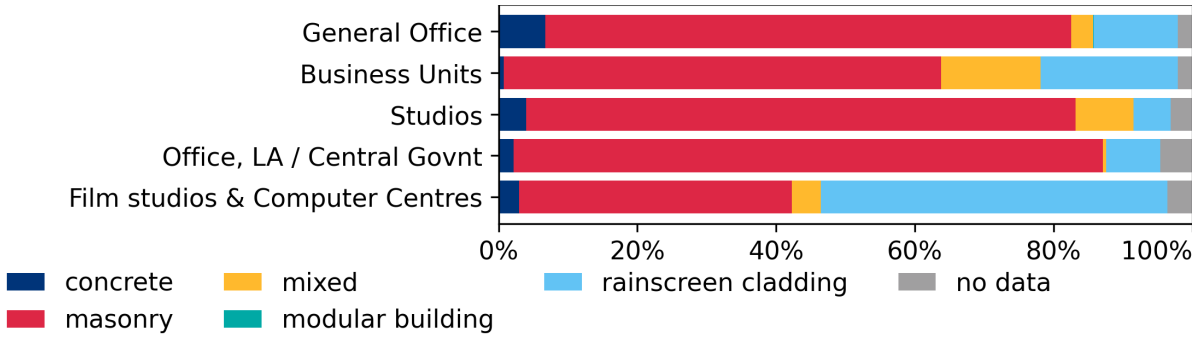


Figure 3.10-17: Distribution of total wall area by NGD material and activity group

Table 3.10-1: Summary statistics for Office by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
General Office	453,241	157,505	107.19	238	96.3	93.2
Business Units	11,004	2,889	0.98	89	2.3	0.9
Studios	2,756	1,399	0.82	301	0.6	0.7
Office, LA / Central Govnt	2,546	1,980	3.48	1,373	0.5	3.0
Film studios & Computer Centres	908	573	2.51	2,800	0.2	2.2

Table 3.10-2: Summary energy statistics for Office by activity group

Activity group	median total EUI (kWh/m^2/year)	total GWh	% by total energy
General Office	103	8,354.46	78.4
Business Units	64	57.09	0.5
Studios	47	18.65	0.2
Office, LA / Central Govnt	126	398.73	3.7
Film studios & Computer Centres	131	1,826.57	17.1

3.11 Shop

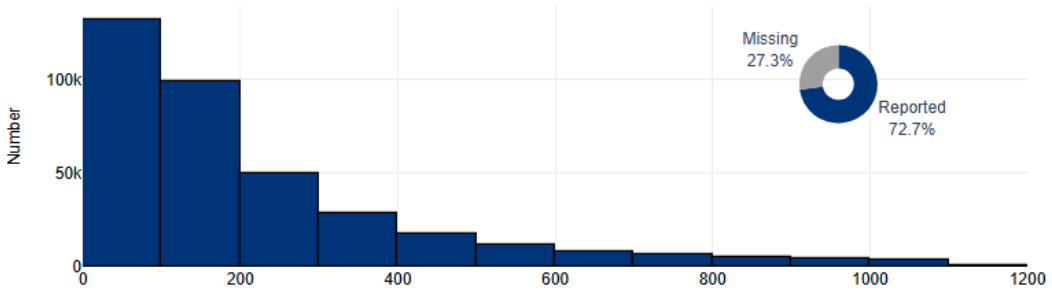
Overview

In the Shop activity class, the analysis covers 561,380 premises. The average Energy Use Intensity (EUI) is 327 kWh/m²/annum. The dominant building age group is pre-1919 (27%), and the predominant heating fuel is Mains Gas (32%).

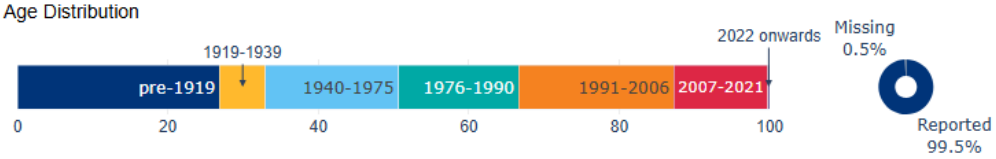
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Shops, Showrooms, Banks etc	507.9	82.64
Hair/Beauty Salon etc	25.6	1.84
Supermarket, Retail Warehouses & Other large shops	21.0	51.17
Betting Shops & Amusement Arcades	5.7	1.02
Launderette	1.3	0.11

Energy Use Intensity (kWh/m²/annum)

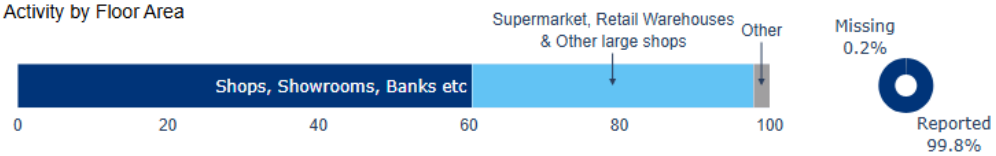


Age Distribution

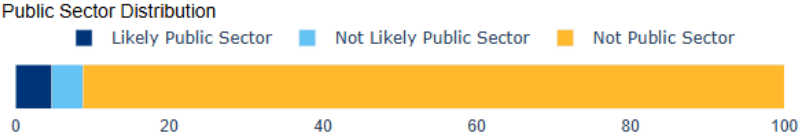


Heating Fuel Distribution (reported only; 35.3% missing)

Activity by Floor Area



Public Sector Distribution



3.11.1 Overview

The 'Shop' class has a total of 561,380 premises and 136.78 million m² of floorspace. Shop is the largest class in terms of the number of premises with 25% of all non-domestic premises and it is the third largest class in terms of floorspace with 15% of all non-domestic floorspace. This class contains 37 activities, which have been grouped into five activity groups. The largest activity by count is 'Shop' with 457,139 premises. The largest by total floorspace is 'Shop' with 59.98 million m² of floorspace. In total NBD reports 453,429 SCUs (which roughly equate to buildings) for 'Shop'.

For 'Shop' as a whole, ND-NEED (2023) reports 0.50 million buildings (109% of NBD SCUs) and 98.92 million m² of floorspace (72% of NBD). BEES (2014) reported 487,400 premises (87% of NBD premises) and 113 million m² of floorspace (83% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.11-1 below shows all activities in the 'Shop' class aggregated into five activity groups. 'Shops, Showrooms, Banks etc' has the largest number of premises but these have a relatively small median floorspace (85 m²), making it the first largest activity group in terms of floorspace within 'Shop'. The activity group with the largest total floorspace is 'Shops, Showrooms, Banks etc' where the median floor area is 85 m² and the total floor area is 82.64 million m². This activity group also represents the largest share of matched total energy demand.

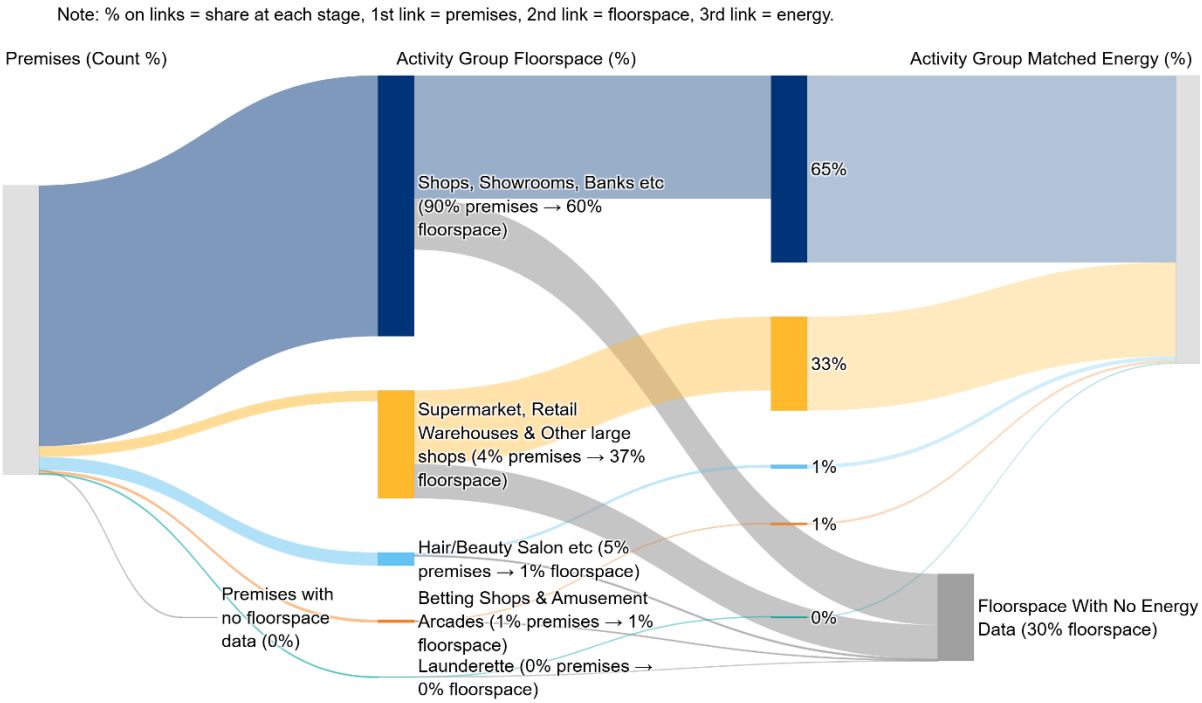


Figure 3.11-1: Share of activity group by number of premises, floorspace and total energy demand

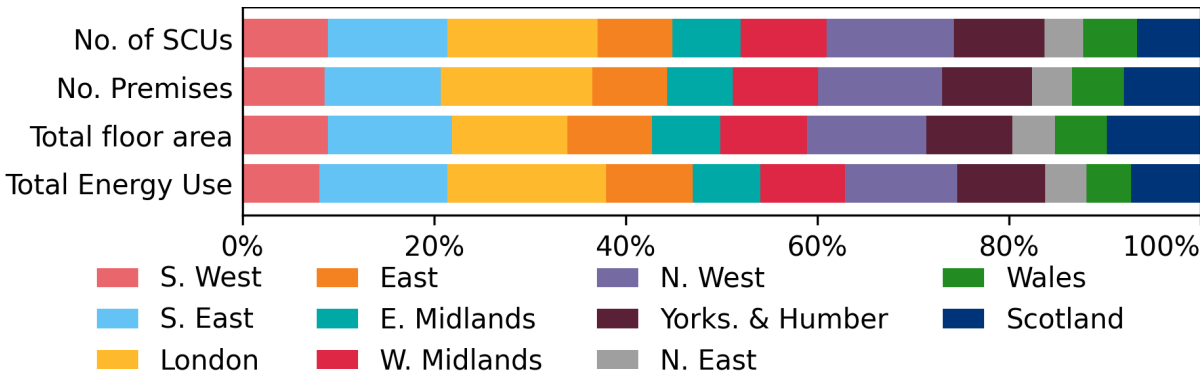


Figure 3.11-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.11-2), for England these are the comparable with the NUTS regions. For 'Shop' the London has the largest percentage of premises (16%) and SCUs (16%). The largest percentage of floorspace is in South East (13%). For the regional share of total energy demand, London has the largest percentage (17%).

3.11.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Supermarket, Retail Warehouses & Other large shops' (1,559 m²) and the smallest is 'Hair/Beauty Salon etc' (54 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.11-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

Figure 3.11-3: Distribution of premises total floor area by activity group

3.11.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 72% of ‘Shop’ premises have at least one matched electricity meter and 30% have at least one matched gas meter. The total matched energy use for 'Shop' is 18,692 GWh per year, which consists of 12,407 GWh for electricity and 6,285 GWh for gas per year. See Figure 3.11-4 for a breakdown of energy use per activity group.

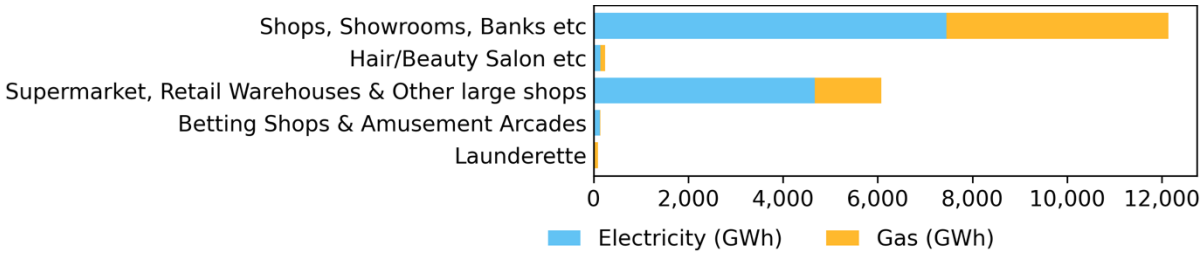


Figure 3.11-4: Total energy demand (GWh) for 'Shop' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Shop’ is Profile Class 3, which represents 57% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

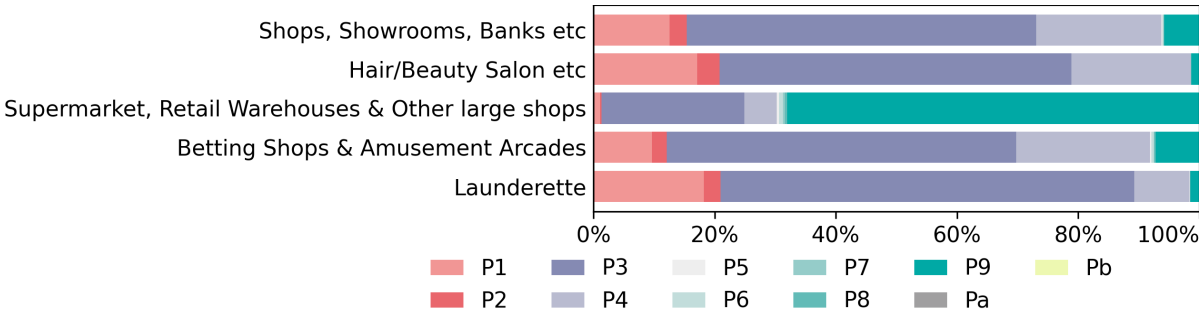


Figure 3.11-5: Percentage of meter profile classes for electricity meters by activity group

Around 4% of all 'Shop' premises (6% of 'Shop' floorspace) are located in postcodes classified as off the gas grid. Figure 3.11-6 below shows that 'Supermarket, Retail Warehouses & Other large shops' is the activity group that has the largest share (6% by floorspace) of off the gas grid postcodes and 'Launderette' have the lowest share (1%). Large retail outlets like supermarkets are slightly more represented in off-grid areas, reflecting regional retail hubs, whereas launderettes remain almost exclusively dependent on urban gas-connected infrastructure. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

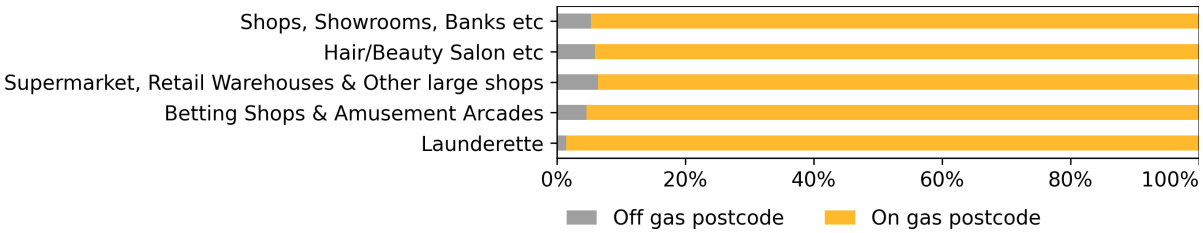
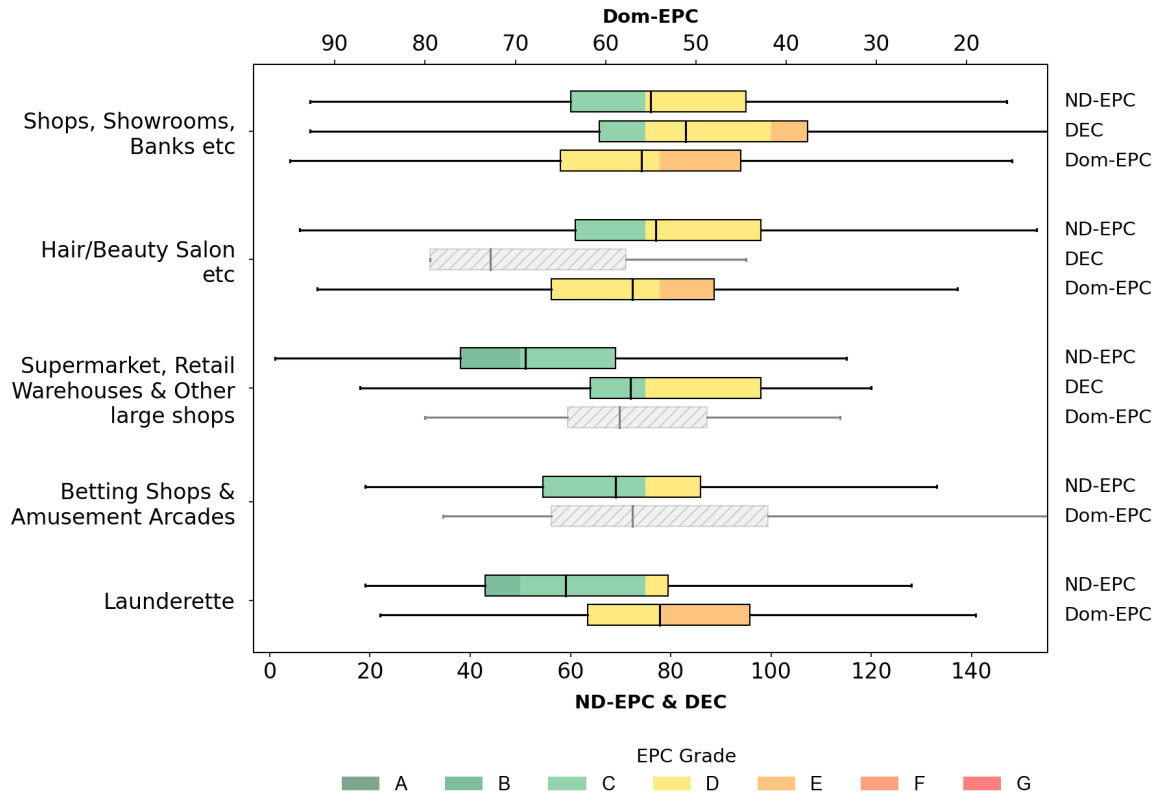


Figure 3.11-6: Percentage of floorspace on or off gas grid by activity group

3.11.4 Energy certification

Around 43% of all 'Shop' premises have an energy certificate with around 43% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Shop' was November 2018.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.11-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level ‘Shops, Showrooms, Banks etc’ and ‘Hair/Beauty Salon etc’ have the lowest performing median non-domestic EPCs with a median asset rating of 76 and 77 respectively (D) while ‘Supermarket, Retail Warehouses & Other large shops’ have the best performing median asset rating of 51 (C).

3.11.5 Energy use detailed insights

Within 'Shop', the activity group with the highest median energy use intensity (EUI) for electricity is 'Betting Shops & Amusement Arcades' (180 kWh/m² per year) and for gas it is 'Launderette' (896 kWh/m² per year). For total EUI (gas and electricity combined) 'Launderette' have the highest value (762 kWh/m² per year), see Figure 3.11-8 below (chart values truncated to 76th percentile of highest activity group).

Figure 3.11-8: Distribution of total Energy Use Intensity (EUI) by activity group

In Figure 3.11-9 below, ‘No EC’ indicates that no energy certificate (EPC/DEC) has been matched to premises. What remains shows that much of the floorspace is heated by

'Electricity', with the exception being 'Supermarket, Retail Warehouses & Other large shops' which are predominantly heated using gas, possibly correlating with the higher ceiling heights and subsequent building volumes associated with these types of Shops.

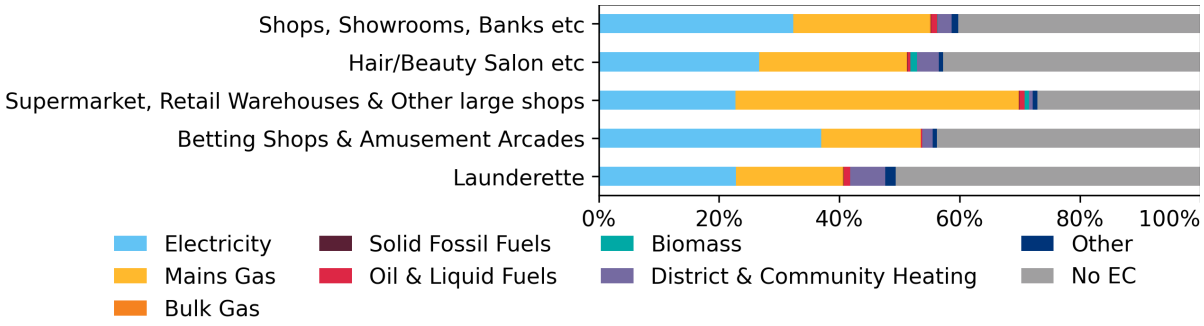


Figure 3.11-9: Heating fuels as percentage of total floorspace by activity group

Again, where an energy certificate has been matched to premises, Figure 3.10-10 below, shows that 'Film studios & Computer Centres' have substantial 'Air Conditioning', as they require a lot of cooling to maintain internal environments conducive to their activities. This group also has a small percentage of floorspace treated by 'Other' systems. The 'General Office' group treats almost half its floorspace using 'Air conditioning', but the remaining groups mostly use 'Heating and Ventilation'.

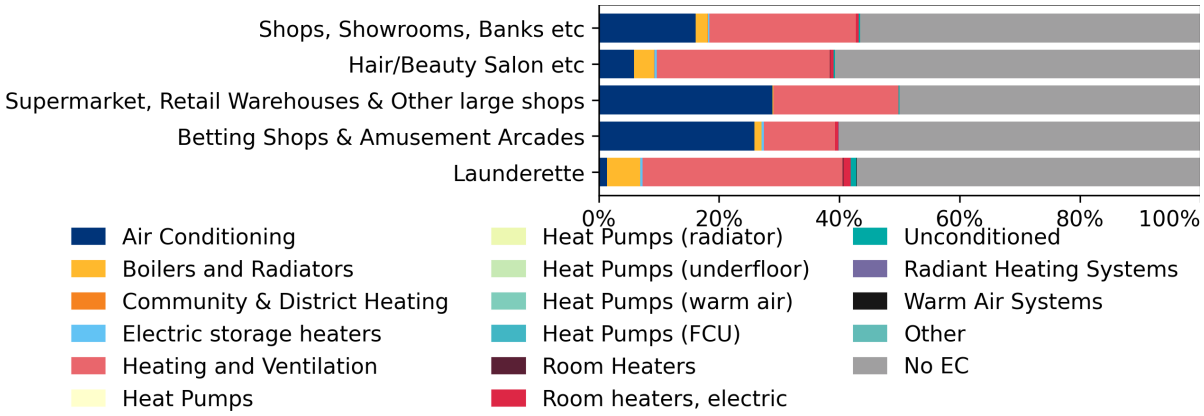


Figure 3.11-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Supermarket, Retail Warehouses & Other large shops' (66%) whilst the lowest percentage is for 'Launderette' (1%), as shown in Figure 3.11-11 below.

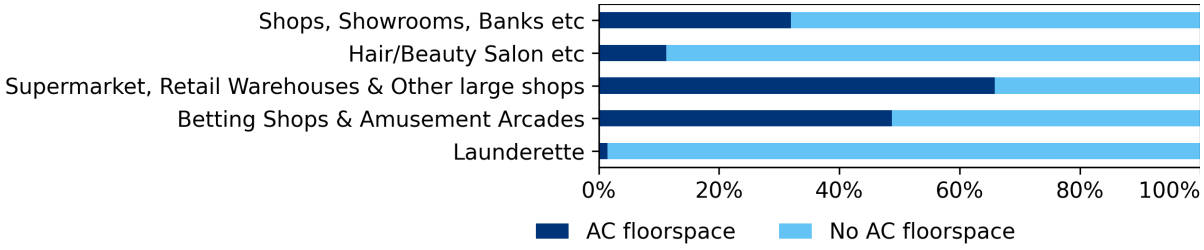


Figure 3.11-11: Air-conditioned floorspace by activity group

3.11.6 Heritage and Rural Urban

63% of all 'Shop' premises are in an area with no Conservation area or Listed building restrictions whilst 37% are either in a Conservation area, or are a Listed building or both. 'Hair/Beauty Salon etc' has the largest amount of their floorspace in heritage restricted areas (38%). More details can be seen in Figure 3.11-12 below.

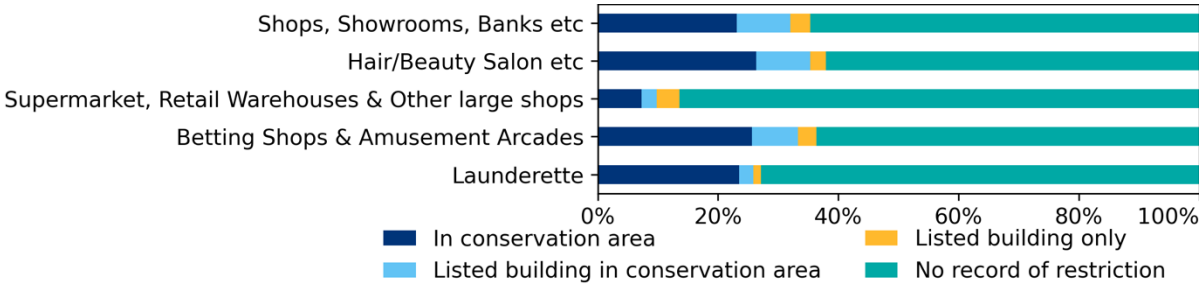


Figure 3.11-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 89% of premises and 92% of floorspace in the 'Shop' activity class may be found in an urban area. The largest activity group is 'Supermarket, Retail Warehouses & Other large shops' where 96% of its floorspace is in an urban area, whilst 'Hair/Beauty Salon etc' has the largest percentage of its floorspace in rural areas (14%), as shown in Figure 3.11-13 below.

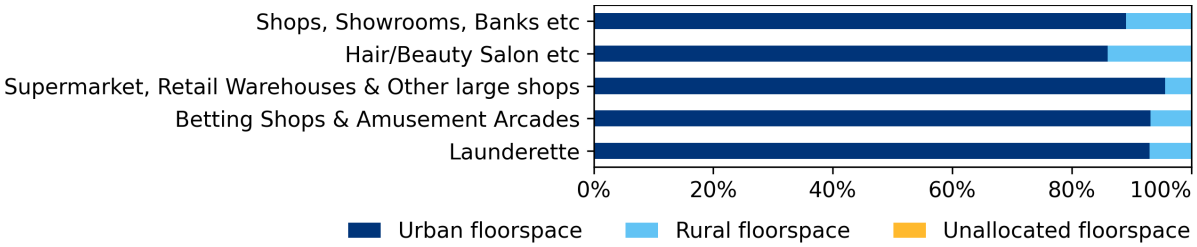


Figure 3.11-13: Floorspace by ONS Urban / rural classification by activity group

3.11.7 Mixed-use buildings

Within the 'Shop' class, 38% of SCUs are occupied by a single 'Shop' premises, whilst 12% share the SCU with other non-domestic premises and 49% share the SCU with domestic premises.

Figure 3.11-14 below shows 'Supermarket, Retail Warehouses & Other large shops' is the activity group with the highest percentage of cases where they are the sole occupier of the building (70%) whilst 'Supermarket, Retail Warehouses & Other large shops' has the highest percentage of SCUs shared with other non-domestic premises (26%) and 'Launderette' has the highest percentage of SCUs shared with domestic residential uses (72%).

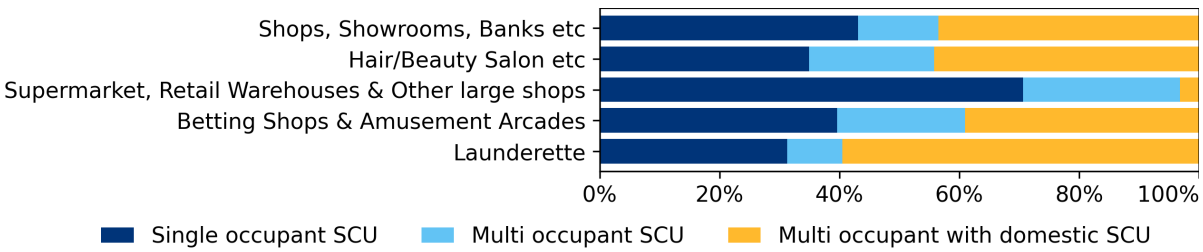


Figure 3.11-14: Percentage of premises by mixed-use SCU classification by activity group

3.11.8 Public sector

Around 5% of Shop premises and 5% of Shop floorspace is likely to be Public Sector. Figure 3.11-15 shows the break-down of these by activity group where 'Shops, Showrooms, Banks etc' is the activity group with the highest percentage of premises likely to be Public Sector (6%) and this represents 7% of their activity group floorspace. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

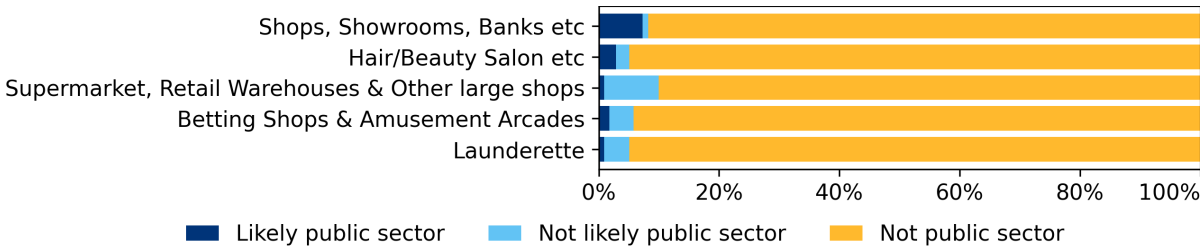


Figure 3.11-15: Percentage of floor area assigned 'Public sector' by activity group

3.11.9 Age and materials

52% of 'Shop' premises and 27% of Shop floorspace is classified in the 'pre-1919' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '2007-2021' for premises (6%), which represents 12% of floorspace.

The details at the activity group level are shown in Figure 3.11-16 below, where ‘Supermarket, Retail Warehouses & Other large shops’ stand out as having the largest percentage of premises located in buildings built after 1990.

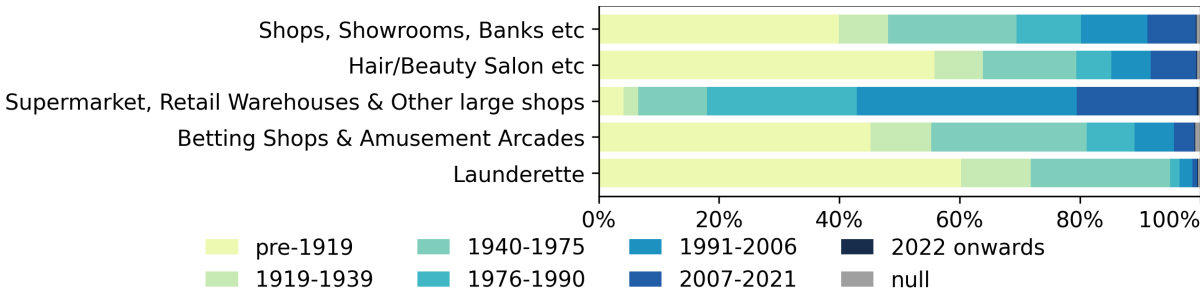


Figure 3.11-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Shop' activity class (measured by wall area). The 'Shops, Showrooms, Banks etc' activity group has the largest wall area (38.9 million m²) when measured from the 3D geometry in the database, and 87% of this is masonry which represents 67% of the total wall area in 'Shop' (see Figure 3.11-17).

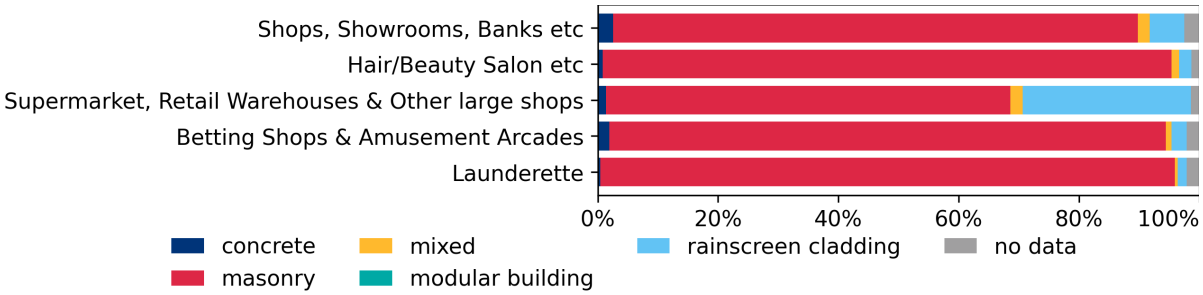


Figure 3.11-17: Distribution of total wall area by NGD material and activity group

Table 3.11-1: Summary statistics for Shop by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Shops, Showrooms, Banks etc	507,867	412,763	82.64	163	90.5	60.4
Hair/Beauty Salon etc	25,555	24,028	1.84	72	4.6	1.3
Supermarket, Retail Warehouses & Other large shops	21,004	17,651	51.17	2,442	3.7	37.4
Betting Shops & Amusement Arcades	5,656	5,492	1.02	181	1.0	0.7
Launderette	1,298	1,281	0.11	86	0.2	0.1

Table 3.11-2: Summary energy statistics for Shop by activity group

Activity group	median total EUI (kWh/m²/year)	total GWh	% by total energy
Shops, Showrooms, Banks etc	143	12,137.29	64.9
Hair/Beauty Salon etc	147	246.27	1.3
Supermarket, Retail Warehouses & Other large shops	111	6,075.94	32.5
Betting Shops & Amusement Arcades	191	145.85	0.8
Launderette	762	86.45	0.5

3.12 Sport

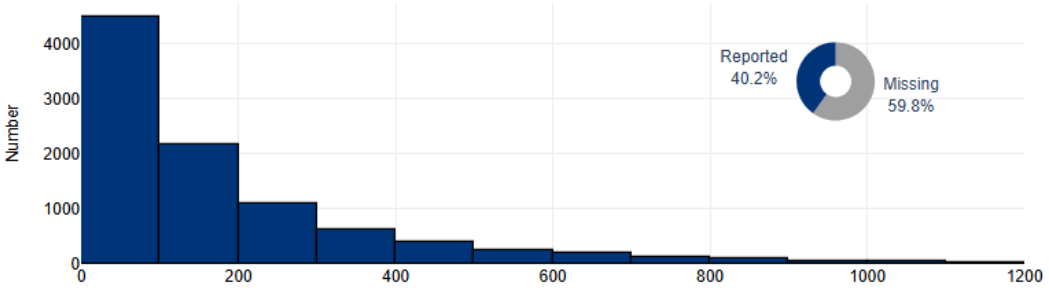
Overview

In the Sport activity class, the analysis covers 26,630 premises. The average Energy Use Intensity (EUI) is 1521 kWh/m²/annum. The dominant building age group is 1976-1990 (21%), and the predominant heating fuel is Mains Gas (38%).

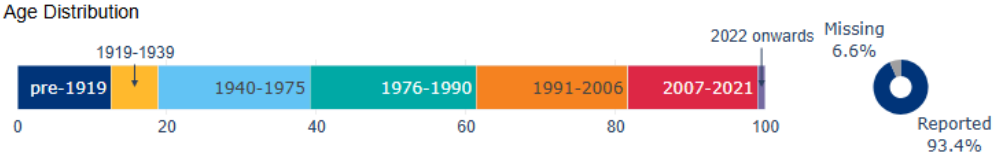
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Gym, Leisure/Fitness centre etc	9.7	9.39
Sports grounds	8.2	3.67
Sports clubs (tennis, squash etc)	5.8	1.2
Golf course/Club	2.5	1.58
Race courses & Motorsport	0.3	0.17
Sport, other	0.1	0.06

Energy Use Intensity (kWh/m²/annum)

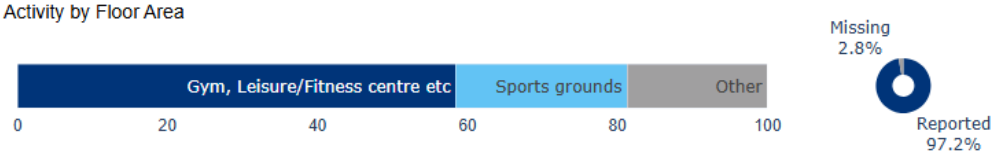


Age Distribution

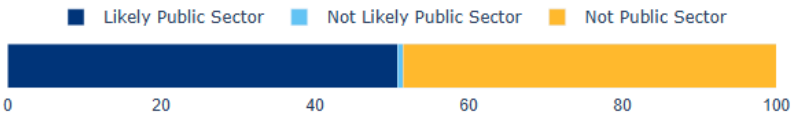


Heating Fuel Distribution (reported only; 52.8% missing)

Activity by Floor Area



Public Sector Distribution



3.12.1 Overview

The 'Sport' class has a total of 26,630 premises and 16.07 million m² of floorspace. This means Sport is the eleventh largest class in terms of premises counts with 1% of all non-domestic premises and it is tenth largest in terms of floorspace with 2% of all non-domestic floorspace. This class contains 38 activities, which have been grouped into six activity groups. The largest activity by count is 'Gymnasium, fitness centre' with 5,257 premises. The largest by total floorspace is 'Leisure centre (with swimming) (Local Authority)' with 3.76 million m² of floorspace. In total NBD reports 20,579 SCUs (which roughly equate to buildings) for 'Sport'.

It is not possible to make comparisons with ND-NEED (2023) or BEES (2014) since neither of these sources report Sport as a grouping of activities. (Sports Centres and Sports grounds are instead included as part of the ND-NEED group ‘Arts, Community and Leisure’).

Figure 3.12-1 below shows all activities in the 'Sport' class aggregated into six activity groups. 'Gym, Leisure/Fitness centre etc' has the largest number of premises within 'Sport'. The activity group with the largest total floorspace is also 'Gym, Leisure/Fitness centre etc' where the median floor area is 225 m² and the total floor area is 9.39 million m². This activity grouping also has the largest share of the matched total energy demand.

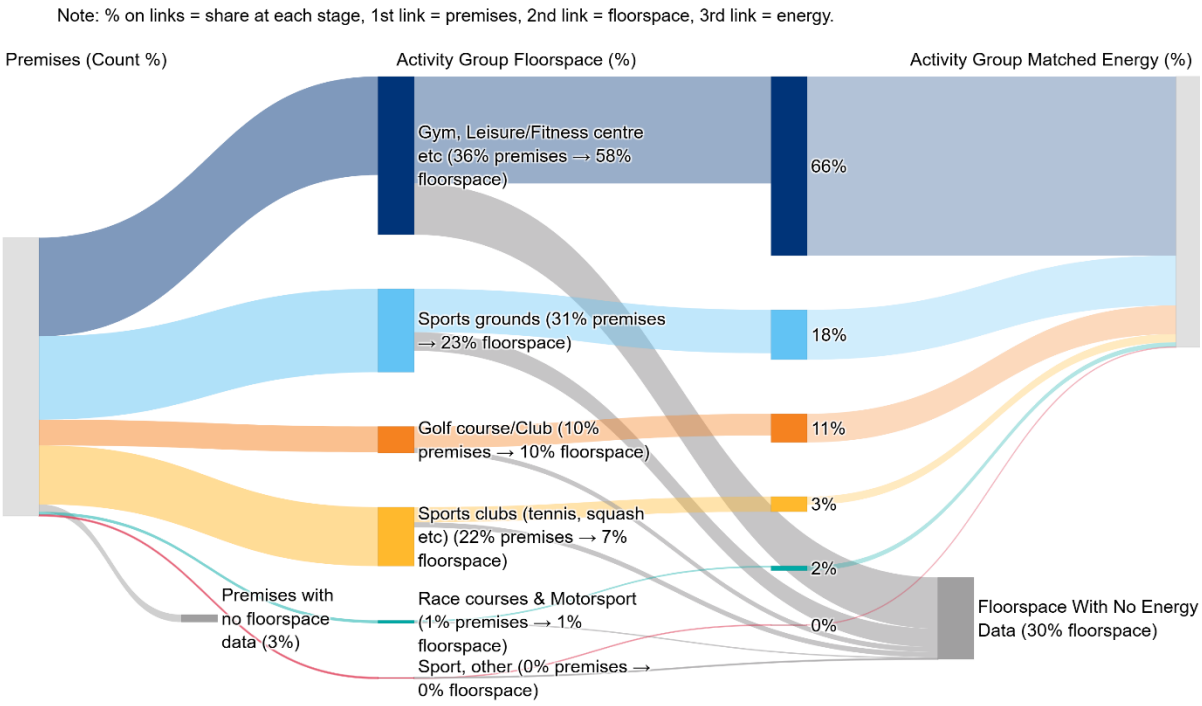


Figure 3.12-1: Share of activity group by number of premises, floorspace and total energy demand

Figure 3.12-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.12-2), for England these are comparable with the NUTS regions. For 'Sport' the South East has the largest percentage of premises (14%) and SCUs (14%). The largest percentage of floorspace is in Scotland (19%). For the regional share of total energy demand, South East has the largest percentage (16%).

3.12.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Golf course/Club' (552 m²) and the smallest is 'Sports clubs (tennis, squash etc)' (57 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.12-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

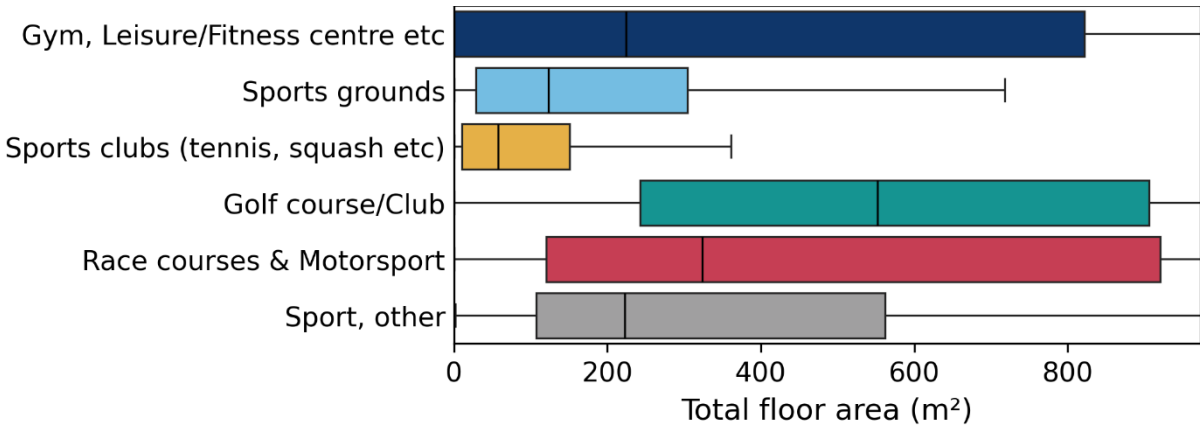


Figure 3.12-3: Distribution of premises total floor area by activity group

3.12.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 43% of ‘Sport' premises have at least one matched electricity meter and 22% have at least one matched gas meter. The total matched energy use for 'Sport' is 3,215 GWh per year, which consists of 1,309 GWh for electricity and 1,906 GWh for gas per year. See Figure 3.12-4 for a breakdown of energy use per activity group. The value for ‘Sport, other’ is too small to be visible on the chart at the axis scale.

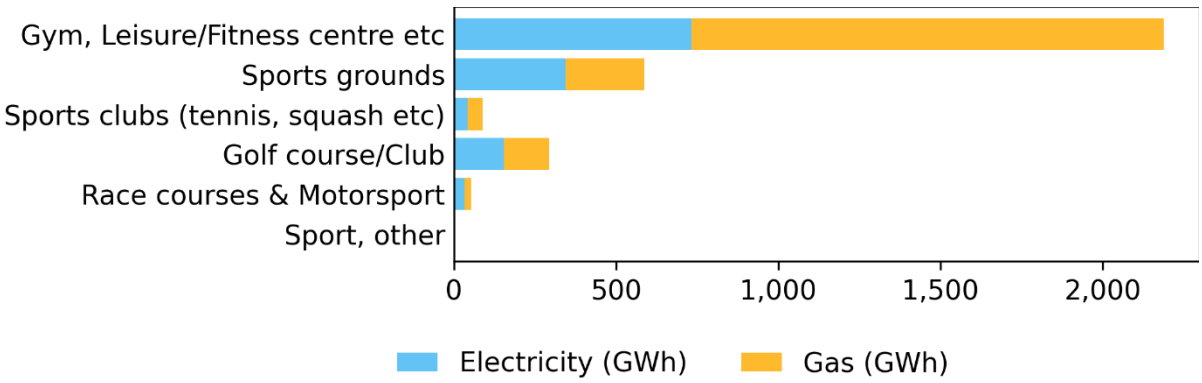


Figure 3.12-4: Total energy demand (GWh) for 'Sport' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in 'Sport' is Profile Class 3, which represents 48% of all electricity meters in **this** activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

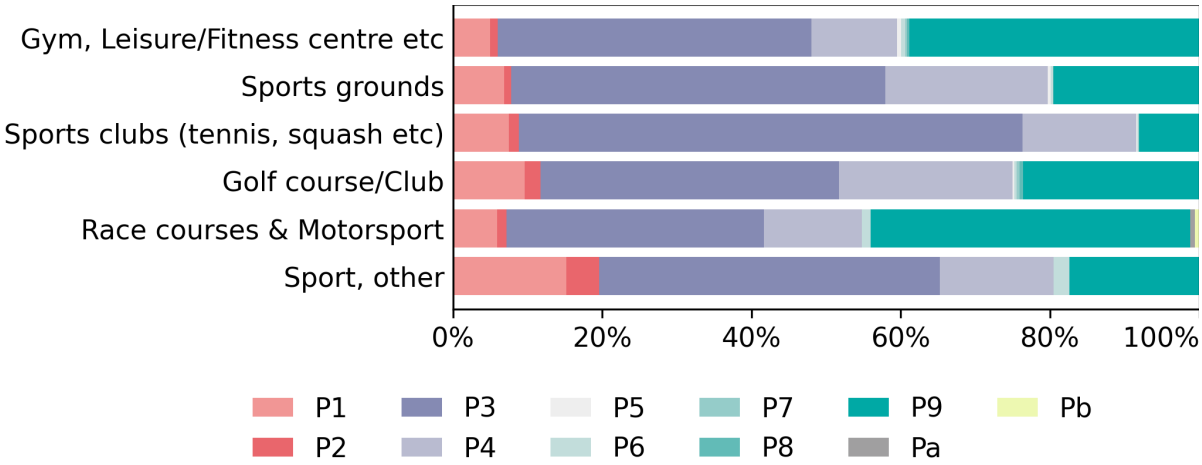


Figure 3.12-5: Percentage of meter profile classes for electricity meters by activity group

Around 11% of all 'Sport' premises (7% of 'Sport' floorspace) are located in postcodes classified as off the gas grid. Figure 3.12-6 below shows that 'Race courses & Motorsport' is the activity group that has the largest share (21% by floorspace) of off the gas grid postcodes and 'Gym, Leisure/Fitness centre etc' have the lowest share (6%). 'Race courses & Motorsport' venues are more likely to be in remote, off-grid areas, while gyms and fitness centres are concentrated in urban, gas-connected locations. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

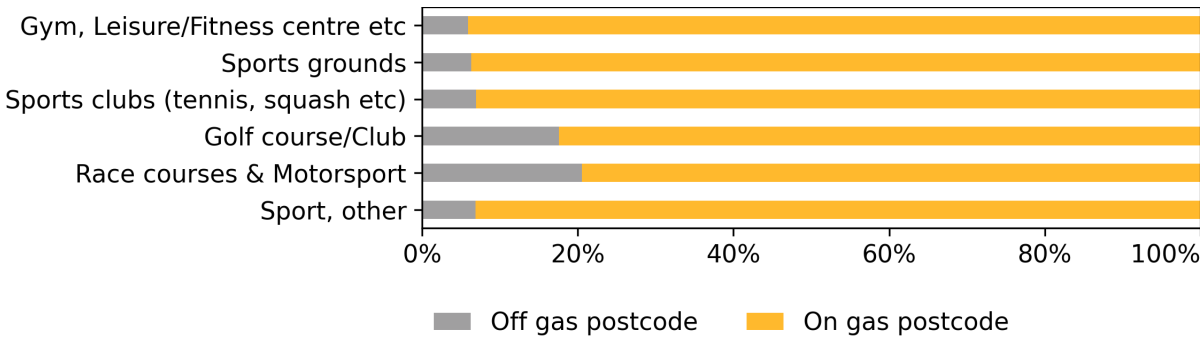
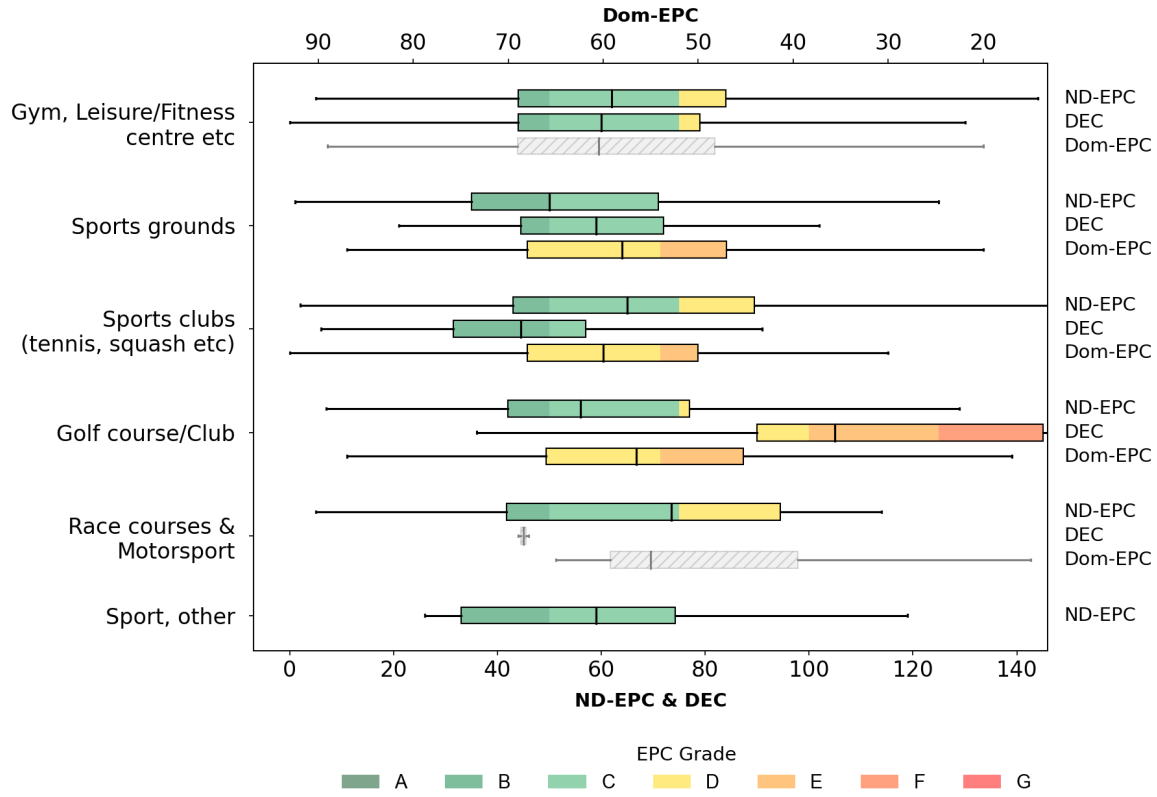


Figure 3.12-6: Percentage of floorspace on or off gas grid by activity group

3.12.4 Energy certification

Around 18% of all 'Sport' premises have an energy certificate with around 13% of these being non-domestic EPCs and 4% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Sport' was August 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.12-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level shown in Figure 3.12-7 ‘Gym, Leisure/Fitness centre etc’ is the only activity grouping with a reasonable number of DECs (11% match rate) and these show a median current operational rating of 60 (C). They also have a 23% match rate to non-domestic EPCs with a median asset rating of 62 (C). The best performing median EPC asset rating is for ‘Golf course/Club’ with 56 (C) although conversely, they have the lowest median DEC current operational rating of 105 (‘E’).

3.12.5 Energy use detailed insights

Within 'Sport', the activity group with the highest median energy use intensity (EUI) for electricity is 'Race courses & Motorsport' (194 kWh/m² per year) and for gas it is 'Golf course/Club' (162 kWh/m² per year). For total EUI (gas and electricity combined) 'Race courses & Motorsport' have the highest value (280 kWh/m² per year), see Figure 3.12-8 below (chart values truncated to 76th percentile of highest activity group).

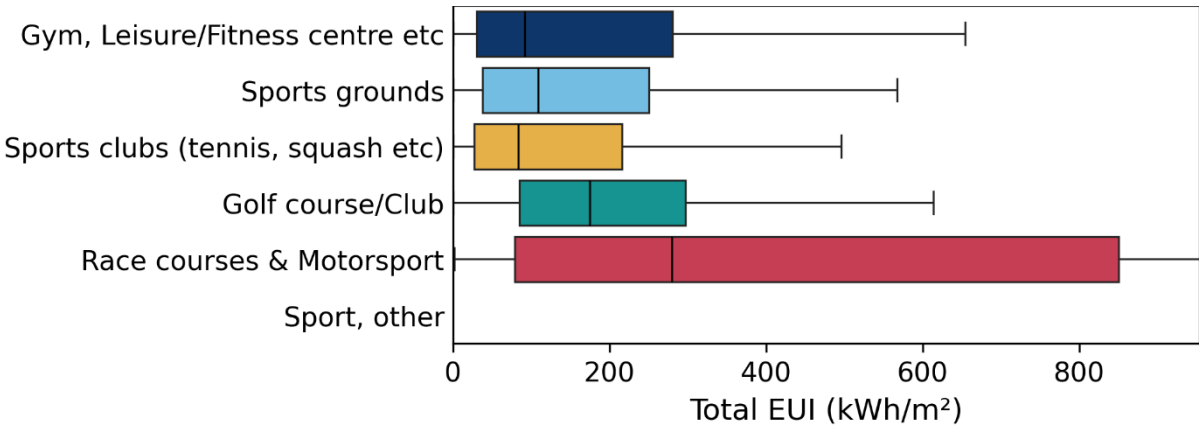


Figure 3.12-8: Distribution of total Energy Use Intensity (EUI) by activity group

Figure 3.12-9 shows that ‘Mains Gas’ is the principal energy source used in Sport premises, where an energy certificate has been matched, especially in the ‘Gym, Leisure/Fitness centre etc’ group. ‘Electricity’ is the second most common energy source in all activity groups, except ‘Sport, other’, which is the only group to have a significant percentage of ‘Other’ fuel use. ‘Sport, other’ is the only group not to contain at least some ‘District & Community Heating’, but across the Sport class use of this fuel category is quite limited.

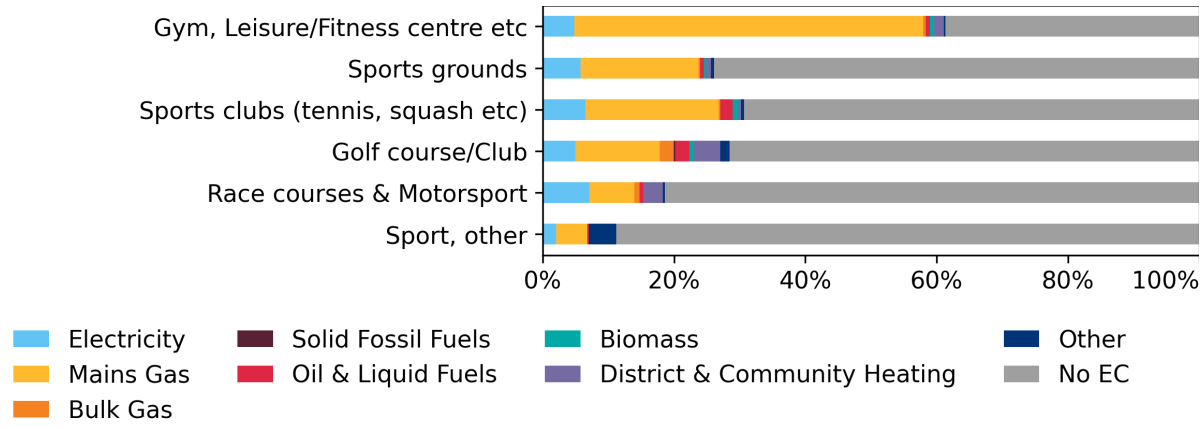


Figure 3.12-9: Heating fuels as percentage of total floorspace by activity group

Matched energy certificates indicate in 3.12-10, below, that ‘Heating and Ventilation’ equipment treats the largest percentage of floorspace in each activity group, except ‘Race courses & Motorsport’, which has a higher percentage for ‘Air Conditioning’. ‘Boilers and Radiators’ are moderately prominent in ‘Race courses & Motorsport’ and ‘Golf course/Club’, whilst ‘Sport, other’ has areas that are left unconditioned.

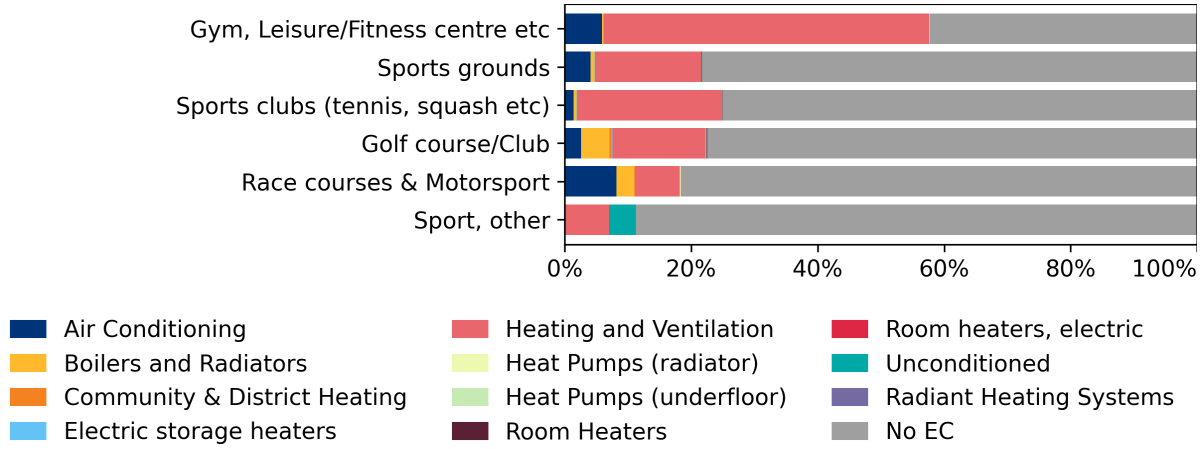


Figure 3.12-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Gym, Leisure/Fitness centre etc' (46%) whilst the lowest percentage is for 'Sport, other' (1%), as shown in Figure 3.12-11 below.

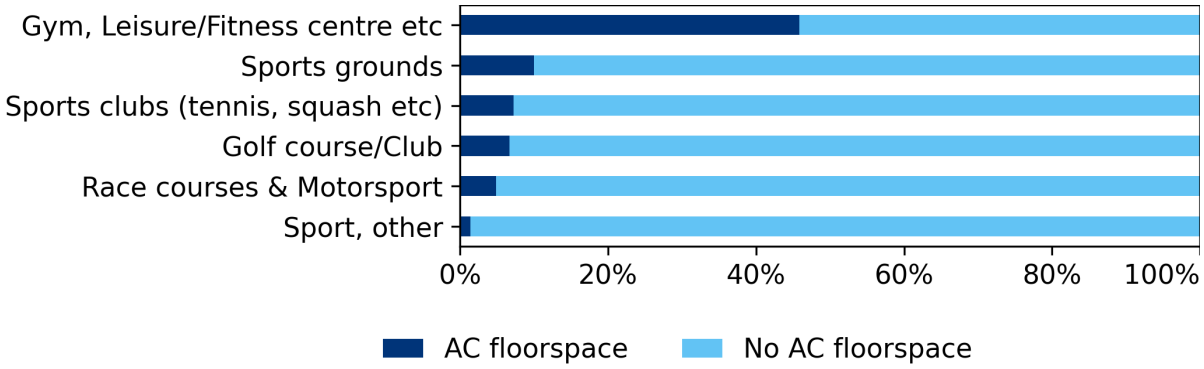


Figure 3.12-11: Air-conditioned floorspace by activity group

3.12.6 Heritage and Rural Urban

81% of all 'Sport' premises are in an area with no Conservation area or Listed building restrictions whilst 19% are either in a Conservation area, or are a Listed building or both. 'Sports clubs (tennis, squash etc)' has the largest amount of their floorspace in heritage restricted areas (31%). More details can be seen in Figure 3.12-12 below.

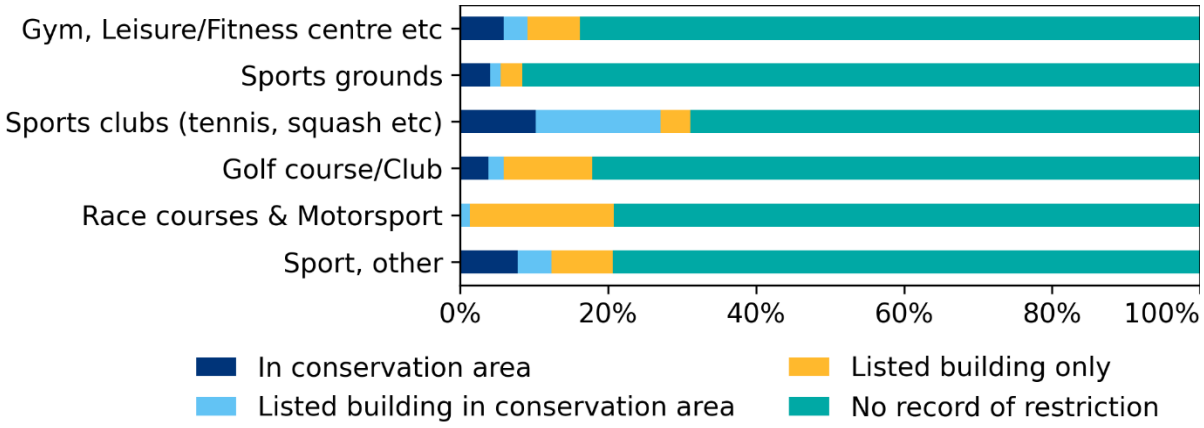


Figure 3.12-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 69% of premises and 85% of floorspace in the 'Sport' activity class may be found in an urban area. The largest activity group is 'Gym, Leisure/Fitness centre etc' where 91% of its floorspace is in an urban area, whilst 'Golf course/Club' has the largest percentage of its floorspace in rural areas (47%), as shown in Figure 3.12-13 below.

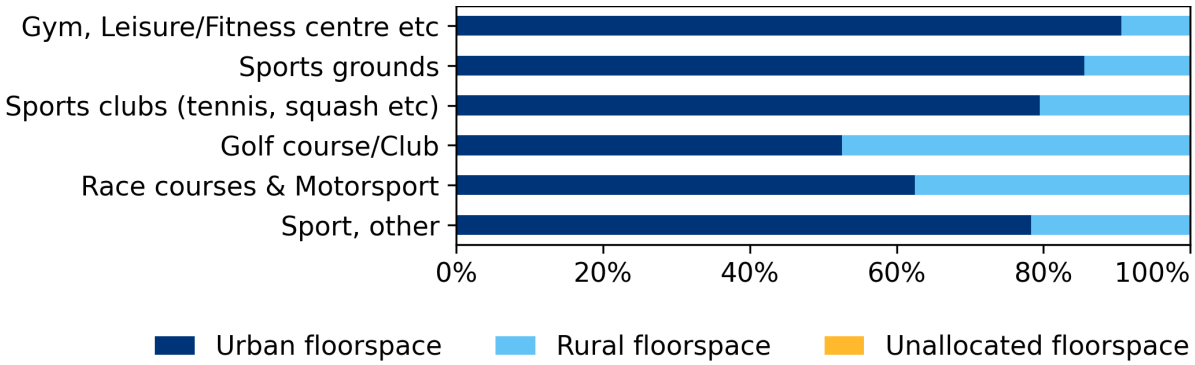


Figure 3.12-13: Floorspace by ONS Urban / rural classification by activity group

3.12.7 Mixed-use buildings

Within the 'Sport' class, 63% of SCUs are occupied by a single 'Sport' premises, whilst 26% share the SCU with other non-domestic premises and 11% share the SCU with domestic premises.

Figure 3.12-14 below shows 'Sports clubs (tennis, squash etc)' is the activity group with the highest percentage of cases where they are the sole occupier of the building (80%) whilst 'Sport, other' has the highest percentage of SCUs shared with other non-domestic premises (51%) and 'Golf course/Club' has the highest percentage of SCUs shared with domestic residential uses (31%).

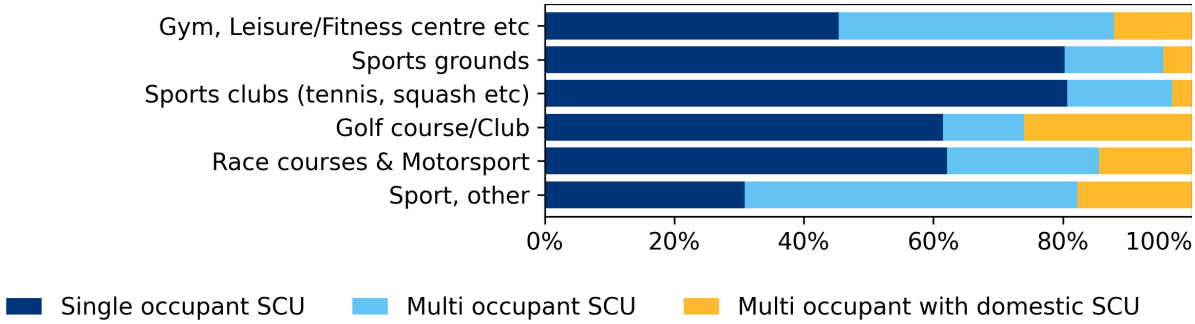


Figure 3.12-14: Percentage of premises by mixed-use SCU classification by activity group

3.12.8 Public sector

Around 20% of Sport premises and 51% of Sport floorspace is likely to be Public Sector. The most common examples of these are sports or leisure facilities that are owned or managed by a local authority. This is shown clearly in Figure 3.12-15 where 'Gym, Leisure/Fitness centre etc' is the activity group with the highest percentage of premises likely to be Public Sector (27%) and this represents 73% of their activity group floorspace. These cases will largely be premises owned or managed by local government authorities around the nation.

'Sport, other' is the activity group with the lowest percentage of premises (5%) and floorspace (1%) likely to be Public Sector. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

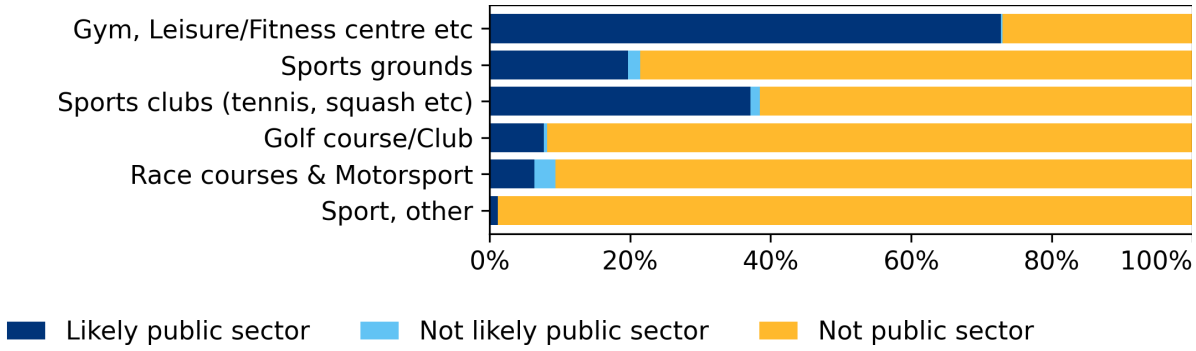


Figure 3.12-15: Percentage of floor area assigned 'Public sector' by activity group

3.12.9 Age and materials

21% of 'Sport' premises and 19% of Sport floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (7%), which represents 6% of floorspace.

The details at the activity group level are shown in Figure 3.12-16 below.

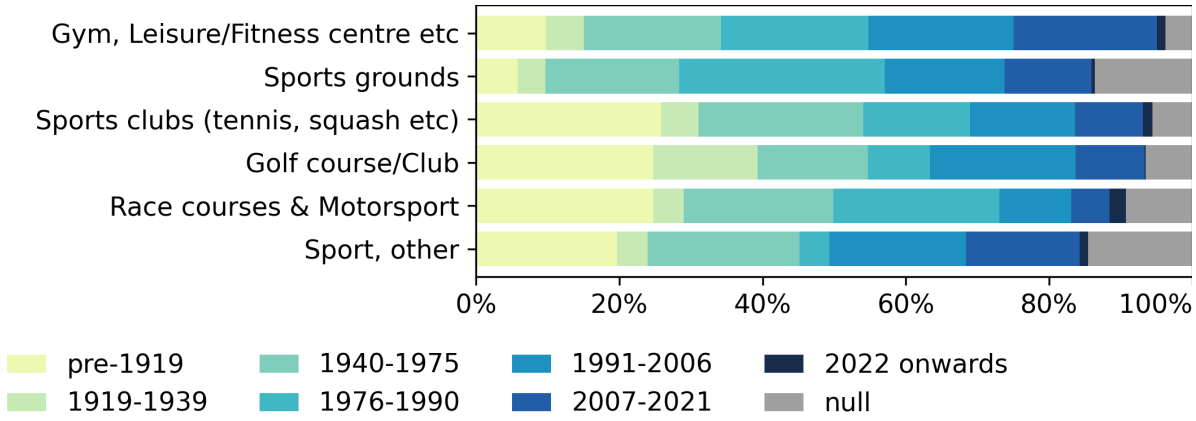


Figure 3.12-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Sport' activity class (measured by wall area). The 'Gym, Leisure/Fitness centre etc' activity group has the largest wall area (3.5 million m²) when measured from the 3D geometry in the database, and 77% of this is masonry which represents 41% of the total wall area in 'Sport' (see Figure 3.12-17).

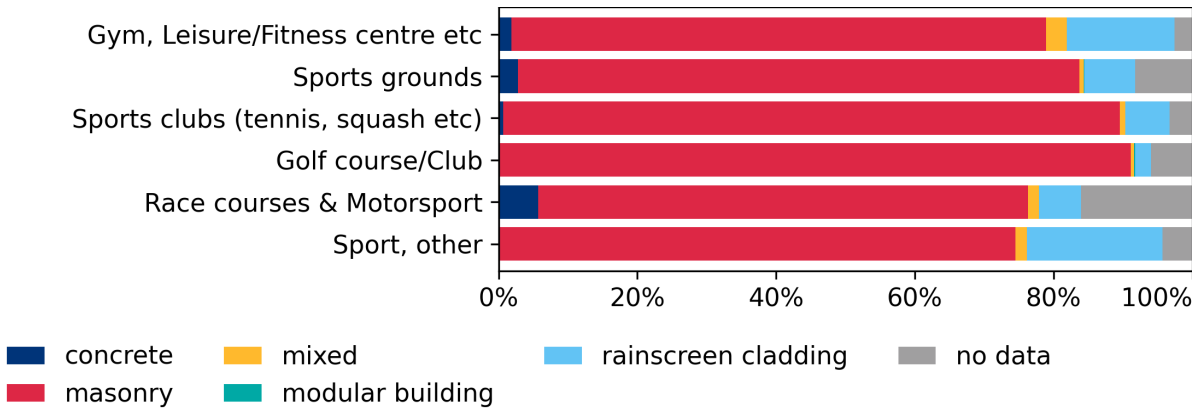


Figure 3.12-17: Distribution of total wall area by NGD material and activity group

Table 3.12-1: Summary statistics for Sport by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Gym, Leisure/Fitness centre etc	9,690	8,561	9.38	985	36.4	58.4
Sports grounds	8,201	5,028	3.68	465	30.8	22.9
Sports clubs (tennis, squash etc)	5,795	4,073	1.20	210	21.8	7.4
Golf course/Club	2,539	2,135	1.58	641	9.5	9.8
Race courses & Motorsport	292	153	0.17	898	1.1	1.1
Sport, other	113	107	0.06	542	0.4	0.4

Table 3.12-2: Summary energy statistics for Sport by activity group

Activity group	median total EUI (kWh/m^2/year)	total GWh	% by total energy
Gym, Leisure/Fitness centre etc	92	2,188.31	68.1
Sports grounds	109	588.24	18.3
Sports clubs (tennis, squash etc)	83	89.71	2.8
Golf course/Club	175	294.25	9.2
Race courses & Motorsport	280	52.49	1.6
Sport, other	-	-	-

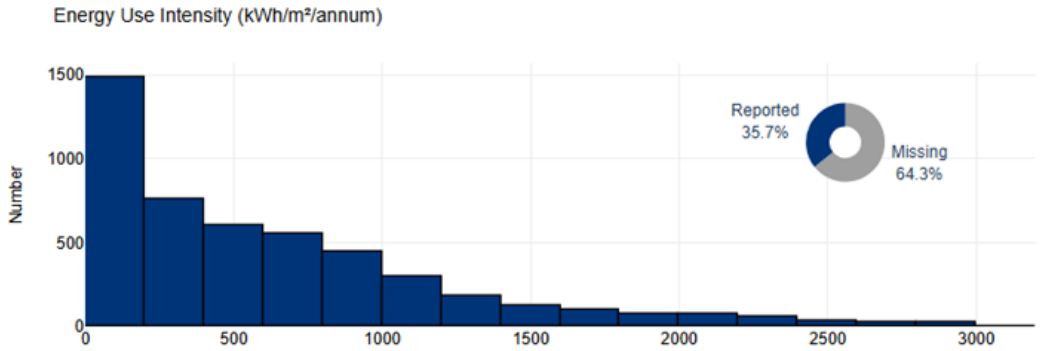
3.13 Transport

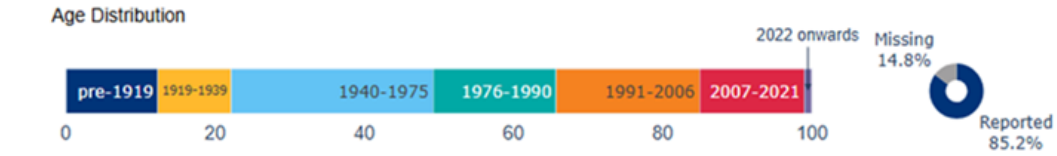
Overview

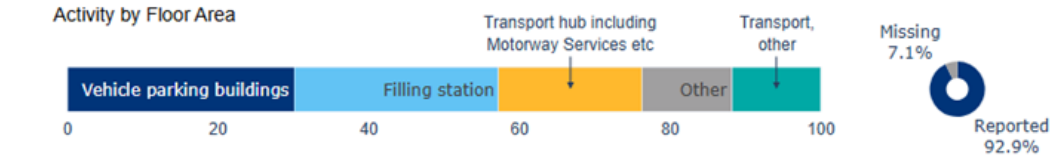
In the Transport activity class, the analysis covers 15,109 premises. The average Energy Use Intensity (EUI) is 1323 kWh/m²/annum. The dominant building age group is 1940-1975 (23%), and the predominant heating fuel is Electricity (14%).

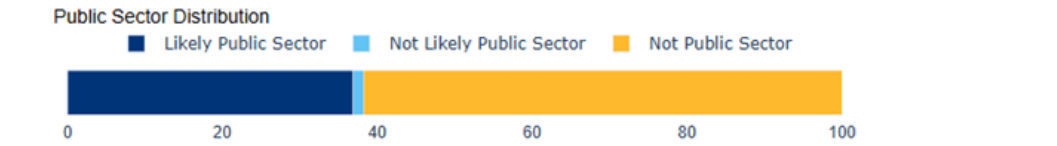
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Filling station	5.7	1.39
Car wash	3.2	0.14
Vehicle parking buildings	2.5	1.54
Transport hub including Motorway Services etc	2.7	0.97
Harbour etc	0.5	0.47
Transport, other	0.5	0.6









3.13.1 Overview

The 'Transport' class has a total of 15,109 premises and 5.11 million m² of floorspace This makes it the twelfth largest class in terms of the counts of premises with 1% of all non-domestic premises and thirteenth largest class in terms of floorspace with 1% of all non-domestic floorspace. This class contains 25 activities, which have been grouped into six activity groups. The largest activity by count is 'Petrol filling station' with 5,710 premises. The largest by total floorspace is 'Petrol filling station' with 1.39 million m² of floorspace. In total NBD reports 12,155 SCUs (which roughly equate to buildings) for 'Transport'.

There are no equivalent groupings in either ND-NEED (2023) or BEES (2014) for direct comparisons with this class of activity.

Figure 3.13-1 below shows all activities in the 'Transport' class aggregated into six activity groups. 'Filling station' has the largest number of premises but these have a relatively small median floorspace (156 m²), making it the fourth largest activity group in terms of floorspace within 'Transport'. The activity group with the largest total floorspace is 'Vehicle parking buildings' where the total floor area is 1.54 million m². ’Vehicle parking buildings’ also represents the largest share of matched total energy demand.

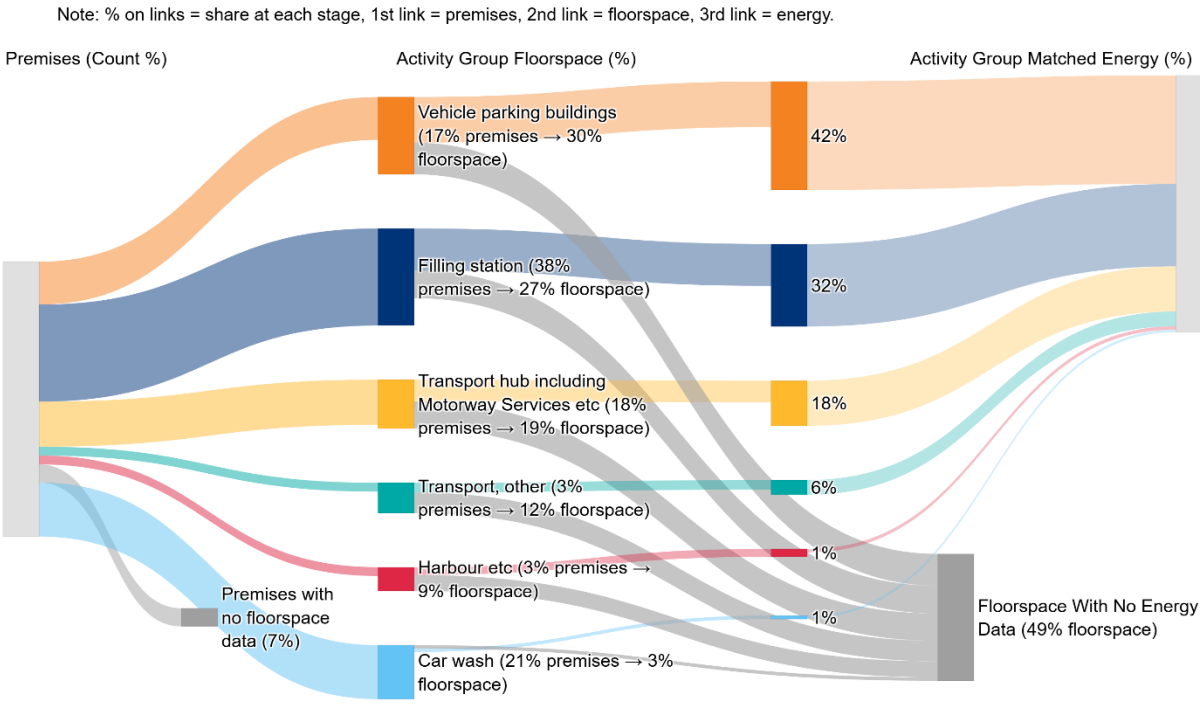


Figure 3.13-1: Share of activity group by number of premises, floorspace and total energy demand

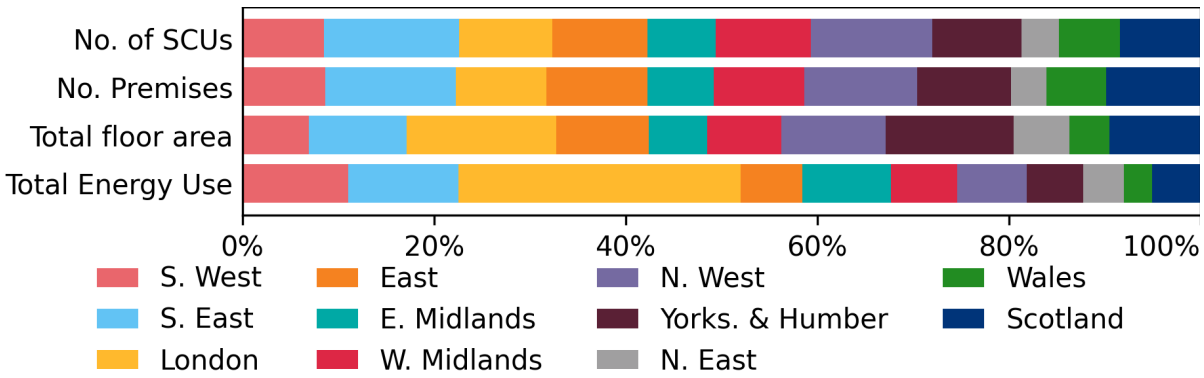


Figure 3.13-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.13-2), for England these are comparable with the NUTS regions. For 'Transport' the South East has the largest percentage of premises (14%) and SCUs (14%). The largest percentage of floorspace is in London (16%). For the regional share of total energy demand, London has the largest percentage (29%).

3.13.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Transport, other' (202 m²) and the smallest is 'Car wash' (< 1 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.13-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

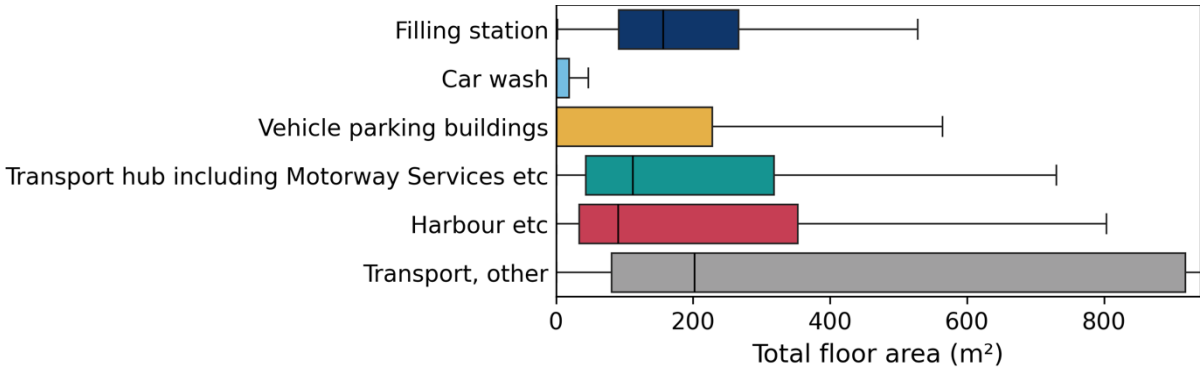


Figure 3.13-3: Distribution of premises total floor area by activity group

3.13.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 42% of ‘Transport' premises have at least one matched electricity meter and 8% have at least one matched gas meter. The total matched energy use for 'Transport' is 1,404 GWh per year, which consists of 1,042 GWh for electricity and 363 GWh for gas per year. See Figure 3.13-4 or a breakdown of energy use per activity group.

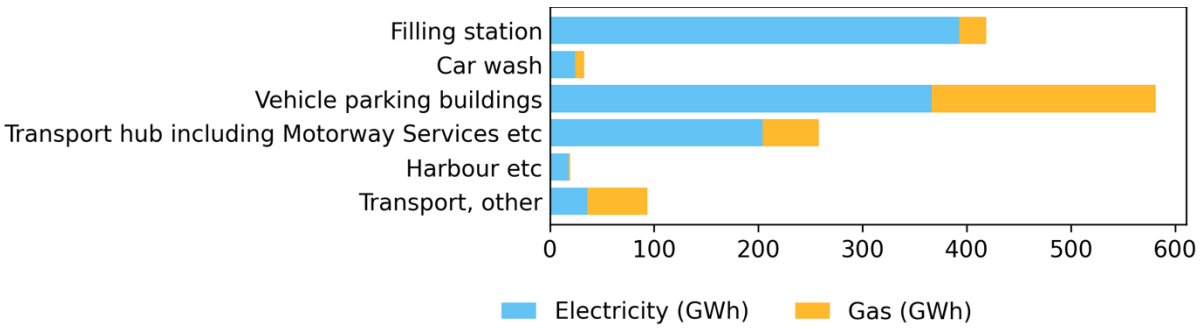


Figure 3.13-4: Total energy demand (GWh) for 'Transport' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in 'Transport' is Profile Class 9, which represents 38% of all electricity meters in this activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

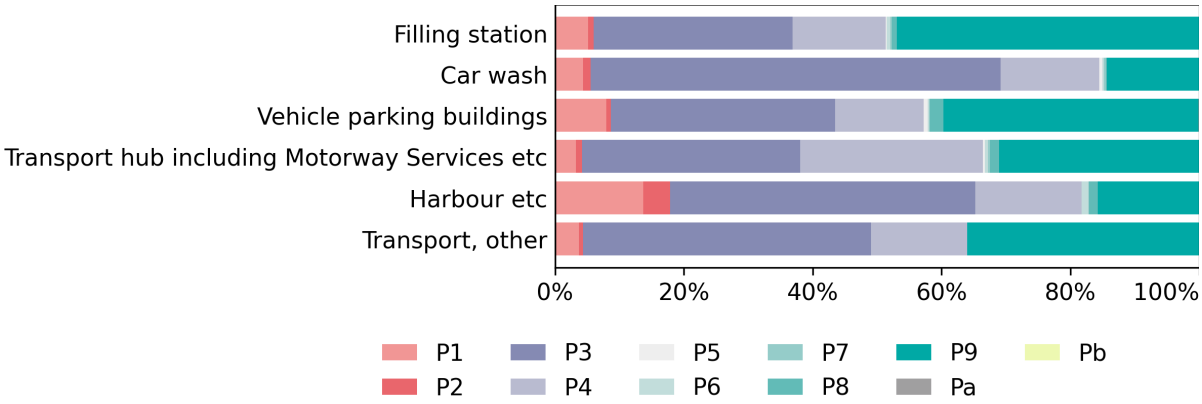


Figure 3.13-5: Percentage of meter profile classes for electricity meters by activity group

Around 14% of all 'Transport' premises (17% of 'Transport' floorspace) are located in postcodes classified as off the gas grid. Figure 3.13-6 below shows that 'Harbour etc' is the activity group that has the largest share (48% by floorspace) of off the gas grid postcodes and 'Car wash' have the lowest share (4%). 'Harbour' facilities are predominantly located off the gas grid, reflecting their coastal placement, while 'Car washes' are highly reliant on gas-connected urban infrastructure. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

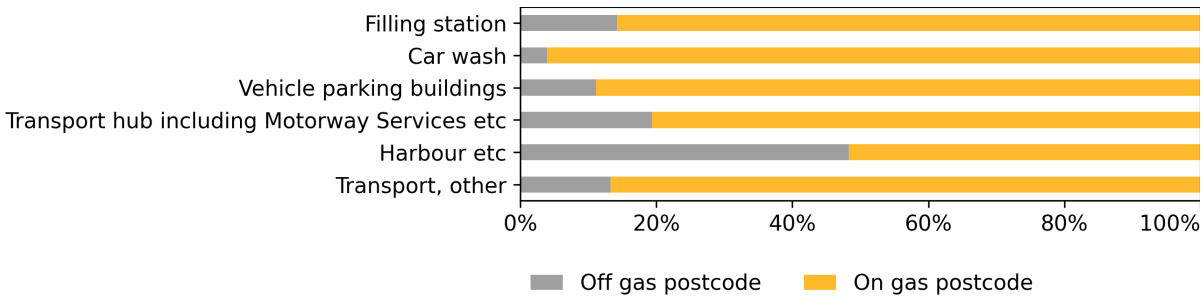
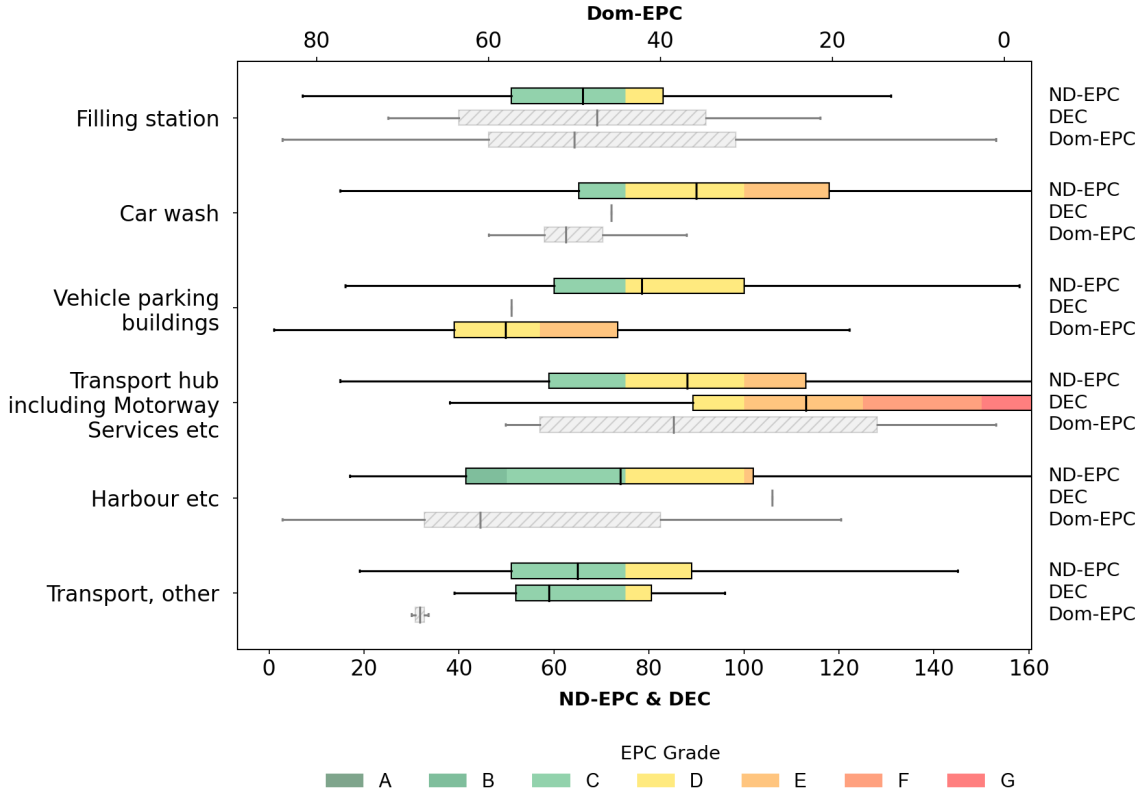


Figure 3.13-6: Percentage of floorspace on or off gas grid by activity group

3.13.4 Energy certification

Around 18% of all 'Transport' premises have an energy certificate with around 17% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Transport' was June 2018.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.13-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that the activity group ‘Filling Station’ has the largest percentage of matches to non-domestic EPCs (32%) and that the median asset rating of these is 66 (C). ‘Car wash’ and ‘Transport hub including Motorway Services etc’ have the lowest performing median non-domestic EPCs with asset ratings of 90 and 88 respectively (D). Relatively few DECs match to ‘Transport hub including Motorway Services etc’ (1%) but for those that do the median current operational rating is 113 (E).

3.13.5 Energy use detailed insights

Within 'Transport', the activity group with the highest median energy use intensity (EUI) for electricity is 'Filling station' (591 kWh/m² per year) and for gas it is 'Transport hub including Motorway Services etc' (262 kWh/m² per year). For total EUI (gas and electricity combined) 'Filling station' have the highest value (590 kWh/m² per year), see Figure 3.13-8 below (chart values truncated to 76th percentile of highest activity group).

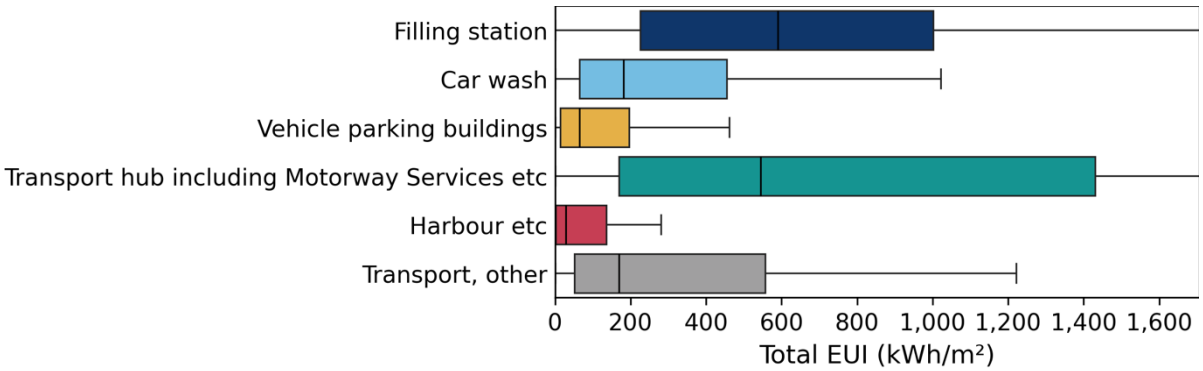


Figure 3.13-8: Distribution of total Energy Use Intensity (EUI) by activity group

Figure 3.13-9 below indicates a mix of fuels being used across the Transport class. ‘Mains Gas’ is widely used, but substantial percentages of floorspace use ‘Electricity’ as the main energy source, especially in the ‘Filling station’ group, likely due to fire safety regulations. ‘Harbour etc’ also uses mostly ‘Electricity’, but also some ‘Oil & Liquid Fuels’, probably due to physical constraints at such sites in terms of gas network supply.

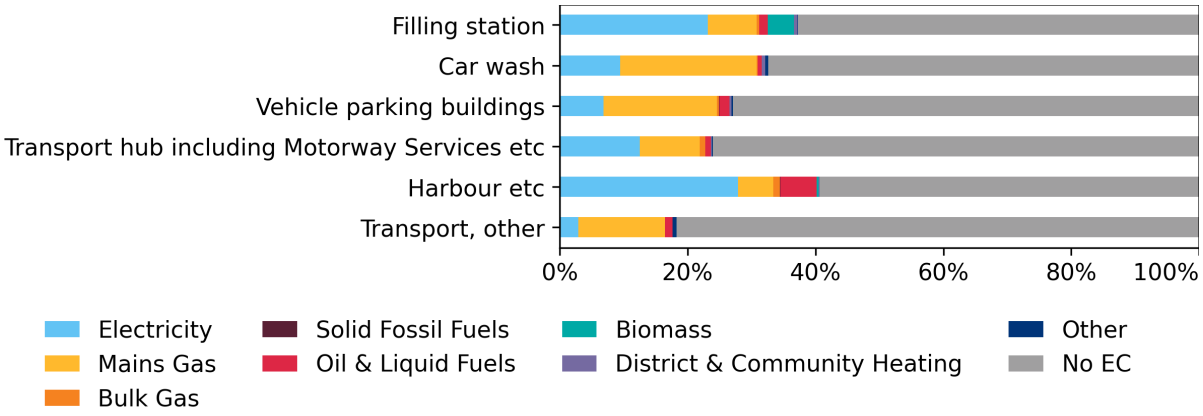


Figure 3.13-9: Heating fuels as percentage of total floorspace by activity group

Where energy certificates have been matched, the largest percentages of each activity group’s floorspace are treated by ‘Heating and Ventilation’, except in ‘Filling station’, which uses a lot of ‘Air Conditioning’, as shown in 3.13-10 below. Despite the diversity of fuels used, shown above, the types of space treatment systems are very limited.

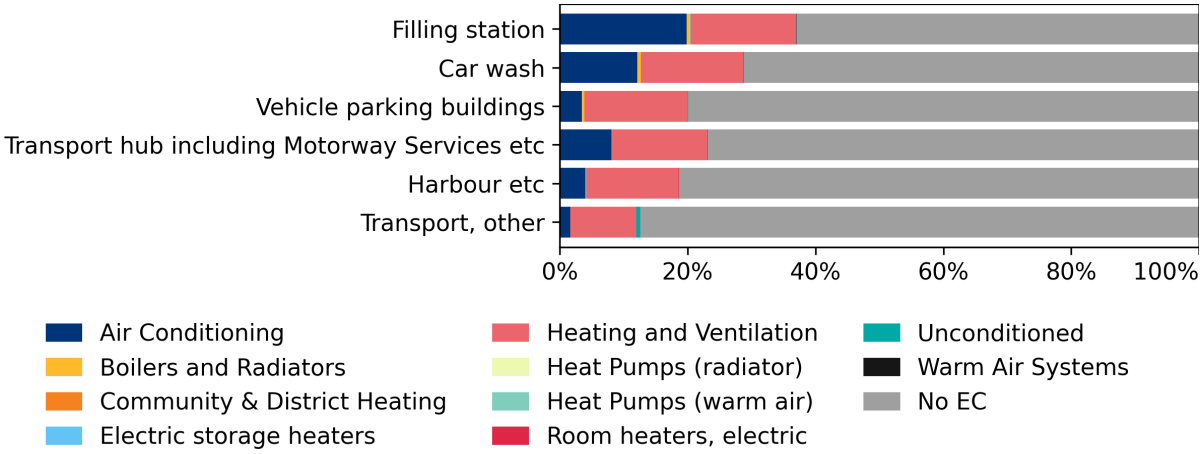


Figure 3.13-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Transport hub including Motorway Services etc' (13%) whilst the lowest percentage is for 'Transport, other' (8%), as shown in Figure 3.13-11 below.

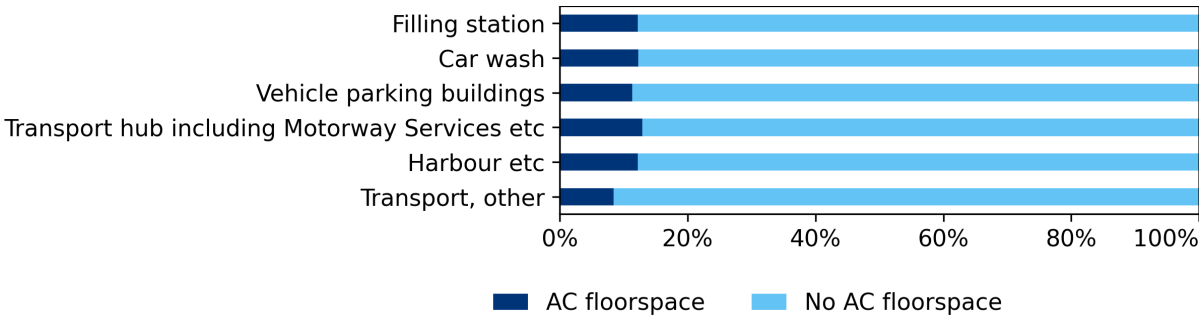


Figure 3.13-11: Air-conditioned floorspace by activity group

3.13.6 Heritage and Rural Urban

87% of all 'Transport' premises are in an area with no Conservation area or Listed building restrictions whilst 13% are either in a Conservation area, or are a Listed building or both. 'Transport hub including Motorway Services etc' has the largest amount of their floorspace in heritage restricted areas (20%). More details can be seen in Figure 3.13-12 below.

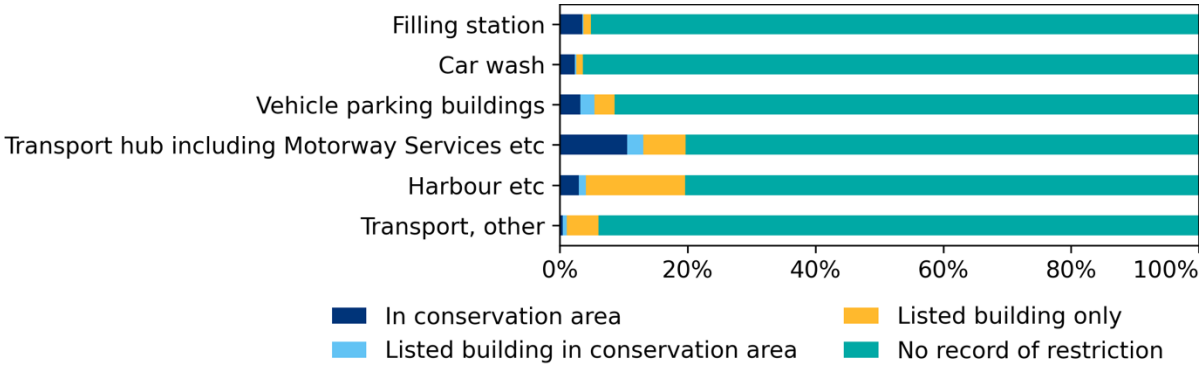


Figure 3.13-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 77% of premises and 79% of floorspace in the 'Transport' activity class may be found in an urban area. The largest activity group is 'Car wash' where 95% of its floorspace is in an urban area, whilst 'Harbour etc' has the largest percentage of its floorspace in rural areas (49%), as shown in Figure 3.13-13 below.

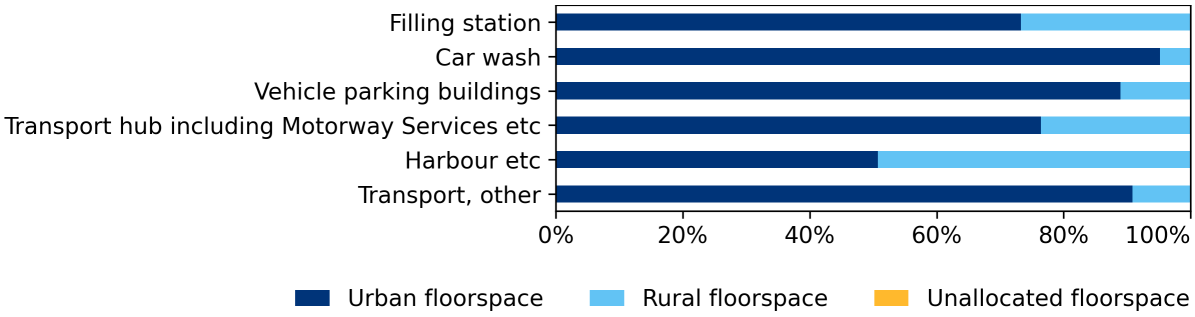


Figure 3.13-13: Floorspace by ONS Urban / rural classification by activity group

3.13.7 Mixed-use buildings

Within the 'Transport' class, 69% of SCUs are occupied by a single 'Transport' premises, whilst 26% share the SCU with other non-domestic premises and 5% share the SCU with domestic premises.

Figure 3.13-14 below shows 'Transport, other' is the activity group with the highest percentage of cases where they are the sole occupier of the building (83%) whilst 'Harbour etc' has the highest percentage of SCUs shared with other non-domestic premises (59%) and 'Harbour etc' has the highest percentage of SCUs shared with domestic residential uses (9%).

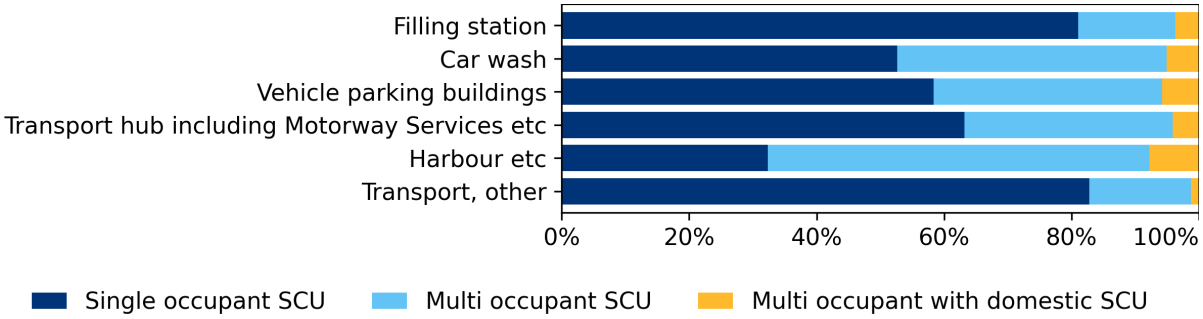


Figure 3.13-14: Percentage of premises by mixed-use SCU classification by activity group

3.13.8 Public sector

Around 13% of Transport premises and 37% of Transport floorspace is likely to be Public Sector. These cases represent premises where they are likely to be owned or managed by Local or Central Government. More detail is available in Figure 3.13-15 which shows that 'Transport hub including Motorway Services etc' is the activity group with the highest percentage of premises likely to be Public Sector (70%) and this represents 55% of their activity group floorspace. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

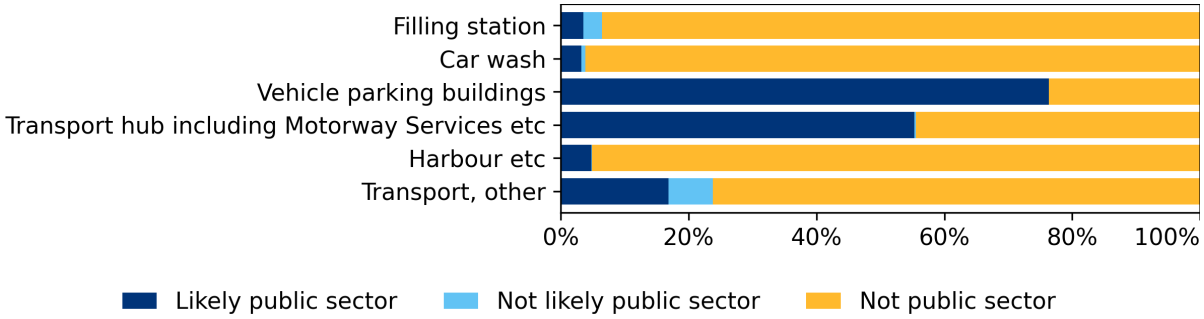


Figure 3.13-15: Percentage of floor area assigned 'Public sector' by activity group

3.13.9 Age and materials

19% of 'Transport' premises and 23% of Transport floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (6%), which represents 8% of floorspace.

The details at the activity group level are shown in Figure 3.13-16 below.

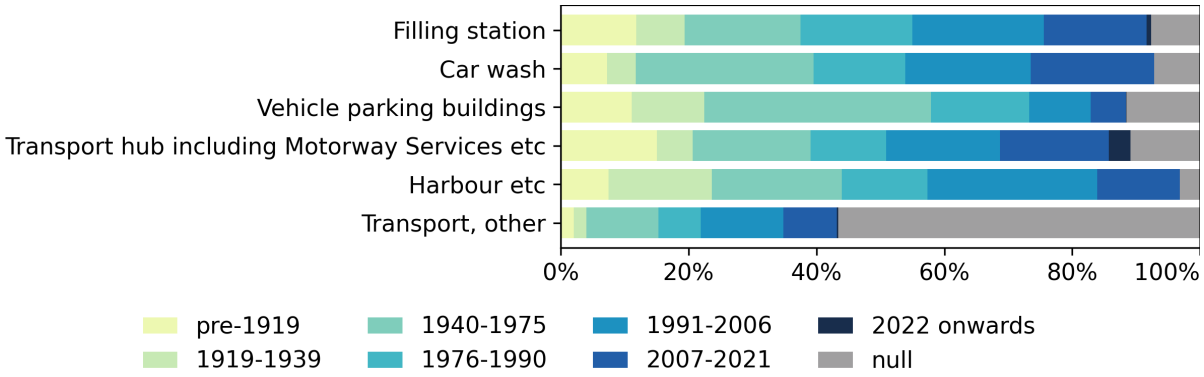


Figure 3.13-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Transport' activity class (measured by wall area). The 'Vehicle parking buildings' activity group has the largest wall area (0.9 million m²) when measured from the 3D geometry in the database, and 55% of this is no data which represents 23% of the total wall area in 'Transport' (see Figure 3.13-17).

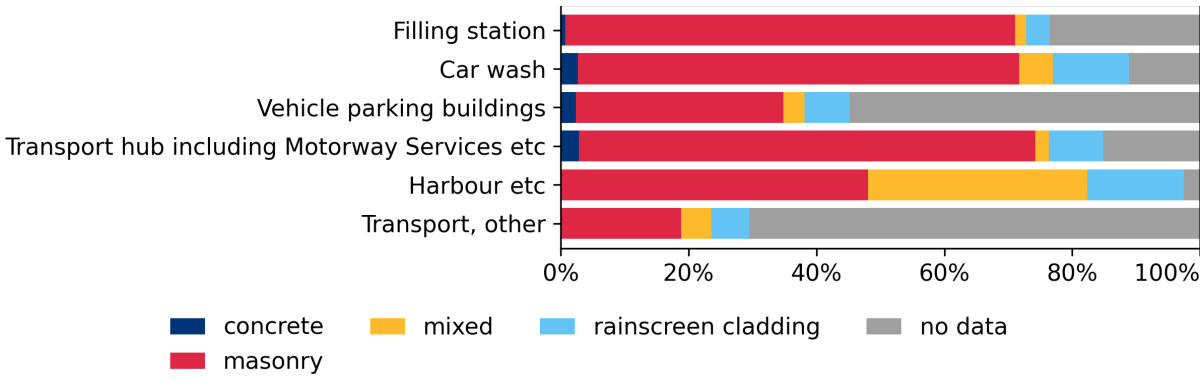


Figure 3.13-17: Distribution of total wall area by NGD material and activity group

Table 3.13-1: Summary statistics for Transport by activity group

Activity group	No. of premises	No. of SCUs	total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Filling station	5,710	5,441	1.39	248	37.8	27.1
Car wash	3,175	2,388	0.14	43	21.0	2.7
Vehicle parking buildings	2,526	1,716	1.54	618	16.7	30.1
Transport hub including Motorway Services etc	2,656	1,914	0.97	479	17.6	19.1
Harbour etc	520	244	0.47	1,311	3.4	9.3
Transport, other	522	400	0.60	1,365	3.5	11.8

Table 3.13-2: Summary energy statistics for Transport by activity group

Activity group	median total EUI ($kWh/m^2/year$)	total GWh	% by total energy
Filling station	590	419.01	29.8
Car wash	181	32.71	2.3
Vehicle parking buildings	65	581.5	41.4
Transport hub including Motorway Services etc	545	258.16	18.4
Harbour etc	28	19.59	1.4
Transport, other	169	93.36	6.6

3.14 Utilities

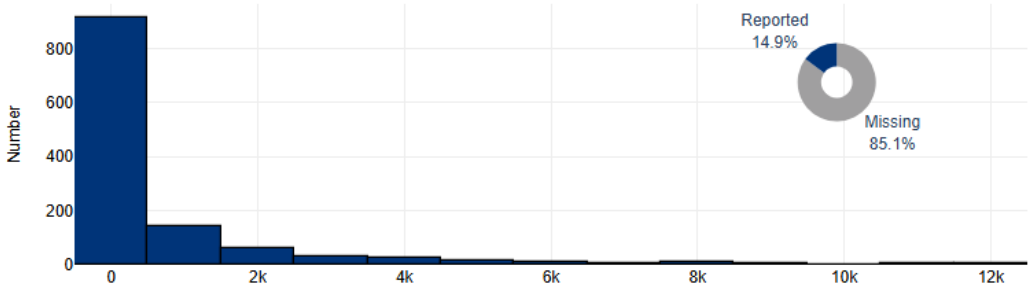
Overview

In the Utilities activity class, the analysis covers 9,260 premises. The average Energy Use Intensity (EUI) is 5470 kWh/m²/annum. The dominant building age group is 1991-2006 (25%), and the predominant heating fuel is Mains Gas (3%).

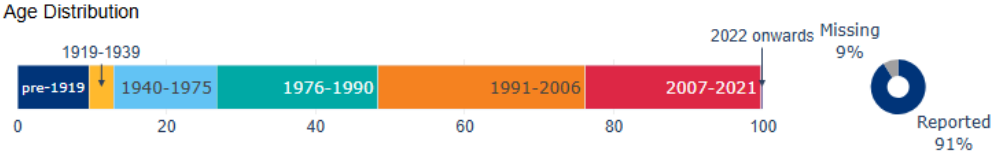
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Water Treatment Works etc	5.8	0.84
Refuse recycling/disposal	2.0	4.05
Electricity gen. renewable	0.7	0.49
Electricity gen. probably not renewable	0.4	2.77
Utilities, other	0.4	0.16

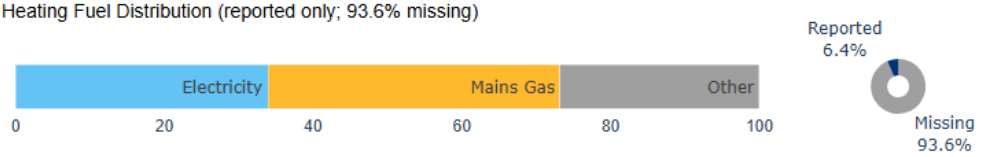
Energy Use Intensity (kWh/m²/annum)



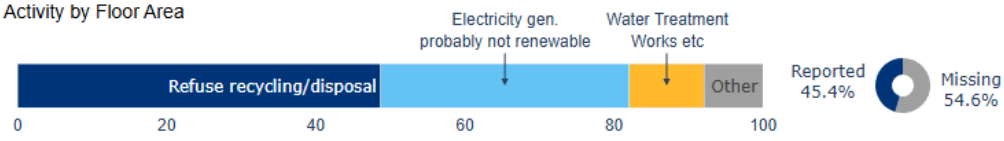
Age Distribution



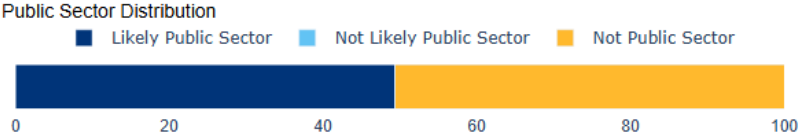
Heating Fuel Distribution (reported only; 93.6% missing)



Activity by Floor Area



Public Sector Distribution



3.14.1 Overview

The 'Utilities' class has a total of 9,260 premises and 8.31 million m² of floorspace. This makes ‘Utilities’ the thirteenth largest class by count of premises with less than 1% of all non-domestic premises and the twelfth largest class by floorspace with 1% of all non-domestic floorspace. This class contains 17 activities, which have been grouped into five activity groups. The largest activity by count is 'Sewage/Waste Water Treatment Works' with 5,715 premises. The largest by total floorspace is 'Refuse handling/disposal' with 3.95 million m² of floorspace. In total NBD reports 4,220 SCUs (which roughly equate to buildings) for 'Utilities'.

Neither ND-NEED (2023) nor BEES (2014) reported any statistics that relate to Utilities so no comparisons can be made with these sources.

Figure 3.14-1 below shows all activities in the 'Utilities' class aggregated into five activity groups. 'Water Treatment Works etc' has the largest number of premises but these have a relatively small median floorspace (97 m²), making it the second largest activity group in terms of floorspace within 'Utilities'. The activity group with the largest total floorspace is 'Refuse recycling/disposal' where the median floor area is 684 m² and the total floor area is 4.05 million m². The largest share of matched energy demand is for the activity group named ‘Electricity gen. probably not renewable.

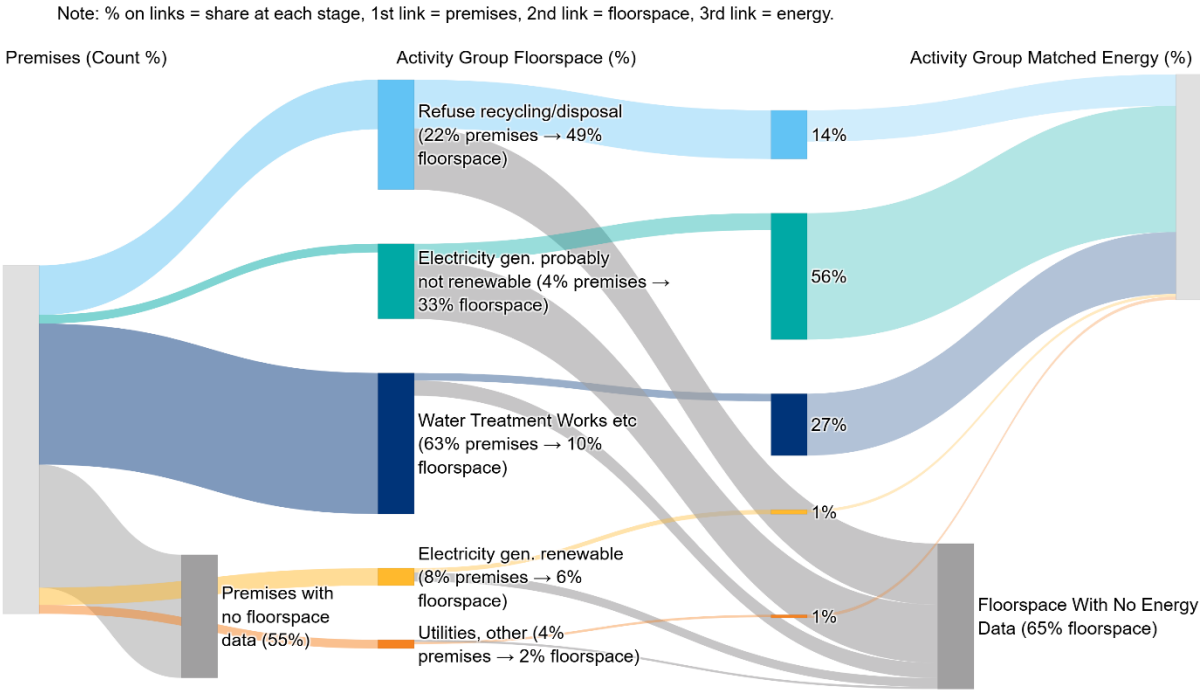


Figure 3.14-1: Share of activity group by number of premises, floorspace and total energy demand

Figure 3.14-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.14-2), for England these are comparable with the NUTS regions. For 'Utilities' the South West has the largest percentage of premises (15%) and SCUs (14%). The largest percentage of floorspace is in Yorkshire and The Humber (17%). For the regional share of total energy demand, North West has the largest percentage (28%).

3.14.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Refuse recycling/disposal' (684 m²) and the smallest is 'Water Treatment Works etc' (97 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.14-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

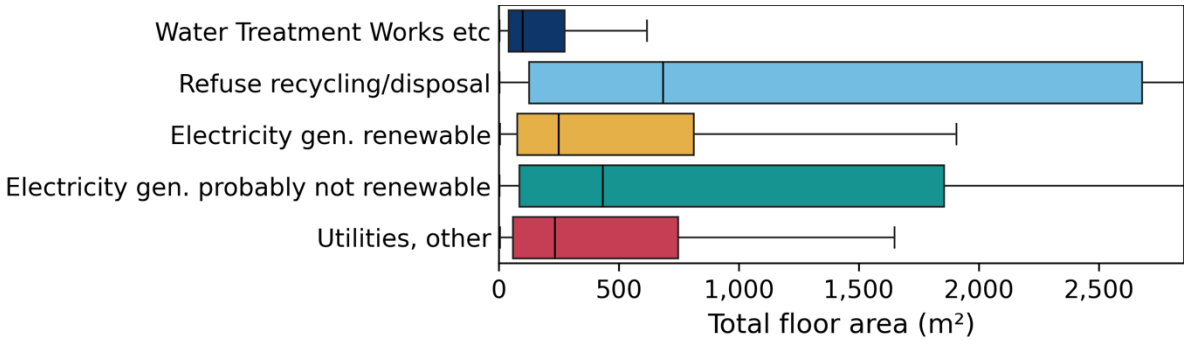


Figure 3.14-3: Distribution of premises total floor area by activity group

3.14.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 20% of ‘Utilities’ premises have at least one matched electricity meter and 3% have at least one matched gas meter. The total matched energy use for 'Utilities' is 2,692 GWh per year, which consists of 760 GWh for electricity and 1,931 GWh for gas per year. See Figure 3.14-4 for a breakdown of energy use per activity group.

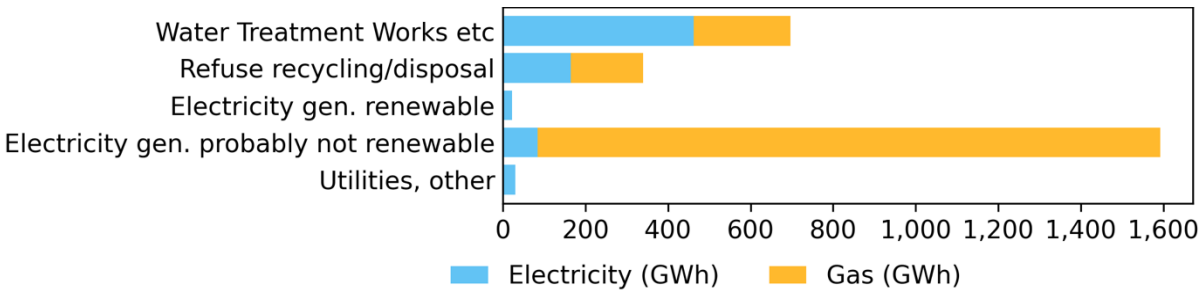


Figure 3.14-4: Total energy demand (GWh) for 'Utilities' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in ‘Utilties’ is Profile Class 9, which represents 37% of all electricity meters in **this** activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

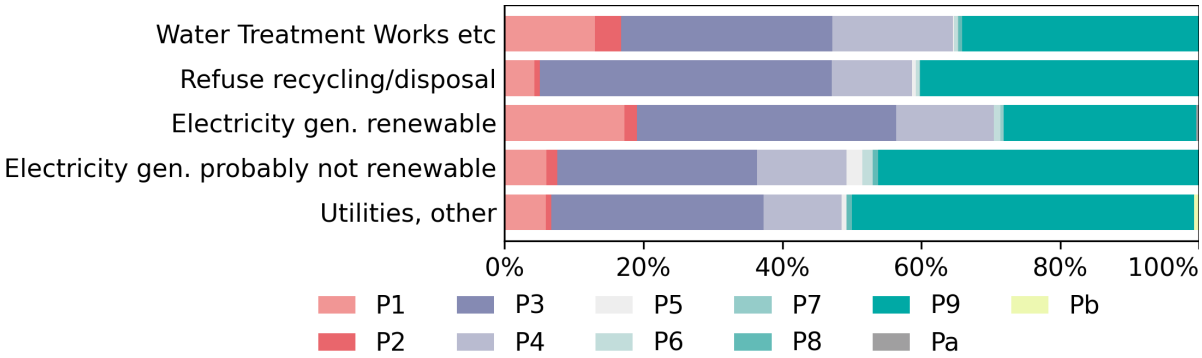


Figure 3.14-5: Percentage of meter profile classes for electricity meters by activity group

Around 41% of all 'Utilities' premises (23% of 'Utilities' floorspace) are located in postcodes classified as off the gas grid. Figure 3.14-6 below shows that 'Electricity gen. renewable' is the activity group that has the largest share (51% by floorspace) of off the gas grid postcodes and 'Refuse recycling/disposal' have the lowest share (19%). 'Electricity generation from renewables' is most concentrated in off-grid areas, while 'Refuse recycling/disposal' remains largely tied to locations with gas infrastructure. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

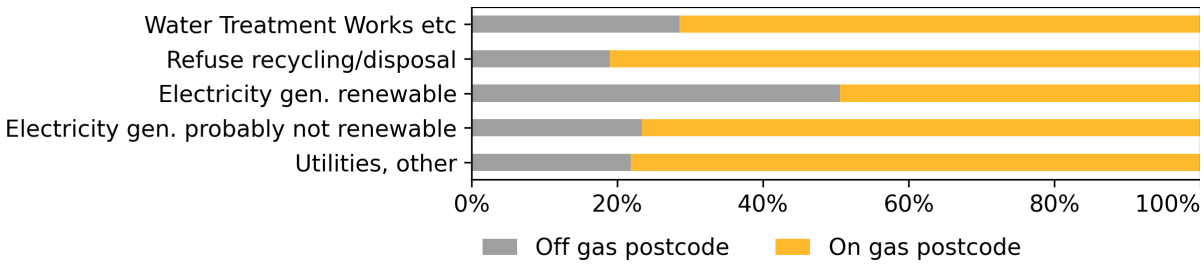
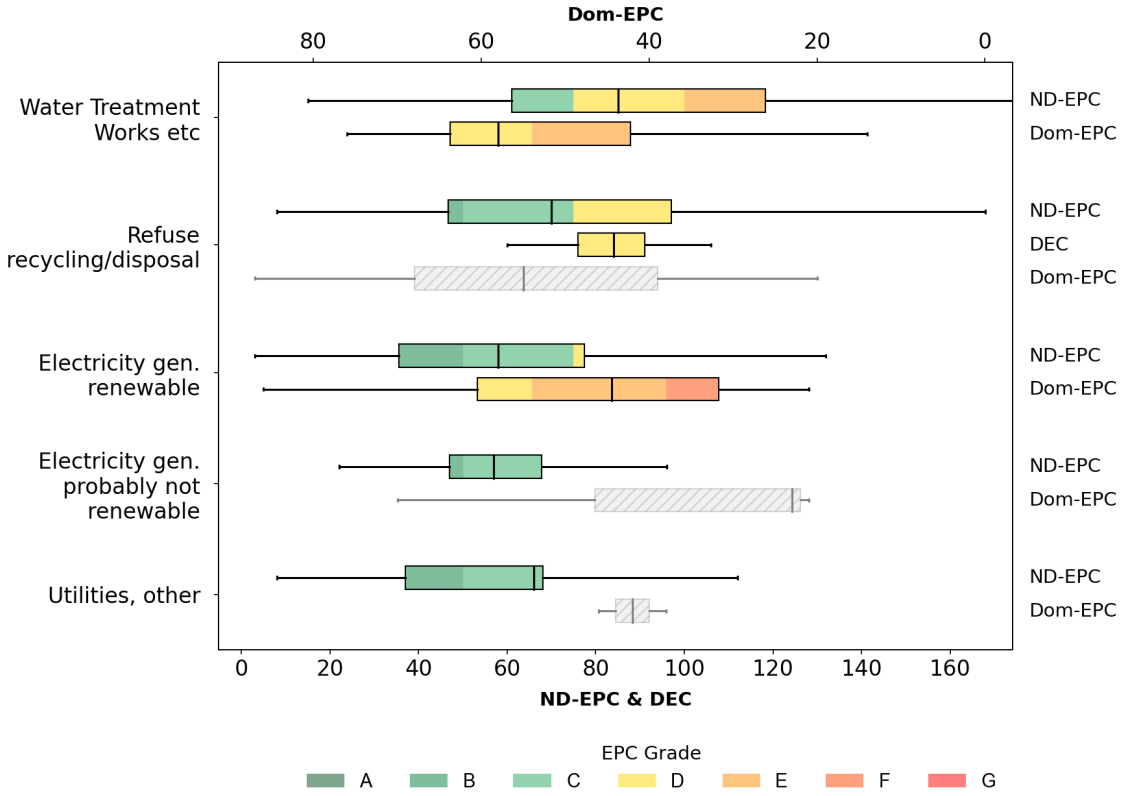


Figure 3.14-6: Percentage of floorspace on or off gas grid by activity group

3.14.4 Energy certification

Around 3% of all 'Utilities' premises have an energy certificate with around 3% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a C, the median DEC is a C grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Utilities' was August 2018.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.14-7: Distribution of energy certificate numeric rating by activity group

Figure 3.14-7 shows box and whisker plots for the energy certificates linked to the premises at the activity grouping level. For the non-domestic EPCs the median asset rating is lowest for ‘Water Treatment Works etc’ where it is 85 (D) and it is highest for ‘Electricity gen. probably not renewable’ where it is 57 (C).

3.14.5 Energy use detailed insights

Within 'Utilities', the activity group with the highest median energy use intensity (EUI) for electricity is 'Utilities, other' (161 kWh/m² per year) and for gas it is 'Electricity gen. probably not renewable' (8,877 kWh/m² per year). For total EUI (gas and electricity combined) 'Water

Treatment Works etc' have the highest value (214 kWh/m² per year), see Figure 3.14-8 below (chart values truncated to 76th percentile of highest activity group).

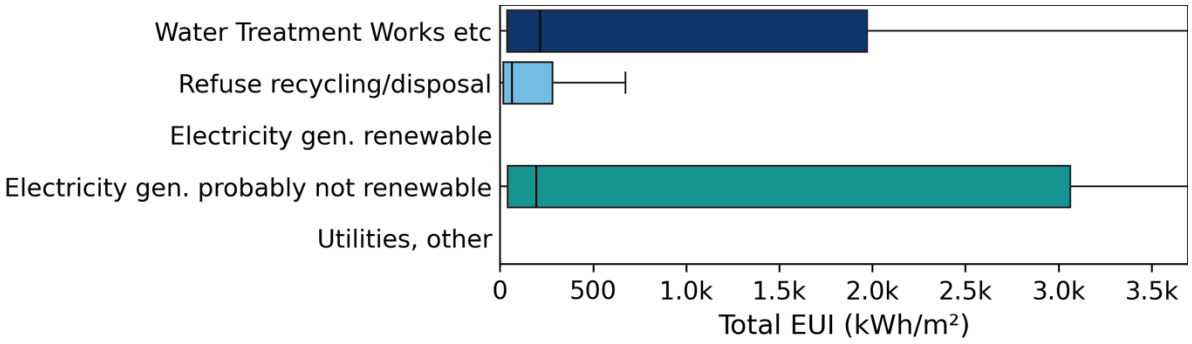


Figure 3.14-8: Distribution of total Energy Use Intensity (EUI) by activity group

In Figure 3.14-9 below, it can be seen that very little floorspace in the Utilities class has been matched to an energy certificate, likely due to premises in this class having very low occupier churn and not being open to the public. Utility floorspace has complex splits of energy source. 'Oil & Liquid Fuels' is fairly prominent, perhaps due to some utility premises being located in rural areas off the gas grid.

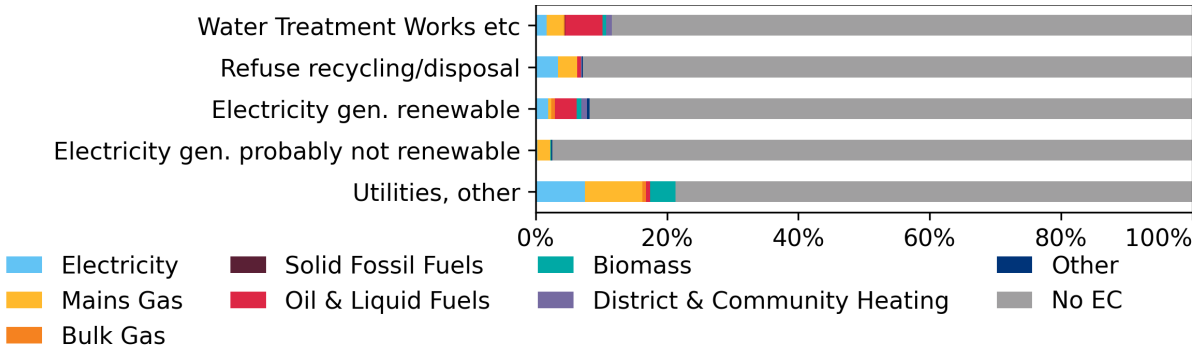


Figure 3.14-9: Heating fuels as percentage of total floorspace by activity group

'Heating and Ventilation' treats the largest percentages of floorspace, as shown in 3.14-10 below, with most of the remainder being treated using 'Air Conditioning'.

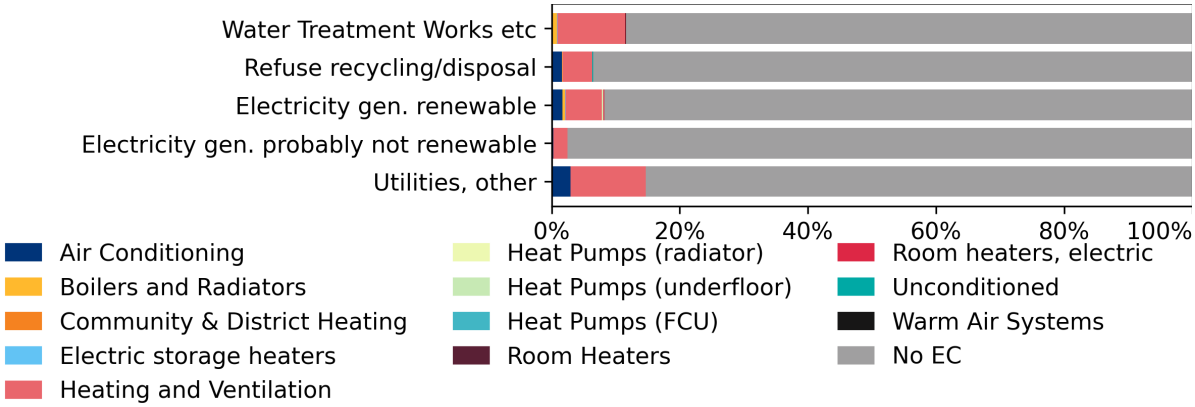


Figure 3.14-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is

'Utilities, other' (17%) whilst the lowest percentage is for 'Electricity gen. probably not renewable' (< 1%), as shown in Figure 3.14-11 below.

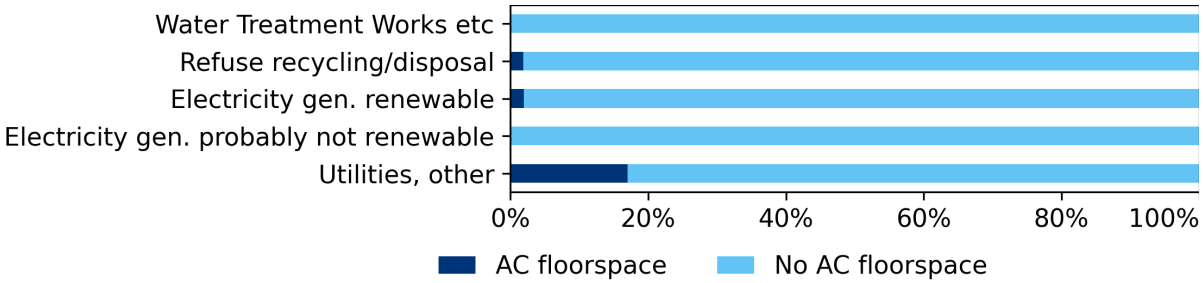


Figure 3.14-11: Air-conditioned floorspace by activity group

3.14.6 Heritage and Rural Urban

92% of all 'Utilities' premises are in an area with no Conservation area or Listed building restrictions whilst 8% are either in a Conservation area, or are a Listed building or both. 'Electricity gen. renewable' has the largest amount of their floorspace in heritage restricted areas (12%). More details can be seen in Figure 3.14-12 below.

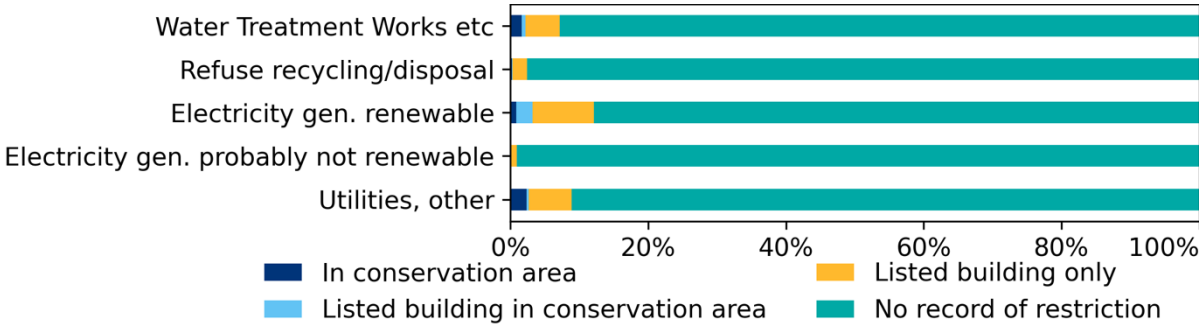


Figure 3.14-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 26% of premises and 55% of floorspace in the 'Utilities' activity class may be found in an urban area. The largest activity group is 'Refuse recycling/disposal' where 74% of its floorspace is in an urban area, whilst 'Electricity gen. renewable' has the largest percentage of its floorspace in rural areas (84%), as shown in Figure 3.14-13 below.

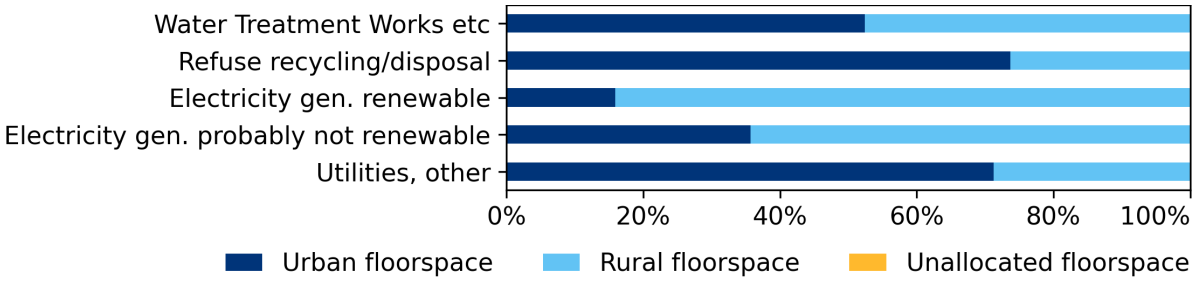


Figure 3.14-13: Floorspace by ONS Urban / rural classification by activity group

3.14.7 Mixed-use buildings

Within the 'Utilities' class, 76% of SCUs are occupied by a single 'Utilities' premises, whilst 17% share the SCU with other non-domestic premises and 7% share the SCU with domestic premises.

Figure 3.14-14 below shows 'Water Treatment Works etc' is the activity group with the highest percentage of cases where they are the sole occupier of the building (83%) whilst 'Utilities, other' has the highest percentage of SCUs shared with other non-domestic premises (45%) and 'Electricity gen. renewable' has the highest percentage of SCUs shared with domestic residential uses (25%).

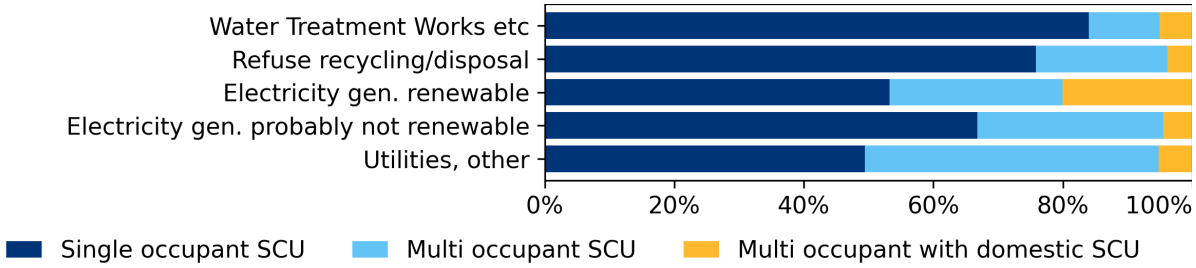


Figure 3.14-14: Percentage of premises by mixed-use SCU classification by activity group

3.14.8 Public sector

Around 26% of Utilities premises and 49% of Utilities floorspace is likely to be Public Sector. Premises in this activity class are likely to be given a Public Sector flag if they are owned or managed by Local or Central Government. Figure 3.14-15 gives more details and shows that 'Refuse recycling/disposal' is the activity group with the highest percentage of premises likely to be Public Sector (98%) and this represents 98% of their activity group floorspace. 'Electricity gen. renewable' is the activity group with the lowest percentage of premises (1%) and floorspace (2%) likely to be Public Sector. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

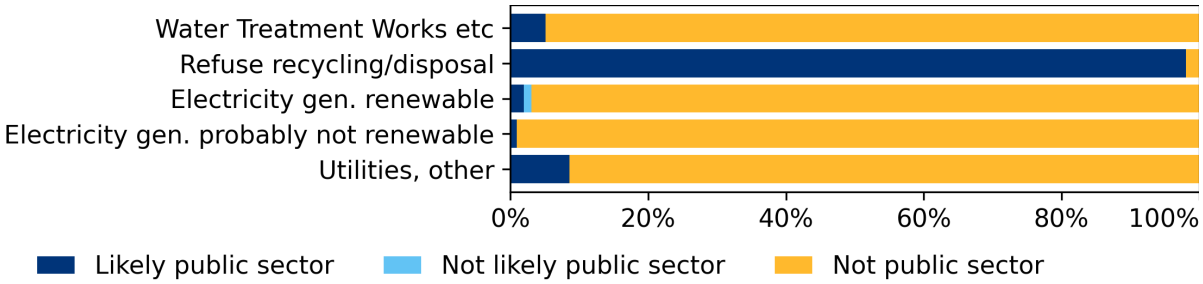


Figure 3.14-15: Percentage of floor area assigned 'Public sector' by activity group

3.14.9 Age and materials

58% of 'Utilities' premises and 9% of Utilities floorspace is classified in the 'null' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1976-1990' for premises (3%), which represents 20% of floorspace.

The details at the activity group level are shown in Figure 3.14-16 below.

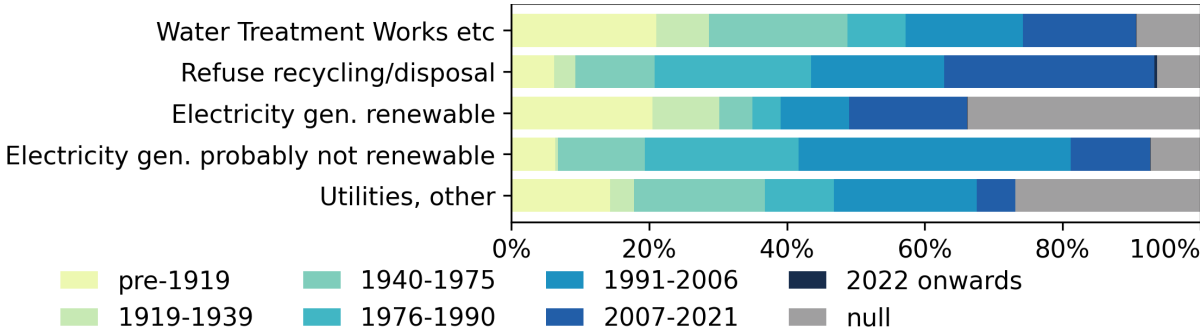


Figure 3.14-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Utilities' activity class (measured by wall area). The 'Refuse recycling/disposal' activity group has the largest wall area (0.7 million m²) when measured from the 3D geometry in the database, and 53% of this is masonry which represents 27% of the total wall area in 'Utilities' (see Figure 3.14-17).

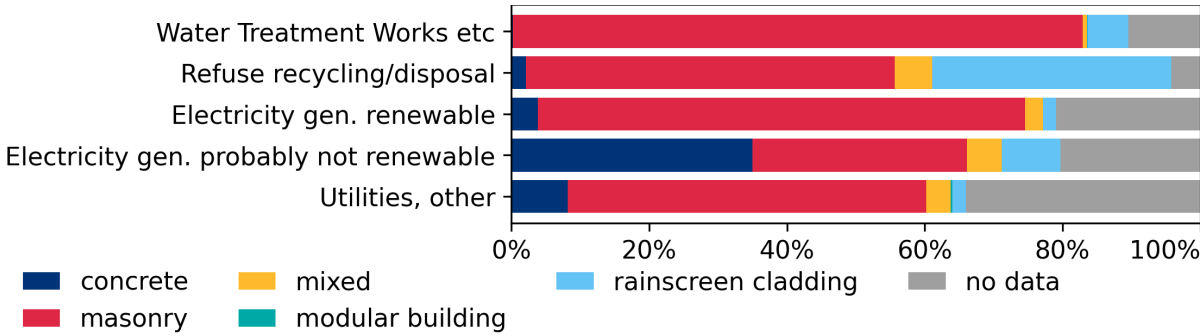


Figure 3.14-17: Distribution of total wall area by NGD material and activity group

Table 3.14-1: Summary statistics for Utilities by activity group

Activity group	No. of premises	No. of SCUs	total floorspace (million m²)	Avg. floorspace (m²)	% by count	% by floorspace
Water Treatment Works etc	5,795	2,189	0.84	436	62.6	10.1
Refuse recycling/disposal	2,035	1,211	4.05	3,018	22.0	48.7
Electricity gen. renewable	715	434	0.49	1,017	7.7	5.9
Electricity gen. probably not renewable	357	223	2.77	10,859	3.9	33.3
Utilities, other	358	174	0.16	814	3.9	2.0

Table 3.14-2: Summary energy statistics for Utilities by activity group

Activity group	median total EUI (kWh/m^2/year)	total GWh	% by total energy
Water Treatment Works etc	214	696.06	25.9
Refuse recycling/disposal	62	339.42	12.6
Electricity gen. renewable	82	30.53	1.1
Electricity gen. probably not renewable	193	1,592.50	59.2
Utilities, other	161	33.17	1.2

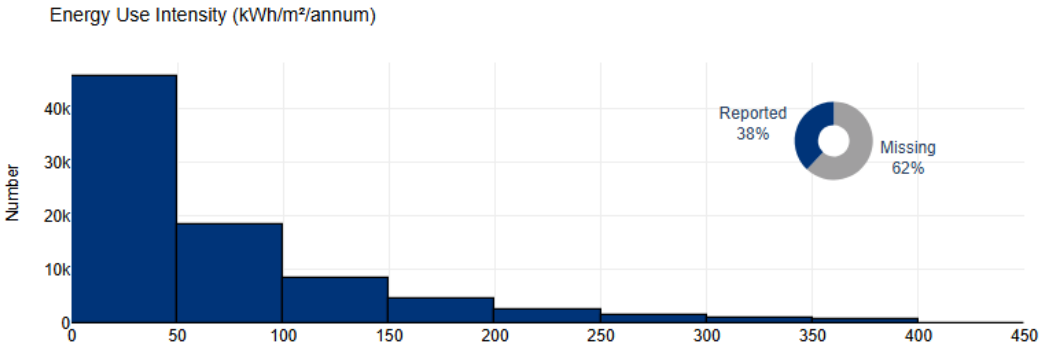
3.15 Warehouse

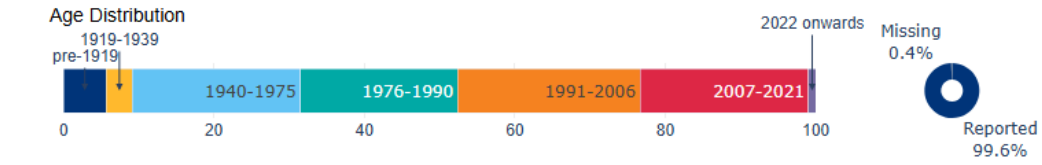
Overview

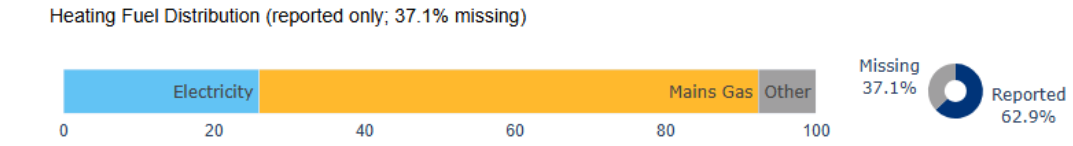
In the Warehouse activity class, the analysis covers 246,163 premises. The average Energy Use Intensity (EUI) is 170 kWh/m²/annum. The dominant building age group is 1991-2006 (24%), and the predominant heating fuel is Mains Gas (42%).

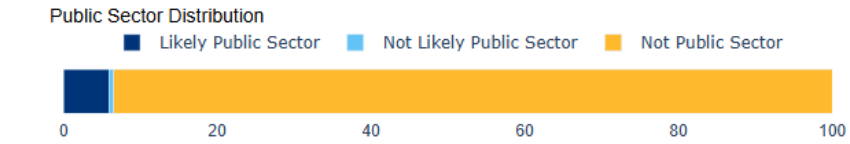
These percentages include missing data; the bar charts below are adjusted to exclude missing data so they are easier to read.

Activity Group	Premises (thousands)	Floorspace (millions m²)
Warehouse	131.6	108.26
Stores and Self-storage	109.3	18.81
Storage depots (fuel, crop storage etc.)	2.9	3.23
Large Warehouses etc	2.4	41.71









3.15.1 Overview

The 'Warehouse' class has a total of 246,163 premises and 172.01 million m² of floorspace. This makes Warehouse the fifth largest class by premises count with 11% of all non-domestic premises and the second largest class by floorspace with 19% of all non-domestic floorspace. This class contains 17 activities, which have been grouped into four activity groups. The largest activity by count is 'Warehouse' with 131,446 premises. The largest by total floorspace is 'Warehouse' with 108.11 million m² of floorspace. In total NBD reports 150,016 SCUs (which roughly equate to buildings) for 'Warehouse'.

For 'Warehouse' as a whole, ND-NEED (2023) reports 0.22 million buildings (147% of NBD SCUs) and 214.06 million m² of floorspace (124% of NBD). BEES (2014) reported 178,700 premises (73% of NBD premises) and 140 million m² of floorspace (81% of NBD) for the year 2014. Differences in the data inputs and methods used in ND-NEED, BEES and NBD, make direct comparisons difficult.

Figure 3.15-1 below shows all activities in the 'Warehouse' class aggregated into four activity groups. 'Warehouse' has the largest number of premises. The activity group with the largest total floorspace is also 'Warehouse' where the median floor area is 323 m² and the total floor area is 108.26 million m². The ‘Warehouse’ activity group also represents the largest share of matched total energy demand.

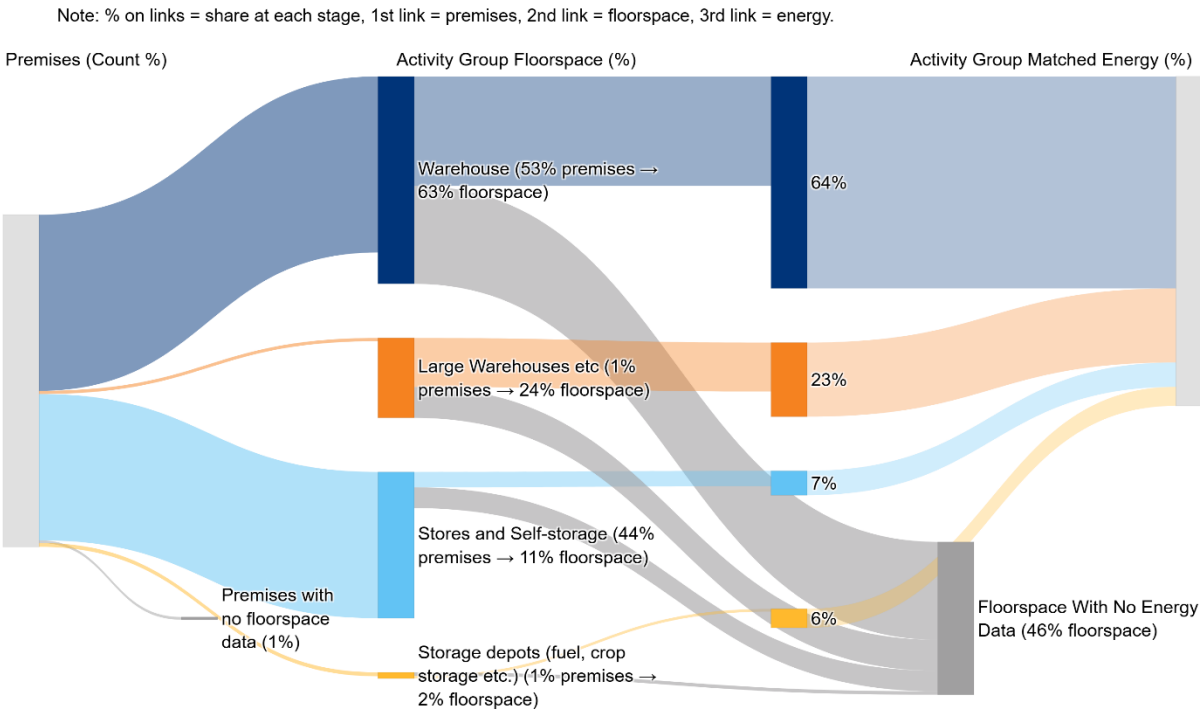


Figure 3.15-1: Share of activity group by number of premises, floorspace and total energy demand

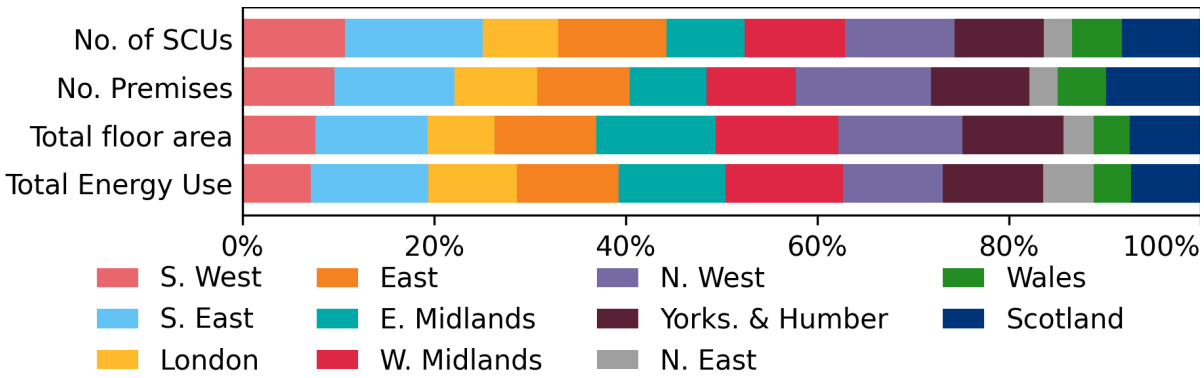


Figure 3.15-2: Regional distribution by SCU and premises count, floorspace and total energy demand

Using the spatial data within NBD it is possible to aggregate the data by International Territorial Level (ITL) 1 geographies (Figure 3.15-2), for England these are comparable with the NUTS regions. For 'Warehouse' the North West has the largest percentage of premises (14%) and SCUs (14%). The largest percentage of floorspace is in North West (13%). For the regional share of total energy demand, West Midlands has the largest percentage (12%).

3.15.2 Floorspace

At the premises level, the largest median floorspace by activity group is 'Large Warehouses etc' (10,488 m²) and the smallest is 'Stores and Self-storage' (53 m²). These are shown by the vertical bar in the 'boxes' in the box and whisker plots in Figure 3.15-3, the chart is truncated to the 76th percentile of the largest activity group, the right whisker extends to the 98th percentile for activity groups, where visible.

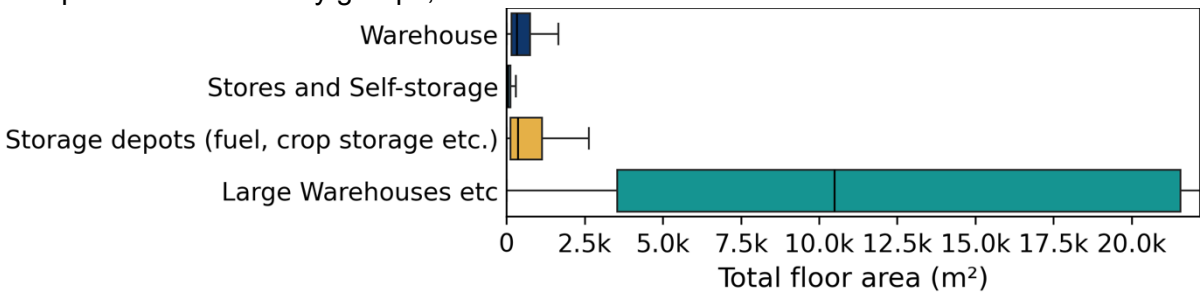


Figure 3.15-3: Distribution of premises total floor area by activity group

3.15.3 Energy use overview

It is not always possible to match energy meter data to premises. For the 2023 meter data, 36% of ‘Warehouse’ premises have at least one matched electricity meter and 13% have at least one matched gas meter. The total matched energy use for 'Warehouse' is 9,653 GWh per year, which consists of 6,072 GWh for electricity and 3,582 GWh for gas per year. See Figure 3.15-4 for a breakdown of energy use per activity group.

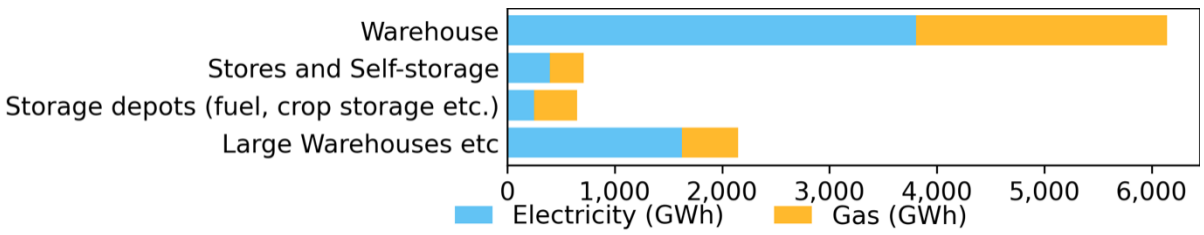


Figure 3.15-4: Total energy demand (GWh) for 'Warehouse' by activity group (excludes bulk fuels and only covers matched energy meters)

The largest Profile Class for electricity meters in 'Warehouse' is Profile Class 3, which represents 62% of all electricity meters in **this** activity class. Profile Classes 1 and 2 are used for domestic electricity meters. Profile classes 3 and above are used for non-domestic with increasing load factors, with Profile Class 9 being the half-hourly meters. Profile Classes Pa and Pb represent cases where very high domestic meter usage means that they are considered to be non-domestic, with Profile Class Pb representing cases where this is backed up by the presence of a non-domestic 'keyword' (e.g. Ltd, Office, PLC etc). Profile Class 9 electricity meters tend be the very highest consuming non-domestic meters and the consumption is monitored on a half-hourly basis.

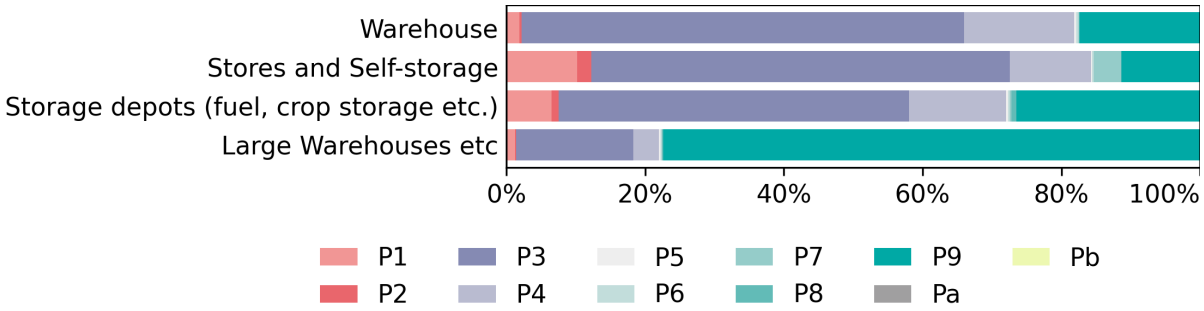


Figure 3.15-5: Percentage of meter profile classes for electricity meters by activity group

Around 12% of all 'Warehouse' premises (9% of 'Warehouse' floorspace) are located in postcodes classified as off the gas grid. Figure 3.15-6 below shows that 'Storage depots (fuel, crop storage etc.)' is the activity group that has the largest share (15% by floorspace) of off the gas grid postcodes and 'Large Warehouses etc' have the lowest share (7%). Storage depots have the highest reliance on off-grid energy, while large warehouses are least affected, highlighting varied energy access across warehouse types. For premises off the gas grid, bulk fuels may account for a large proportion of energy use. However, data on bulk fuels is not available at the premises level and is therefore excluded from the figure.

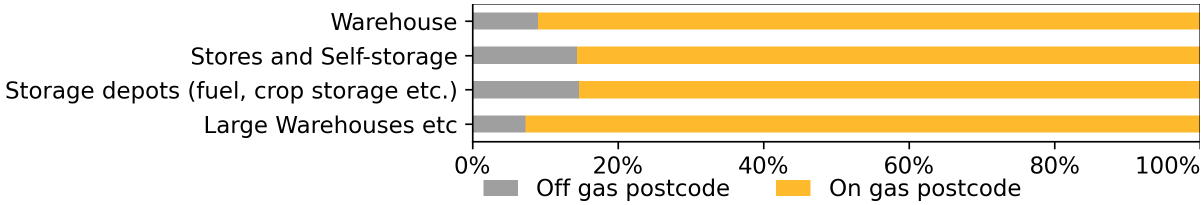
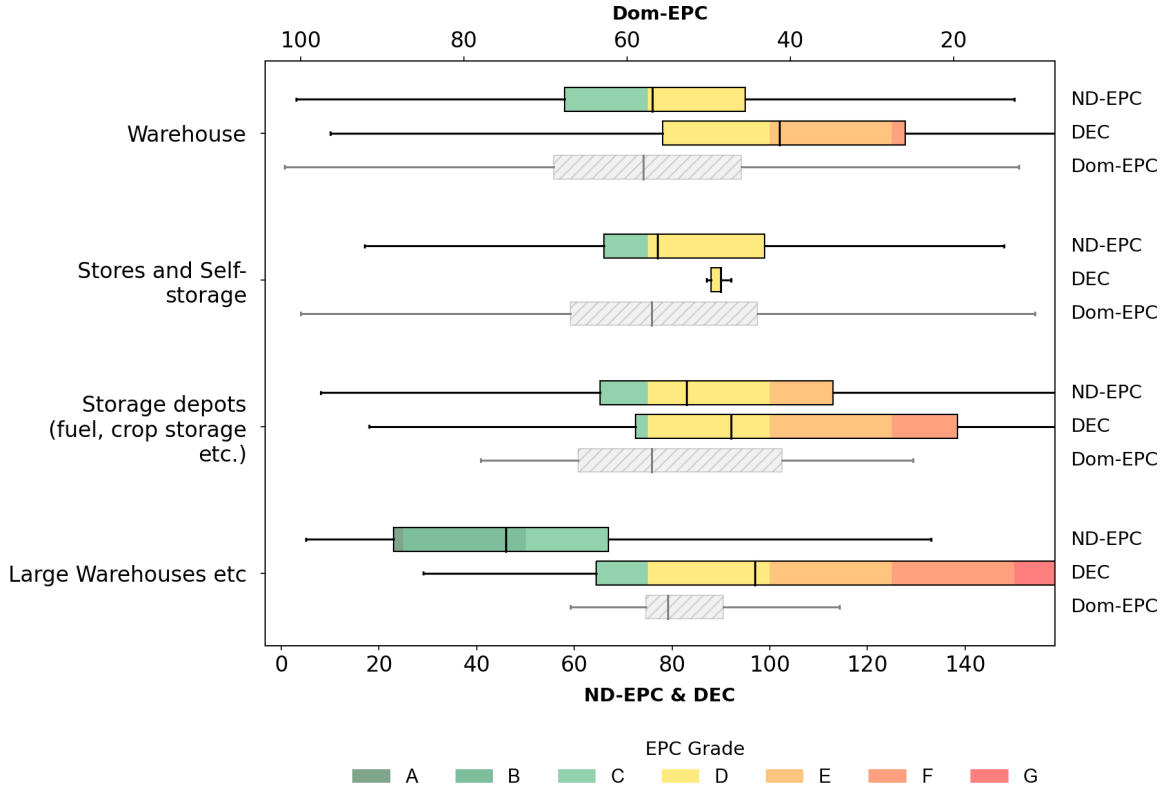


Figure 3.15-6: Percentage of floorspace on or off gas grid by activity group

3.15.4 Energy certification

Around 26% of all 'Warehouse' premises have an energy certificate with around 25% of these being non-domestic EPCs and < 1% being DECs. The median non-domestic EPC grade is a D, the median DEC is a D grade. The mean 'lodgement date' (when it was submitted to the national EPC Register) for an EPC/DEC for 'Warehouse' was July 2019.



Note: Boxes hatched in grey indicate too few or inapplicable records; any box with fewer than 10 records is also hatched; absence of an ND-EPC, DEC or Dom-EPC box indicates no data for that type.

Figure 3.15-7: Distribution of energy certificate numeric rating by activity group

At the activity grouping level it is clear that relatively few (just under 400) DECs match to any of the activity groups. ‘Warehouse’ and ‘Large Warehouses etc’ have the highest level of matches to non-domestic EPCs (35% and 39% respectively) and their median asset rating is 76 (D) and 46 (B) respectively. The lowest median non-domestic EPC asset rating is for ‘Storage depots (fuel, crop storage etc.)’ with 83 (D).

3.15.5 Energy use detailed insights

Within 'Warehouse', the activity group with the highest median energy use intensity (EUI) for electricity is 'Storage depots (fuel, crop storage etc.)' (54 kWh/m² per year) and for gas it is 'Stores and Self-storage' (66 kWh/m² per year). For total EUI (gas and electricity combined) 'Storage depots (fuel, crop storage etc.)' have the highest value (67 kWh/m² per year), see Figure 3.15-8 below (chart values truncated to 76th percentile of highest activity group).

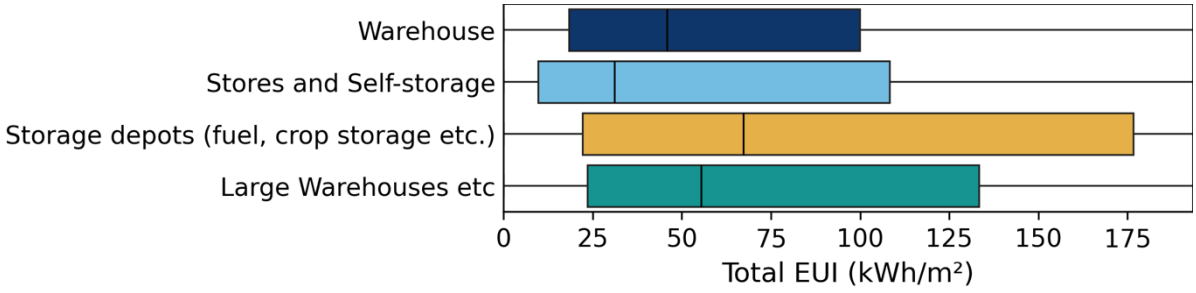


Figure 3.15-8: Distribution of total Energy Use Intensity (EUI) by activity group

Within Warehouse, the activity group with the highest median energy use intensity (EUI) for electricity is 'Storage depots (fuel, crop storage etc.)'(54 kWh/m² per year) and for gas is 'Stores and Self-storage' (66 kWh/m² per year). For total EUI (gas and electricity combined) 'Storage depots (fuel, crop storage etc.)' have the highest value (67 kWh/m² per year), see Figure 3.15-8 below.

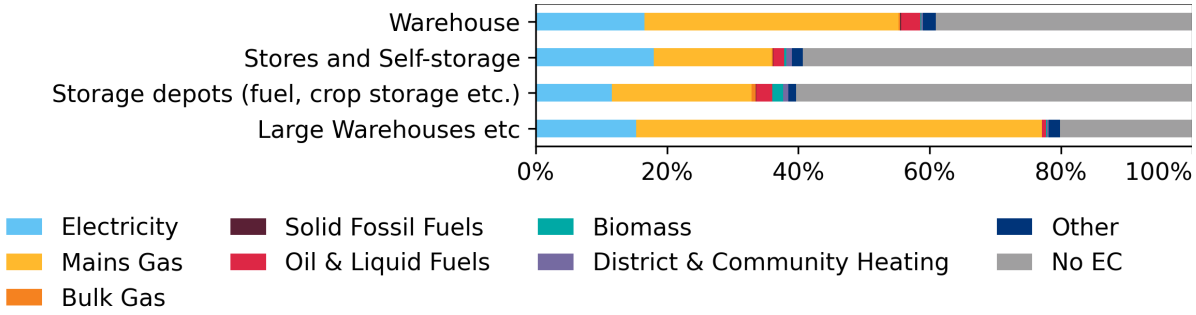


Figure 3.15-9: Heating fuels as percentage of total floorspace by activity group

In Figure 3.15-9 below, ‘No EC’ indicates that no energy certificate (EPC/DEC) has been matched to premises. What remains (approximately 62,000 premises) shows that much of the floorspace is heated by ’Mains Gas’, especially in the ‘Large Warehouses etc’ and ‘Warehouse’ groups, which possibly correlates with the higher ceiling/clear roof heights and subsequent building volumes associated with these types of premises. ‘Electricity’ is the second most prolific fuel type, but there are also instances of ‘Oil & Liquid Fuels’ and ‘Other’ fuels worth noting.

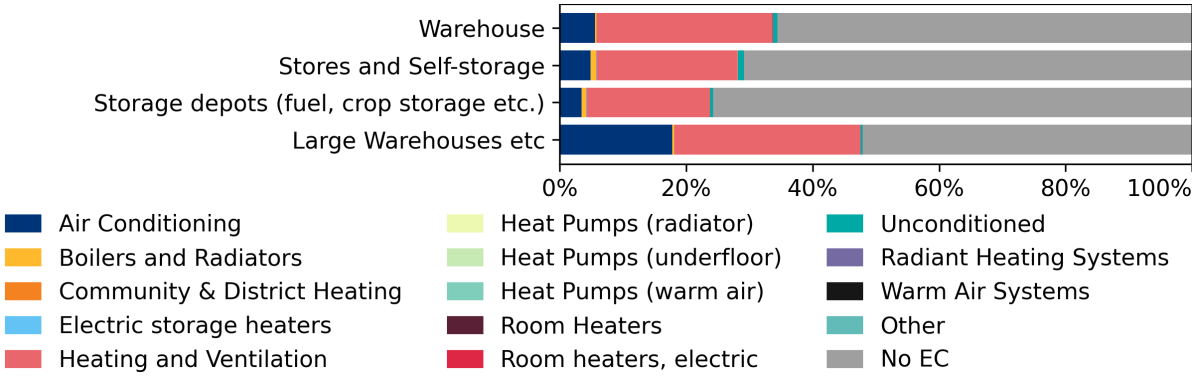


Figure 3.15-10: Distribution of total floorspace with heating system by activity group

The activity group with the highest percentage of floorspace that is air-conditioned is 'Large Warehouses etc' (68%) whilst the lowest percentage is for 'Stores and Self-storage' (10%), as shown in Figure 3.15-11 below.

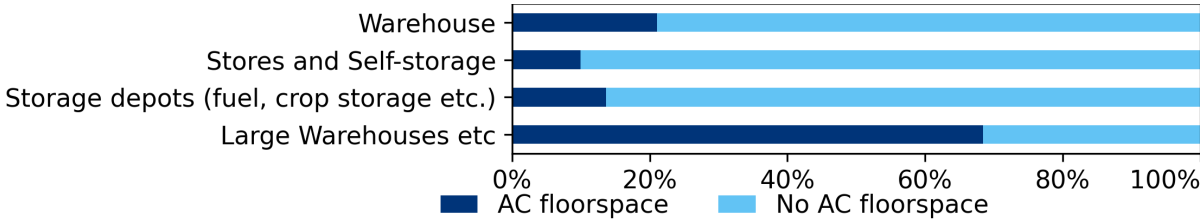


Figure 3.15-11: Air-conditioned floorspace by activity group

3.15.6 Heritage and Rural Urban

87% of all 'Warehouse' premises are in an area with no Conservation area or Listed building restrictions whilst 13% are either in a Conservation area, or are a Listed building or both. 'Stores and Self-storage' has the largest amount of their floorspace in heritage restricted areas (17%). More details can be seen in Figure 3.15-12 below.

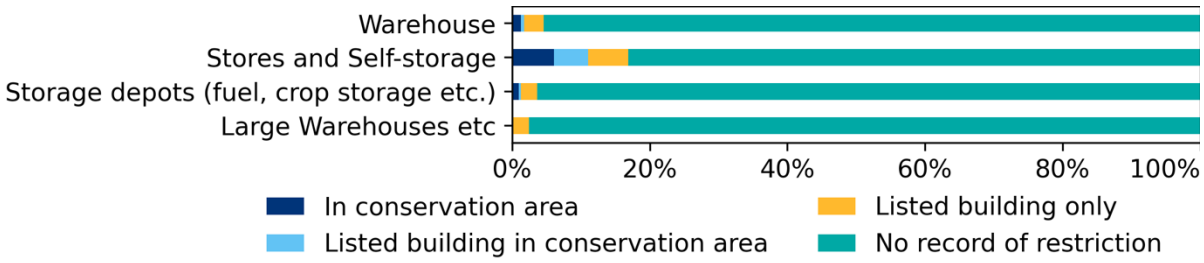


Figure 3.15-12: Planning restricted floorspace by activity group

Using the ONS flag for whether an address is rural or urban shows that 77% of premises and 79% of floorspace in the 'Warehouse' activity class may be found in an urban area. The largest activity group is 'Warehouse' where 81% of its floorspace is in an urban area, whilst 'Storage depots (fuel, crop storage etc.)' has the largest percentage of its floorspace in rural areas (30%), as shown in Figure 3.15-13 below.

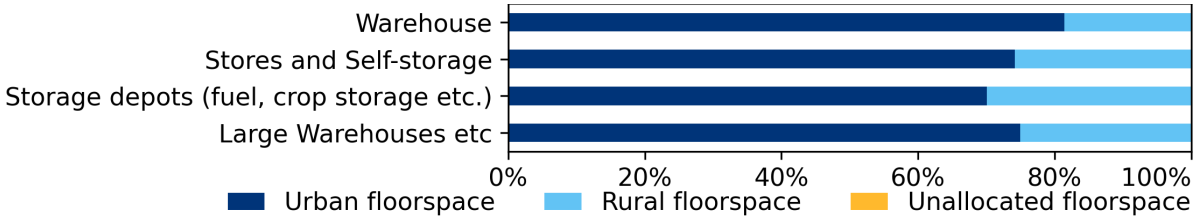


Figure 3.15-13: Floorspace by ONS Urban / rural classification by activity group

3.15.7 Mixed-use buildings

Within the 'Warehouse' class, 62% of SCUs are occupied by a single 'Warehouse' premises, whilst 32% share the SCU with other non-domestic premises and 6% share the SCU with domestic premises.

Figure 3.15-14 below shows 'Large Warehouses etc' is the activity group with the highest percentage of cases where they are the sole occupier of the building (83%) whilst 'Stores and Self-storage' has the highest percentage of SCUs shared with other non-domestic premises (42%) and 'Stores and Self-storage' has the highest percentage of SCUs shared with domestic residential uses (13%).

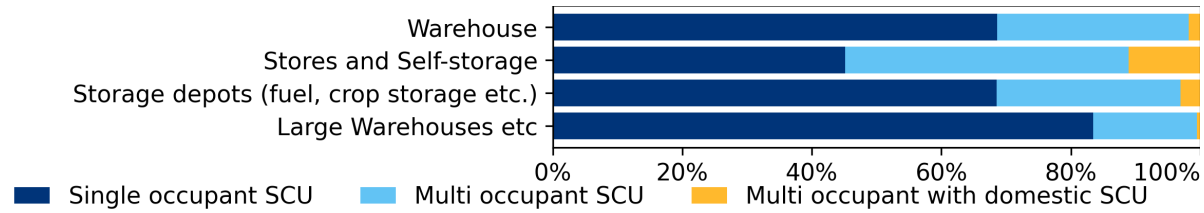


Figure 3.15-14: Percentage of premises by mixed-use SCU classification by activity group

3.15.8 Public sector

Around 7% of Warehouse premises and 6% of Warehouse floorspace is likely to be Public Sector. More detail can be seen in Figure 3.15-15 where 'Storage depots (fuel, crop storage etc.)' is the activity group with the highest percentage of premises likely to be Public Sector (18%) and this represents 25% of their activity group floorspace. 'Large Warehouses etc' is the activity group with the lowest percentage of premises (5%) and floorspace (4%) likely to be Public Sector. Note that we cannot always say definitively that a premises is Public Sector, and where there is ambiguity premises and floor area are labelled ‘Likely public sector’ in NBD.

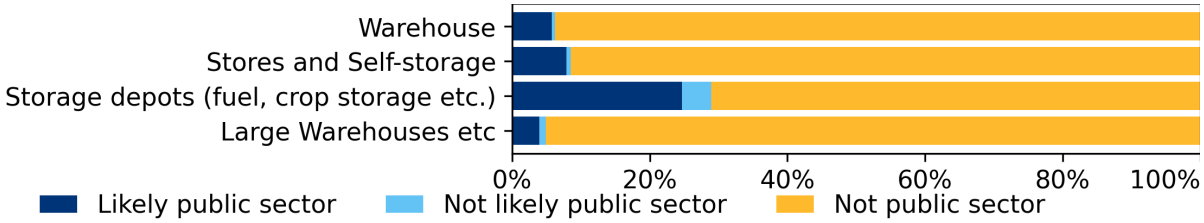


Figure 3.15-15: Percentage of floor area assigned 'Public sector' by activity group

3.15.9 Age and materials

25% of 'Warehouse' premises and 22% of Warehouse floorspace is classified in the '1940-1975' period for building age. The lowest percentages (excluding '2022 onwards' and 'null') are for the period '1919-1939' for premises (6%), which represents 3% of floorspace.

The details at the activity group level are shown in Figure 3.15-16 below, where it is clear that over 50% of ‘Large Warehouses etc’ premises occupy buildings built after 2006.

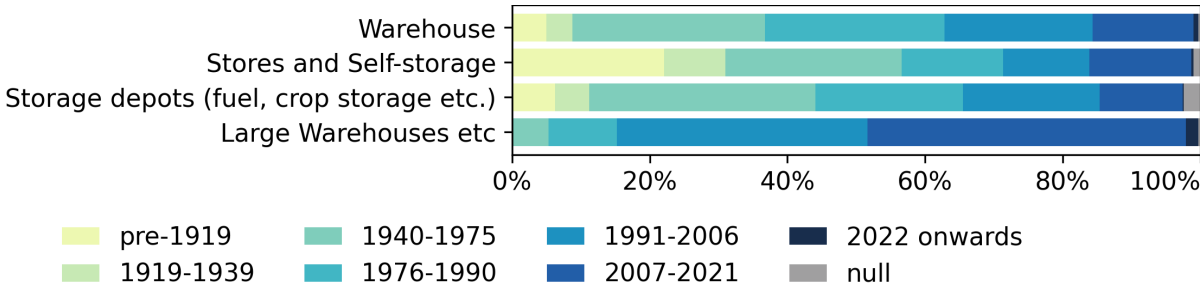


Figure 3.15-16: Distribution of premises on age by activity group

Masonry is the most common wall material in the 'Warehouse' activity class (measured by wall area). The 'Warehouse' activity group has the largest wall area (25.6 million m²) when measured from the 3D geometry in the database, and 52% of this is masonry which represents 27% of the total wall area in 'Warehouse' (see Figure 3.15-17).

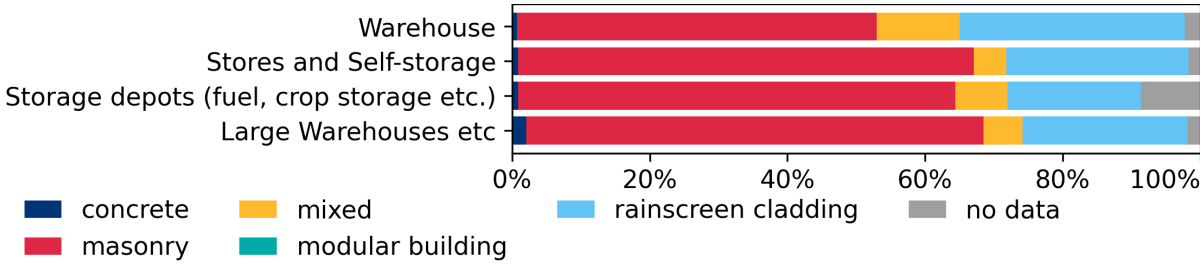


Figure 3.15-17: Distribution of total wall area by NGD material and activity group

Table 3.15-1: Summary statistics for Warehouse by activity group

Activity group	No. of premises	No. of SCUs	Total floorspace (million m^2)	Avg. floorspace (m^2)	% by count	% by floorspace
Warehouse	131,568	94,701	108.19	824	53.4	62.9
Stores and Self-storage	109,255	54,888	18.81	175	44.4	10.9
Storage depots (fuel, crop storage etc.)	2,905	2,401	3.24	1,174	1.2	1.9
Large Warehouses etc	2,435	2,192	41.71	17,179	1.0	24.3

Table 3.15-2: Summary energy statistics for Warehouse by activity group

Activity group	Median total EUI ($kWh/m^2/year$)	Total GWh	% by total energy
Warehouse	46	6,143.34	63.6
Stores and Self-storage	31	714.44	7.4
Storage depots (fuel, crop storage etc.)	67	651.22	6.7
Large Warehouses etc	55	2,147.17	22.2

4 Methods

4.1 Role and functioning of the NBD database

The database is the repository for the data that form the NBD. Although the database contains information on the domestic (residential) building stock, this report concentrates on quantifying and describing the non-domestic building stock. The database enables the precise cross-referencing of data tables to allow specific analyses to be performed.

The model operates as a Geographic Information System (GIS) with a layer structure and the various schemas (data folders) in the database reflect this structure.

4.2 Target date

1st of April 2023 was chosen as the target date for the NBD, so wherever possible the database reflects the status of buildings and premises on that date. It is not possible to construct the NBD to operate as a dynamic model because *all* constituent input datasets would have to be updated continuously. Much of the input data is not updated continuously, but periodically, and hence the data are selected that most closely relate to the target dates. Issues surrounding input data are described and explained below.

4.3 Input data

The following sub-sections briefly explain the most important input data, their caveats and confidence in their contents. the methods used to obtain and ingest them into the NBD are also mentioned.

The core datasets for the NBD

The Valuation Office Agency (VOA), the Scottish Assessors Association (SAA) and the Ordnance Survey are the three most important sources of data in the NBD, see Table 4-1. The VOA is one of the most reliable sources of information about non-domestic activity for England and Wales. The VOA is a division of His Majesty's Revenue and Customs (HMRC), responsible for the assignment of a theoretical annual rental value to all non-domestic premises, upon which business rates are then based. The SAA is the equivalent agency for Scotland, and this collects similar data, also very reliable. Ordnance Survey's Address Base (OSAB) adds important mapping data, which allows us to construct the NBD as a GIS.

Table 4-1: Principal input datasets and confidence in them

Dataset	Acronym	Level of confidence	Rationale	Particular caveats
Ordnance Survey AddressBase Premium	OSAB	High	Based on legal requirement for local authorities to provide a Local Land and Property Gazetteer (LLPG). Contains Post Office Address File (PAF) data.	Varying levels of activity classification. Not all levels always used
Ordnance Survey Mastermap Topo layer	OSMM	High	Standardised method with frequent updates	Shows building footprints, not premises
Valuation Office Agency	VOA	High	Legal standing; Updated daily; Open to appeals	Contains premises, not necessarily buildings
Scottish Assessors' Association SAA	SAA	High	Legal standing; Updated daily; Open to appeals	Contains premises, not necessarily buildings
His Majesty's Land Registry	HMLR	High	Legal standing. Provides property land parcel boundaries and links to ownership.	
Ordnance Survey Sites data	OS Sites	High	Requires accuracy to meet health and safety role. Provides land boundaries of some properties, such as schools and chemical works.	
Energy Performance Certificates (Domestic). England & Wales	EPC	Medium High	Legal requirement. But: EPCs may be withdrawn by property owner; known anomalies within data; frequently completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease.
Energy Performance Certificates (Commercial) England & Wales	CEPC	Medium High	Has a legal requirement. But perhaps completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease. Low coverage, compared to domestic
Energy Performance Certificates (Domestic). Scotland	EPC	Medium High	Legal requirement. But: EPCs may be withdrawn by property owner; known anomalies within data; frequently completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease.

Energy Performance Certificates (Commercial). Scotland	CEPC	Medium High	Has a legal requirement. But: perhaps completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease. No DECs for Scotland. These data contain flag for public access EPC. Low coverage compared to domestic.
Display Energy Certificates England & Wales	DEC	Medium High	Has a legal requirement and is required every year. But: perhaps completed at lowest price (so Assessors may cut corners and make mistakes).	Only stipulated for premises/buildings with areas > 250 m^2.
Environment Agency LiDAR data	LiDAR	High	Provides height of objects above ground surface.	Data collection frequency is biased towards urban areas.
Energy use data from electricity and gas meters		High	Subject to DESNZ QA processes	Can contain estimates of consumption. Relatively poor addressing.

Additional datasets that supplement the detailed content of the NBD

The datasets listed in Table 4-2 are considered to be supplementary to the core inputs, because either they do not apply to all premises across GB, or the data are linked only to core data inputs. For example, non-public Energy Performance Certificates (EPCs) for England and Wales and for Scotland, both domestic and non-domestic, which contain much more detailed information than contained in the publicly available data. These data can only be linked to premises via a matched EPC certificate and thus do not form part of the core data processing, whereas floorspace from EPCs may form part of the core data processing to identify the floorspace of premises, or SCUs (see Sections 4.7 and 4.8). The same applies to the non-public Display Energy Certificate (DEC) data for England and Wales.

The ePIMS (Electronic Property Information Mapping Service) dataset was obtained from the Office for Government Property (OGP) and has been used to help identify properties (both buildings and premises) that are owned and/or operated by organisations within the public sector.

There were some issues with aligning these different datasets, particularly regarding categorical variables such as age bands (see Table 4-4 below), and construction materials.

Table 4-2: Supplementary input datasets and confidence in them

Dataset	Acronym	Level of confidence	Rationale	Particular caveats
Non-public Energy Performance Certificates (Domestic). England & Wales, model outputs (Contain significantly more detail than publicly available data)	EPC	Medium High	Legal requirement. But EPCs may be withdrawn by property owner; known anomalies within data; frequently completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease.
Non-public non-domestic Energy Performance Certificates (EPCs) for England and Wales, model outputs (Contain significantly more detail than publicly available data)		Medium High	Has a legal requirement. But: perhaps completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease. Low coverage compared to domestic.
Non-public Energy Performance Certificates (Commercial). Scotland, model outputs (Contain significantly more detail than publicly available data)		Medium High	Has a legal requirement. But: perhaps completed at lowest price (so Assessors may cut corners and make mistakes).	Only required on sale/rent. Certificates valid for 10 years and might not be replaced if premises not sold/new lease. No DECs for Scotland. These data contain flag for public access EPC. Low coverage compared to domestic.
Commercial and Corporate Ownership Data	CCOD	High	Legal standing	Does not contain data for individual persons, or overseas ownership
Electronic Property Information Mapping Service	ePIMS	Medium High	Significant source for identifying public sector properties	UPRNs not always correct, or may be for only one building on a site
Estates Returns Information Collection	ERIC	High	Central Government dataset	Covers centrally operated health sector, so mostly excludes primary care
ONS Public Sector Classification Guide	PSCG	High	Derived from UK National Accounts	
Historic England Conservation Areas		High	Affects planning decisions	
Historic England Listed Buildings		High	Affects planning decisions	

Scotland Conservation Areas		High	Affects planning decisions	
Scotland Listed Buildings		High	Affects planning decisions	
Wales Conservation Areas		High	Affects planning decisions	
Wales Listed Buildings		High	Affects planning decisions	
National Geographic Database	NGD	Medium High	Linked to OSAB	Some data may not be collected by experts

Obtaining and ingesting the data
Some of the above were available via an Application Programming Interface (API), whilst others were sourced directly from data custodians.

Data loaders were written to load these various datasets in formats that can be used within the NBD.

4.4 Data processing

Cleaning of data
It seems that no dataset is ever "perfect", as each will contain errors and/or omissions that need to be dealt with. Many of the apparent anomalies are due to human involvement in the recording of data, such as simple typos or the wrong option selected from a dropdown list. Frequently, established code identifiers are overwritten, or where a default value should be overwritten, it is not.

Significant effort is expended dealing with these situations so that as much information as possible can be retained, but in a useable form to enable useful analysis.

Alignment of data
Some datasets, such as EPCs, contain multiple records for the same entity. Given the target date of 1st of April 2023, all data that are closest to, but no later than, this date were selected.

UPRNs

As the Unique Property Reference Number (UPRN) is the spine of the NBD, this is used, whenever present, to make joins between input dataset records. However, in some cases, UPRNs provided as link identifiers in datasets external to the OS can be prone to errors or may not reference all of a site or premises. There can also be multiple UPRNs inside a premises and vice versa. All such situations have had to be identified and accounted for.

Many non-domestic UPRNs have a direct link to VOA premises, but where this fails, or is not present, address matching is used to establish a cross-reference (see below). Similarly, some EPCs and other data also hold a UPRN, but these are not always correct, or reference only part of a premises.

Geospatial data

The input data provide links from OSAB UPRNs to OS map polygons, which allows UPRNs to be located spatially. Other data, as described elsewhere, may then be linked to the UPRN and thence to a map building polygon.

Sometimes, a premises contains multiple map polygons, but this relationship is not held within the VOA, OSAB, or other data. To ensure that all relevant building polygons are associated with premises, the Land Registry (HMLR) property boundary is used to contain all polygons relevant to individual premises. For large campus sites such as Schools and Hospitals the product OS Sites provides a polygon boundary to contain the site and enables the grouping of buildings within this boundary.

Addresses

British Standard BS7666 'Spatial datasets for geographical referencing' is the standard structure for recording and maintaining addresses in the UK. However, BS7666 is not applied rigorously in many of the principal and supplementary input datasets of the NBD, apart from Ordnance Survey AddressBase. The processing of address data aims to align the content of a dataset's address field(s) with the BS7666 structure held for each OSAB UPRN. Following this, the quality of the match is assessed by calculating the Levenshtein distance (a metric used to measure how different two text strings are).

Address-matching is not always successful. Matches may occur that are not sufficiently robust for us to consider them reliable. Some addresses may be missing essential components (e.g. street name, postcode) which makes address matching impossible. In other cases, addresses may refer to premises which no longer exist (due to demolition, or the conversion of a building e.g. from 'Factory' to domestic flats).

Organisation identities

This method is mostly used to identify, or cross-reference, public sector premises/buildings and sites. Examples include cross-references to the list of relevant organisations in the ONS Public Sector Classification Guide (which aims to list all public sector bodies in the economy) and then to the Commercial and Corporate Ownership Data from Land Registry (which lists all company-owned or corporate premises in the UK). The organisation names can be used to search both.

4.5 Activities within the NBD

As the NBD uses data from multiple sources, the activities recorded in these are not perfectly consistent. To overcome this, the NBD employs the CaRBE (Carbon Reduction in the Built Environment) activity classification system, which is largely based on Valuation Office Agency classifications, with additions from Ordnance Survey AddressBase and the Scottish Assessors' Association data. Each of these datasets is processed to provide a "derived activity", which is the foundation level and most detailed within the NBD. Thus, CaRBE is developed from the bottom up, and no disaggregation is employed at any stage: everything is worked upwards from the derived activity.

These derived activities for individual premises and addressable objects are classified into "CaRBE activities", such as "Factory", "Computer Centre", "Office (Local Authority)", "Public House/Pub Restaurant", "Supermarket/Hypermarket/Superstore", "Surgery / Clinic / Health Centre" and so forth. In total, there are 365 CaRBE activities in the NBD population. For high level analyses, these are grouped into CaRBE classes, as shown in Table 4-3, together with the count of CaRBE activities in each class. The Miscellaneous class contains activities that have descriptions sufficiently vague as to make it risky to place them into a more defined class. "UNCODED" indicates where the activity could not be established with adequate reliability. The Miscellaneous and UNCODED classes are mentioned here for information only, and do not form part of the NBD population reports in Sections 1, 2 or 3.

Table 4-3: CaRBE Activity Classes, with counts of activity and activity groups per class[9]

CaRBE Class	Abbreviation	Number of activities in class	Number of activity groups in class
Agriculture, Countryside, Animals	AG	17	4
Arts and Leisure	AR	30	6
Community	CO	17	7
Domestic	DO	12	1
Education	ED	22	7
Emergency	EM	5	4
Factory	FA	58	7
Health	HE	9	5
Hospitality	HO	29	6
Miscellaneous	MI	1	1
MoD	MO	13	5
Office	OF	13	5
Shop	SH	38	5
Sport	SP	39	6
Transport	TR	27	6
UNCODED	UNCODED	1	0
Utilities	UT	17	5
Warehouse	WA	18	4

Each activity is categorised as highly likely, possibly, or unlikely to be (parts of) a building. The NBD excludes premises with activities that are unlikely to be a building (e.g. telegraph poles). What remains is included in the NBD population, subject to the previous paragraph.

Note that the **activities and classes used in the NBD are not equivalent to, or associated with, Standard Industrial Codes** (SICs) used in measurements of economic activity in an economic "sector". This is because the actual activity in a building (premises or addressable object) is not necessarily the same as the SIC(s) chosen by the occupier. For example, a petrochemicals company may have the SIC code "19201" indicating "Mineral oil refining", loosely in the "industrial sector", but the actual activity in its head office would be "office work", not the refining of mineral oil.

The "activity groups" used here have been designed to sit between the activity and class levels, with the objective of aggregating activities with similar operational characteristics and levels of energy use, within each class. Examples are: "Food and Drink Production" in the "Factory" class, or "Supermarket, Retail Warehouses & Other large shops" in the "Shops" class. See Table 4-3 for the counts of groups per class.

[9] The total number of CaRBE activities available can exceed those used for a model snapshot. Table 4-3 lists the numbers of activities available in CaRBE. Some activities may cease to be used by the VOA (for example 'Customs Inspection Facility') whilst for others, there may simply be no trading premises for that activity at the time of the model snapshot. For this reason the numbers of CaRBE activities listed in Table 4-3 may not always align with the numbers reported elsewhere in this report.

This activity group level of classification is used in many of the energy analyses and to produce synthetic datasets (see 'Synthetic Buildings', Section 4.10, below), and were also the basis of the survey sampling described in Section 4.11.

4.6 Physical characteristics of buildings

Age

The age of the stock is taken from VOA data and/or from the Ordnance Survey National Geographic Database (NGD), where VOA data are not available. The age structures of these datasets are not the same, so a compromise set of age periods has been applied, as explained in Table 4-4.

Table 4-4: NBD building stock age periods

NBD age period	VOA (non-domestic) age periods that overlap	NGD age periods	EPC age periods (E&W) that overlap
pre-1919	Pre-1900, 1900-1918	Pre-1837, 1837-1869, 1870-1918, Pre-1919	Pre 1900, 1900-1929
1919-1939	1919-1939	1919-1944	1900-1929, 1930-1949
1940-1975	1940-1954, 1955-1964, 1965-1970, 1971, 1972, 1973, 1974, 1975	1919-1944, 1945-1959, 1960-1979 (and yearly data available)	1930-1949, 1950-1966, 1967-1975
1976-1990	yearly (e.g. 1976, 1977 etc)	1960-1979, 1980-1989, 1990-1999	1976-1982, 1983-1990
1991-2006	yearly (e.g. 1991, 1992 etc)	1990-1999, 2000-2009 (and yearly data available)	1991-1995, 1996-2002, 2003-2006
2007-2021	yearly (e.g. 2007, 2008 etc)	2000-2009, 2010-2019, 2020-2029 (and yearly data available)	2007-2011, 2012-2021
2022 onwards	yearly (e.g. 2022, 2023 etc)	2020-2029 (and yearly data available)	2022 onwards
No available data			

Structure, Walls, Roof

The VOA data contain codes for each premises' structure, wall and roof constructions. Most are standard, such as structure = 'traditional', wall = 'brick' and roof = 'slate'. However, while some premises have complex strings of codes, which are more difficult to categorise, the vast majority of such codes have been categorised. Not all premises have such codes, depending upon the survey and valuation method used by the VOA.

Similar descriptions are available from the NGD, but again, these are not in perfect alignment.

Main fuel

Where available, EPC data (including non-domestic EPCs, domestic EPCs, and DECs) was used as the primary source to identify the main fuel, as EPCs often provide more detailed and structured information. When EPC data was missing or insufficient, VOA data was used as a secondary source. While the VOA may include a record of the main fuel used at a property, this information is not consistently available.

Heating, ventilation and cooling (HVAC)

Only EPC data (including non-domestic EPCs, domestic EPCs, and DECs) was used to identify HVAC systems, as it provides more comprehensive and consistent information on building environmental systems.

4.7 Constructing the NBD 3D model, using 3DStock

In addition to the NBD content describing premises and addresses and their activities, it is also necessary to construct a model to represent the complex relationship between premises, addresses and buildings. Using the 3DStock model, developed over decades at UCL (Evans et al, 2017), a 3D representation of the NBD has been constructed to capture these complex relationships.

The Self-contained Unit (SCU)

There is no definitive list of buildings, together with their activity, for GB. There are records for premises and addresses (activities), plus building footprints on maps, but stitching these together can be complex.

Premises do not always equate to buildings. Some premises – such as phone masts, market stalls, or storage land – are not even buildings, whilst others can be just parts of buildings, such as an individual office suite in an “office building”. Premises can also contain multiple buildings, such as a school or factory site. Frequently, domestic and non-domestic premises can be found within the same building. Similarly, energy meters can record consumption in complex arrangements of premises and buildings. To deal with these scenarios, the NBD uses the Self-contained Unit (SCU) concept to place a definable boundary around what is being described and measured.

3DStock generates a SCU by plotting the geospatial locations of premises and then aggregating those that fall within a geometric map polygon representing the building footprint. Where possible, the different premises are correctly allocated to the floor(s) that they are located on which builds up a three-dimensional stack of activity within each building polygon. When activities span multiple building footprints, such as when a premises is located across multiple (historic) addresses, e.g. ‘7-9 The High Street’, then the SCU boundary expands from a single building footprint to encompass the neighbouring building footprints as required. The SCU is designed so that it does not divide any premises and treats the enclosed objects as a single unit. An example is shown in Figure 4-1.

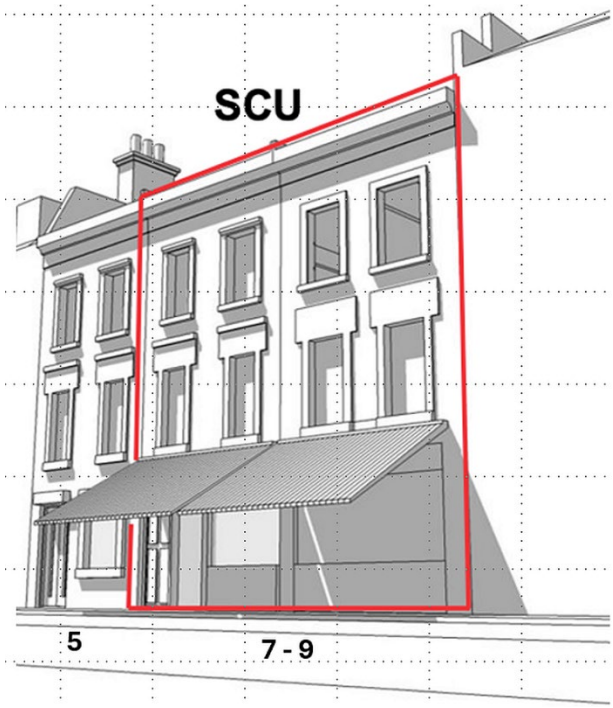


Figure 4-1: The assignment of a self-contained unit (SCU) around a ground floor shop that spans two buildings (e.g. 7-9 The High Street) with domestic flats above

The geometry of the SCU is constructed from the interaction of the SCU's building polygon(s) and LiDAR data, which provide the heights of surfaces above the ground and thus roof and wall areas. The areas of party and exposed walls are also calculated in 3DStock.

Once a SCU has been constructed, it is possible to calculate floor areas for an entire SCU where it is not occupied by premises with recorded floorspace (e.g. from VOA data, or EPCs). An algorithm effectively slices the SCU across each floor level, with the floor-to-floor distance being based on empirical data and values calculated from within the model (avoiding a circular calculation). This method ("the slicer") allows the model to infer floorspace where no data are available.

As well as identifying the three-dimensional boundary of each SCU, the energy meters associated with each component of the SCU can be aggregated and applied to the unit. In many instances it has been possible to allocate an energy meter to an individual premises, within a unit, but this does not necessarily mean that all of the energy passing through that meter feeds just the specific premises.

In the example in Figure 4-1 , the ground floor shop could have just one electricity meter for the whole premises, or two meters because each part of the ground floor still uses the metering left over from when it was two shops prior to the expansion. It is also possible that meter(s) matched to the shop also feed the flats above, or only some of the flats, which do not have their own meter(s). Metering can be complex.

4.8 Calculating floorspace

By bringing together the principal input datasets and applying a hierarchical approach (illustrated in Figure 4-2) for each activity, floorspace figures for each premises, UPRN or SCU may be derived. The hierarchy funnels towards the best recorded floorspace, or calculated floorspace, for each premises. The VOA floorspace data (shown as the red layer)

are generally reliable, with a flag to indicate where this is true. If there is no VOA record of floor area, the method gathers non-domestic EPC floor area data (blue), where available. If this fails and the model permits it for a few specific activities (such as 'Holiday Home (Self Catering)', the method passes to domestic EPC floor area (green). (Note that to avoid inaccurate matching, not all activities are allowed to substitute domestic EPC floor area). If no EPC data have been gathered, the calculated floor area derived from the 3DStock model (gold) is used. Finally, if all stages fail, there are no floorspace data in the database for the premises (grey).

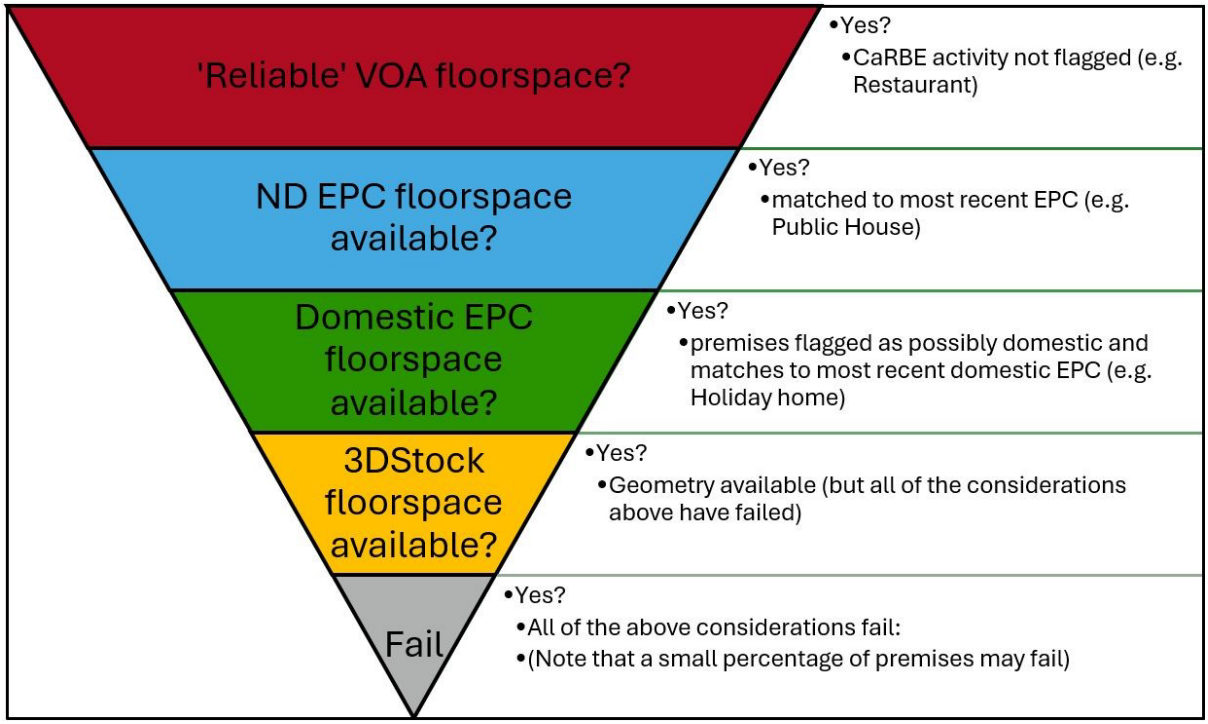


Figure 4-2: The method of selecting the most appropriate floorspace data for non-domestic premises using activity and other data

The floorspace defined in each layer of the identification process is normalised to gross internal area (GIA), regardless of the source, using a set of conversion factors. GIA is the internal area of spaces, measured from the internal face of one wall to the opposite wall and this is used because it is the method employed in Energy Performance Certificates and Display Energy Certificates. It is also the measurement convention that best describes the total floorspace of premises. The final output from the above method is the "best floorspace".

4.9 Energy Use Intensity (EUI)

As energy use in buildings is largely determined by the activity and the floorspace it occupies, energy use intensity is generally the best way to compare energy use across SCUs/buildings/premises of varying size and type.

In the NBD, EUI for each energy vector (in this case mains gas and electricity meter data via NEED/ND-NEED) is calculated by dividing the annual recorded energy use by the best floorspace. This gives the EUI as kWh/m^2 GIA/year. Where all required input data are identified, these values are recorded for each object in the NBD population.

4.10 Synthetic Buildings

The Synthetic Buildings Population is a premises-level representation of the GB non-domestic building stock, providing the data types shown in Table 4-5. The synthesis aggregates premises according to activity group and geographical location, such that these data have a useful level of granularity, without becoming disclosive Each synthetic record is associated with an area code (either Middle-Layer Super Output Area for England and Wales or Intermediate Zone for Scotland) and an activity group. A synthetic record is generated only where at least ten complete source observations exist for the same area-activity combination; this threshold provides a minimum level of anonymity. If the threshold is not met, the model aggregates upwards – either geographically or in terms of activity taxonomy – until the requirement is satisfied. Strata that remain under-populated are excluded from the release.

Data for Synthetic Buildings includes energy use data, building structure/materials data, and some contextual data, see Table 4-5.

Table 4-5: Identifiers and variables available in the synthetic building dataset

Identifiers	
MSOA or Intermediate Zone code	CaRBE activity group
Premises structural attributes	
Number of storeys	Wall construction description
Total floor area	Age band
Roof construction description	U Value (W/m²K))
Technologies	
AC present (yes/no)	Main heating fuel
Annual energy use breakdown - units of kWh per square metre (kWh/m²)	
metered energy (electricity)	heating energy
metered energy (gas)	cooling energy
oil use	lighting energy
biomass use	equipment energy
	DHW energy
	auxiliary energy
Additional context	
In mixed-use building (yes/no)	Has heritage status (yes/no)

4.11 Validating EPC data

The first phase of the National Buildings Database project identified EPC lodgement data held by MHCLG and DESNZ as an important data source for non-domestic buildings, in particular. While less detailed than the lodgement data held for domestic buildings, this dataset contains key variables which are not present in the public release of EPC data, nor available in any other comprehensive publicly available dataset.

The variables include summary HVAC (heating, ventilation and air conditioning) system details, floor areas for different activities, HVAC sub-systems serving discrete areas, fuels used, and an energy end-use breakdown. These variables were reported for the Hospitality Activity Class at an early stage of the project. Although EPC data is potentially very valuable, the gap between metered energy data and EPC rating is well-documented in the literature. Consequently, an audit programme was undertaken to assess the reliability of variables in the EPC data, see Figure 4-3 below.

The auditing included conducting EPC surveys at selected non-domestic sites. Since EPC ratings are calculated using standard profiles for occupancy, set-point temperatures, and equipment loads, actual data were also recorded for these in summary form. For reasons of practicality, this data was collected in interviews with building occupiers rather than by direct monitoring.

Metered data for gas and electricity use were also collected. These data were used to construct a calibrated dynamic thermal simulation model. A series of successive intermodal comparisons was conducted to examine the gap between EPC models and calibrated models. This allowed the relative impact of actual weather data, actual loads and occupancy, and setpoint temperatures and building fabric characteristics to be assessed. The comparison was undertaken on a class-by-class basis (see Appendix B).

Figure 4-3: Flowchart showing audits and simulation workflow to compare EPCs against bottom-up modelling

4.12 Maintaining and updating the NBD

As the NBD sources data from many and varied sources, the most reliable means of updating the model will be to assign a new, more recent, target date and assemble the same source datasets for the target date. This requires a degree of planning, as some datasets need to be pre-ordered to arrive in time for the target date (e.g. SAA data).

Partial updating of the database is possible, but this runs a real risk of applying data with different time stamps. Some datasets change daily (e.g. VOA), whilst others may change once every few years (e.g. LiDAR).

5 Quality Assurance and Confidence

The NBD employs reliable data sources which cover the great majority of building footprints in Great Britain. The main sources of data it relies on - the Ordnance Survey (OS), the Valuation Office Agency (VOA), Scottish Assessors' Association (SAA) and Land Registry - are updated frequently. Monetary and legal transactions depend on these sources, and their users will tend to complain about errors. However, it is difficult to assess the quality of NBD information independently, since there is no equivalent database to compare against, and the principal NBD data inputs can be largely considered to be the definitive sources of relevant data. Using these for validation would be circular, and is therefore inappropriate.

This section of the report outlines the work that has been completed to ascertain how reliable NBD is. We begin by comparing numbers of premises in NBD against other data published by a wide variety of organisations, both public and private. Next we describe two interview surveys carried out to evaluate how accurately addresses, activities and names of organisations are recorded in NBD. Then we describe detailed site audits that were carried out, again to assess and validate, and to contextualise data in the NBD.

5.1 Comparing against other sources

There are some instances where counts of premises/addresses in the NBD closely match data from non-NBD sources. However, there are many more situations where there are discrepancies between these external sources and NBD, as the example comparisons below illustrate. This is for a series of reasons.

First, data may be obtainable for England, Wales, Scotland, GB, or for the whole UK not broken down into the countries. Information may be for different years, which is important for counts in rapidly changing activities like shops that change from, say, a shoe shop to a café very easily.

The external sources can also cover differing administrative, or geographical, areas. For example, one source may refer to 'England' only, whilst another source for the same activity might refer to the 'UK'. In some cases the criteria are very specific, such as 'in Edinburgh'. In each case, the equivalent data have been pulled from the NBD population for comparison. As the NBD does not yet include Northern Ireland, all external statistics for the UK are reduced by 3% to adjust to Great Britain. This 3% reduction is unlikely to be perfect, but it is based upon aggregate Northern Ireland Valuation Office Agency (NI VOA) data combined with VOA data for England and Wales, plus the Scottish Assessors' Association data.

Second, the unit of accounting in NBD is either the premises or an address. Non-NBD sources tend to give numbers of businesses or institutions, or occasionally numbers of buildings or locations. There are some types where you might expect the number of premises to equate to the number of institutions, for example, prisons with their single sites and boundary walls. However, Doncaster Prison, for example, is on four separate sites.

Third, numbers of businesses have an uncertain relationship to numbers of premises. There can be significant discrepancies where commercial activities can be home-based, or mobile, such as hairdressing. At the other extreme, some businesses can have many premises, such as a supermarket chain. These one-to-many situations are particularly problematic due to there being so many organisations/businesses with multiple sites or branches.

Fourth, the types of activity where better matches are found tend to be those defined by law and which must obtain licenses, such as pubs, casinos or betting shops. There are also good matches for public institutions like state schools, most prisons, and NHS hospitals –

although here the published data is mostly for numbers of institutions, and numbers of buildings are more difficult to obtain. There is reasonable data – although some surprising gaps – for the emergency services.

Further problems arise from using vague or ambiguous categories, both in the VOA/SAA/OS data, as carried forward into the NBD, and in the sources of information outside NBD. An example would be 'clubhouses and clubrooms' which takes in a great range from gentlemen's clubs in London, to 'club' lounges in airports, to working men's clubs, to clubs for a variety of pursuits. In NBD the great majority of premises appear somewhere in the database, but not always in the places that other data sources would indicate.

Of the 148 sources of external verification data that were found, only 73 were used in the final comparison, based on the perceived reliability and precision of the data. For example, five external sources of data for the activity ‘Distillery’ were found, covering various geographical or administrative areas and with a range of dates. The sources were provided by two organisations, one a trade organisation (three sources) and the other the ONS (two sources). The ONS is an official body, which adds weight to the perceived veracity of the data. For the trade association, no precise criteria could be found for inclusion. The date stamp for one of the ONS sources was 2023, which aligns with the NBD target date of 1st April 2023 and the area covered was England and Wales (which can be specified within the NBD). Therefore, the ONS data for 2023 were chosen as the ‘best match’ and was thus included in the final 73 external sources.

Comparing NBD activities, or groups of activities against sources outside NBD indicates that 21% of all NBD activities can be matched against an external source, in some form or other. This list also accounts for 17% of the NBD population of Unique Property Reference Numbers (UPRNs, address reference codes) and 15% of Unique Address Reference Numbers (UARNs, premises reference codes) in a similar manner.

17% may appear a relatively small proportion of the population of UPRNs. However, readers should note that approximately 58% of the population falls into activities that cannot practically be checked (due to ambiguous naming and input data constraints). This 58% is accounted for by just ten activities across the Shop, Office and Factory activity classes.

All these factors taken together mean that 4.9% and 5.2% of NBD activities have counts of specific UPRNs and premises in NBD that are within +/- 15% of the figures found in external sources.

The research and subsequent analyses given above may be summarised by saying that identifying and categorising the non-domestic building stock primarily depends upon who is doing it and for what purpose. With so many organisations deciding upon their own categorisation and with many premises/businesses/individuals/organisations self-reporting their activity classification, it is unlikely any single definitive list can be established, with the same time stamp, for all activities or even a single activity. As the NBD is fundamentally built on official data, mostly with legal weight behind them, it is very likely that NBD data is more reliable than unofficial sources of data.

Visual summary comparing NBD to other sources

Figure 5-1 summarises the matching of activities to external sources of information. The activities as a percentage (%) bar indicate the percentage of activities, per class, that were matched against the other source (based on the activity). The UPRNs as a percentage (%) of class indicates the percentage of all *addresses*, per class, that were matched (based on their activity). The UARNs as a percentage (%) of class indicates the proportion of all

premises, per class, that were matched to an external source (based on their activity). For example, 67% of Emergency activity types were matched to some external source of validation; whilst 48% of all UPRNs and 47% of UARNs in the Emergency class were matched to an external source. Note that the Miscellaneous, MoD and Domestic activity classes are not included due to either a lack of data, or – in the case of Domestic – lack of need.

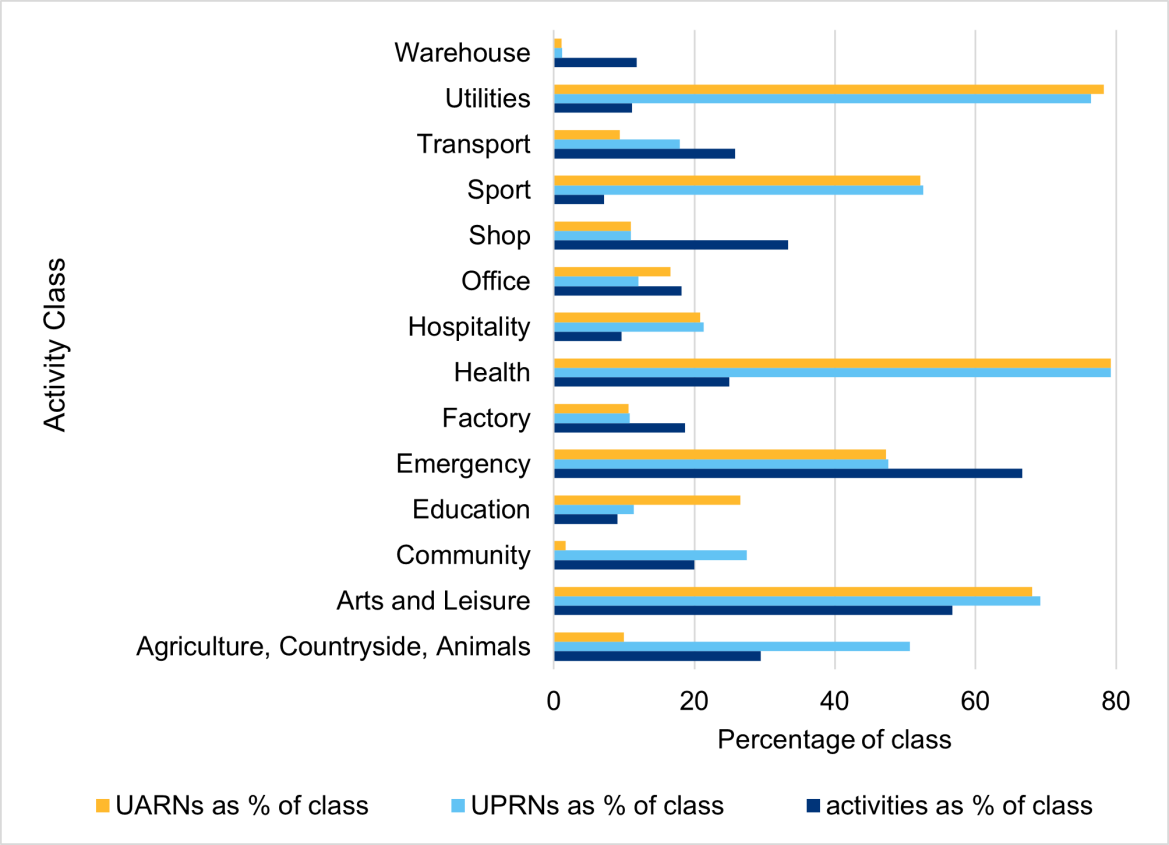


Figure 5-1: Percentages of each activity class compared to external data sources

5.2 Interview surveys

In addition to comparing NBD against other sources of data about GB buildings, two broad types of survey were also performed: interviews with premises users, and site inspections or 'audits'. These surveys were both intended to act as processes for validating the content of the principal input datasets and the allocation of activities to premises. The surveys are described below, starting with the interviews.

The Insight Survey and QA Survey

The Insight Survey was an important secondary strand of data collection, consisting of 807 telephone interviews with people from 10 of the 15 activity classes defined in previous work by UCL. The interviews were carried out by Winning Moves, using questions drawn up by UCL, and they were intended to take no more than 25 minutes for each interview. The survey had two principal objectives:

1. To examine the robustness and accuracy of address matching, activity records, and organisation names recorded in NBD.

2. To provide additional, more detailed information about premises, energy management practices, and installed heating, ventilation and air conditioning equipment that is not available through other means.

Prior to carrying out the Insight Survey, a shorter 'Quality Assurance' survey was carried out. This had similar objectives to the Insight Survey, but it was also intended as a test of the methods and approach of asking representatives from organisations about their premises.

Sampling (QA and Insight Surveys)

Our sampling approach set out to achieve a minimum number of responses from activity classes representing more than around 1,000 premises in NBD. It also aimed to achieve more responses from activity classes with highest energy-use intensity (i.e. energy use per square metre), and where there was more limited previous work – for example, premises in the 'Factory' activity class.

For the QA survey, an additional objective was to achieve at least 20 responses from each activity class. The achieved sample sizes are shown in Table 5-1 below.

Table 5-1: Proportions of premises and sample sizes for QA and Insight Surveys

Activity Class	Proportion of all premises	QA Survey Sample*	Insight Survey Sample	Insight Survey Percentage
Agriculture, Countryside, Animals	1.6%	62	0	0.0%
Arts and Leisure	1.7%	63	30	3.7%
Community	3.4%	62	50	6.2%
Education	6.3%	65	54	6.7%
Emergency	0.2%	28	0	0.0%
Factory	13.6%	151	215	26.6%
Health	1.3%	57	49	6.1%
Hospitality	11.4%	134	0	0.0%
Office	21.8%	242	66	8.2%
Shop	25.1%	278	149	18.5%
Sport	1.3%	63	50	6.2%
Transport	0.6%	56	25	3.1%
Utilities	0.4%	62	0	0.0%
Warehouse	11.3%	126	119	14.7%
MoD	0.0%	0	0	0.0%
Total	100.0%	1,449	807	

*Note that some of the QA survey respondent premises were also included in the full Insight Survey sample. Additional questions were put to them in the Insight Survey telephone interview.

Recruitment

Prior to starting recruitment of interviewees, UCL developed a microsite providing an overview of the research and explaining how and why the National Buildings Database was carried out. This was referenced when making the telephone approach asking for an interview. We used the Experian database of contacts in organisations from each of the

targeted activity classes, which included telephone numbers and addresses, as well as a description of the Standard Industrial Classification (SIC) of the organisation.

Interviewers directed their enquiries to a member of staff with some knowledge of energy use within the organisation. They used a written script with multiple routes through questions, so that the response to one question dictated which other questions would be posed. There were also different routes through the questions for different activity classes to allow for tailoring questions to the appropriate activity class. Interviewees were asked if they were willing for Winning Moves to record the interview. If so, it was recorded, otherwise the interview proceeded without an audio recording.

The Quality Assurance (QA) Survey

The QA Survey was piloted prior to full recruitment and implementation. This pilot was aimed to test the database of contact information, provided by Experian, to check wording and clarity of questions used in the interview, and at the same time to assess how well organisations in the database matched their allocated activity classes. It also explored whether different data collections and questions would be needed for different activity classes.

Questions in the QA Survey started with background and contextual information about the organisation and its premises, including the size of the premises and the number of storeys. There followed questions about their energy consumption, energy management, operating hours, and whether they had energy certificates (EPCs or Display Energy Certificates). Then there were questions about installed building services, challenges to energy management, and what additional support would be useful to improve energy management.

The Insight Survey

Piloting of questions with the Hospitality Class revealed that some questions were difficult for interviewees to answer, especially when there was variation across the year (e.g. peak and off-peak seasons). For this reason, questions about seasonal variations in use and/or opening hours were removed from the full Insight Survey. The QA Survey also revealed that many interviewees did not know the age of construction of their building(s). Consequently, the question about building age was also removed from the full Insight Survey.

The final set of questions used in the full Insight Survey are summarised in Appendix 1. Broadly, the interview schedule included sections about:

- the organisation – including staffing
- the premises – one of more buildings, or part of a building, size of building(s), number of floors
- how energy is managed
- hours of operation – through the year, and day-by-day
- heating, ventilation and air conditioning equipment
- energy performance certificate
- main challenges relating to energy management
- what non-financial support is needed from Government.

Questions were tailored where necessary (e.g. hours of operation, staff) to specific activity classes to make it easy for respondents to answer clearly.

There were also specific, tailored questions for certain activity classes. For example, for the Education activity class (which includes nurseries, schools and universities), we asked if respondents have a data centre or server room, or any other high-energy use equipment. For the Factories activity class (including workshops, laundries, food and drink production, mineral production and vehicle repairs), we asked what processes take place on their premises, and which of their processes uses most space. We also asked 'Factories' if they ran their premises continuously 24/7, and what proportion of their premises is used for office work, storage, packaging and distribution, or preparing food for a canteen/restaurant.

Findings from QA and Insight Surveys

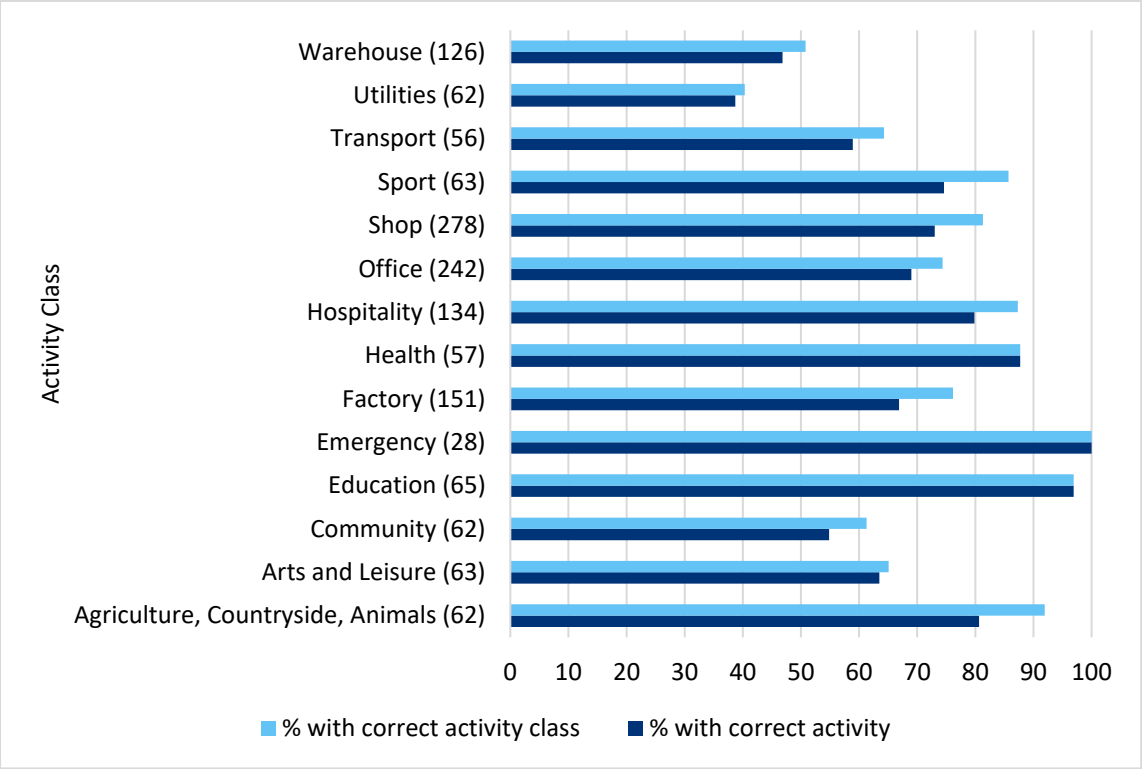
Both the QA Survey and the Insight Survey indicated that NBD accurately records their address, see Table 5-2. Both show that about 90% of respondents agreed with the addresses in NBD. Success rates for business names and activities were lower, and less impressive: 69% correct description of activity (see Table 5-3 and Figure 5-2), and from 33% to 50% correct record of the business name (see Table 5-4 and Table 5-5). (Note that the Insight Survey did not ask whether the activity was correctly recorded.) This is likely to be at least partly due to more rapid turnover in businesses over time than changes in addresses.

Table 5-2: Are addresses correct in NBD (QA and Insight Surveys)

	QA Survey	Insight Survey
Interviewees report correct address in NBD	91%	89%
No address in NBD	-	-
Incorrect name in NBD	9%	11%

Table 5-3: Are activities correct in NBD (QA and Insight Surveys)

	QA Survey	Insight Survey
Interviewees report correct description of activity in NBD	69%	-
NBD activity occurs on premises but not primary activity	5%	-
Incorrect activity in NBD	26%	-



Note: numbers in parentheses indicate the number of respondents.

Figure 5-2: QA survey, percentages per activity class with correct classifications in NBD

Table 5-4: Are business names correct in NBD (QA and Insight Surveys)

	QA Survey	Insight Survey
Interviewees report correct business name in NBD	50%	33%
No name in NBD	24%	32%
Incorrect name in NBD	26%	36%

Table 5-5: Are business names AND addresses correct in NBD (QA and Insight Surveys)

	QA Survey	Insight Survey
Interviewees report correct description of business name AND address in NBD	-	58%
EITHER business name or address is wrong	-	37%
BOTH business name and address is wrong	-	5%

Limitations

One limitation of the quota sampling approach is that although findings from the Insight Survey and QA Survey are representative within an individual activity class, the aggregated findings across all activity classes may not be representative. Higher samples in priority activity classes such as factories may distort responses towards activity classes with fewer premises and larger quotas.

There is an additional limitation from the fact that responses are not evenly spread across all sizes of organisation. There is some evidence that larger organisations are more likely to have dedicated energy managers – and so were more likely to respond to a survey about

energy use. Conversely there is also evidence that some smaller organisations (with on-site staff rather than arms-length energy managers based at another site) were also more likely to respond. It is possible that the sizes of organisations responding also differs between activity class, so that skewed sampling affects different classes differently.

5.3 Detailed Site Surveys

In addition to the comparisons with external data sources, the QA survey and the Insight survey, Verco was commissioned to carry out detailed site surveys of a limited number of sites. These full 'audits' of premises collected detailed data suitable for constructing dynamic simulation models of the sites. However, although the numbers of surveys were decided based on a combination of the stock profile and the level of existing knowledge of the detailed workings of some premises activities, only limited numbers of premises/buildings could be surveyed, due to the difficulties in recruiting suitable sites.

The site surveys and subsequent simulation models are described elsewhere and do not link directly to the premises/buildings in the NBD, except via the activity classifications. A summary of the sample is given in Table 5-6.

Table 5-6: Summary of Site Surveys

Activity class	Target (Number of Sites)	Surveys Completed (Number of Sites)	% of Target	Surveys Completed (Number of Premises)	Average size (m^2 TUFA)
Agriculture, Countryside, Animals	0	1	n/a	1	340
Arts and leisure	5	5	100	5	2,336
Community	4	4	100	7	1,937
Education	7	8	114	9	8,654
Emergency	2	2	100	2	1,774
Factories	9	11	122	11	8,585
Health	4	2	50	8	2,869
Hospitality	5	6	120	17	2,226
MOD	0	0	n/a	0	n/a
Offices	12	12	100	210	3,703
Shops	8	9	113	13	3,453
Sport	5	5	100	6	4,663
Transport	1	1	100	2	380
Utilities	2	0	0	0	n/a
Warehouses	6	6	100	6	12,765
Sum	70	72	100	297	5,304

6 Caveats and Challenges

6.1 Context

The National Buildings Database (NBD) provides a detailed, three-dimensional representation of the non-domestic building stock across Great Britain. However, both the utilisation and updating of the NBD are subject to several technical, logistical, and data-related challenges. The majority of these challenges are not new and the UCL team responsible for creating the NBD has developed considerable understanding of the issues and in many cases implemented actions to eradicate, limit and mitigate their impact on the quality and useability of the database.

This section of the report identifies these challenges and indicates the extent to which they persist by way of 'caveats' and the 'challenges' they present for future updates of the NBD, as shown in Table 6-1.

Table 6-1: Summary of Caveats and Update Challenges

Data Source	Purpose/Use in NBD	Key Caveats	Update Challenges
OS MasterMap Topography Layer	Provides 2D building footprints and spatial context; basis for assigning TOIDs	May be outdated in high-growth areas; limited precision for internal divisions	Updates quarterly but requires full reprocessing; costly for large-scale updates
OS Building Height Data	Used with MasterMap to generate 3D volumes	Average heights; limited detail on sloping or stepped roofs	Does not track changes in roof alterations or extensions
VOA Ratings List	Supplies floor area, use classification, construction date, 'main fuel' etc. and rateable value	Aggregates multiple units under one assessment; mixed accuracy in floor area	Updated on reassessment; licence access may limit scope
SAA Rating Data	Provides activity classification and address data for Scottish premises	Does not contain floor areas. Cannot be obtained for dates in the past.	Dataset needs to be ordered ahead of target date
Energy Performance Certificates (EPCs)	Provide modelled energy efficiency and assumed construction details	Coverage is incomplete and biased toward newer or transacted premises; quality varies	Only required on sale, lease or rent of property. Only valid for 10 years and might not be renewed if no sale/new lease/new rental of property. Energy assumptions may not reflect real performance due to e, or activity (without change of occupier)
Display Energy Certificates (DECs)	Capture actual energy use in public buildings	Only required for some public sector owned or occupied premises; Do	Annual in theory but compliance varies. Not required for premises/buildings < 250 m^2

		not exist in Scotland.	
AddressBase Premium	Provides UPRN and address hierarchy data; key for linking datasets	Address can be ambiguous and lead to mismatches; duplicate or obsolete UPRNs occur but these are largely correct in NBD.	Misalignments with TOID and VOA data persist, more problematic when there are multiple premises within a single UPRN.
Land Registry Price Paid and Ownership Data	Establishes ownership structure and transaction timing	Does not include leasehold or complex commercial arrangements	Update lag; lack of comprehensive access for commercial properties
LiDAR and Aerial Photography	Validation of height and massing; development of 3D geometry	Point-in-time; gaps in data around airports and other sensitive facilities.	Mainly overcome by automated processing code, which now operates at speed on high data volumes.
Gas and Electricity Meter Data (where available)	Provide energy data for meters which can be matched to premises or multiple premises	Not all meters can be matched; occasional anomalous data.	Annual updates only and data is historic by up to 12 months.

6.2 Caveats

Completeness and Accuracy Issues

A number of factors impact on the completeness and accuracy of the NBD:

- Floor area values from VOA may misrepresent true usable space due to outdated assessments or grouping of multiple units under one entry.
- AddressBase data can result in mismatched identifiers across datasets (e.g. UPRN not aligning with TOID), leading to mis-attribution of energy or occupancy data.
- EPCs and DECs offer useful benchmarks but are derived using different methodologies; EPC energy and carbon predictions are modelled but are based on measured data gathered from the premises or the design of a new building. This data is employed in the NBD (see Appendix B for further details of EPC data accuracy and usefulness). DECs are based on measured energy use. They are not interchangeable.

Complex Building Forms and Use

Mixed-use buildings and subdivided properties are difficult to accurately model in Scotland due to unavailability of floor space data in the Scottish Assessors' Association valuation data set. NBD calculates missing floor space from 3D geometry using the 'slicer' method (see Section 4.8).

Data Linkage and Attribution Risks
Occasional assignment of characteristics at the wrong level (e.g. attributing a DEC to the whole building when it applies to a part or vice versa) can lead to major mis-estimates in scenario modelling.

Temporal Misalignment
Key datasets are updated at different rates, causing the database to become inconsistent over time. For example, building geometry may reflect 2023 OS data while EPCs reflect 2018 submissions.

Missing Activities
The NBD does not cover all activities and does not represent some activities and activity groupings completely. There are a small number of activities which are hard to identify, an example is Special Educational Needs provision. When this is recorded as a separate building or site it can be identified, but if included within a school the provision is difficult to distinguish. Equally, data on some activities such as MoD facilities is not available.

Missing or Estimated Energy Data
It was not possible to match energy consumption data against all premises in NBD, and matching varied between activity classes, see Chapter 3. This means that the figures quoted for aggregate energy demand are not necessarily total demand in each activity class. In addition, some of the energy-use data from premises without half-hourly meters was ‘estimated’ (in the same way that energy suppliers estimate consumption where they do not have meter readings). Some of these estimates are more accurate than others, depending on meter-reading frequency. However, this only affects a modest proportion of non-domestic premises.

6.3 Challenges in Using EPC-Derived End-Use Energy Estimates

As part of efforts to break down total energy consumption into end uses (e.g. heating, lighting, hot water, cooling, and auxiliary), the NBD incorporates synthetic end-use estimates derived from Energy Performance Certificates (EPCs). These are typically produced by SBEM (Simplified Building Energy Model) or DSM (Dynamic Simulation Model) and include assumptions about internal gains, occupancy schedules, and system efficiencies.

Key Considerations:

- Model-Driven Estimates: The end-use breakdowns in EPCs are not measurements but are generated through modelling using default values, unless user-specific information is input.
- Assumption Uniformity: Inputs such as operating hours, equipment loads, and climatic assumptions follow national defaults and are not tailored to specific buildings unless overridden by assessors, which is rare.
- Building Use Simplifications: In cases where a building includes multiple uses, the EPC model often simplifies this to a dominant use class, potentially distorting energy end-use splits.
- Temporal Misalignment: EPCs reflect conditions at the time of assessment. They may not account for changes in use, occupancy, or retrofits since the certificate was issued.
- Comparability Limitations: End-use figures from EPCs cannot be directly compared with actual energy consumption or DEC data, which reflect empirical use. EPC end-use values serve best as indicative benchmarks or for comparing relative performance across similar building types.

- Calibration Gaps: EPC-derived end-use figures are not routinely calibrated against real-world energy meter data, and so cannot reliably predict actual energy demand profiles without significant adjustments.

Qualification: Modelling of a sample of fully measured buildings with high resolution meter data has been employed in the NBD project with the aim of qualifying the usefulness of the energy end-use breakdowns derived from EPCs (see Appendix B).

6.4 Detailed Challenges in Updating the NBD

A number of challenges persist for the future updating of the NBD and these are set out in the following sections.

Asynchronous Data Cycles

VOA data are updated every day, but some data may may be up to 5 years old (though potentially still valid). OS MasterMap updates quarterly. OSAB data are updated at six-weekly intervals. EPCs are updated typically at point-of-transaction, but can be updated voluntarily at any time. Aligning these and all other data is technically complex.

To achieve the best alignment of datasets, it will be necessary to plan new iterations of the NBD carefully. Certain datasets should be ordered ahead of the time that the data will be ingested into the system, to allow for lead times on obtaining the data required for the designated target date of the snapshot (e.g. SAA data).

Variable Data Quality and Definitions

Different datasets use different definitions of building (TOID, UPRN, unit), which can cause structural inconsistencies. For example, a warehouse subdivided into three business units may appear as one entity in VOA but three in AddressBase, or vice versa. The NBD resolves this challenge by adopting the Self-Contained Unit approach to combine premises and buildings within a single system boundary, but without losing the detail within (see Section 4.7).

Geometry Maintenance at Scale

NBD's geometry relies on the latest height and footprint data. However, real-world changes (e.g. partial demolitions, new mezzanines) will not be captured until the OS and LiDAR datasets are updated.

Licensing and Legal Barriers

The NBD relies on commercial or restricted licenses for datasets such as OS and VOA. Government access to these datasets allows the construction of NBD and the provision of useable outputs that would not be possible outside of government. Restrictive changes to the license and access arrangements in the future could undermine the ability to update the NBD. Equally, the removal of restrictions would be beneficial.

Computational Infrastructure

The database operates on high-performance platforms capable of processing billions of data points. Regular updates require significant computational time and cloud/cluster support.

Version Control and Provenance

Model updates must preserve lineage so users can distinguish between data vintages. This is not yet implemented in a user-facing tool, which can cause confusion about which values are most up-to-date. For this reason the developers recommend fully, rather than, partially updating of the whole database.

Institutional Uncertainty
Updates to the NBD and several underlying datasets will depend on available resources within the relevant government department(s).

6.5 Recommendations for Effective Use

A number of recommendations are made to recognise and sometimes account for the caveats and challenges set out in this chapter. These are:

- Document Assumptions: Any policy or modelling output using the NBD should transparently declare what assumptions are being made about energy use, building condition, and occupancy etc.
- Avoid Over-Precision: Scenario modelling should use the NBD to explore relative rather than absolute outcomes, especially where data quality is variable.
- Cross-Validate: Where feasible, triangulate NBD-derived insights with external datasets (e.g. meter data, local authority surveys, planning registers).
- Support Infrastructure and Resourcing of Investment: Resourcing a structured, regular update cycle is critical for long-term usability.
- Explore User Interfaces: Tools that visualise data quality or provide dates-of-origin will empower better analysis and reduce the risk of incorrect conclusions.

6.6 Conclusion

The National Buildings Database is a powerful tool to support decarbonisation, urban planning, and infrastructure investment. However, its value is significantly shaped by the timeliness, granularity, and provenance of its underlying data. Users must interpret outputs within this context and advocate for long-term investment in maintaining and extending this critical national asset.

7 National Building Database - Use cases

The full National Buildings Database will be accessible to approved government users through a secure data platform. During the development of the database, many queries on the non-domestic stock, which could not be answered through existing data sets, were identified. This section of the report demonstrates some of the use cases that NBD can support; specifically, how decision makers and others can use it to answer specific questions about the building stock. The questions listed here were selected to illustrate the range of capabilities offered by NBD. In addition, it shows some of the depth of data available to approved government users (all 2.2 million non-domestic premises in GB at full geographic resolution), and the breadth of the database (4,500 unique attributes). Compared to existing databases (like ND-NEED) and prior evidence data (like BEES), NBD has full coverage of GB for a much wider range of key variables. This includes (for the first time) full building geometries for measurements.

7.1 "How many premises use coal for heating?"

Although coal has been phased out as a source of fuel for electricity it is still used as fuel for heat in some premises. One use case of NDB is to identify the sources of data on fuels and heating systems by the location, type count and floor area of premises. This includes use of solid fossil fuels (including coal and anthracite) for heating, which may be seen in the reports for each activity class (Figure 9 in each of the Activity-Class Summaries in Section 3). Users with access to the full database can query individual fuel types. For coal/anthracite in total there are **1,440 premises (<1%)**, comprising 0.6 million m^2 of floorspace, and the 'Factory' activity class is the largest user. Previously, the evidence base for this figure would have been from energy certificates, which only covered 6% of premises, and 2% of floor area.

7.2 "How does the number of buildings compare to the number of premises in Great Britain?"

There are complex relationships between premises and buildings. NBD captures these through the self-contained unit (SCU), see Section 4.7. A school may have one or more buildings within it, all connected to a single meter, so to measure the energy use intensity these buildings are assigned a single SCU identifier. For the first time NBD identifies the number of premises and SCUs for the whole of GB (compared to ND-NEED coverage of England and Wales). The non-domestic stock spans **2.2 million premises, 1.3 million SCUs and nearly 900 million m^2 of floorspace**. The largest 100 SCUs contain 4% of GB's total floorspace. Figure 7-7-1 illustrates the relationship between distribution of floor area and number of premises, for Education ~12% of premises have a floor area of 1,000 m^2 or higher, whereas for Emergency ~20% of premises are above that size.

Figure 7-7-2 shows the same analysis for Health, Transport, MoD and Utilities.

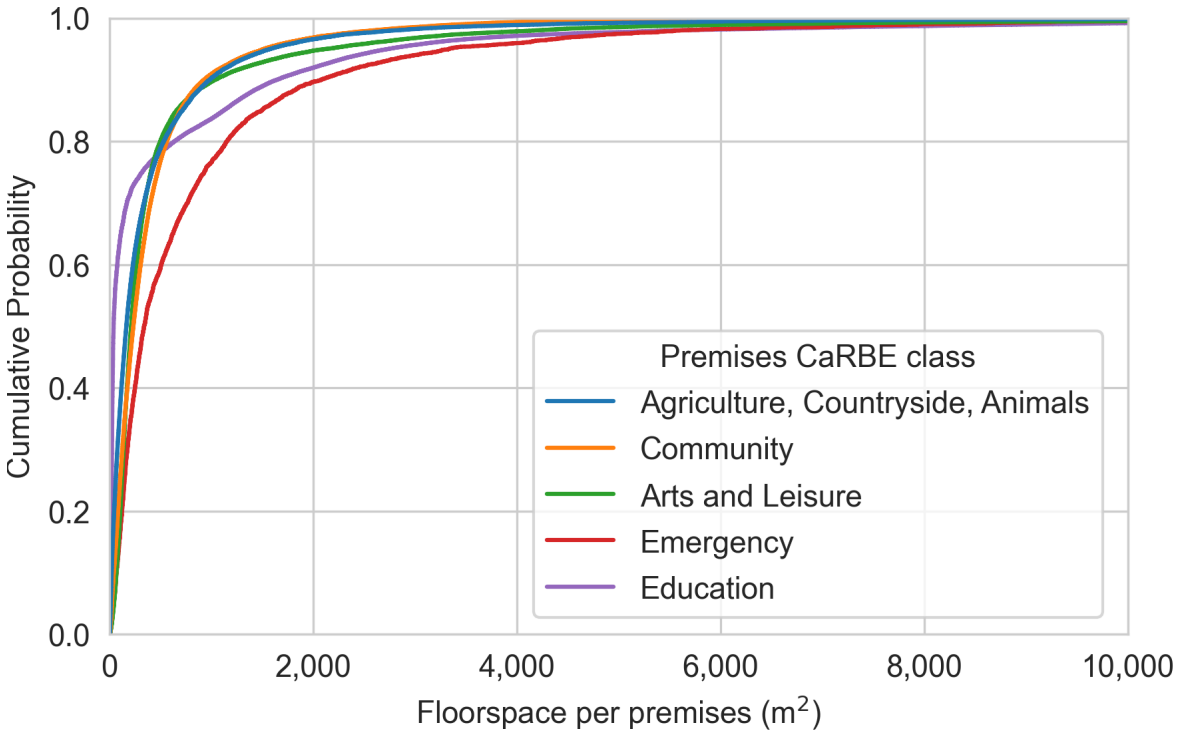


Figure 7-7-1 Cumulative distribution of floorspace for selected activity classes, chart 1

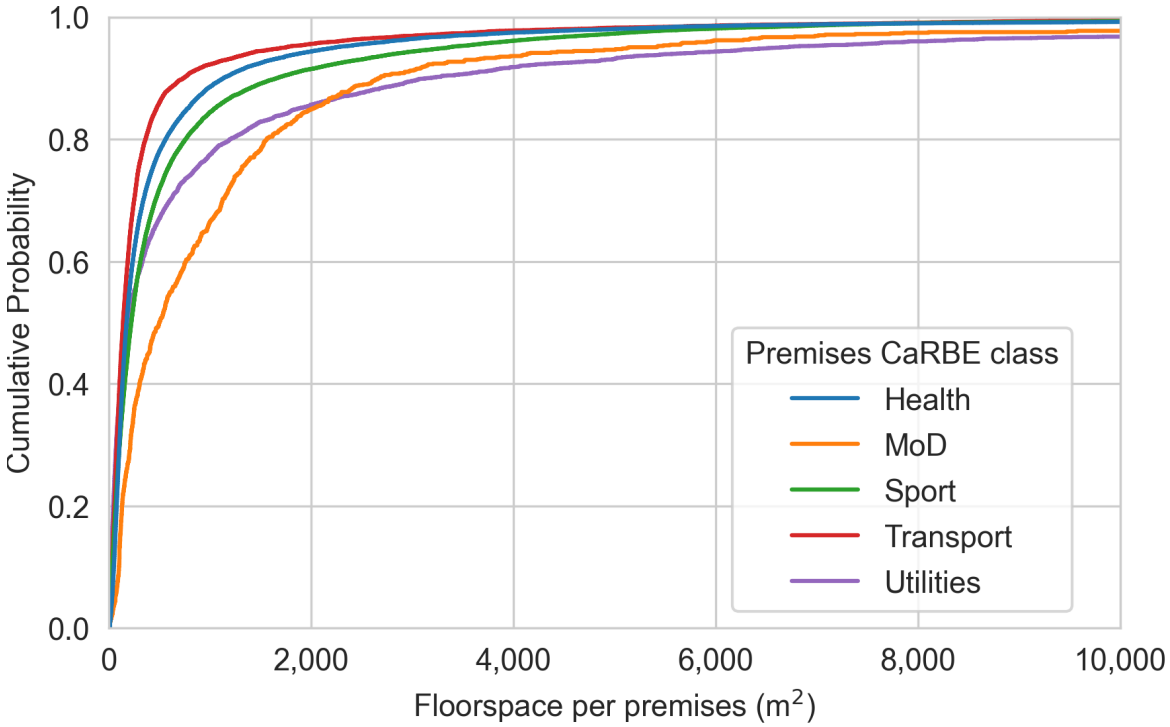


Figure 7-7-2 Cumulative distribution of floorspace for selected activity classes, chart 2

7.3 "Do we really understand the size of the public-sector stock?"

Prior to NBD the size and classification of the public sector our understanding of the non-domestic stock was highly reliant on data from DECs. However, only buildings over 250 m^2 are required to have a DEC. Analysis run on NBD combined ownership data from Land

Registry, DECs and activity class to provide a revised estimate of the size and distribution of the public sector stock. This includes stock constructed under PFI and stock owned by public sector bodies for investment purposes, such as commercial buildings. NBD reports **183,000 premises and 161 million m^2 of floorspace** across 14 activity classes, relative to DECs alone which show ~27,000 UPRNs and 53.2 million m^2.

7.4 "How many premises are used by voluntary, community and social enterprises?"

The voluntary, community and social enterprise (VSCE) sector is formed of diverse organisation types (including registered charities), but there is no authoritative address list for these. NBD was used to make the first national assessment of the VSCE stock. This analysis combined insights from Land Registry's list of UK companies that own property (England and Wales) and the NBD activity classes (GB) to assign a likelihood score for non-domestic premises being occupied by a VCSE. NBD identifies **159,000 premises comprising 20.5 million m^2 of floor area** as being likely to be VSCE, see Figure 7-7-3. This compares to the 185,000 charities recorded on the official government register (https://register-of-charities.charitycommission.gov.uk/en/sector-data/sector-overview).

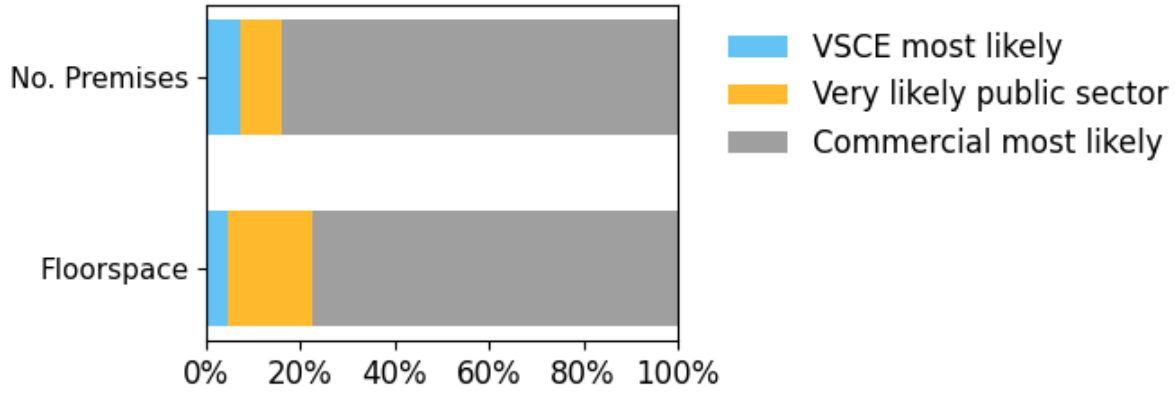


Figure 7-7-3 GB non-domestic stock by occupier organisation type

7.5 "What is the size breakdown of the stock?"

Historically, reporting on both the domestic and non-domestic stock has segmented the stock in groups based on size as the simplest form of archetype. Information on size was considered a key insight given the relationship between the volume of space and the energy required to condition it. Prior to NBD, illustrative 'archetypes' were often used to represent the stock, these were drawn from limited (BEES) or large scale (ND-NEED) samples. A frequent use of archetypes was to classify premises by size of floor area as small, medium or large. Floor area within the non-domestic stock is highly heterogenous and has a very skewed distribution, due to the presence of very large premises (such as distribution centres). NBD assigns floorspace for the full population of GB, allowing for more accurate classifications to be assigned.

Table 7-1, below, classifies premises by floor area from XS – XL as an example. This uses a Jenks natural break algorithm (a clustering method used to find the best classification) to set thresholds to classify the data, see Table 7-1, Historically, floorspace classification has used a banded approach that does not fully account for the very largest premises. With knowledge of the full population, the NBD bandings better represent the stock. This approach can be repeated at the activity class level to compare a Small 'Shop' (1,200 – 5,500 m^2) to a Small

'Factory' (5,830 – 28,000 m^2) or repeated for other attributes to look at energy demand, say, or to segment by country.

At the aggregate, **75% of premises are no more than 271m^2, while the other 25% are larger** than this.

Table 7-1: Classification of premises by floor area (m^2)

(Premises data)	XS	S	M	L	XL
Floor space range (m^2)	<= 271	271 - 804	804 - 1734	1734 - 3236	>= 3236
As % of floor space	16	17	13	12	43
Percentage of premises	75	15	5	2	2
Floor space (m^2) million	148.5	153.3	120.5	109.0	396.2
Dominant activity class	Shop	Factory	Warehouse	Warehouse	Warehouse
No. of premises	1,645,021	341,080	104,143	47,233	42,882

7.6 "How many buildings could install a heat pump?"

NBD enables authorised government users to build complex queries and run these against every premises or building (SCU). An example of this is how many SCU's could accommodate an air source heat pump within the site boundary. We can answer this by combining data on physical attributes (type of roof – where flat roofs can accommodate heat pumps, space around the building, structure and material of the envelope – where walls maybe suitable for mounting heat pumps) along with data on planning protections (is the building listed or in a conservation area). This data can then be segmented by type of activity, stock or geographic distribution. Of the 1.3 million non-domestic SCUs in GB, **on paper, 99%** have space to install a heat pump based on current planning restrictions.

7.7 "How many tall buildings are at risk from increased wind speeds from a changing climate?"

NBD is a 3D representation of the GB stock as of the 1st April 2023. Within NBD there is data on the height, roof form, party wall and external wall area (as shown in Section 3, Chart number 14, for each activity class). NBD is a geospatial database so other spatial data can be used to build queries by those with full access to NBD. The chart below shows the counts of the 225 buildings over three storeys high by their age, for the areas of GB that are predicted to see the highest increase in maximum windspeed of 7-11 m/s by 2070, based on current climate change models. See Figure 7-7-4. (Note that only a small proportion of GB is predicted to see such a large increase in windspeed. Out of roughly 11,000 locations modelled for change in windspeed, just 74 were shown to have this maximum increase, and all of them were in Scotland.)

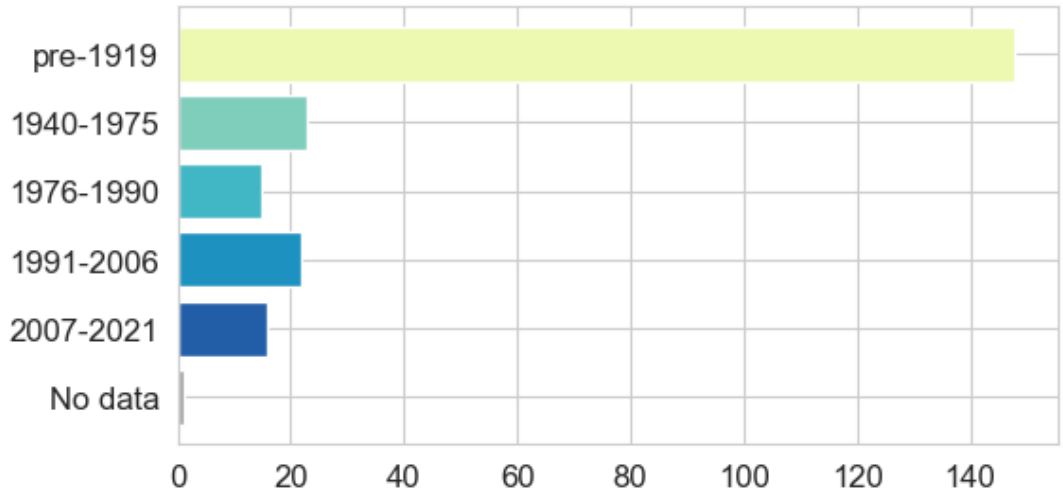


Figure 7-7-4 Number of SCUs by building age period in areas of future high windspeed

7.8 "What if we do not have access to the full NBD dataset?"

For users without access to the full dataset a synthetic dataset of key attributes is provided to run similar queries to those above. Details of the synthetic data approach are provided in Section 4.10. The synthetic data can be used to return energy end-use breakdowns for specific building activities and specific locations (e.g. Warehouses in Nottingham); Figure 7-7-5 shows floor area and annual demand (kWh / m^2 GIA) from the synthetic and real data. There are two versions of the synthetic data: a core version and full version (including an energy-use breakdown). Users should choose the core where geographic accuracy is the priority.

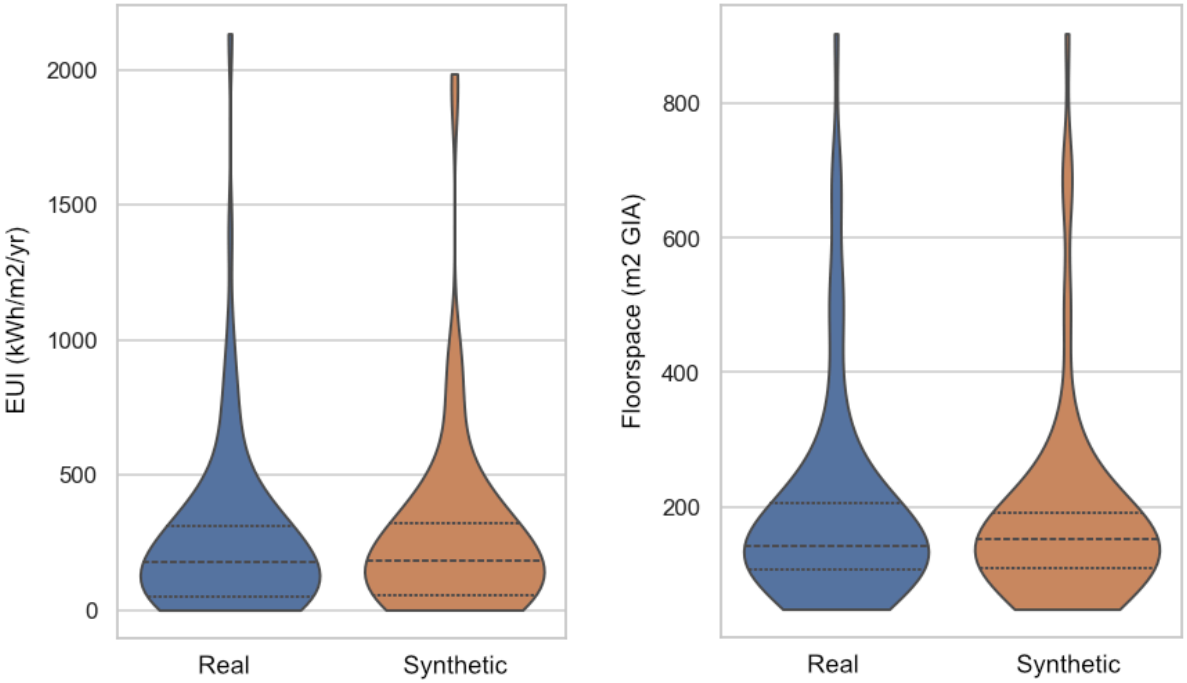


Figure 7-7-5 Comparing synthetic and real data on Energy Use Intensity and Floorspace for warehouses in Nottingham.

Appendix A: Questions used in Insight Survey

Can I confirm whether you are involved in dealing with energy use at <address> (e.g. you have knowledge of the energy uses on your premises) and would be able to answer questions about <recall business name> energy usage and management at this address?
Please can I take your job title?
Can I check that the business/organisation occupying the premises is called < business name>?
Can I confirm, does < business name> occupy <recall database address>?
Please could you tell me more about what your business/organisation does at this address? Please think about what activity uses the most space? Our records have this premises listed as using the space for <recall CaRBE activity from database>: • Would you agree this is the best way to describe what your organisation/business does at this premises? Thinking about your entire premises, what other activities is the space used for? [where more than one activity cited] Of these, what two activities use the most space in your premises?
Please can I confirm does your business/organisation operate within the: • Private sector • Public Sector • Third Sector • Unsure • How many employees work/operate out of <recall correct address>? Interviewer to capture as Full Time Equivalent. How many employees does your business employ in total (i.e. regardless of premises they operate/work from)? Interviewer to capture as Full Time Equivalent.
Thinking about <correct address> which of the following best describes the premises your business/organisation has full use of? • A collection of buildings • A whole building • Part(s) of a building [Where a collection of buildings] Do all of the buildings your business/organisation has use of have the same address i.e. <recall correct address>? • Yes – How many buildings are there? • No – How many buildings have the same address? [Where 2 or 3 buildings] Thinking about each of the <insert number of buildings> buildings your business/organisation occupies at this address, can you give them a name we can refer to them as for this interview? [Where 4 or more buildings]

- We would like to ask some questions about the three largest buildings at this address, please could you provide a name we can refer to the three largest buildings by?

Is this the only business at <recall address>?

- Yes
- No
- Unsure

[Where a whole building or where part of a building]

Can I check, is this the only business at <address>?

- Yes
- No
- Unsure

[If no]

- How many other businesses/organisations operate from this address?

[For those occupying part of a building]

Which of the following comes closest to describing the size of the building that your premises is in?

- Tiny – small kiosk or single room
- Small – larger than a single room but up to the size of a 4- or 5-bedroom house
- Medium - about the size of a local convenience store or supermarket (e.g. Sainsbury's Local)
- Large - about the size of a larger in-town supermarket (e.g. Tesco Superstore)
- Very large – larger than an in-town supermarket
- Unsure

And, using the same scale, which of the following best describes the size of your premises/the part of the building your business occupies?

- Tiny – small kiosk or single room
- Small – larger than a single room but up to the size of a 4- or 5-bedroom house
- Medium - about the size of a local convenience store or supermarket (e.g. Sainsbury's Local)
- Large - about the size of a larger in-town supermarket (e.g. Tesco Superstore)
- Very large – larger than an in-town supermarket
- Unsure

Across how many floors is your premises/part of the building you occupy?

- [Where more than one] What floors does your business/organisation occupy either in full or in part? *Please indicate if the floor is a basement or ground floor*? Interviewer to select all that apply.
- Basement
- Ground floor
- 1
- 2
- 3
- 4
- 5
- Other floor – capture numbers
- Unsure
- [For those occupying a whole building]

How many floors does your building have?

Does the building have a basement? Capture Yes/No/Unsure.

Which of the following comes closest to describing the size of the building you occupy?

[same size bands as above]

[For those occupying multiple buildings that have the same address repeat for each of buildings 1-3 named]

How many floors does <name of building 1-3> have?

Does building <insert name of building 1-3> have a basement?

Which of the following comes closest to describing the size of building <insert name of building 1-3>:

[same size bands as above]

Please can you describe your role in regard to energy use and/or management at <recall business name>?

And thinking about responsibility for energy management in your premises, which of the following have responsibility? (Select all that apply)?

- An organisation/business energy manager who does not normally work in the building
- An energy manager who does normally work in the building
- A dedicated energy team
- Someone who is not a full-time energy manager e.g. building or operations manager but with formal role to look after energy
- An enthusiast or energy champion in the building without formal role to look after energy
- No-one / there is no energy management

Thinking about your premises, does the number of days per week you are open vary by month?

- Yes
- No

What are your opening hours? (capture open and close times)

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

Does the majority of your premises have any of the following:

- openable windows
- heating
- mechanical ventilation
- cooling
- full air conditioning
- none of the above

What type of fixed heating equipment do you have?

What heating/cooling controls do you have?

Which of these make up most of your indoor lighting:

- -fluorescent tubes
- -compact fluorescent
- -LEDs
- -spotlights
- other

Does your business have either of the following: • An Energy Performance Certificate (EPC)? • A Display Energy Certificate (DEC)?
[Where they do have an EPC/DEC in place] Can you recall what recommendations were made to your premiss in your EPC/DEC/EPC and/or DEC? • Yes – What were they and have you made that improvement? (Capture each recommendation and whether the improvement has been made.) • No • Unsure
[Where they do have an EPC/DEC in place] What are the main challenges for you / your business in improving the energy rating of your premises/building(s)?
What are the main challenges (if any) for you / your business/organisation in monitoring your energy consumption? [Open-ended text]
What non financial support from Government would help you reduce energy use and carbon emissions from your premises?
Would you be willing to consider allowing an on-site audit of you premises to be undertaken by our research team?

Appendix B: Modelling to qualify Energy Performance Certificate data

Energy Performance Certificate (EPC) values are determined using the National Calculation Method (NCM) standardised occupancy, equipment, operational schedules and weather data and are intended to represent the underlying performance of a building rather than the characteristics of the actual occupants. Consequently, EPC estimates of energy consumption are unlikely to match metered energy data. Despite this, EPCs provide a potentially useful breakdown of energy consumption into heating, cooling, fans & pumps, lighting, hot water (DHW) and equipment. The reliability of EPC data and this breakdown was assessed by undertaking building audits which were used to produce compliance models, these were translated into calibrated simulation models via a structured sequence of steps, designed to explore the impact on model accuracy of each step in the translation sequence.

- Stage 1 modelling is undertaken by accredited EPC surveyors based on their site visits and using industry-standard accredited software: Integrated Environmental Solutions (IES)[10]. During the audit visits, the building geometry is measured, (or verified if site plans were available ahead of the audit) and details of the activities undertaken in each space are recorded. This allows parameters for Heating Ventilation and Air Conditioning (HVAC), Equipment, Lighting, DHW and activity schedules to be assigned based on the National Calculation Methodology (NCM) as required by the standardised EPC modelling process.
- In Stage 2, EnergyPlus[11] models are developed based on the compliance models developed in Stage 1 in IES. EnergyPlus is an open-source model which is widely used in academia and beyond. Converting the models to EnergyPlus allows later, computationally intensive model calibration steps to be automated and reduces manual processing of results. Overall model geometry is unchanged between the two models but the process of assigning activities to different spaces introduces some differences between models.
- In Stage 3, the Test Reference Year (TRY) weather data required for the EPC model is replaced with actual weather data for the period for which consumption data are available. This set of actual weather data was acquired from Visual Crossing[12]. The 3 nearest weather stations to the audit building postcode are used to create a distance-weighted average of historical weather data for the audit location.
- In Stage 4, standardised NCM values for HVAC, Equipment, Lighting, DHW, and activity schedules are replaced with building specific data on energy using services and equipment and activity schedules, collected during the audit visits.
- In Stage 5, models were calibrated using consumption data for electricity and gas at the site level. Temperature setpoints for heating and cooling, system efficiencies, infiltration and ventilation parameters were adjusted in this process. Models with a Coefficient of Variation of the Root Mean Square Error (CVRMSE) below 30% were considered calibrated. For cases where both fuels (electricity and gas) were present in the meter data, if the meter data for one fuel were more than double compared to the other, then the major fuel was only considered in this selection process. The selection of this threshold was informed by the ASHRAE Guideline 14[13], with an adjustment in order to be able to consider as calibrated more than 50% of the

[10] IES VE 2025 (https://www.iesve.com/ve2025)
[11] Version 9.4 (https://github.com/NREL/EnergyPlus/releases/tag/v9.4.0)
[12] https://www.visualcrossing.com/resources/category/documentation/
[13] ASHRAE. (2014). ASHRAE Guideline 14-2014: Measurement of Energy, Demand, and Water Savings. American Society of Heating, Refrigerating and Air-Conditioning Engineers.

investigated cases. It was therefore based on knowledge experience of the energy modelling team, aligned with latest findings in Chong et al. (2025)[14]. The Normalised Mean Bias Error (NMBE) was used in the selection process for consulting with regards to capturing the seasonality in the meter data. It was not used as a strict criterion but the majority of the calibrated models where within the ±5% as advised by the ASHRAE Guideline 14. This resulted in 33 models out of the 52 for the six activity classes, being considered calibrated. The values for the calibration metrics (CVRMSE, NMBE) and the adjusted parameters for all calibrated models, can be found in Table B- 1 at the end of this Appendix.

The modelling sequence is set out in Figure B- 1.

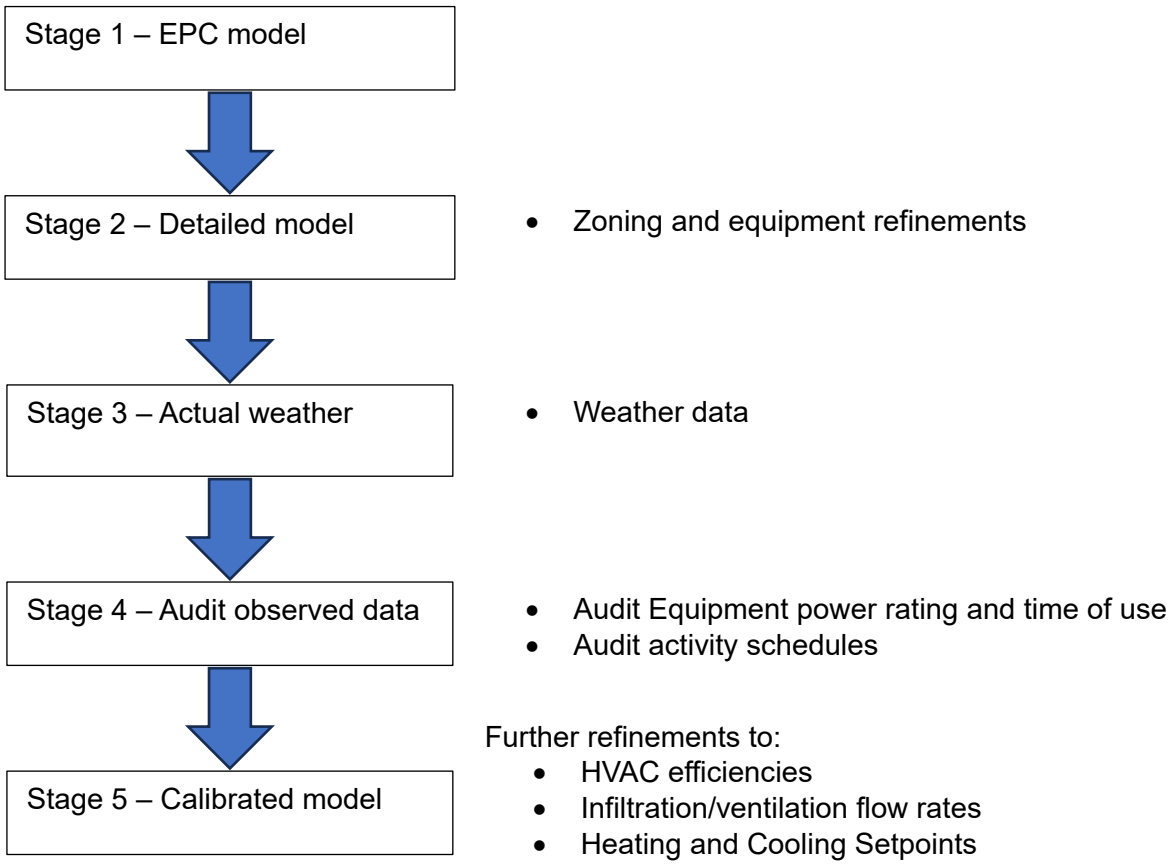


Figure B- 1: Sequence of models transitioning from EPC compliance to calibrated model

The results of these inter-model comparisons and the implications for the interpretation of the much larger EPC data set are discussed by activity class in the following sections. Activity classes in which it was not possible to obtain a minimum of 4 fully calibrated models were excluded from this analysis. Nonetheless, it should be noted that as the full site audit process and the associated modelling work are highly resource-intensive, the results

[14] Chong, A., Yan D., Sun, K., Zhan, S., Cheng, S., Wu, Y., Chen, Y., Hong, T. (2025) "*Ten questions concerning calibrating building energy simulation models*" Building and Environment, Volume 284, 113404, ISSN 0360-1323, https://doi.org/10.1016/j.buildenv.2025.113404

presented here are based on very small sample sizes in which outliers may significantly affect the results.

In the analysis which follows, anonymised results are presented for each audit site. Audit sites are identified by a unique reference number (e.g. HOSP007, FACS004).

Summary

The analysis of Energy Performance Certificates (EPCs) reveals several key insights into their accuracy and reliability. EPCs, which are designed to estimate the energy performance of buildings, often struggle to capture actual meter data accurately. This discrepancy is particularly evident in the overestimation of lighting energy consumption across all activity classes. Additionally, EPCs tend to overestimate heating requirements, except in the Offices activity class, where the estimates are more aligned with usage predicted by calibrated models.

One significant area of concern is the underestimation of cooling needs by EPCs. Although current cooling demands are relatively low, they are expected to increase in the future, which could further exacerbate the inaccuracies in EPC estimates. This underestimation highlights the need for EPCs to adapt to changing climate conditions and the growing importance of cooling in building energy consumption.

The audits conducted as part of this analysis also revealed that the energy use of equipment, as determined from the audits, was largely overestimated and in cases even higher than the total measured electricity consumption. This discrepancy was addressed during the calibration stage, where models were adjusted to better reflect actual energy usage. However, the findings indicate that gas-powered equipment could potentially dominate energy demand, suggesting that EPCs need to account for this factor more accurately.

Improving the accuracy of EPCs for non-domestic buildings would require more comprehensive monitoring, including the collection of submeter data and conducting seasonal audits more than once a year. This approach would provide a more detailed and accurate picture of energy consumption patterns, allowing for better calibration of EPC models and more reliable energy performance estimates.

In the absence of better data from sub-metering or other more detailed methods (e.g. TM22 analysis[15]), the breakdown of energy into individual end uses provided by EPC data at scale across most non-domestic building is a useful guide to this disaggregation, noting the caveats above.

[15] https://www.cibse.org/knowledge-research/knowledge-portal/tm22-energy-assessment-and-reporting-methodology/

Factories

Audits were undertaken for 10 sites in the Factories Activity Class. During calibration three of the sites were dropped as the Stage 5 models resulted in CVRMSEs higher than 30%, leaving 7 models considered as calibrated.

Overall consumption

EPC models (stage 1) underestimate electricity consumption in five of the 7 calibrated models. EPC models estimated measured electricity consumption within a percentage error range of -94 to +364%.

EPC models generally show lower gas consumption than the meter data collected. Since variation between stage 3 and stage 4 models is relatively small in most cases, meaning that replacing NCM values with actual values recorded during the audit has limited impact, the variance is likely due to factors not well-captured by the audit process. In the calibration exercise, this is attributed to Domestic Hot Water (DHW) consumption. However, this may be due to other sources not included in the calibration exercise, such as fabric and materials performance. EPC models estimated measured gas consumption within a percentage error range of -95 to +269%.

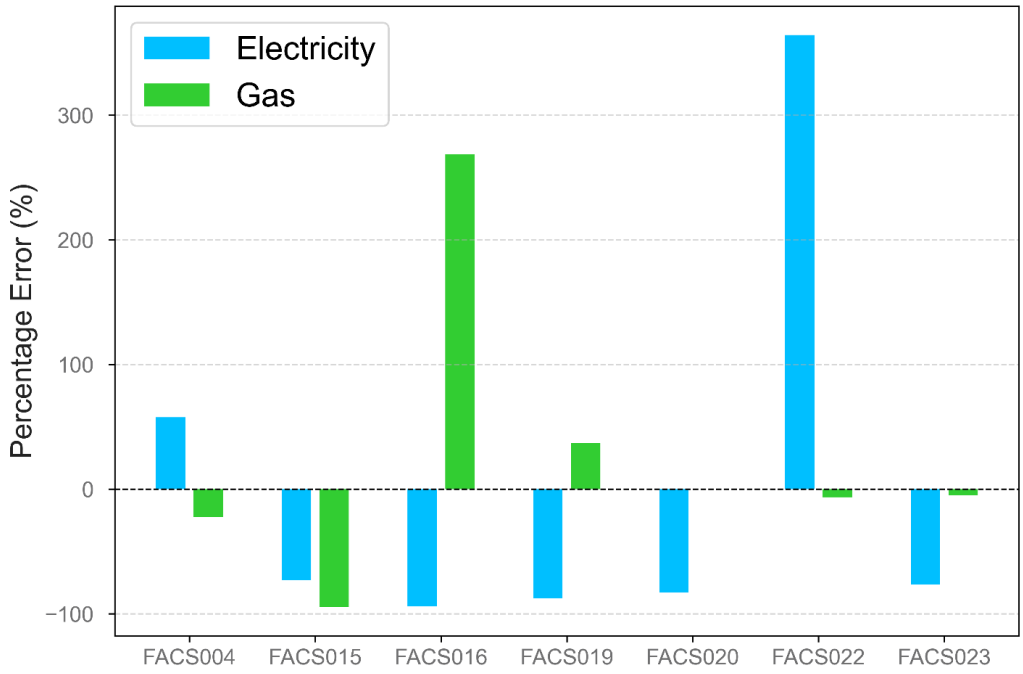


Figure B- 2: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Factories activity class

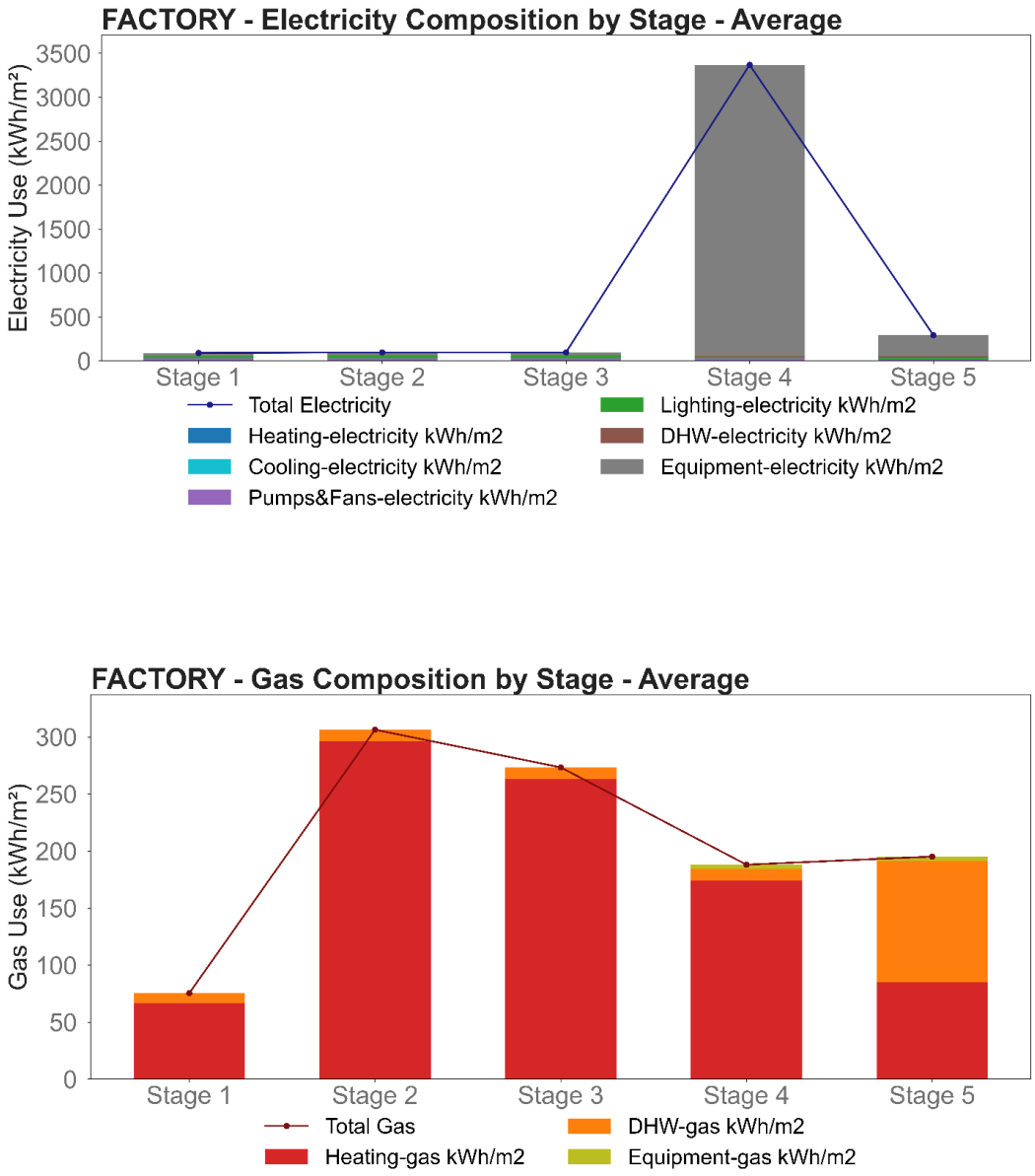


Figure B- 3: Average energy end use breakdown of the 7 calibrated cases for the Factories activity class

Electricity end-use breakdown

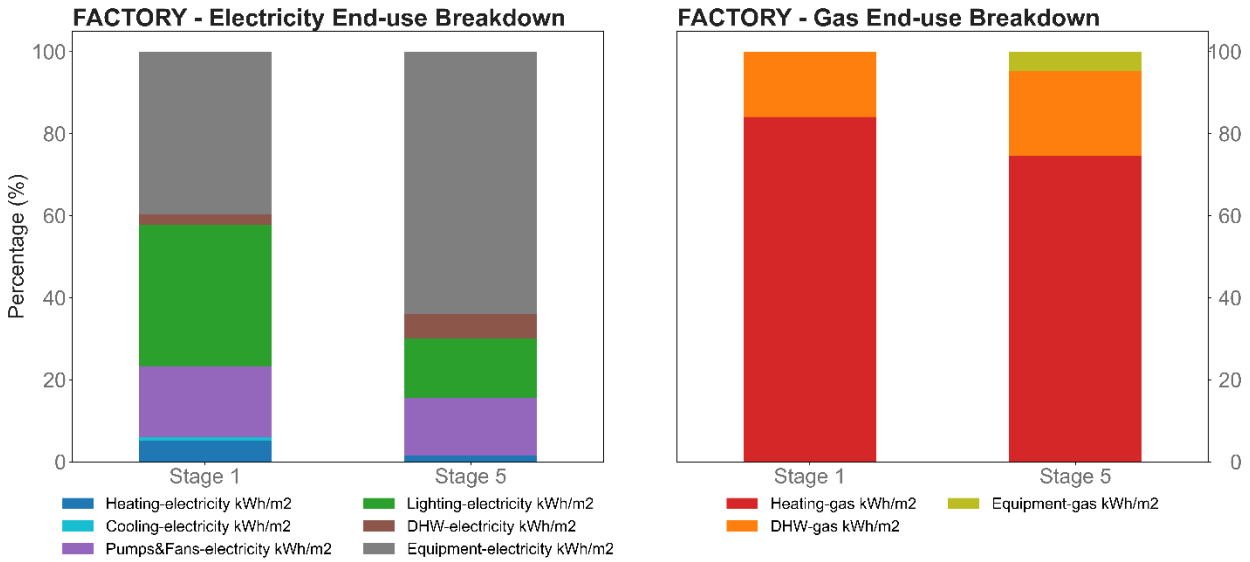


Figure B- 4: Energy end use breakdowns as a percentage of total for the Factories activity class

Overall, most of the electricity consumption in the factories activity class is not related to Heating Ventilation and Air Conditioning (HVAC), with lighting and equipment energy consumption accounting for more than 75% of the total consumption in both EPC and calibrated models. In 5 cases, there is substantial underreporting of equipment energy consumption in the EPC models. This is expected, given the EPC models do not include process energy. The modelling suggests that in 4 cases, electric HVAC energy consumption is over-reported in the EPC modelling. Suggesting that heating is used less intensively than assumed in the EPC models. In 5 of the EPC models, lighting energy is overstated but this is a smaller source of deviation than equipment and HVAC energy.

Sources of variance

In 3 cases, translation of the models from IES to EnergyPlus (stage 1 to stage 2) results in a minor increase in estimated electricity consumption. The picture is more mixed for gas consumption, with 3 models showing an increase in estimated consumption (2 of them substantial increments) and 2 showing a reduction. This suggests that assumptions about which spaces are included in particular zones and space conditioning assumptions applied to those zones can have an influence on energy consumption estimations for this activity class.

The impact of weather conditions on annual consumption is limited, with one site showing a small increase in gas consumption when real weather data is used rather than TRY data and two showing a decrease. All other models show very little impact.

In 2 cases, electricity consumption is reduced once NCM assumptions are replaced with data recorded on-site. In both these cases, there is further reduction during the calibration process. In 5 cases, the electricity consumption is substantially increased when the NCM assumptions for equipment are replaced with those recorded on site in Stage 4. This can be attributed to the process energy uses being captured during the audits. However, in four cases, the energy consumptions determined from the audit data exceed the total measured

electrical consumption from all sources. This highlights the challenge of using nameplate ratings and expected operating hours to assess equipment energy consumption.

Hospitality

Audits were undertaken for 6 sites in the Hospitality Activity Class. During the calibration process; one of the sites was dropped as its Stage 5 models resulted in CVRMSEs higher than 30%, leaving 5 calibrated models.

Overall consumption

EPC models (stage 1) show some variance in estimated electricity consumption with both under and over estimations. EPC models estimated measured electricity consumption within a percentage error range of -79 to +64%.

Gas consumption is considerably higher for domestic hot water production than for heating at all hospitality sites, with 2 sites consuming gas for kitchen related equipment. EPC models estimated measured gas consumption within a percentage error range of -95 to +6%.

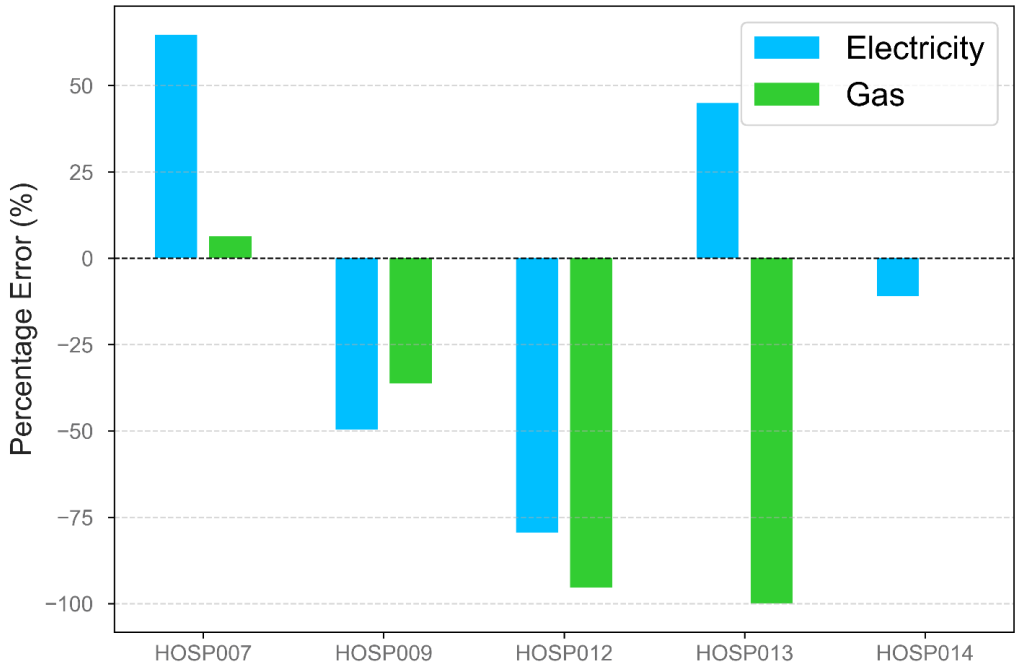


Figure B- 5: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Hospitality activity class

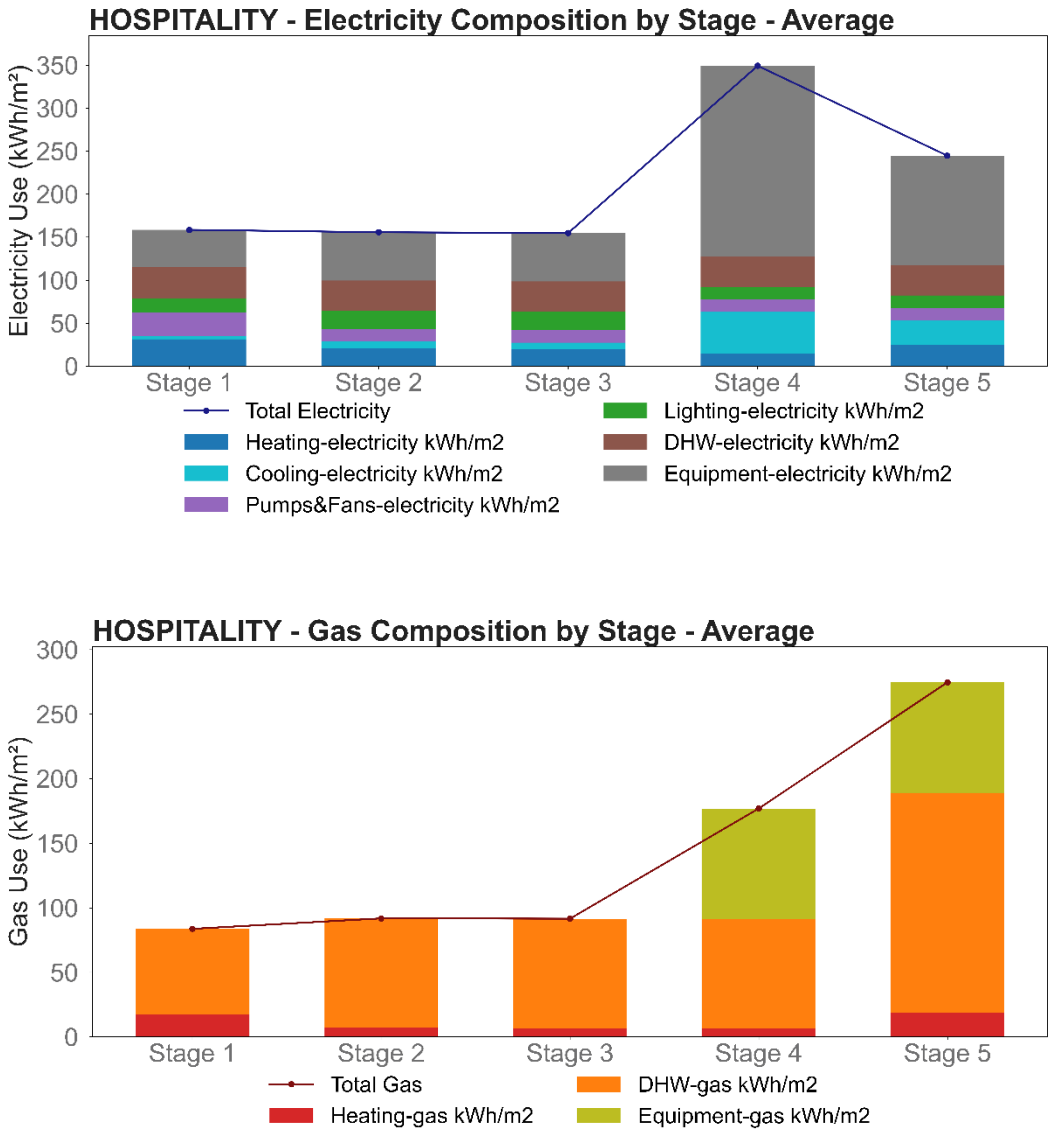


Figure B- 6: Average energy end use breakdown of the 5 calibrated cases for the Factories activity class

Electricity end-use breakdown

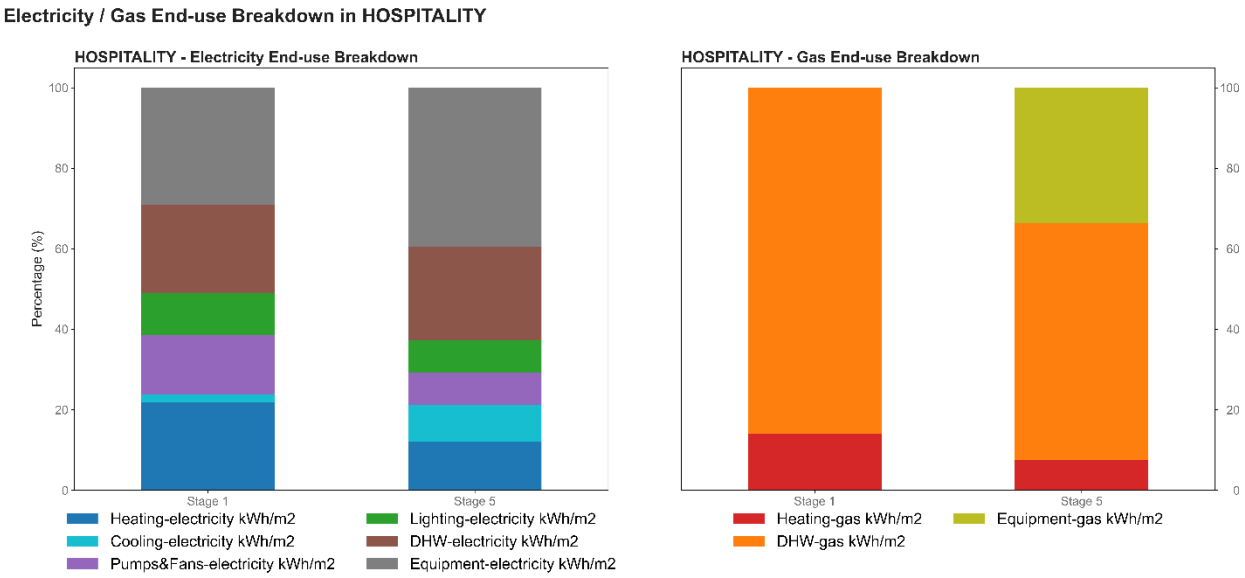


Figure B- 7: Energy end use breakdowns as a percentage of total for the Hospitality activity class

The results from the modelling indicate that in 4 of the 5 audit sites cooling is responsible for a higher proportion of electricity consumption than estimated by EPC models. This is noteworthy since cooling demands are likely to increase with a warming climate. In two of the five sites, domestic hot water production is the primary use for electricity.

Sources of variance

In 3 cases, translation of the models from IES to EnergyPlus (stage 1 to stage 2) does not result in large changes in estimated electricity consumption. Only one of the three sites with gas consumption in both EPC and calibrated models shows any notable variance. This suggests the allocation of spaces to different thermal zones and assumptions about space conditioning and activities in those zones is reasonably well understood.

The impact of weather conditions on annual consumption is minimal; this reflects the relatively low proportions of energy being used for space heating and cooling.

Audit data suggests that equipment electricity consumption can be overstated by NCM assumptions in the EPC models and that cooling demand is understated. However, in 3 of the five cases, actual electricity consumption is higher than suggested by the audit data.

Gas consumption estimates from both IES and EnergyPlus models are in close agreement in two audit sites with the adjustment for real weather also having little impact. Most of the variance is due to either underestimation of DHW energy consumption or the exclusion of the energy consumed by gas-fuelled equipment from the EPC model.

Offices

Audits were undertaken for 12 sites in the Office Activity Class. During the calibration process 7 of the sites were dropped as their Stage 5 models resulted in CVRMSEs higher than 30%, leaving 5 calibrated models.

Overall consumption

EPC models (stage 1) show some variance in estimated electricity consumption with two underestimating and three overestimating energy consumption. EPC models estimated measured electricity consumption within a percentage error range of -81 to +200%. In terms of gas consumption, EPC models' estimations had a percentage error range of -43 to +169%.

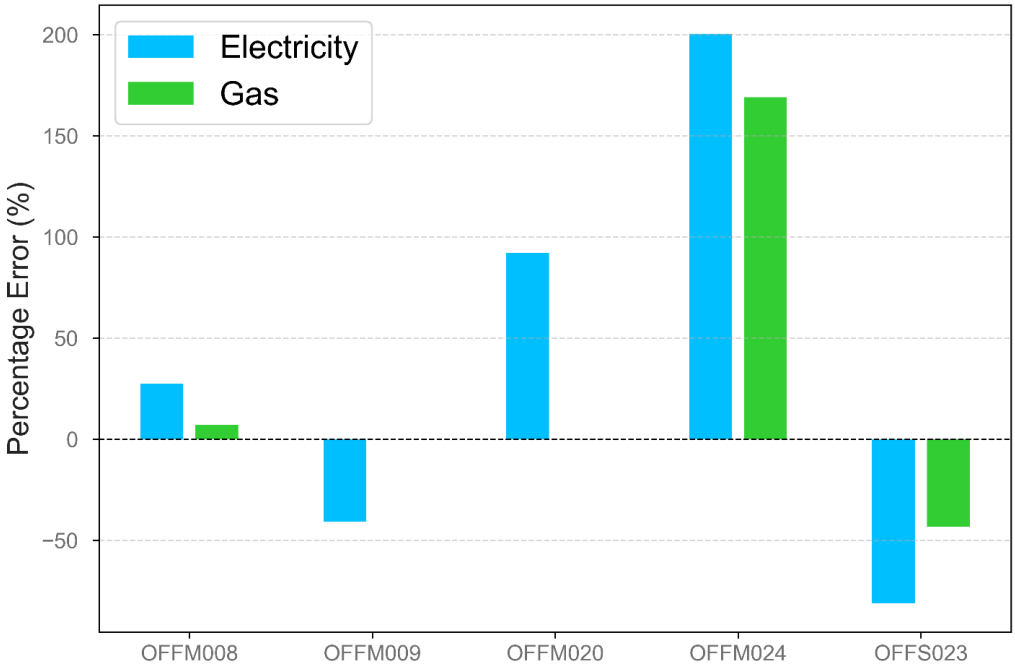


Figure B- 8: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Office activity class

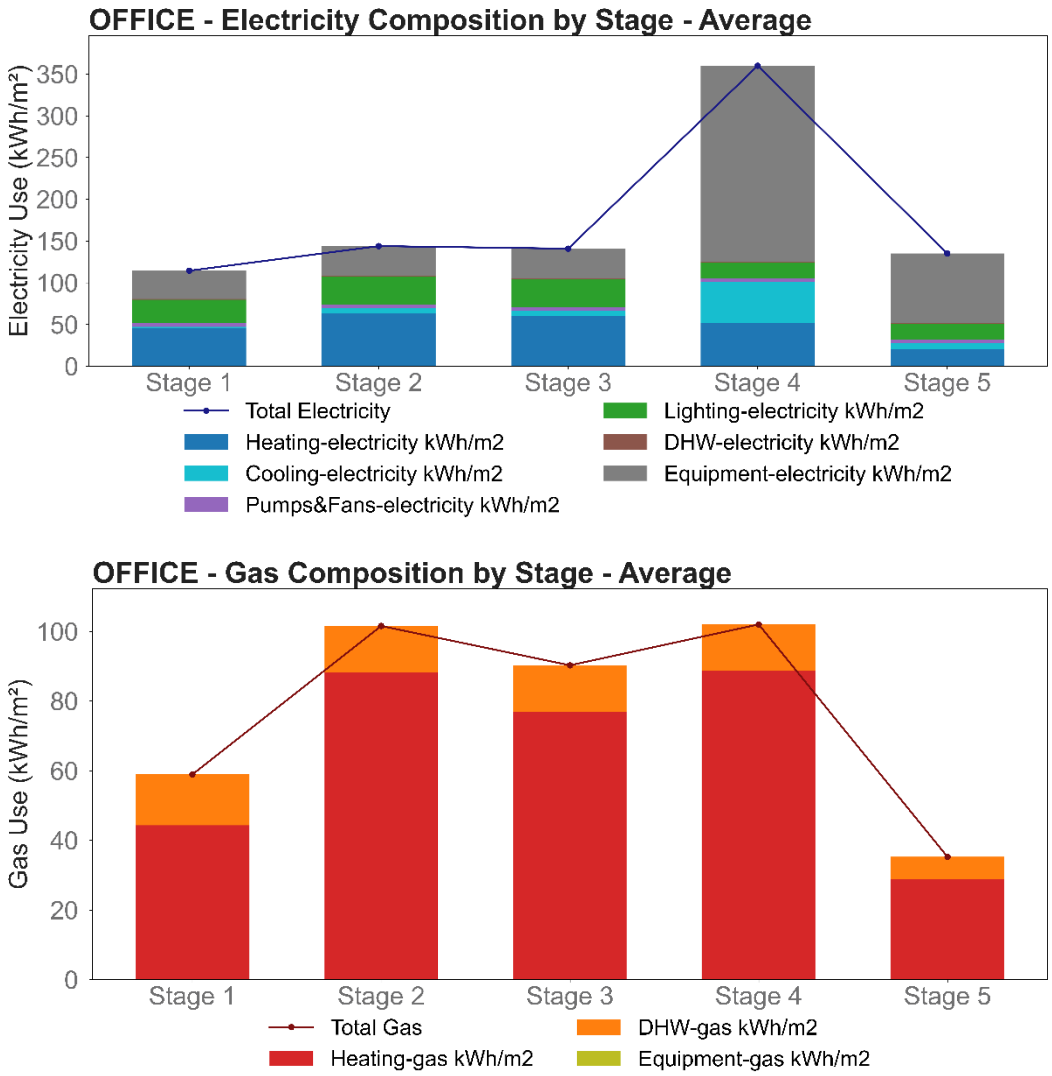


Figure B- 9: Average energy end use breakdown of the 5 calibrated cases for the Offices activity class

Electricity end-use breakdown

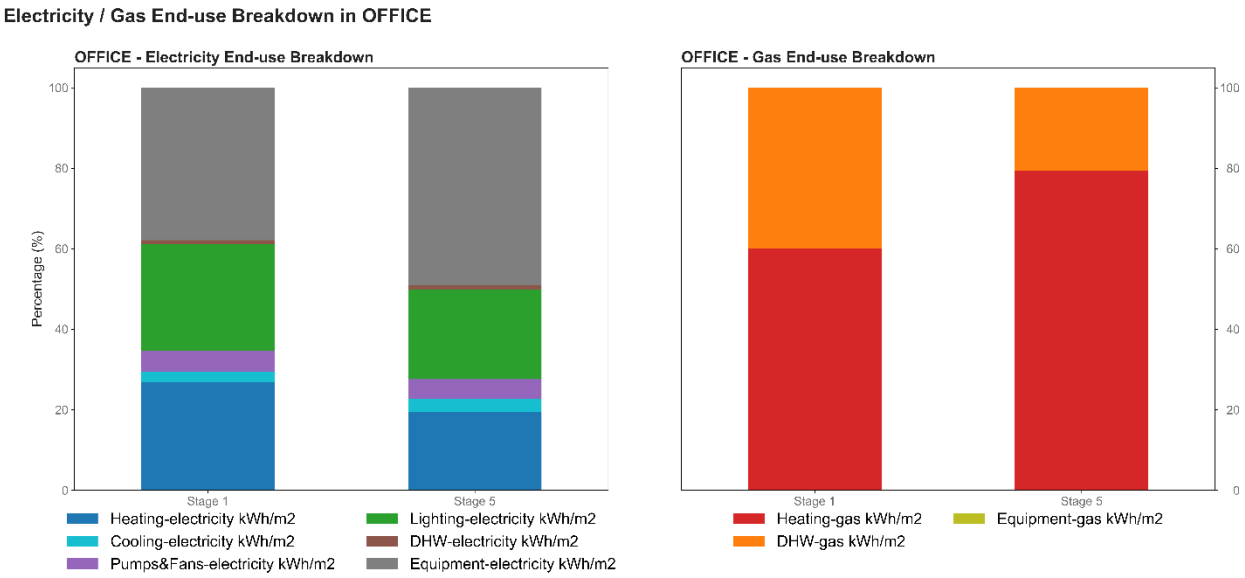


Figure B- 10: Energy end use breakdowns as a percentage of total for the Offices activity class

The modelling results show that 3 of the 5 calibrated models have lower shares of electricity being used for heating than the EPC models with one showing a substantially larger share. Other models show similar shares in EPC and calibrated models. 4 sites show a larger share for equipment with only 1 showing a smaller share.

Sources of variance

In 3 of the calibrated models, translation of the models from IES to EnergyPlus (stage 1 to stage 2) results in small increases in electricity consumption. This suggests that the allocation of spaces to different thermal zones and assumptions about space conditioning and activities in those zones are reasonably well understood. Replacing TRY with real weather data has a marginal impact since the overall share of electricity consumption for cooling is low. For all sites, replacing TRY with real weather data results in a small reduction in heating energy from gas. Across all sites, the replacement of the NCM assumptions with audit data, results in an increase in the electricity consumption for equipment and in 3 models in an overall increase in the electricity consumption of the site. In 3 of the models, the equipment energy consumptions determined from the audits are higher than the meter data for the site, indicating an inconsistency between the audit data for equipment for this activity class, as was the case for the activity class of Factories.

Shops

Audits were undertaken for 9 sites in the Shops Activity Class. During the calibration process, 1 of the sites was dropped as the Stage 5 model resulted in CVRMSEs higher than 30%, leaving 8 models considered as calibrated.

Overall consumption

EPC models (stage 1) show some variance in estimated electricity consumption with 4 models underestimating and four models overestimating, EPC models estimated measured electricity consumption within a percentage error range of -74 to +224%.

For the 3 sites where gas is used this is underestimated in the EPC model. In one case, this is the result of a use case not envisaged in the EPC model: that of gas-fuelled refrigeration systems for industrial and commercial sites. The other case where there is gas-powered equipment, concerns gas-fuelled heaters which were allocated as equipment during the audit.

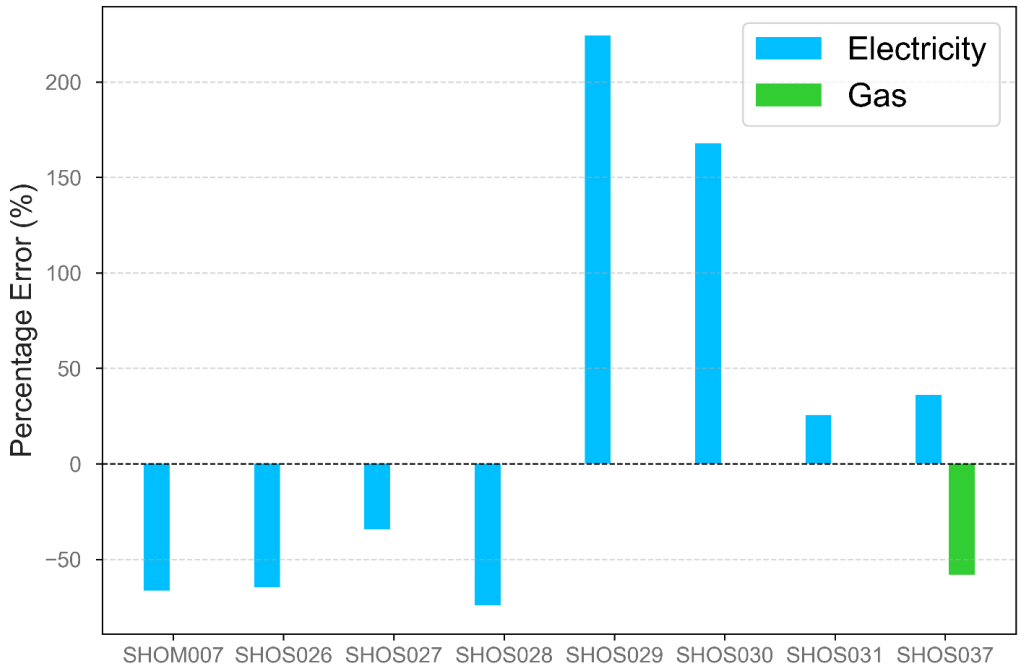


Figure B- 11: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Shops activity class

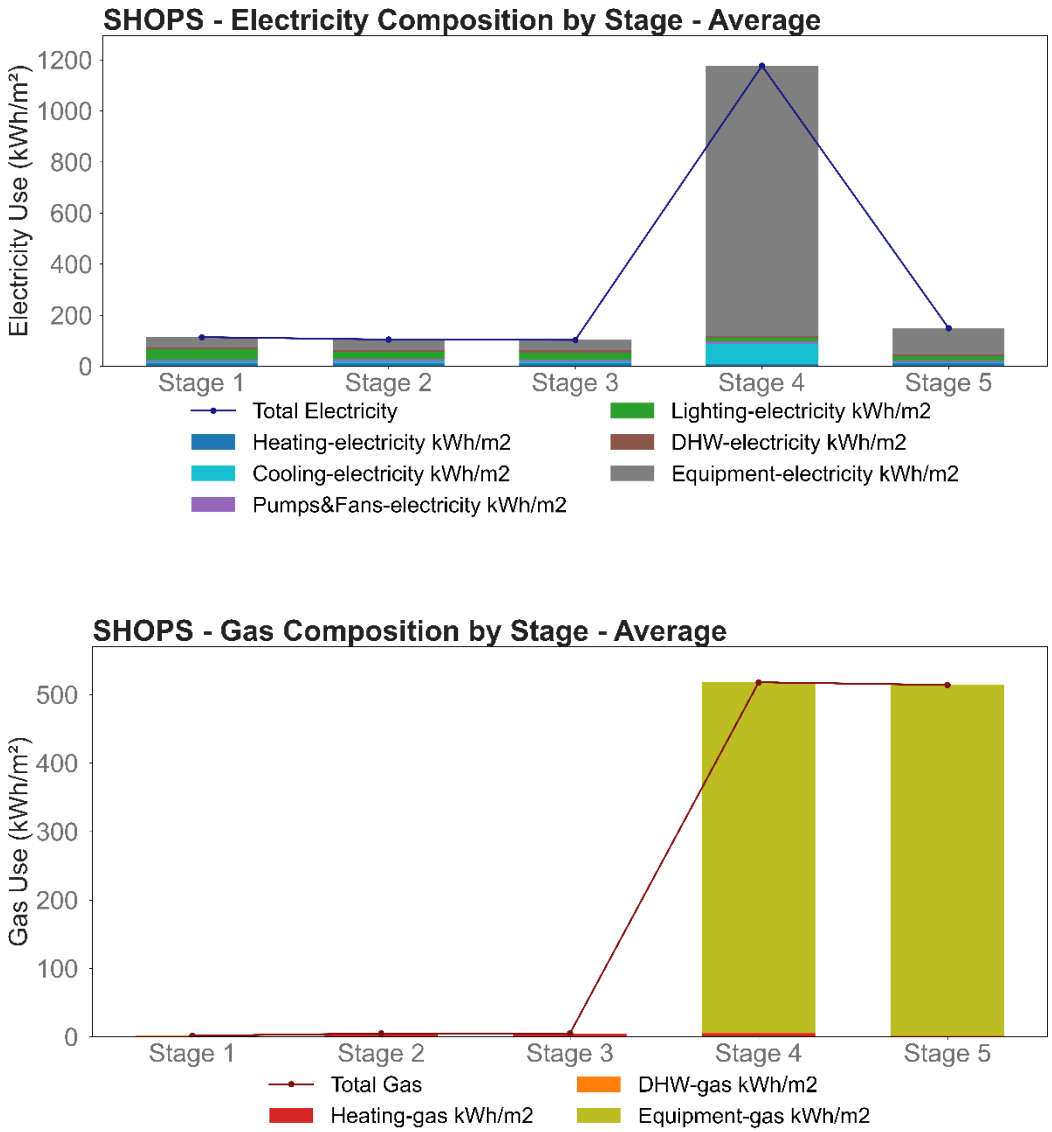


Figure B- 12: Average energy end use breakdown of the 8 calibrated cases for the Shops activity class

Electricity end-use breakdown

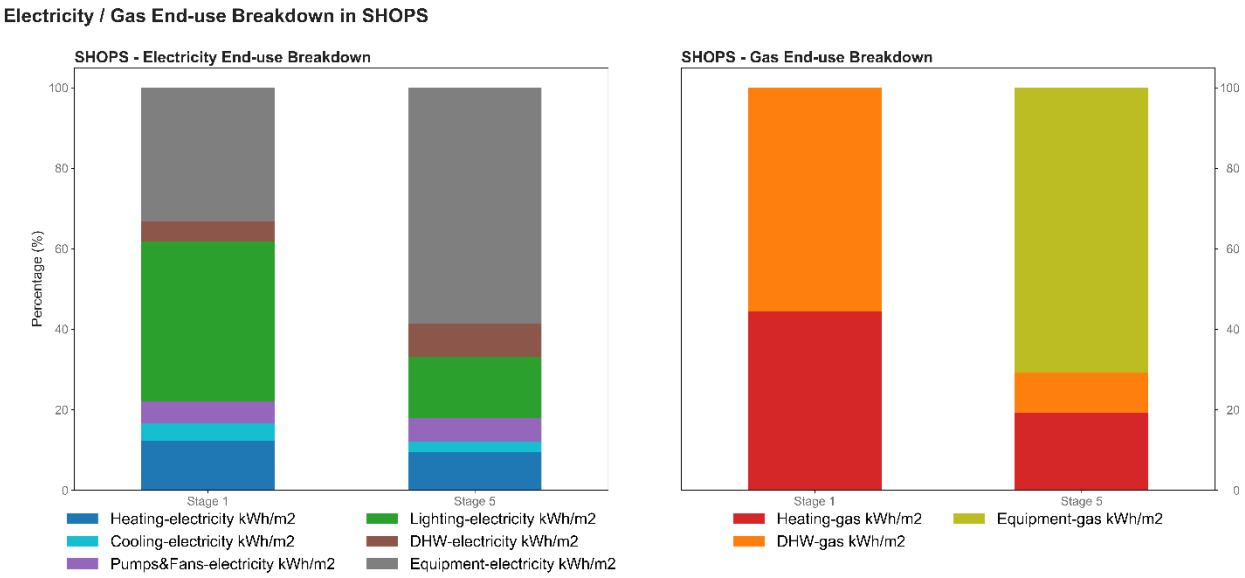


Figure B- 13: Energy end use breakdowns as a percentage of total for the Shops activity class

5 of the 8 calibrated models show lower shares of electricity being used for lighting than the EPC models. In 7 sites, the equipment electricity consumption is comparable to that estimated by the EPC model and in 1 model this is substantially higher due to the presence of industrial refrigeration.

Overall, the electricity consumption for HVAC is less than 20%, with lighting and equipment dominating the demand. For gas, the industrial refrigeration systems are responsible for the majority of the demand.

Sources of variance

In 4 cases, translation from IES to EnergyPlus model results in a small variation in electricity consumption. This suggests that allocation of space conditioning and equipment to zones was reasonably well understood. Replacing NCM assumptions with data collected during the audits results in a large increase in electricity consumption for 6 of the sites. However, in 5 of these models, this is reversed during the calibration process to match the measured data.

Warehouses

Audits were undertaken for 8 sites in the Warehouses Activity Class. During the calibration process, 4 of the sites were dropped as the Stage 5 models resulted in CVRMSEs higher than 30%, leaving 4 models considered as calibrated.

Overall consumption

EPC models (stage 1) show some variance in estimated electricity consumption with 3 models underestimating and 1 model overestimating, EPC models estimated measured electricity consumption within a percentage error range of -84 to +25%.

For the 3 sites where gas is used this is overestimated in the EPC model for 2 sites and under for one with a percentage error range of -45 to +380%.

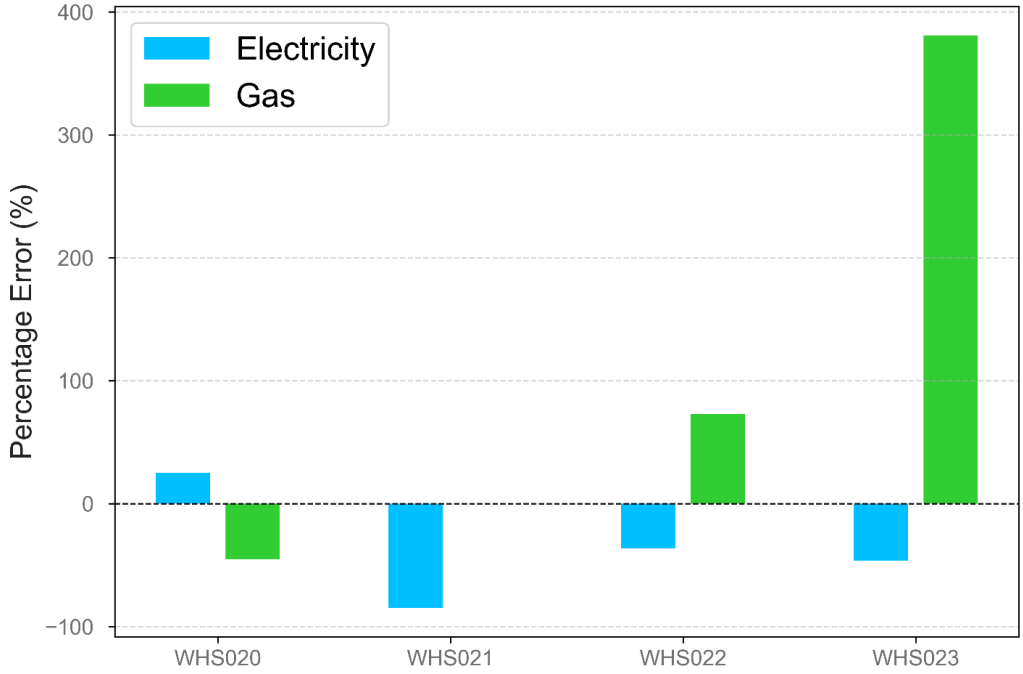


Figure B- 14: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Warehouses activity class

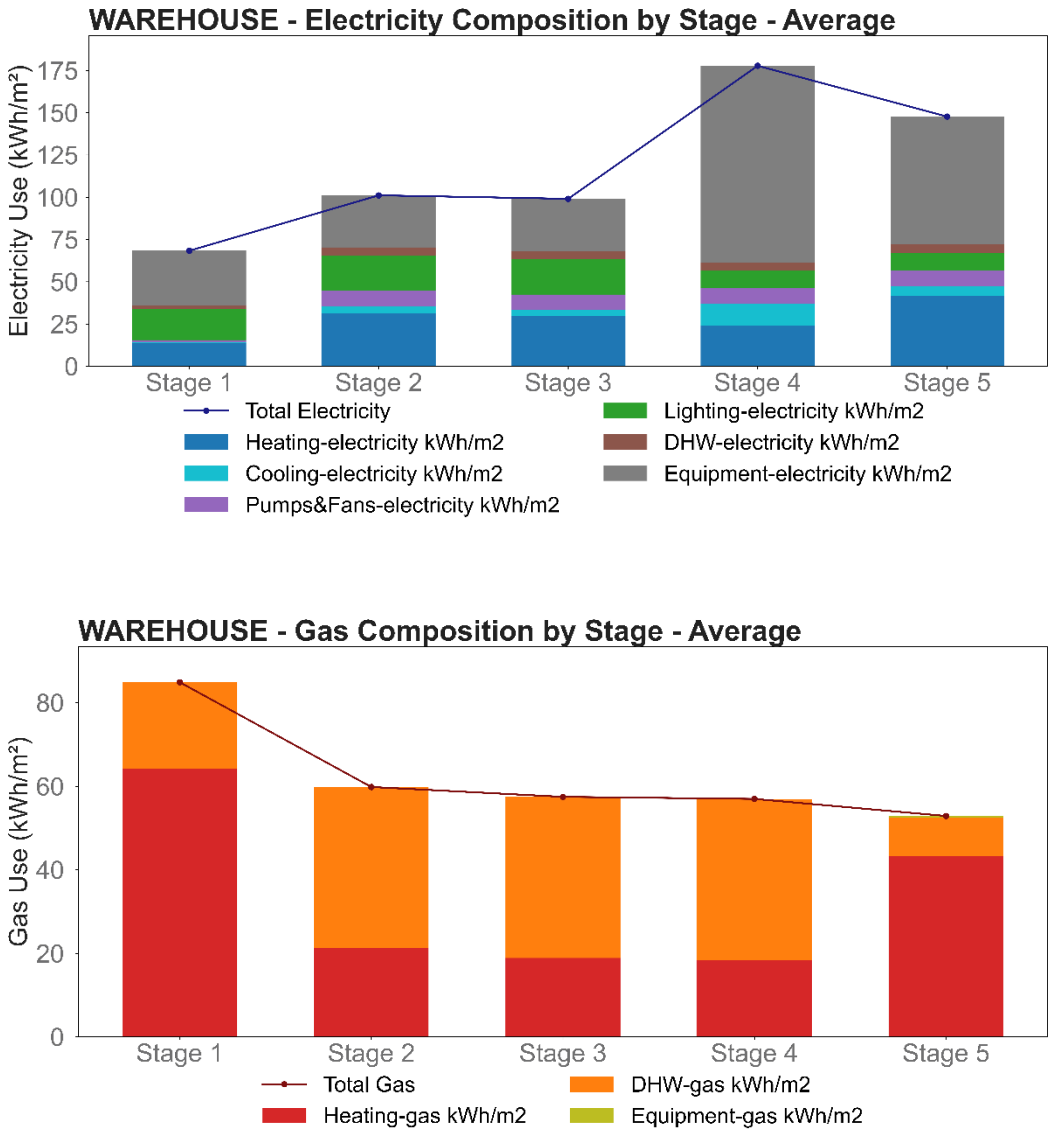


Figure B- 15: Average energy end use breakdown of the 4 calibrated cases for the Warehouses activity class

Electricity end-use breakdown

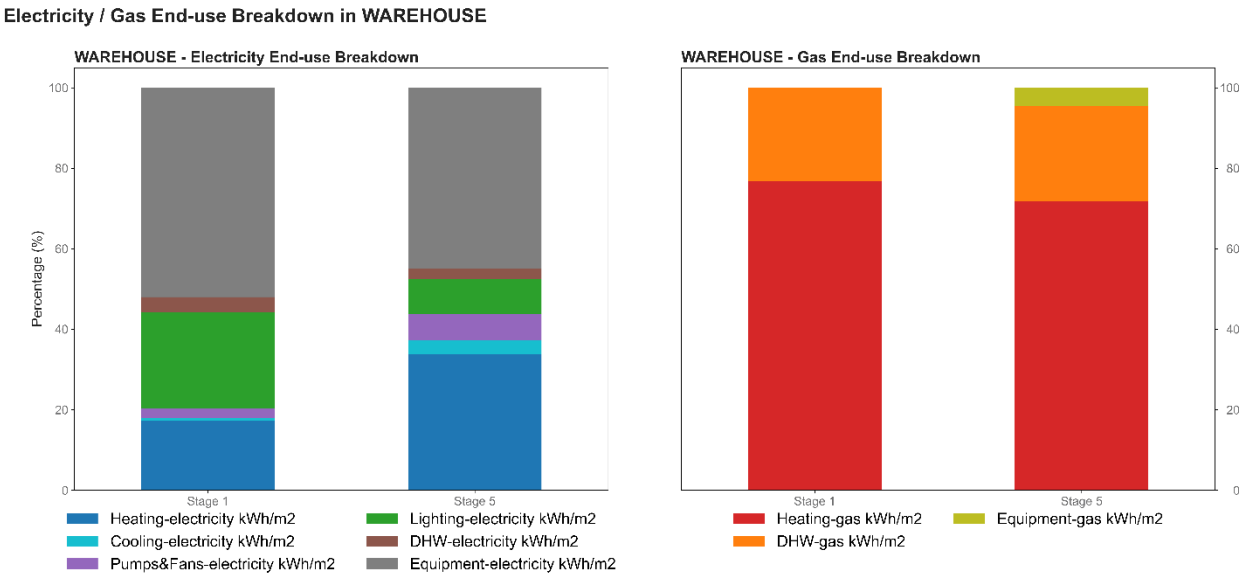


Figure B- 16: Energy end use breakdowns as a percentage of total for the Warehouses activity class

Electricity consumption for space conditioning varies considerably between EPC and calibrated models, associated with this is considerable variance in the heating energy consumption. Electricity consumption for heating is underestimated in 2 models. In 1 of the 4 sites with calibrated models, equipment electricity consumption is underestimated by the EPC model substantially. Lighting electricity consumption is overestimated in 2 of the 4 EPC models.

Sources of variance

In all 4 cases, translation of models from IES to EnergyPlus results in an increase in estimation of electricity consumption and a reduction in gas consumption, however this is marginal in most cases. This suggests that allocation of space conditioning and equipment to zones has not had a large influence on model results for the Warehouse activity class. The use of actual weather data results in small reductions in heating energy requirements from gas in 2 models and a substantial decrease in one. In one case, replacing NCM assumptions with data on equipment power and use collected during audits results in a very large variation in the electricity consumption estimations, while in two, the EPC has estimated the equipment energy consumption rather accurately.

Education

Audits were undertaken for 7 sites in the Education Activity Class. During the calibration process, 3 of the sites were dropped as the Stage 5 models resulted in CVRMSEs higher than 30%, leaving 4 models considered as calibrated.

Overall consumption

EPC models underestimate gas consumption in 4 out of 5 cases; this is primarily due to underestimation of gas consumption for heating but in two cases is due to substantial underestimation of DHW consumption.

EPC models (stage 1) show some variance in estimated electricity consumption with 3 models underestimating and 1 model overestimating, EPC models estimated measured electricity consumption within a percentage error range of -34 to +14%.

EPC models underestimate gas consumption in all 4 cases, with a percentage error range of -64 to -25%. this is primarily due to underestimation of gas consumption for heating but in one case is due to substantial underestimation of DHW consumption.

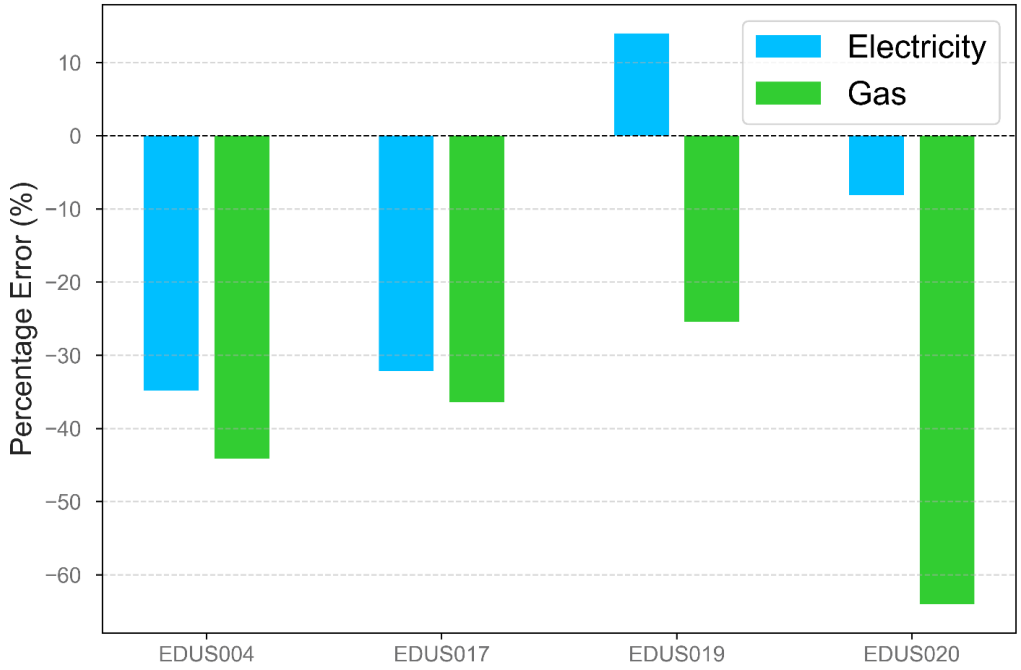


Figure B- 17: Percentage Error (%) between EPC models (Stage 1) and meter data for Electricity and Gas consumption over 1 year for the Education activity class

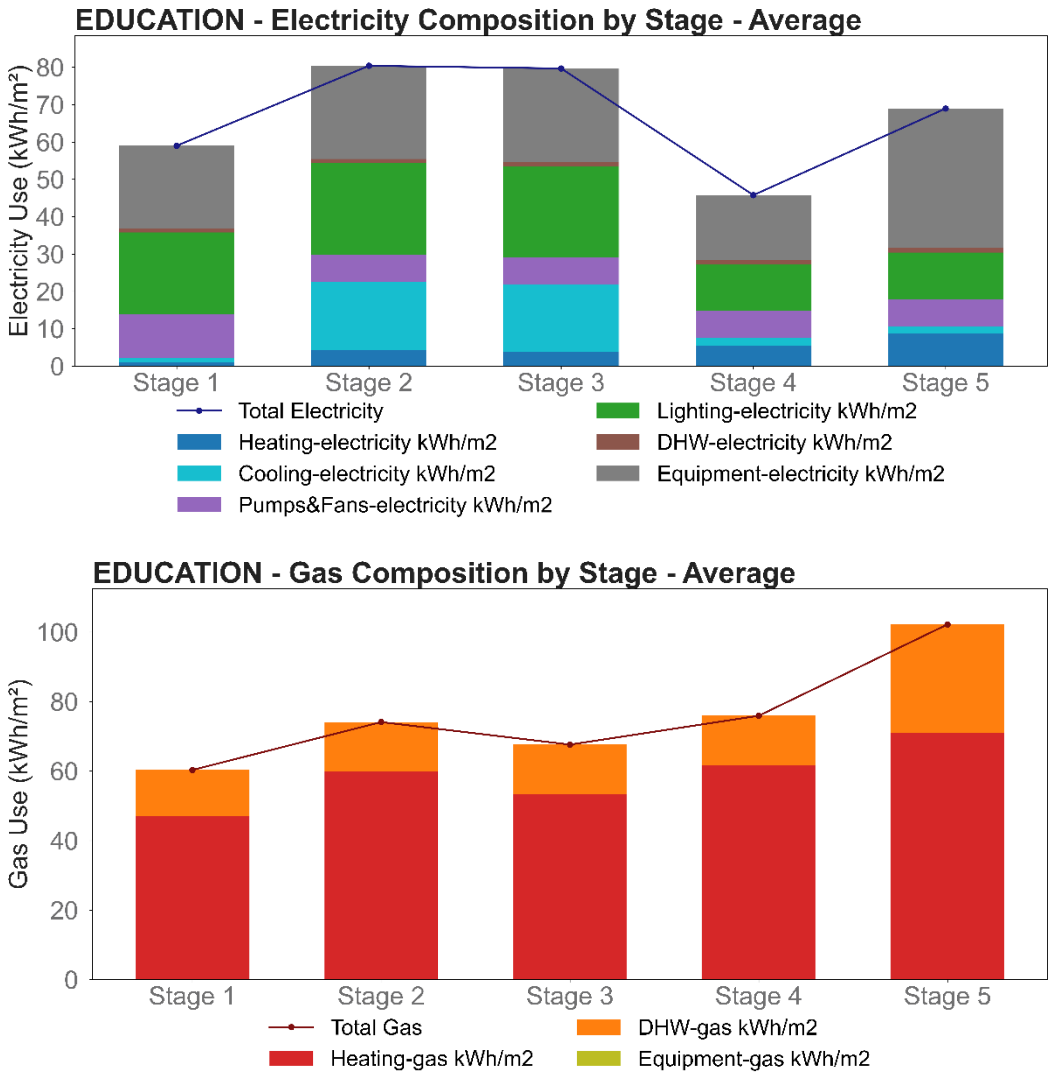


Figure B- 18: Average energy end use breakdown of the 4 calibrated cases for the Education activity class

Electricity end-use breakdown

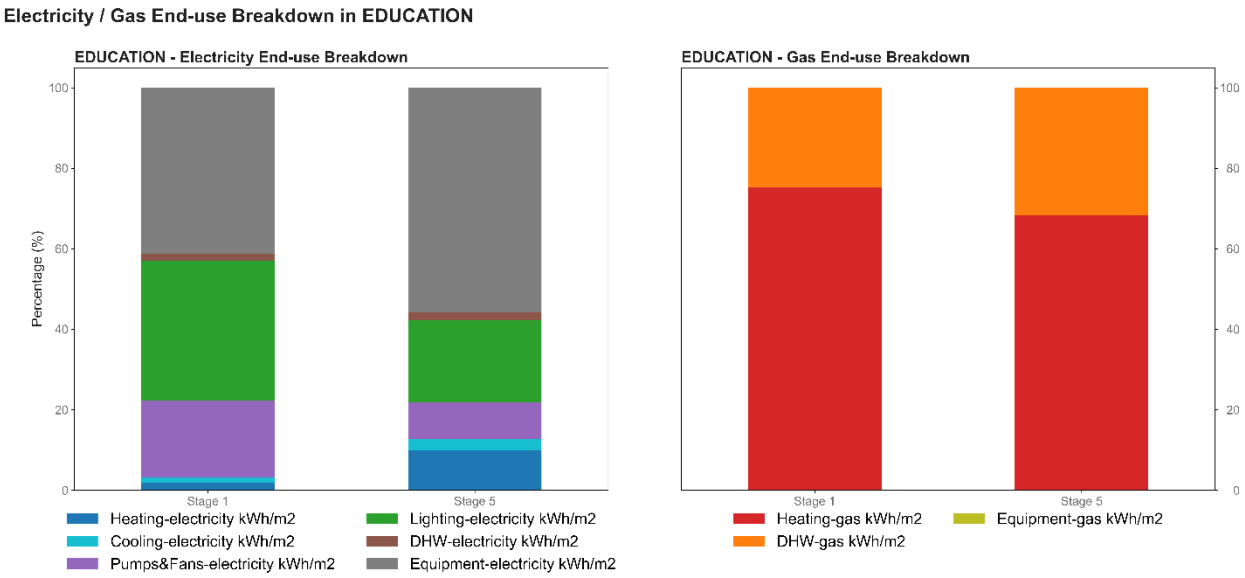


Figure B- 19: Energy end use breakdowns as a percentage of total for the Education activity class

There is a large variation between EPC models and calibrated models as to the share of electricity for lighting, equipment and heating. The majority of the variance in total electricity consumption is due to variance in lighting and equipment energy and to a lesser extent, heating.

Sources of variance

In all models, the translation from IES to EnergyPlus results in an increase in the electricity consumption and particularly for cooling. This highlights the importance of allocating spaces to zones in determining the overall electricity consumption. Replacing TRY weather data with actual weather data does not impact electricity consumption but results in a small reduction in gas consumption. Audit data indicates that electricity consumption for lighting is generally overestimated by the EPC models. While the calibration process, indicates that in 2 of the 4 cases, more electricity is used for heating than indicated in the audits, this is likely to be due to the timing of the audits and the challenges of identifying intermittent use of portable heaters when audits are not undertaken while the devices are actually in use. In all but one case, the calibration process indicates that more gas is being consumed for heating than is expected based on EPC models and audit data.

Appendix B1 Detail charts and data tables

Factories

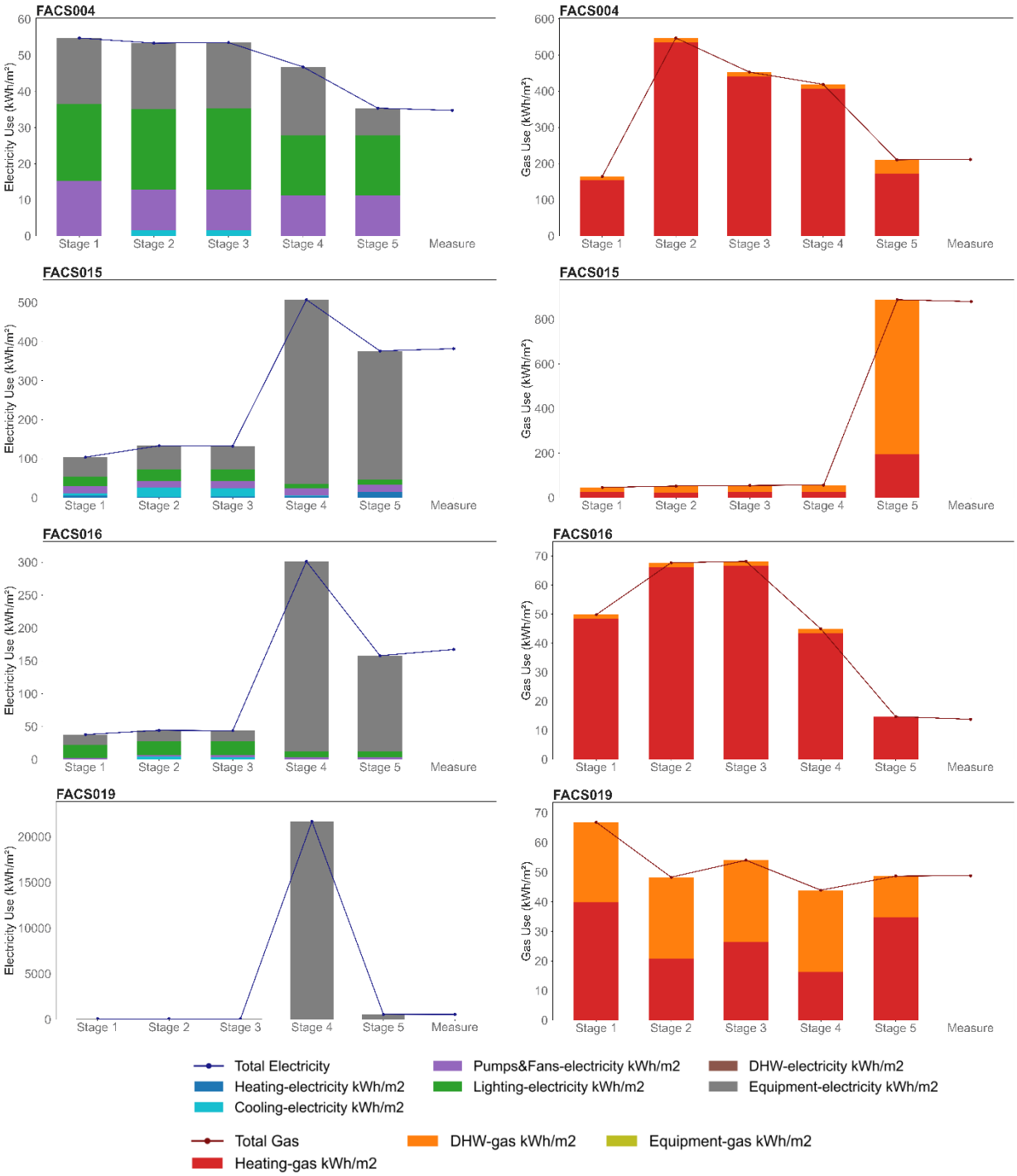


Figure B- 20: Individual model results for the Factories activity class (1/2)

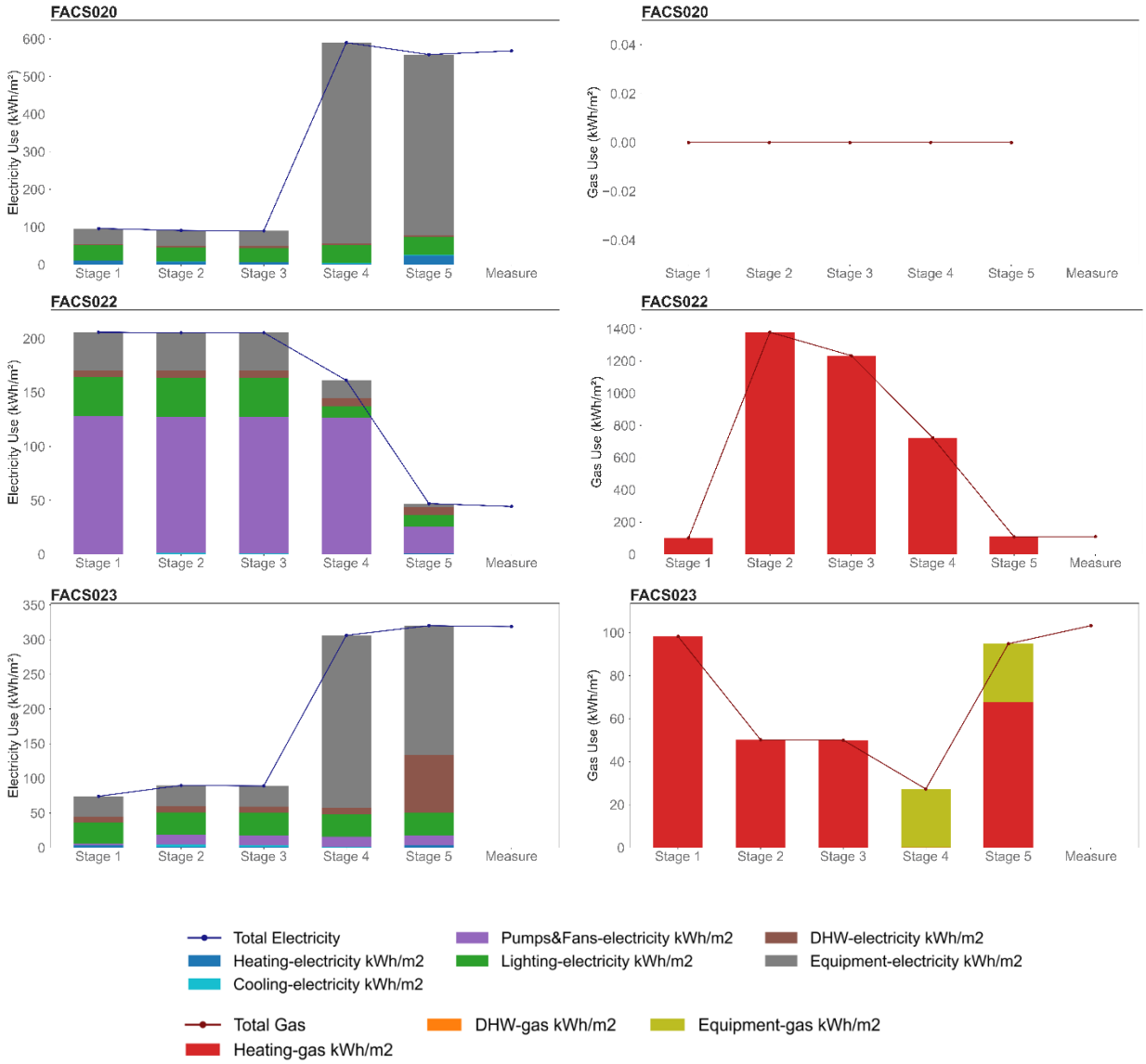


Figure B- 21: Individual model results for the Factories activity class (2/2)

Hospitality

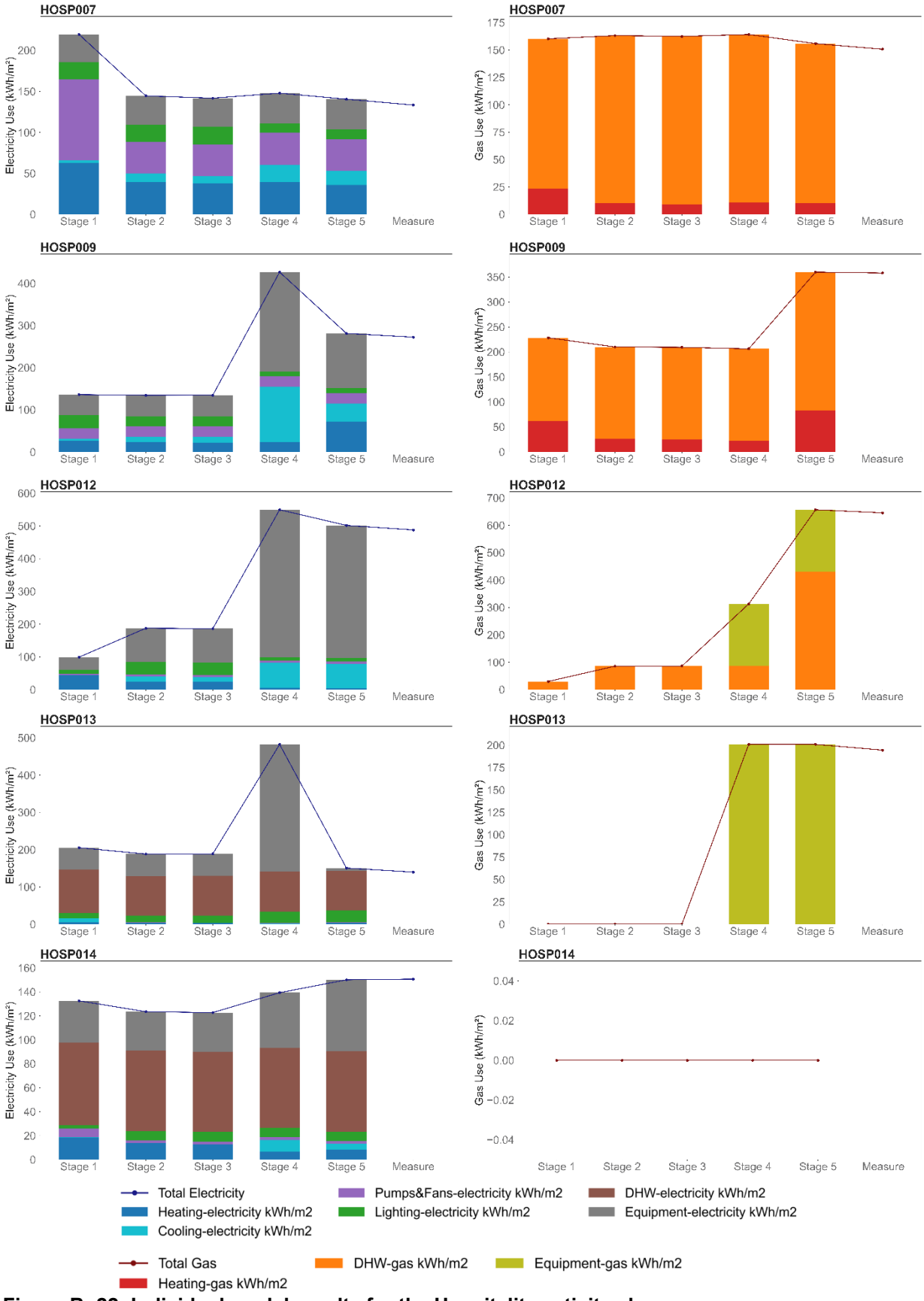


Figure B- 22: Individual model results for the Hospitality activity class

Offices

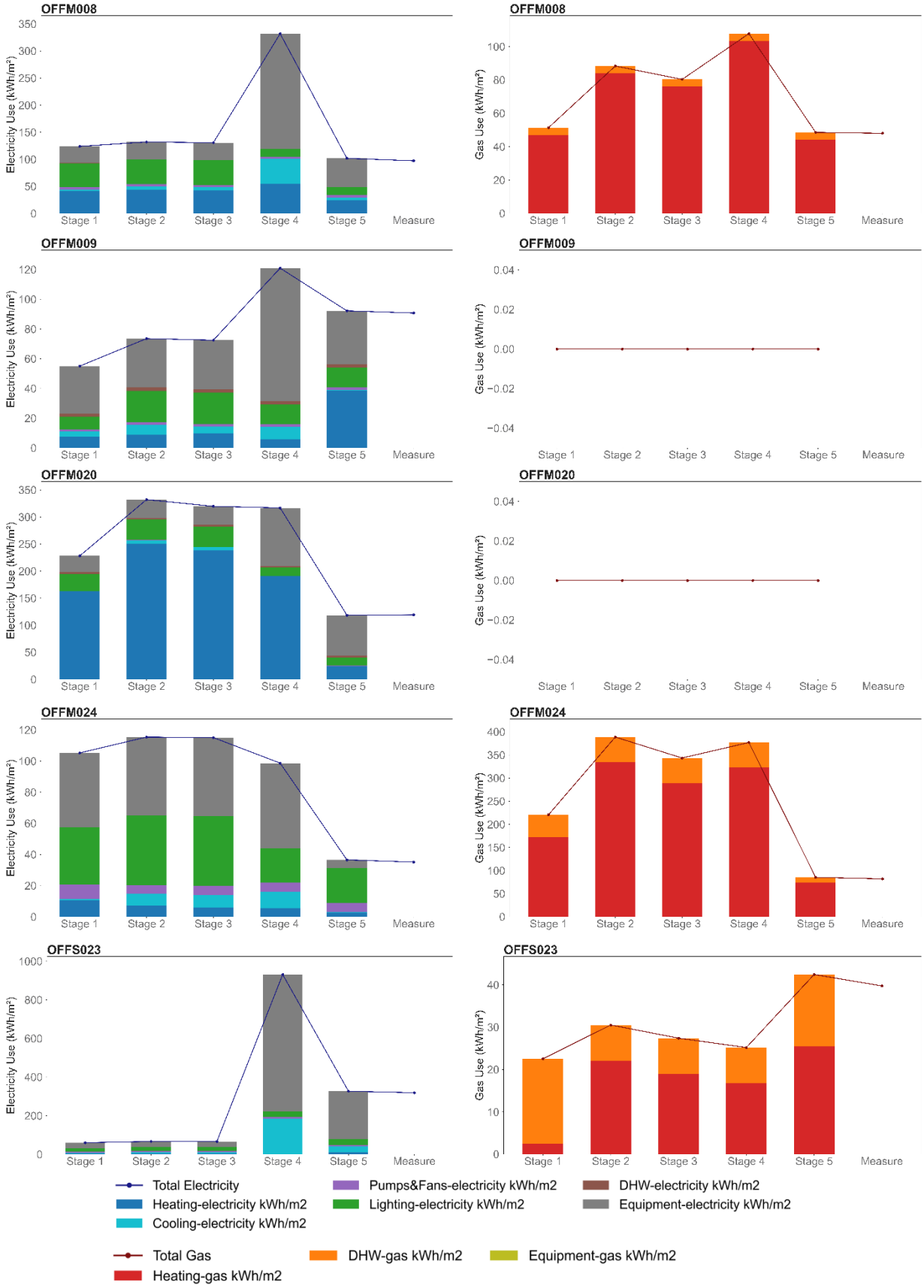


Figure B- 23: Individual model results for the Offices activity class

Shops

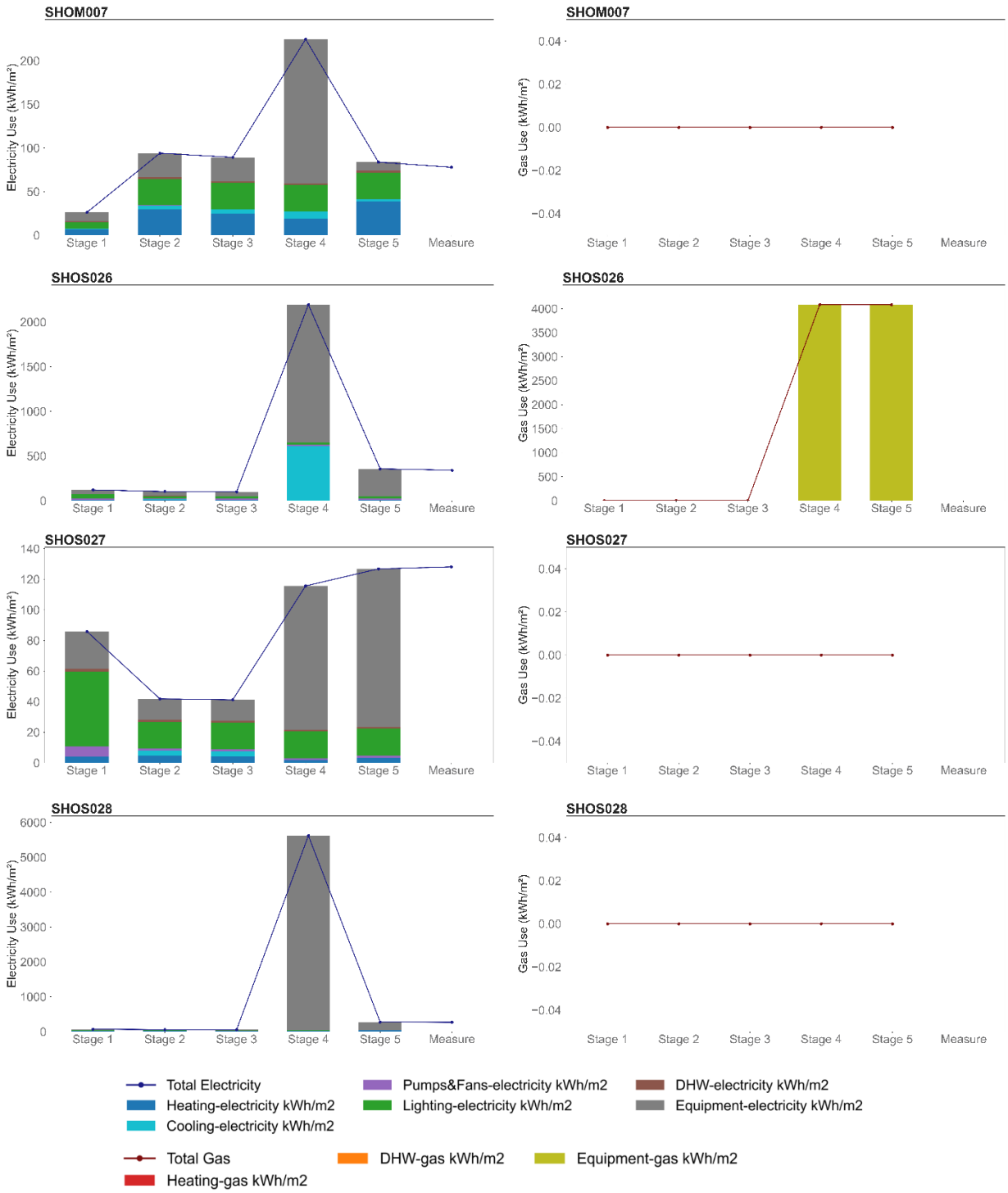


Figure B- 24: Individual model results for the Shops activity class (1/2)

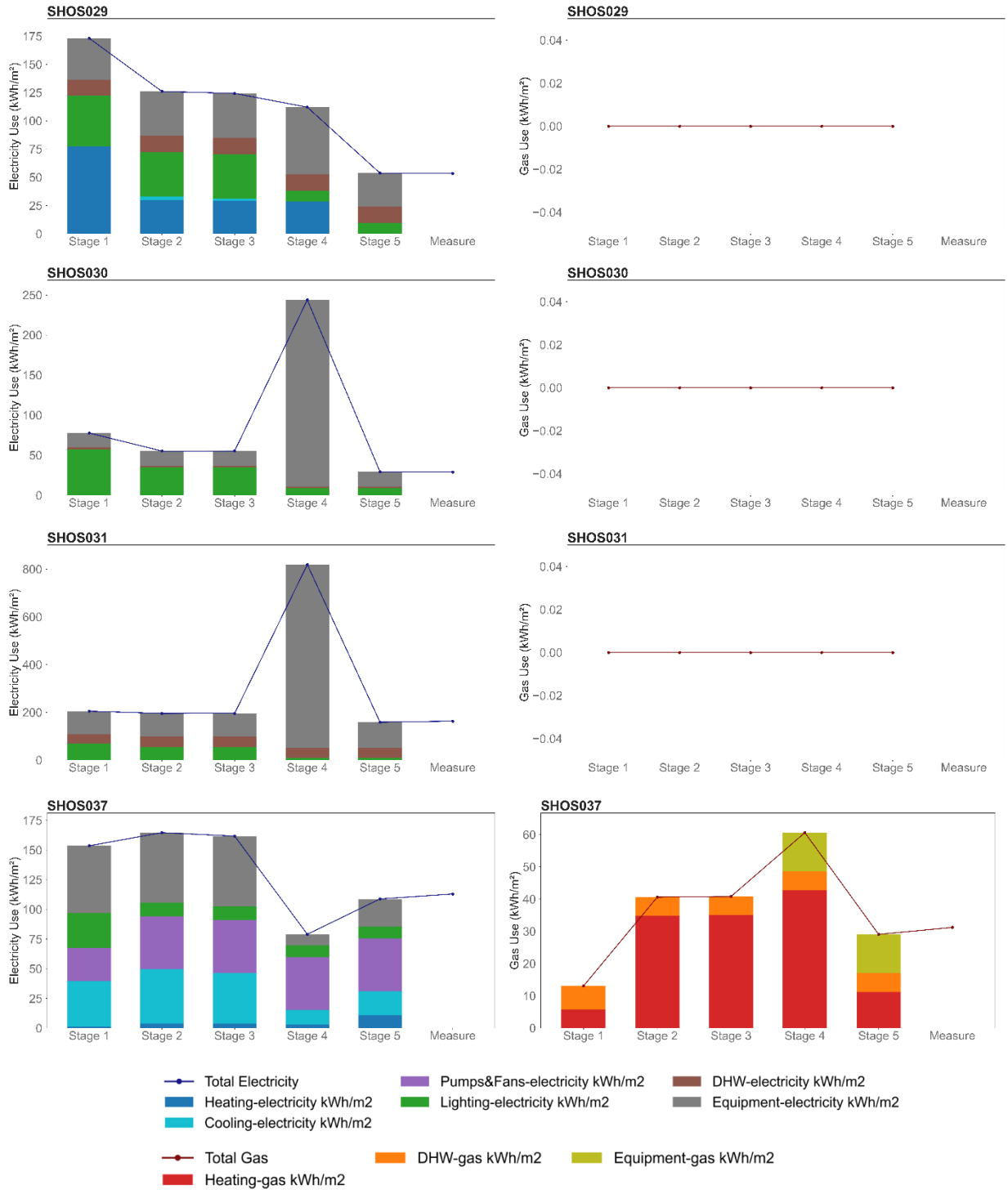


Figure B- 25: Individual model results for the Shops activity class (2/2)

Warehouses

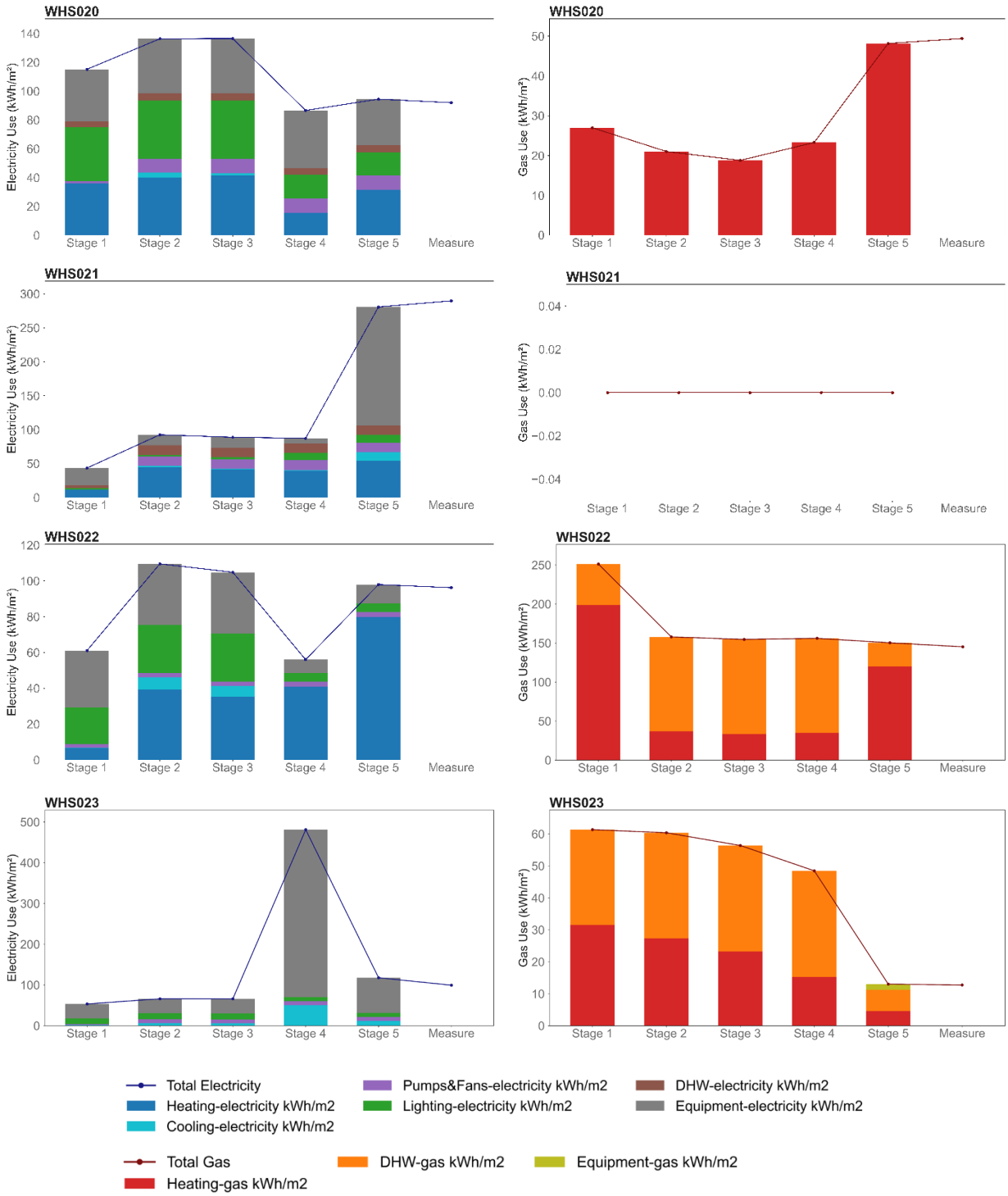


Figure B- 26: Individual model results for the Warehouses activity class

Education

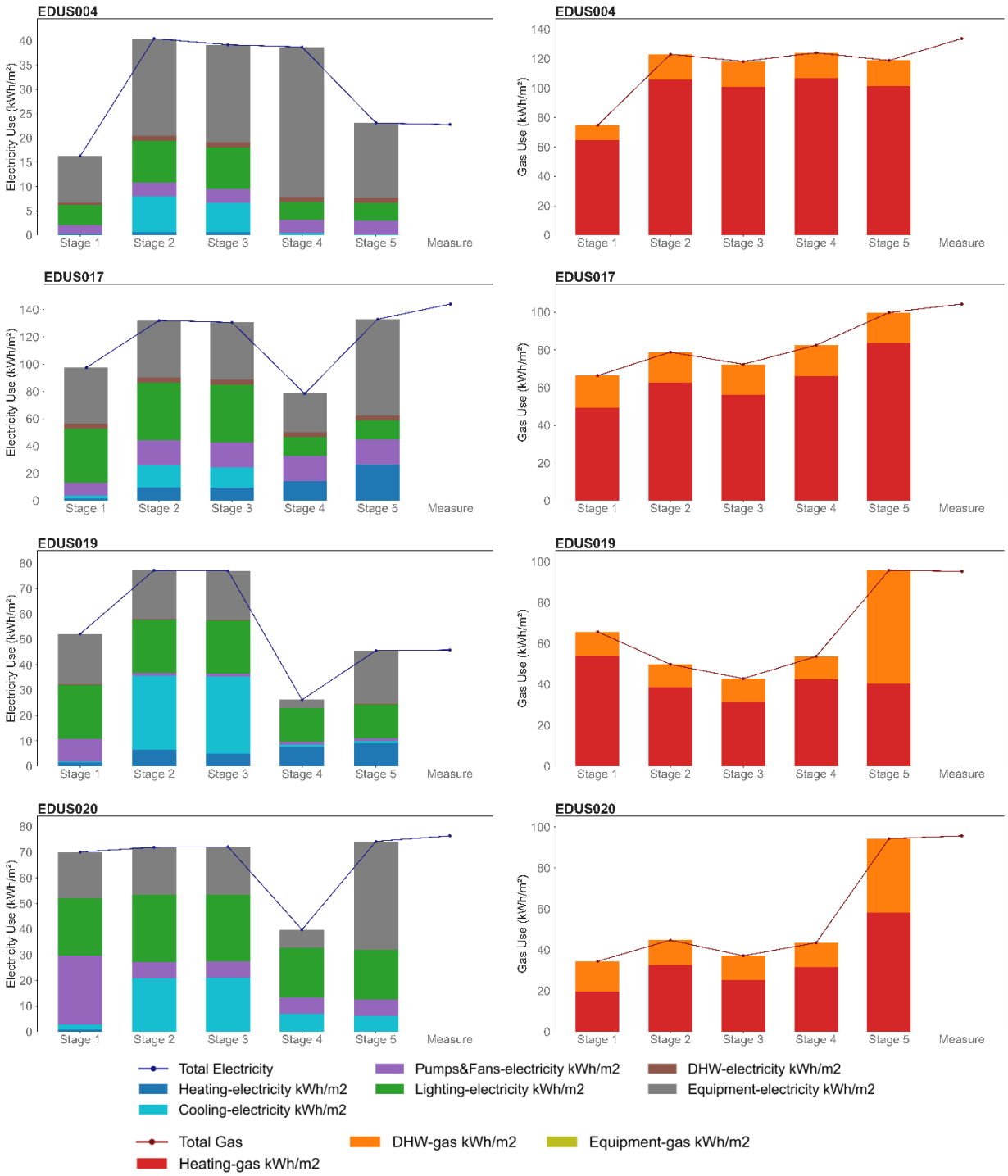


Figure B- 27: Individual model results for the Education activity class

Table B 1: Parameter values for calibrated models for all activity classes (1/3)

	EDUS004	EDUS017	EDUS019	EDUS020	FACS004	FACS015	FACS016	FACS019	FACS020	FACS022	FACS023
CVRMSE: Elec. (month) [%]	45.2	15.0	13.9	12.9	7.4	24.9	17.5	8.1	15.1	10.3	7.7
CVRMSE: Gas (month) [%]	20.0	22.7	29.3	14.4	22.8	25.6	101.4	56.0	-	35.0	28.5
NMBE: Elec. (month) [%]	-1.4	6.4	0.9	1.9	-1.3	1.8	6.2	-3.1	2.3	-6.2	-0.5
NMBE Gas (month) [%]	12.7	-6.4	0.0	3.1	2.3	-0.4	-6.6	2.3	-	-1.6	8.9
Heat. Set Point (°C)	22.0	22.0	23.0	22.0	24.0	-	-	21.0	24.0	22.0	-
Heat. Set Point (Elec.) (°C)	-	-	-	-	-	23.0	12.0	-	-	-	22.0
Heat. Set Point (Gas) (°C)	-	-	-	-	-	28.0	6.0	-	-	-	20.0
Cool. Set Point (°C)	24.0	24.0	24.0	24.0	-	26.0	25.0	28.0	26.0	29.0	27.0
Infil. (ACH)	0.10	0.50	0.10	0.50	3.00	3.00	2.00	1.00	3.00	3.00	0.25
Ventil. (ACH)	-	-	-	-	-	-	-	-	-	6.0	-
HVAC Perform. rate (Elec.)	1.0	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
HVAC Perform. rate (Gas)	1.0	1.0	1.0	0.8	0.6	1.0	1.0	1.0	-	0.6	0.6
DHW Factor	-	-	5.00	3.00	3.00	23.00	0.00	0.50	-	-	9.00
Elect. Equip. Factor (NCM)	0.50	2.50	6.50	6.00	0.40	0.70	0.50	0.03	0.90	0.20	0.75

Table B 2: Parameter values for calibrated models for all activity classes (2/3)

	HOSP007	HOSP009	HOSP012	HOSP013	HOSP014	OFFM008	OFFM009	OFFM020	OFFM024	OFFS023
CVRMSE: Elec. (month) [%]	21.8	13.7	16.3	17.4	9.7	19.8	24.2	8.0	9.0	4.1
CVRMSE: Gas (month) [%]	19.7	8.0	3.8	18.8	-	19.6	-	-	20.4	32.7
NMBE: Elec. (month) [%]	-5.2	-3.5	-3.4	-8.3	0.3	-6.0	-1.5	-0.2	-4.1	-3.1
NMBE Gas (month) [%]	-3.4	-0.5	-1.9	-3.6	-	-0.2	-	-	-2.6	-5.6
Heat. Set Point (°C)	19.0	22.0	21.0	21.0	21.0	18.0	22.0	18.0	-	20.0
Heat. Set Point (Elec.) (°C)	-	-	-	-	-	-	-	-	16.0	-
Heat. Set Point (Gas) (°C)	-	-	-	-	-	-	-	-	16.0	-
Cool. Set Point (°C)	26.0	25.0	24.0	26.0	26.0	24.0	24.0	-	24.0	26.0
Infil. (ACH)	0.50	3.00	0.25	0.75	0.75	0.10	3.00	0.25	0.10	3.00
Ventil. (ACH)	-	-	-	-	-	0	-	-	-	-
HVAC Perform. rate (Elec.)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
HVAC Perform. rate (Gas)	1.0	1.0	-	-	-	0.8	-	-	1.0	1.0
DHW Factor	0.95	1.50	5.00	-	-	-	-	-	0.20	2.00
Elect. Equip. Factor (NCM)	1.00	0.55	0.90	0.02	1.30	0.25	0.40	0.70	0.10	0.35

Table B 3: Parameter values for calibrated models for all activity classes (1/3)

	SHOM007	SHOS026	SHOS027	SHOS028	SHOS029	SHOS030	SHOS031	SHOS037	WHS020	WHS021	WHS022	WHS023
CVRMSE: Elec. (month) [%]	24.8	10.8	6.3	28.6	18.5	24.6	25.5	16.0	22.9	23.9	16.6	20.9
CVRMSE: Gas (month) [%]	-	-	-	-	-	-	-	22.6	37.3	-	21.6	30.0
NMBE: Elec. (month) [%]	-7.2	-4.8	1.2	-2.1	-0.7	-1.4	2.8	-0.4	-3.9	2.3	-1.6	-20.0
NMBE Gas (month) [%]	-	-	-	-	-	-	-	0.9	-0.3	-	-3.4	-2.4
Heat. Set Point (°C)	22.0	16.0	21.0	21.0	18.0	-	-	-	-	18.0	15.0	18.0
Heat. Set Point (Elec.) (°C)	-	-	-	-	-	-	-	23.0	22.0	-	-	-
Heat. Set Point (Gas) (°C)	-	-	-	-	-	-	-	15.0	20.0	-	-	-
Cool. Set Point (°C)	24.0	-	-	-	-	-	-	24.5	27.0	24.5	-	20.0
Infil. (ACH)	1.00	0.25	0.32	0.25	0.75	1.00	1.00	0.10	0.10	0.10	3.00	0.10
Ventil. (ACH)	-	-	-	-	-	-	-	-	-	-	-	-
HVAC Perform. rate (Elec.)	1.0	1.0	1.0	1.0	-	-	-	0.6	1.0	0.6	0.8	1.0
HVAC Perform. rate (Gas)	-	-	-	-	-	-	-	1.0	1.0	-	0.8	1.0
DHW Factor	-	-	-	-	-	-	-	-	-	-	0.25	0.20
Elect. Equip. Factor (NCM)	0.06	0.20	1.10	0.04	0.50	0.08	0.14	2.50	0.80	24.00	1.40	0.21

Appendix C: Hexmaps of Modelled Floorspace by Activity Class

This appendix includes hexagonal-bin (“hexmap”) visualisations showing the spatial distribution of modelled floorspace across Great Britain for fifteen activity classes. By overlaying a uniform hexagonal grid in the Ordnance Survey GB National Grid (EPSG:27700), each hexagon aggregates total floorspace (m²) within its bounds, enabling consistent comparison across space and avoiding artefacts of irregular administrative units. Colours are rendered on a base-10 logarithmic scale – darker hues indicate higher cumulative floorspace – so that both small-scale facilities (e.g. local shops) and large-scale developments (e.g. warehouses) are visible in the same frame. Country boundaries are shown as dashed lines, with the overall UK outline highlighted in black. (The ‘Office’ activity class map is discussed in Section 2, and the full set of activity classes are provided here.)

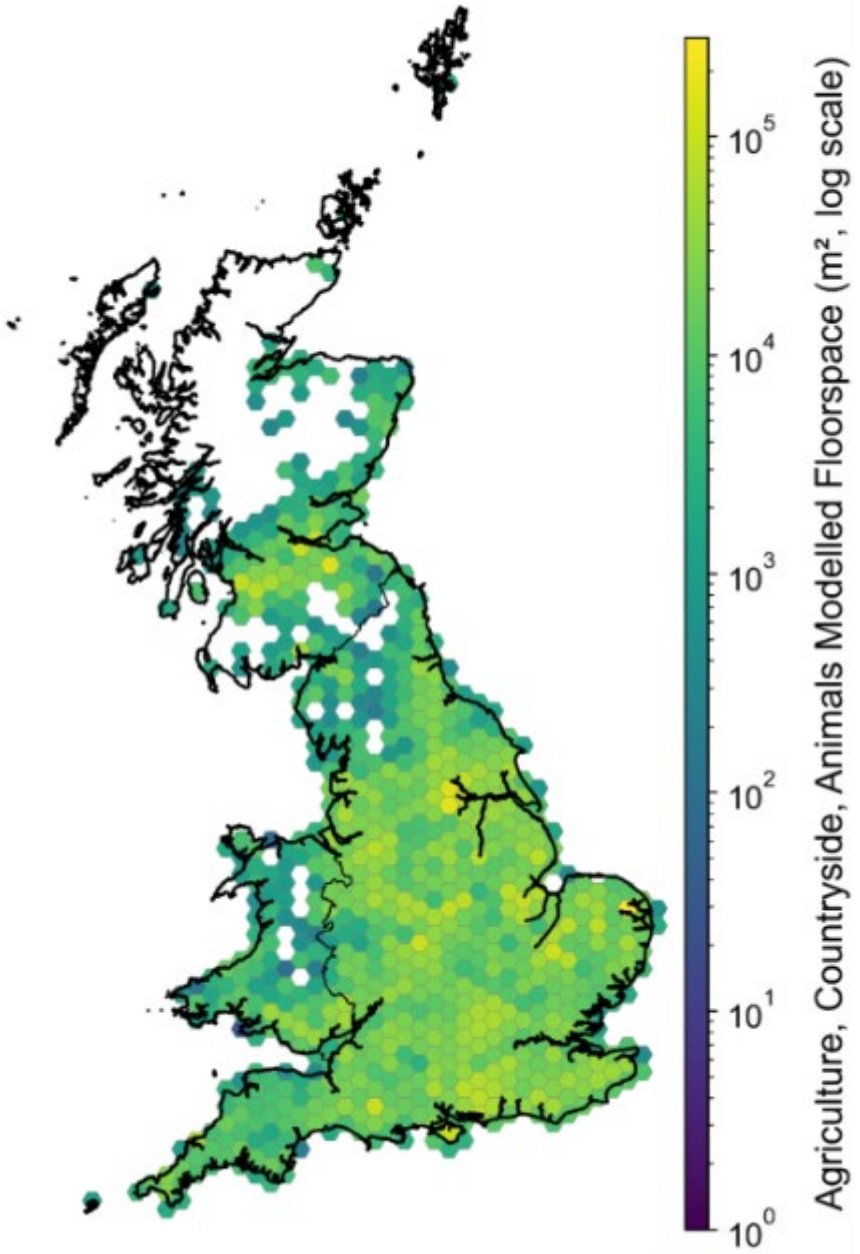


Figure D-0-1 Hexagonal bin map of modelled floorspace (m², log scale) for the Agriculture, Countryside, and Animals activity class.

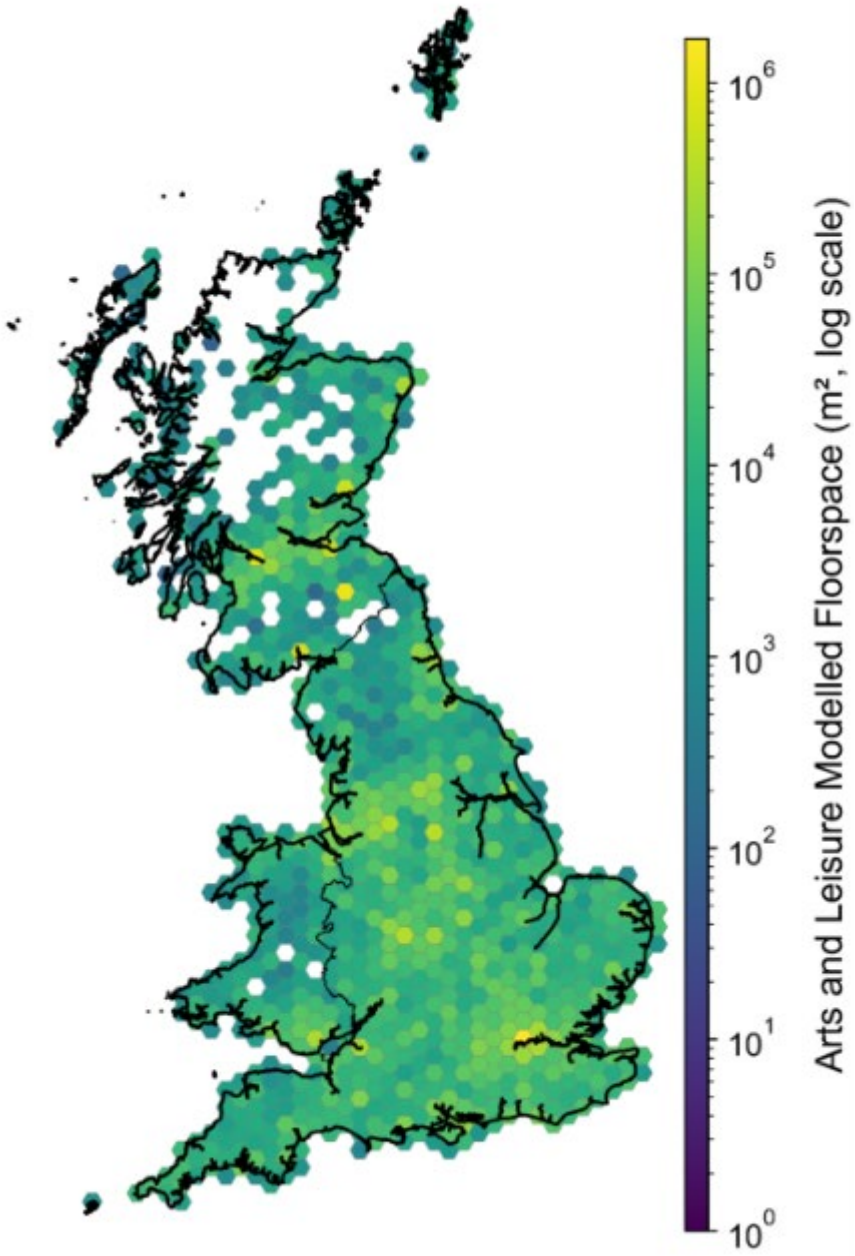


Figure D-0-2 Hexagonal bin map of modelled floorspace (m², log scale) for the Arts and Leisure activity class.

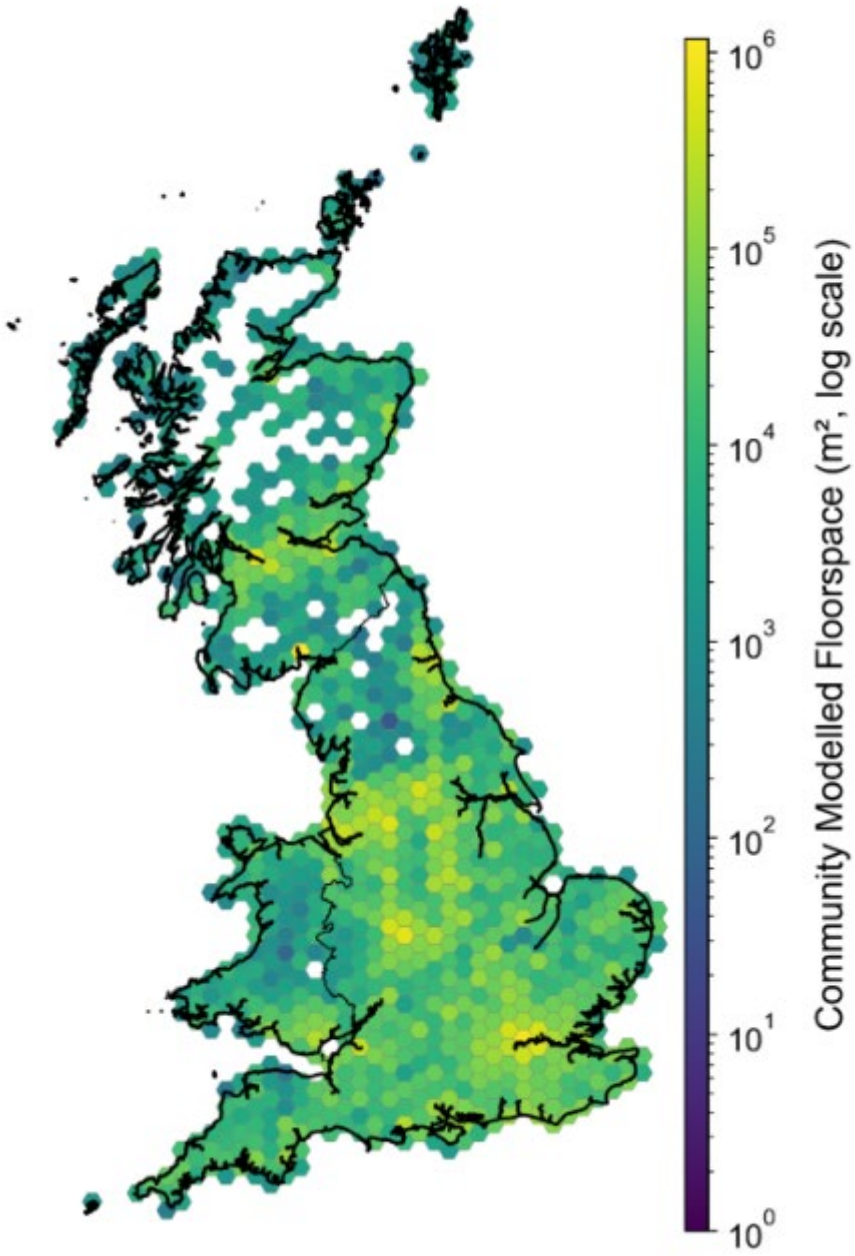


Figure D-0-3 Hexagonal bin map of modelled floorspace (m², log scale) for the Community activity class.

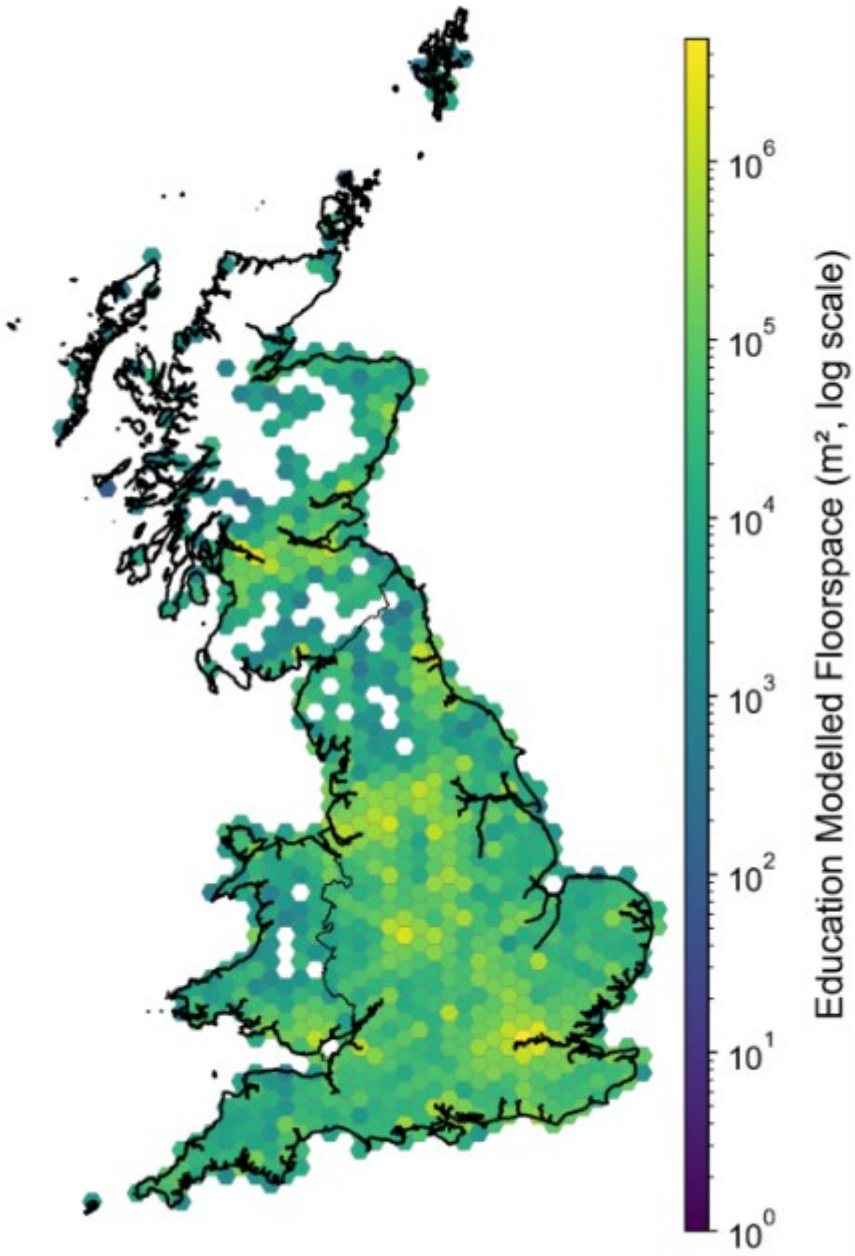


Figure D-0-4 Hexagonal bin map of modelled floorspace (m², log scale) for the Education activity class.

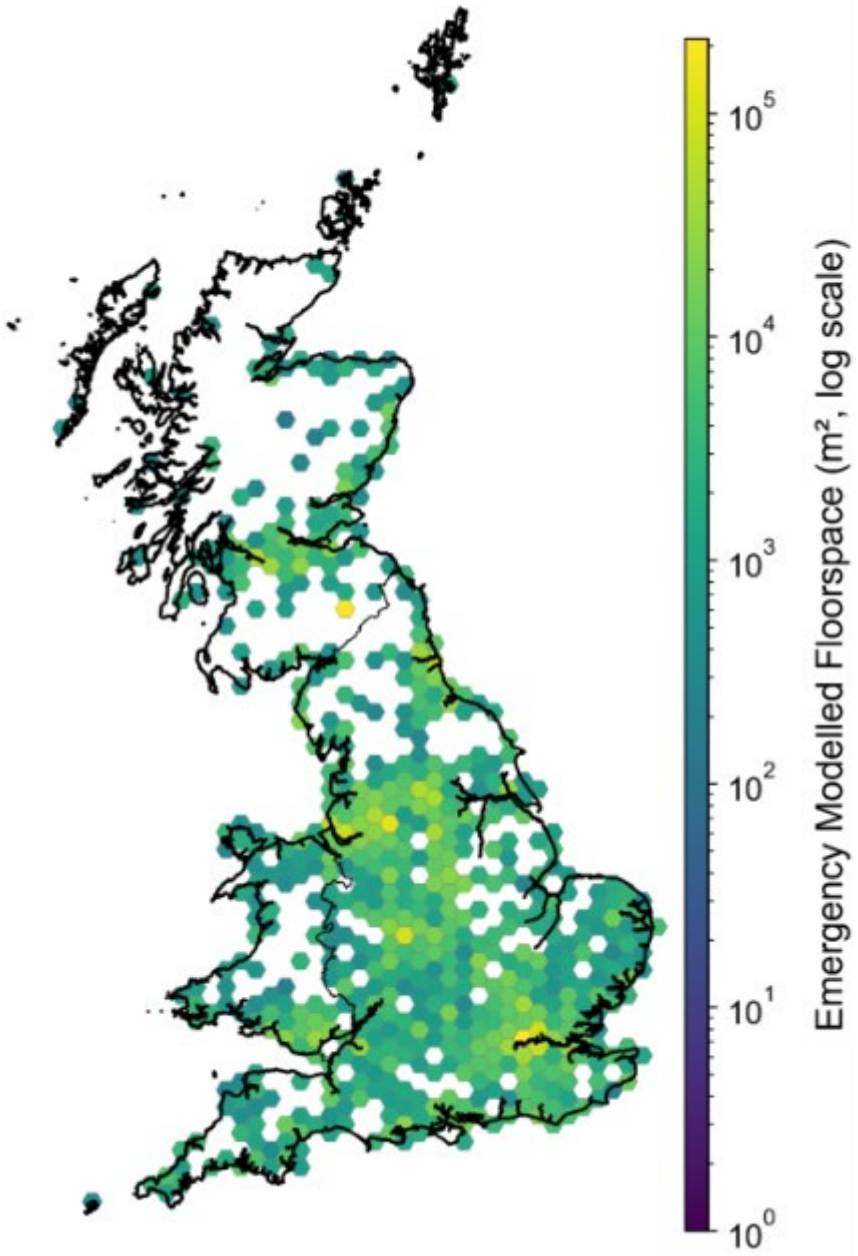


Figure D-0-5 Hexagonal bin map of modelled floorspace (m², log scale) for the Emergency activity class.

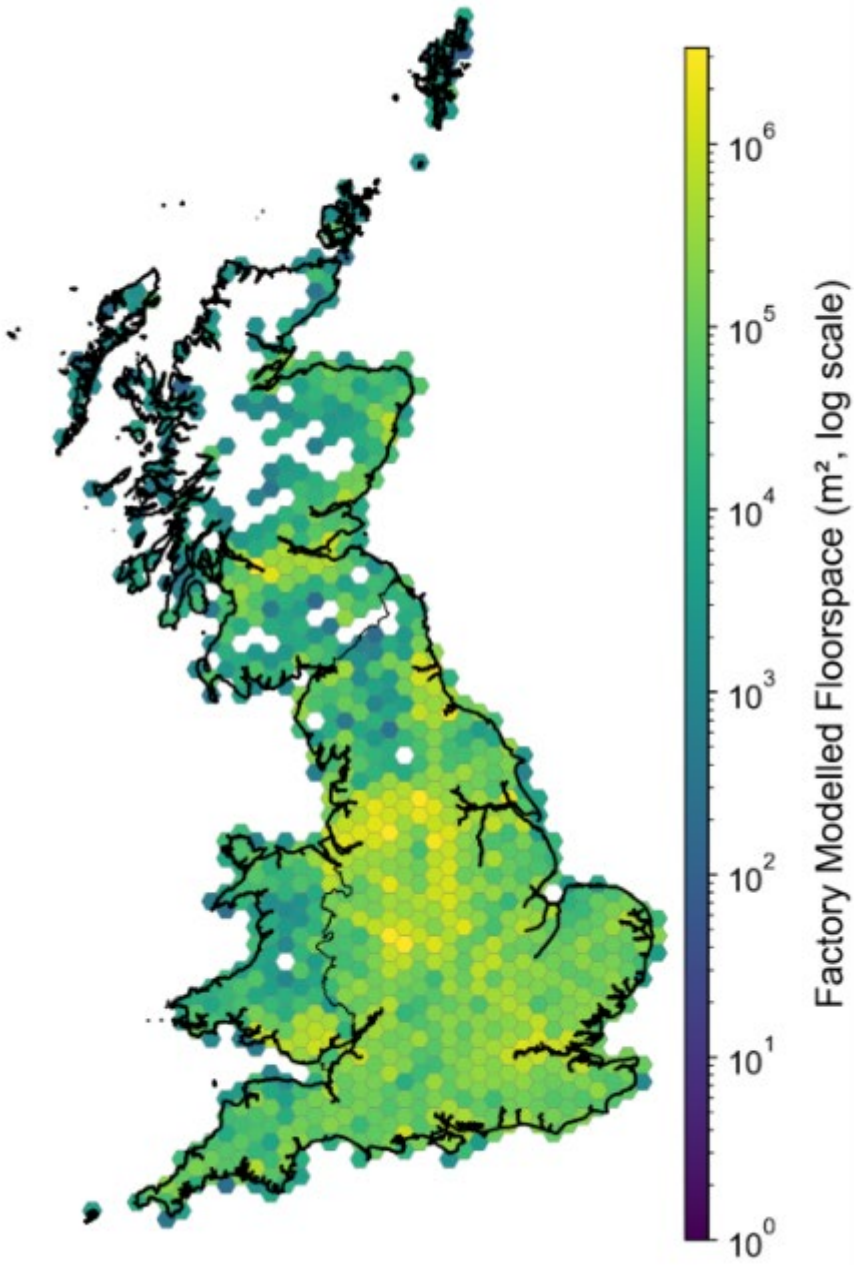


Figure D-0-6 Hexagonal bin map of modelled floorspace (m², log scale) for the Factory activity class.

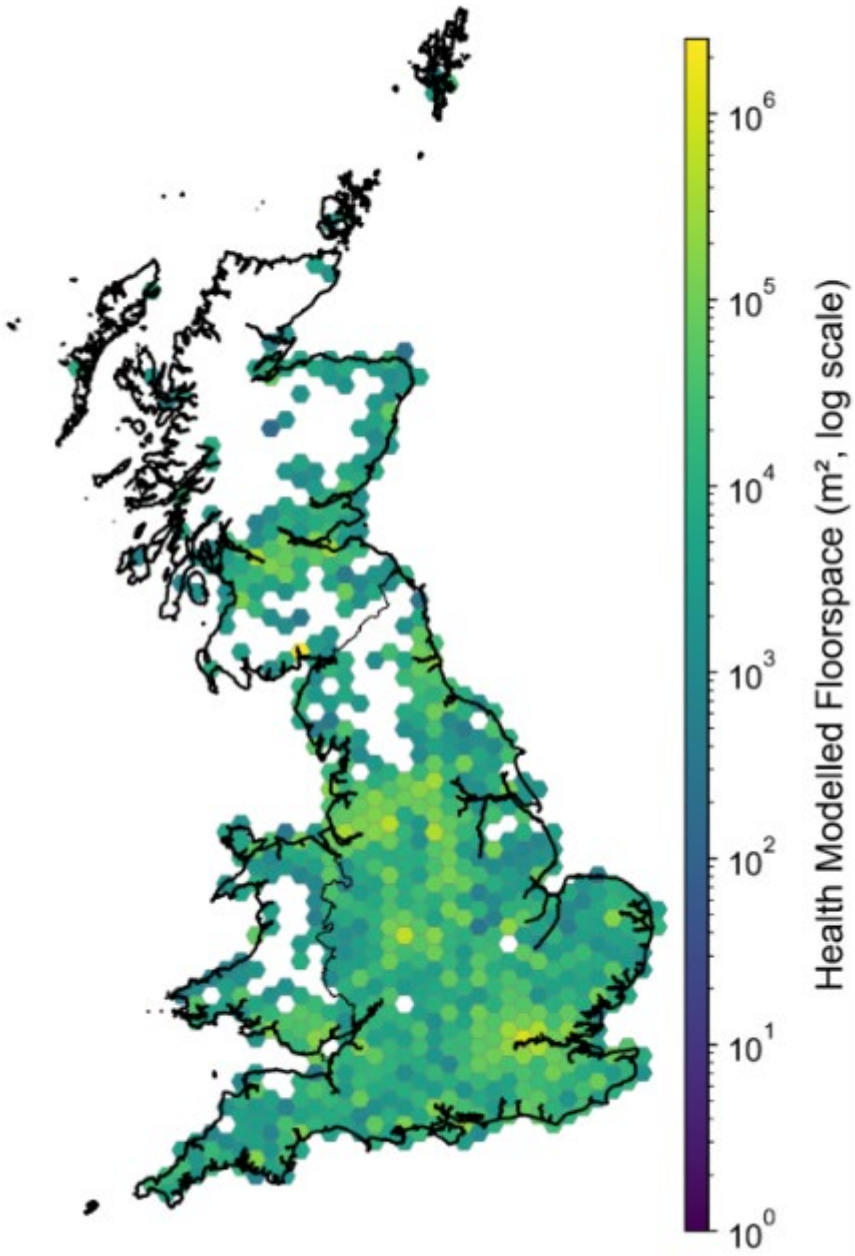


Figure D-0-7 Hexagonal bin map of modelled floorspace (m², log scale) for the Health activity class.

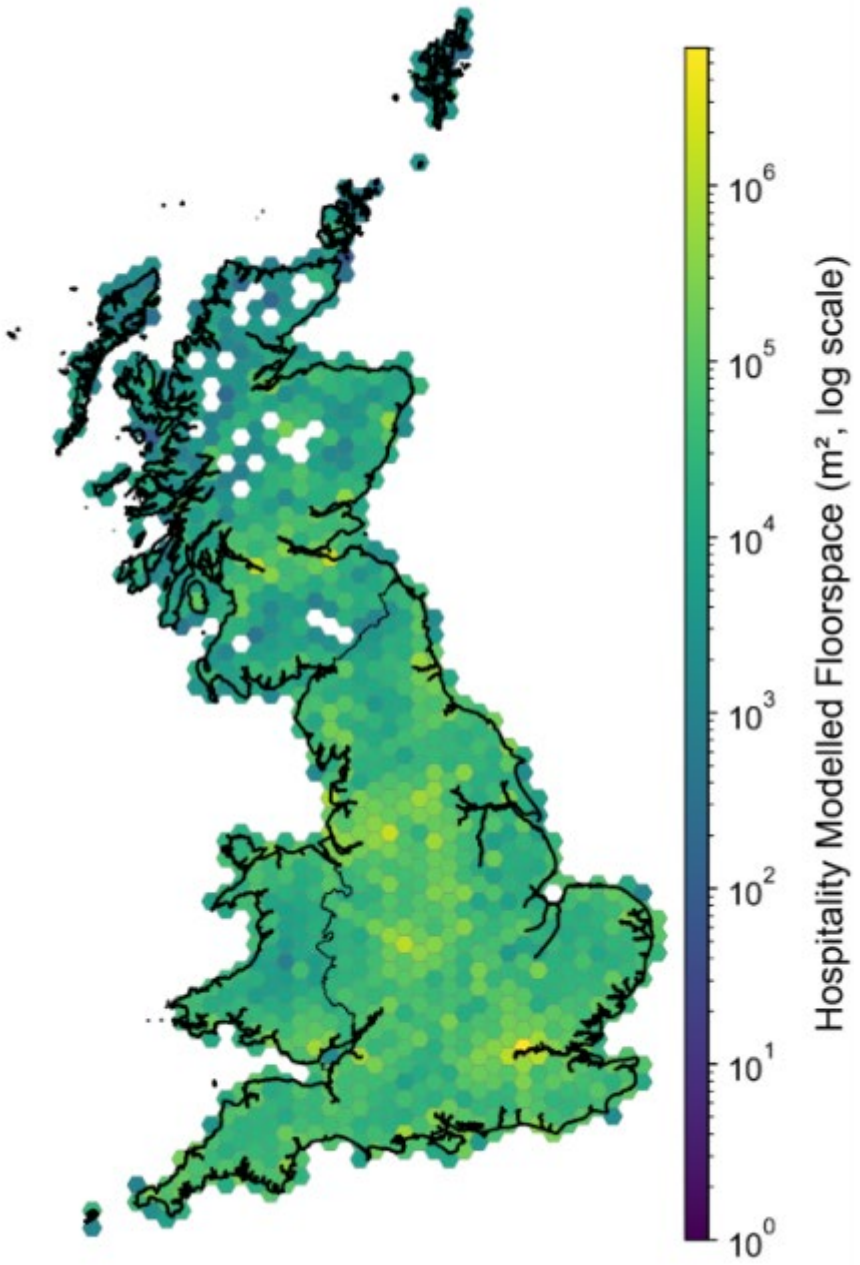


Figure D-0-8 Hexagonal bin map of modelled floorspace (m², log scale) for the Hospitality activity class.

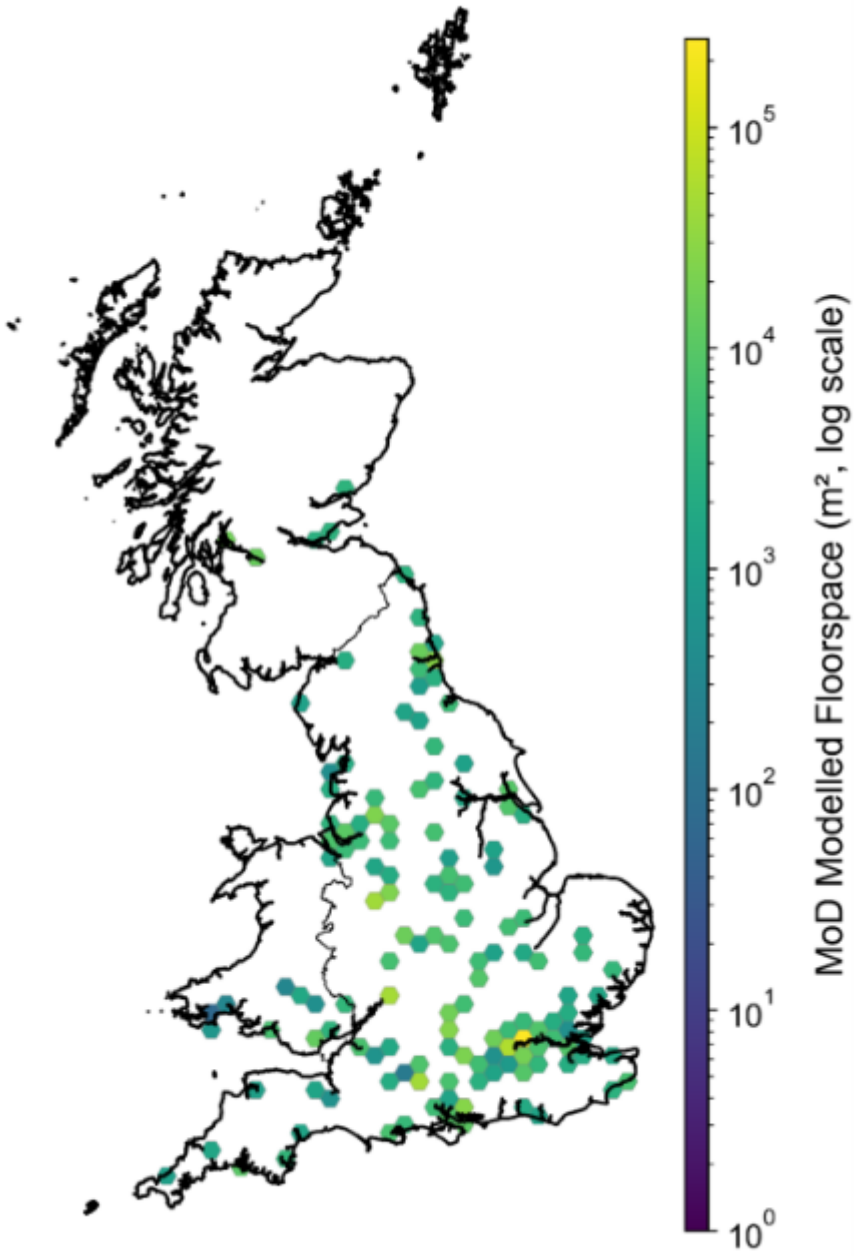


Figure D-0-9 Hexagonal bin map of modelled floorspace (m², log scale) for the MoD activity class.

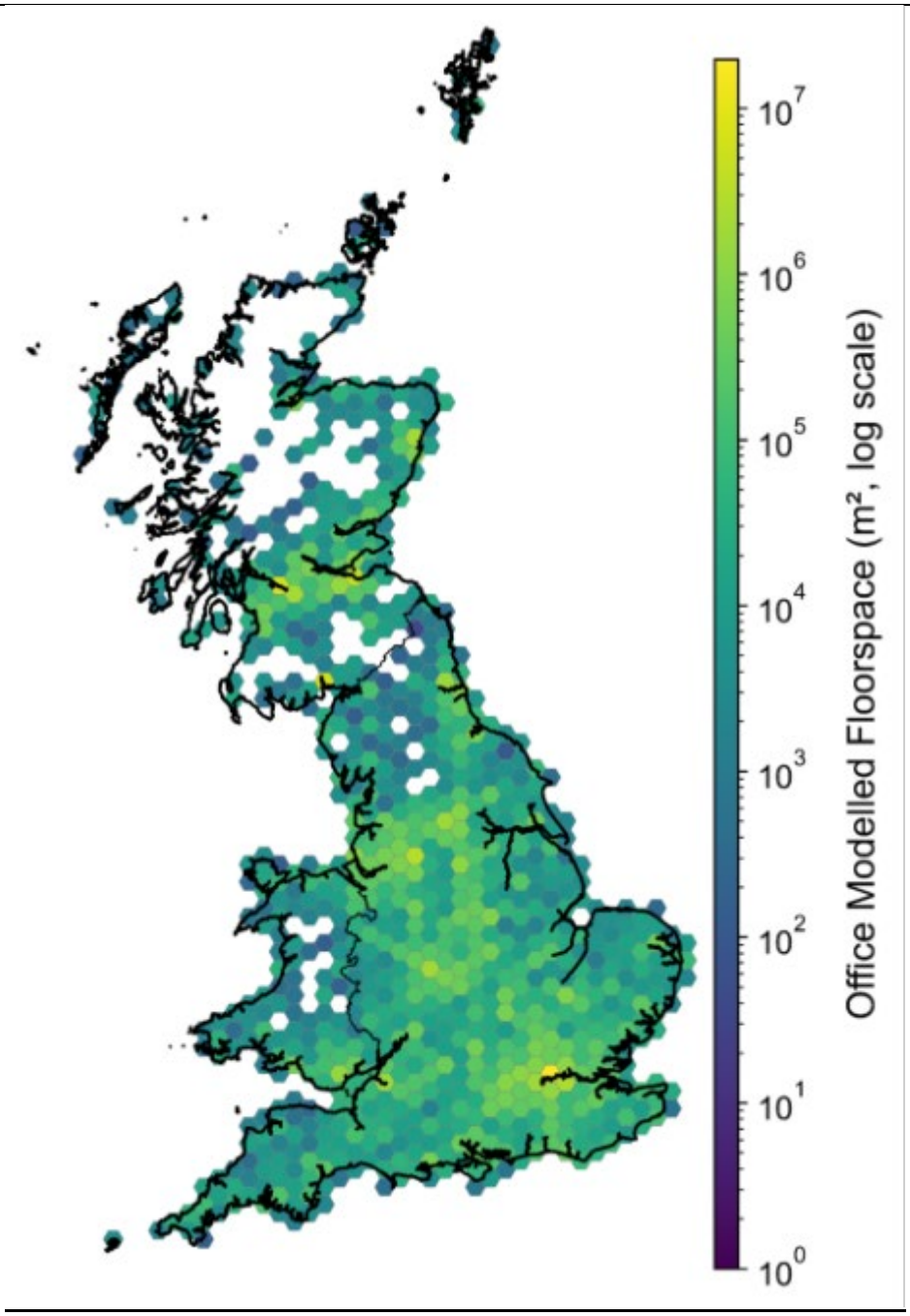


Figure D-0-10 Hexagonal bin map of modelled floorspace (m², log scale) for the Office activity class.

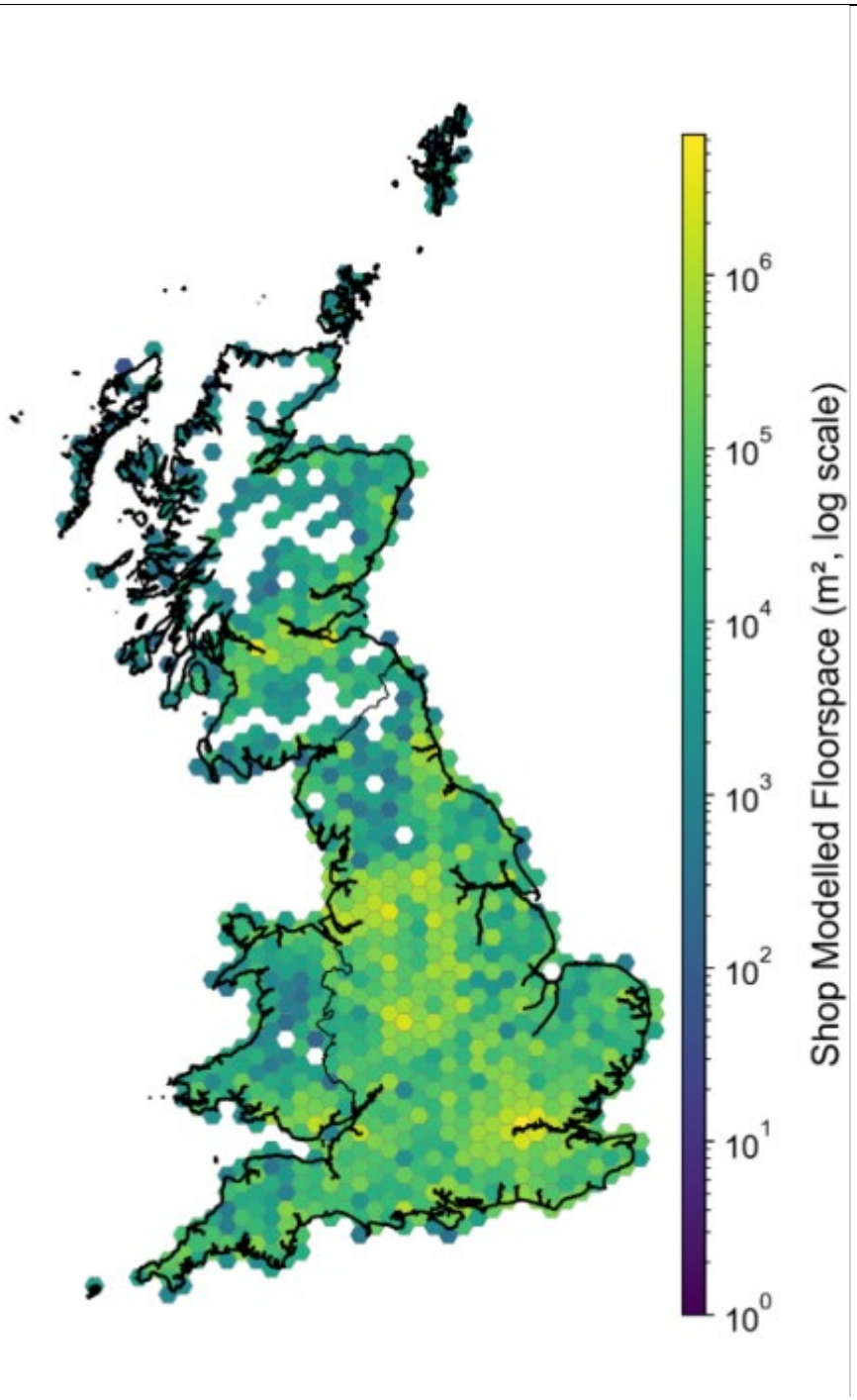


Figure D-0-11 Hexagonal bin map of modelled floorspace (m², log scale) for the Shop activity class.

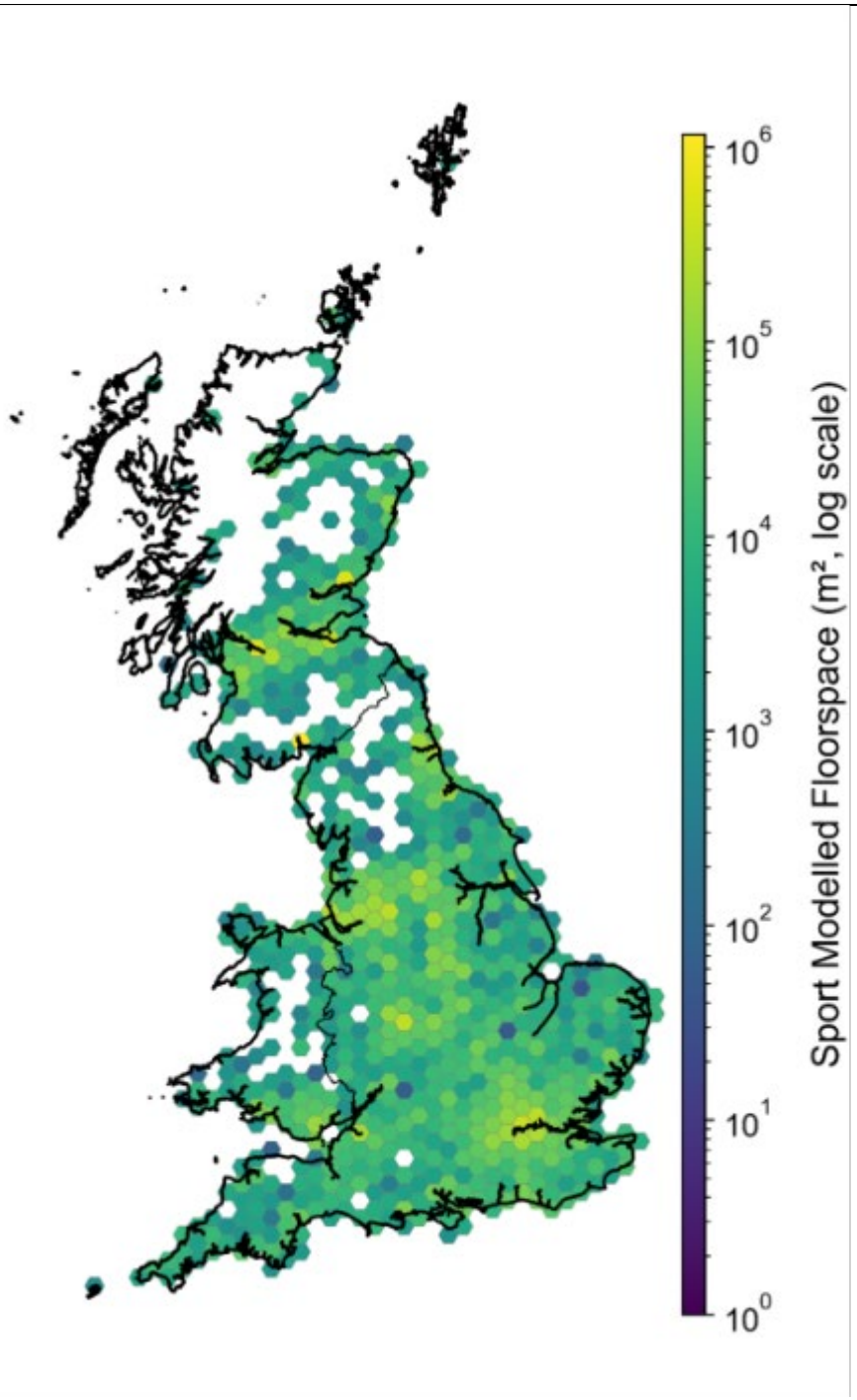


Figure D-0-12 Hexagonal bin map of modelled floorspace (m², log scale) for the Sport activity class.

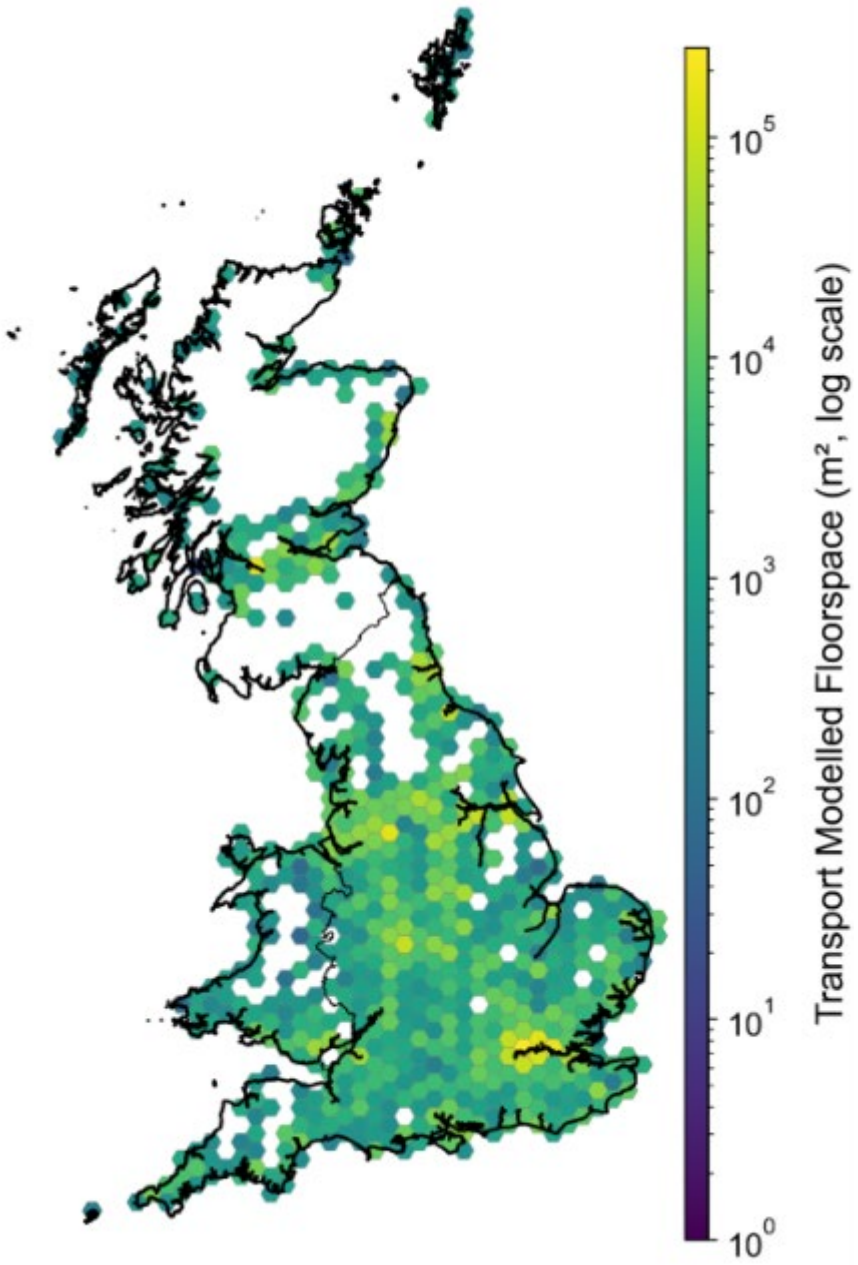


Figure D-0-13 Hexagonal bin map of modelled floorspace (m², log scale) for the Transport activity class.

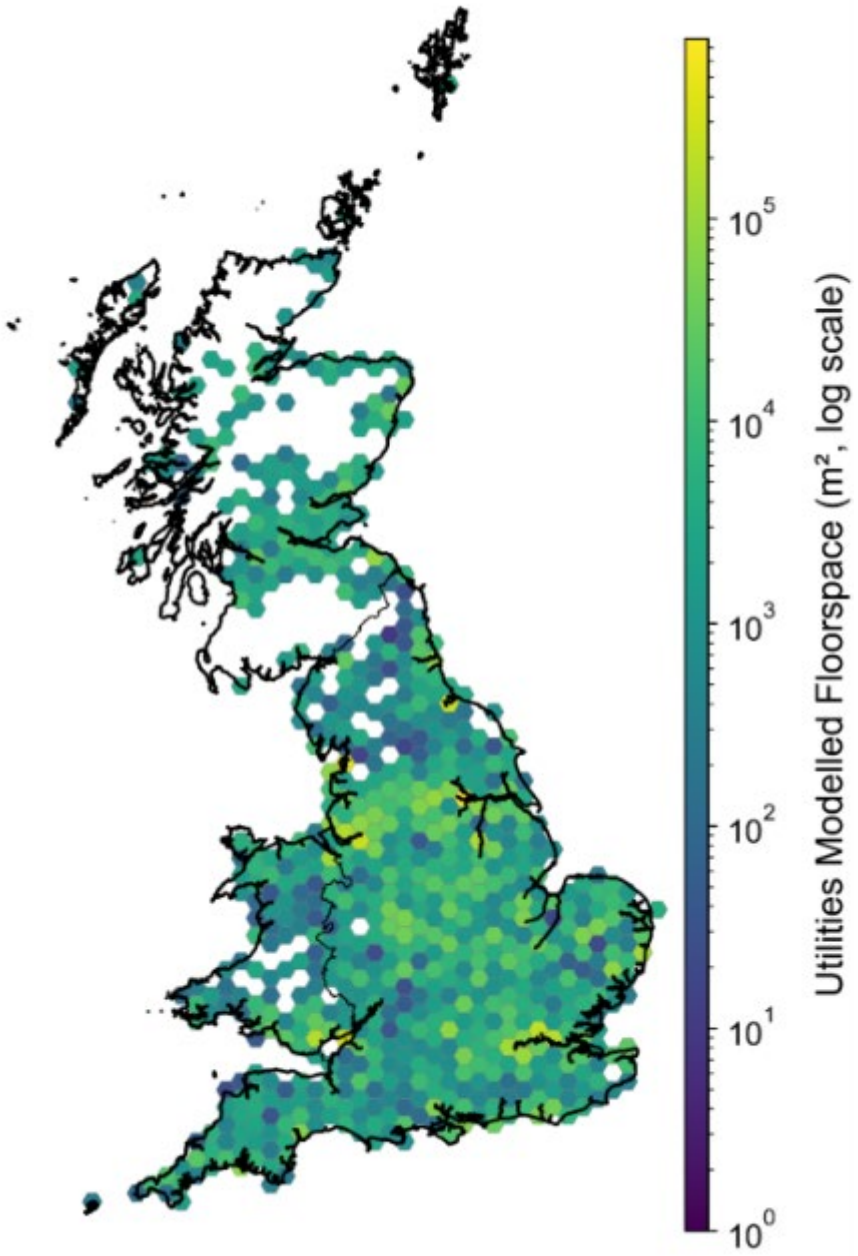


Figure D-0-14 Hexagonal bin map of modelled floorspace (m², log scale) for the Utilities activity class.

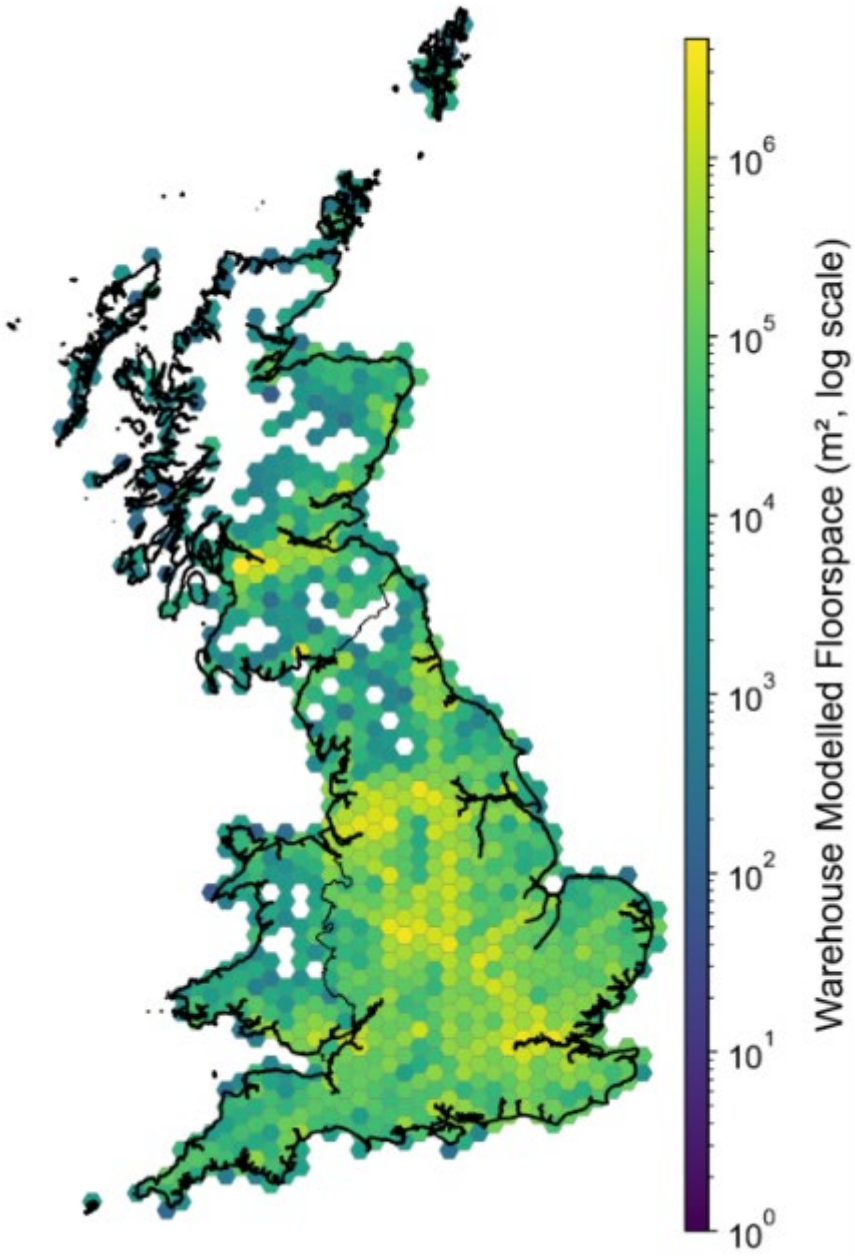


Figure D-0-15 Hexagonal bin map of modelled floorspace (m², log scale) for the Warehouse activity class.

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