



Department for
Business, Energy
& Industrial Strategy

THE UK BUILDING ENERGY EFFICIENCY SURVEY (BEES)



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Department for
Business, Energy
& Industrial Strategy

Overview of presentation

1. Aims, objectives and methodology
2. Energy consumption analysis
3. Lessons learnt





Aims, objectives and methods

Aims

To update the evidence base for energy use and abatement in Non-Domestic buildings across England and Wales:

- how energy is used (for different end uses in each building type and in aggregate), for a snap-shot in time.
- how energy use can be reduced.
- what are the barriers and facilitators of energy abatement.

Scope

- England and Wales only (Scotland & Northern Ireland excluded)
- Abatement from energy efficiency measures only, does not include low carbon heating and cooling
- Does not include process energy use such as industrial processes

BEES approach (Sub-sector specific analysis)

Telephone surveys (3,690 used in modelled analysis)

- 20-25 minutes in length, aimed at energy/facilities managers.
- Collected basic data on building, equipment, usage & energy management.

Site surveys (214) - 0.5-1.5 days depending on building type and complexity:

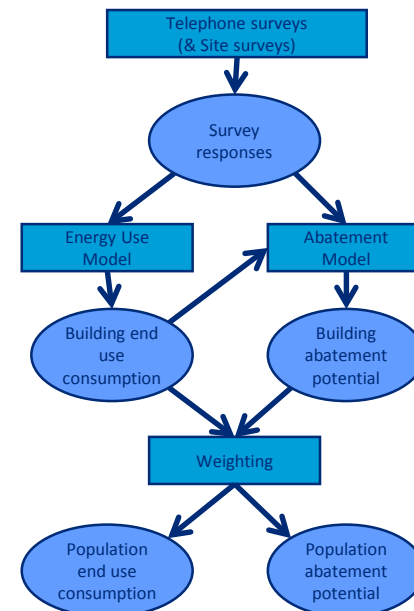
- Validated data and collected more detailed building energy data to help calibrate sub-sector specific parameters in the energy use model.
- 1 hour qualitative interview on barriers to and drivers of energy efficiency.

Energy model

- Used a relatively simple calculation structure to convert the telephone survey responses into energy end use consumption (e.g. how many meals served?)

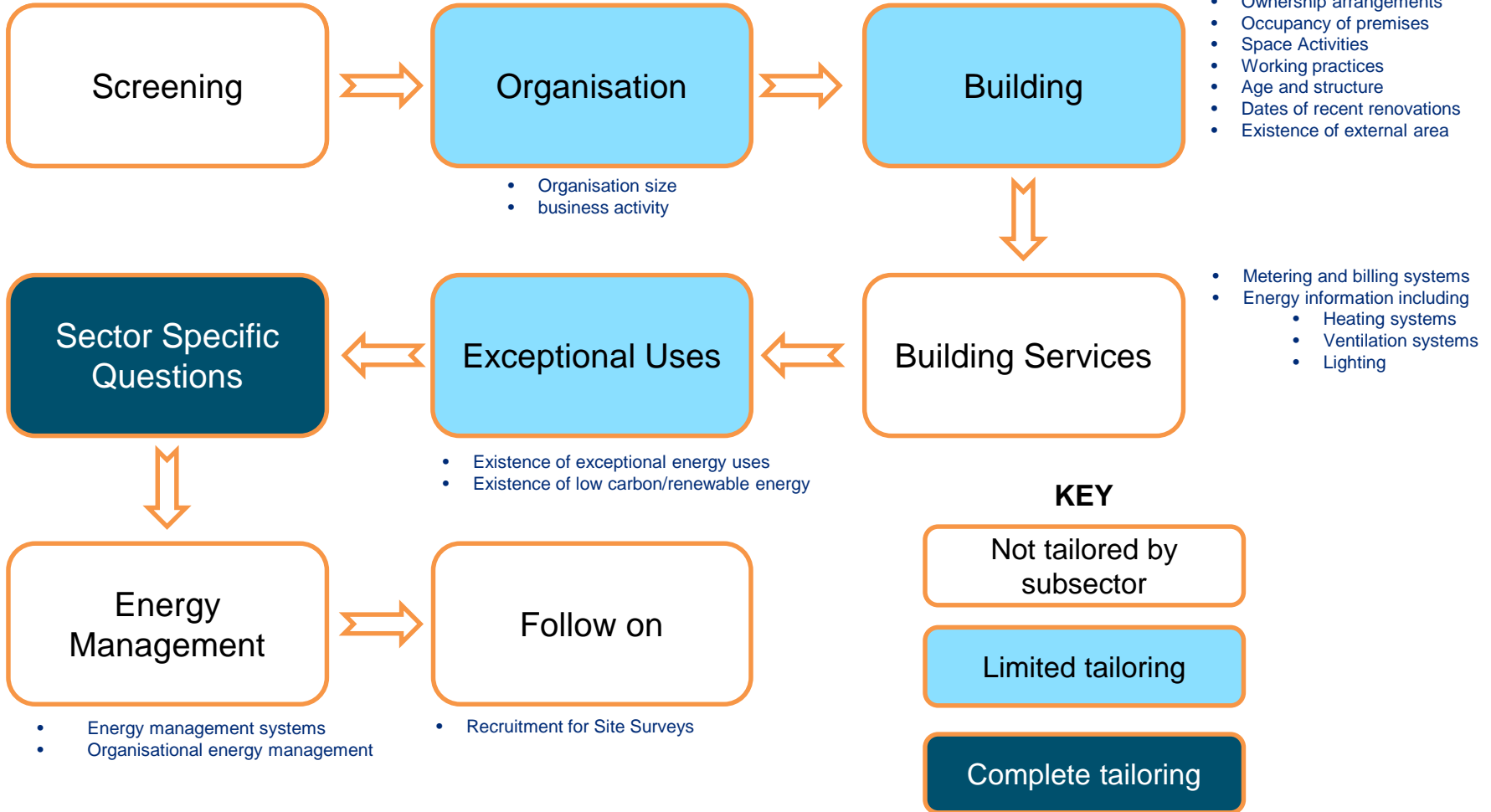
Abatement model

- Assesses whether or not a particular abatement measure is applicable to a building based on telephone survey responses and the costs and savings





Surveys





Sectors and sub-sectors surveyed

Education	Nursery	Offices	Offices (private sector)
	State primary		Offices (public sector)
	State secondary	Retail	Hairdressing/ beauty salon
	University Non-residential		Large food shop (> 750 m2)
	University Residential		Large non-food shop (> 1850 m2)
Emergency Services	Fire + Ambulance station		Retail warehouse
	Law court		Showrooms
	Police station		Small shop
	Prison		Community, arts & leisure
Health	Health centre		
	Hospital	Museum, Gallery, Library	
	Nursing home	Place of worship	
Hospitality	Cafe	Industrial	Theatre, Concert hall, Cinema
	Hotel		Factory
	Pub		Workshop
	Restaurant and Takeaway		Cold store
Military	MOD Accomodation	Storage	Large distribution warehouse
	MOD Offices		Store
	MOD Storage		Warehouse

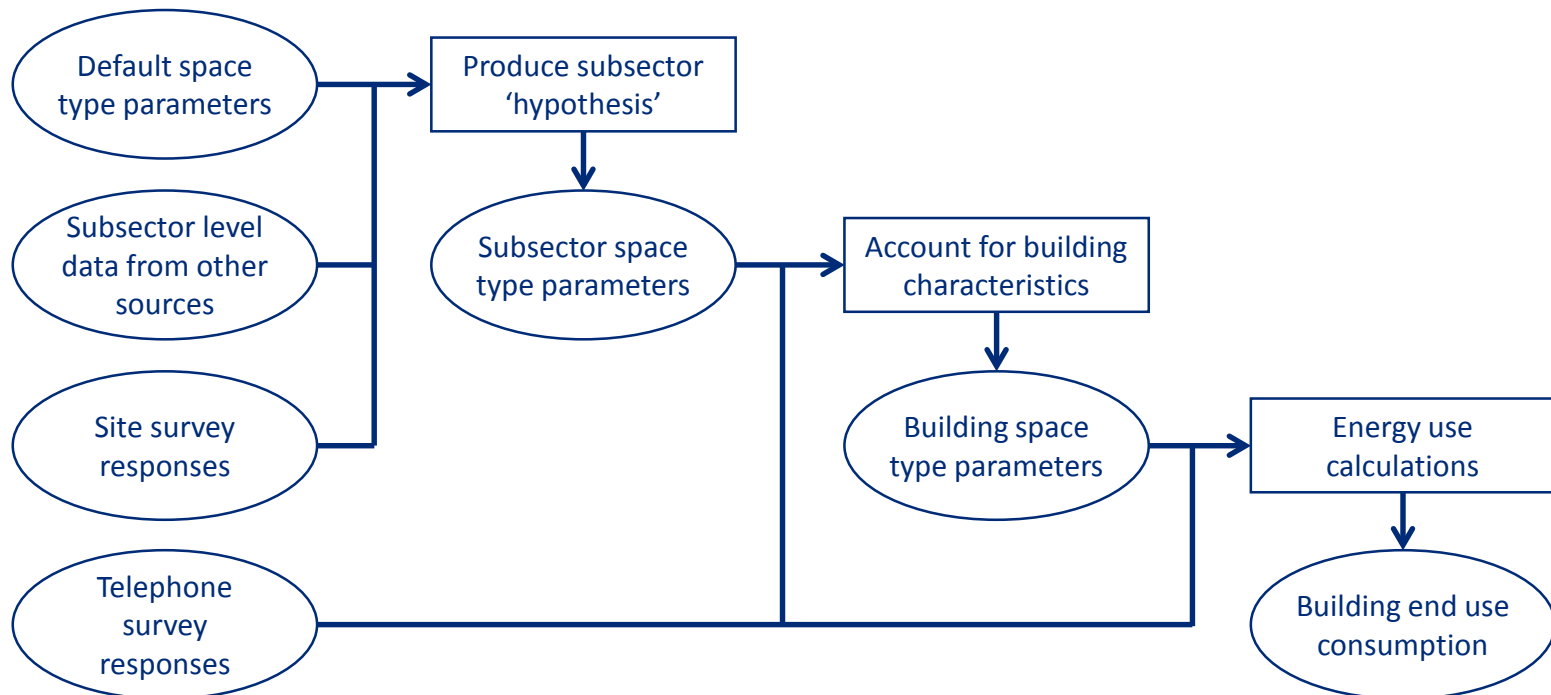
The 38 sub-sectors shown are used in the final reports. Some were surveyed and modelled based on more granular sub-sectors with tailored questionnaires.





Energy demand modelling

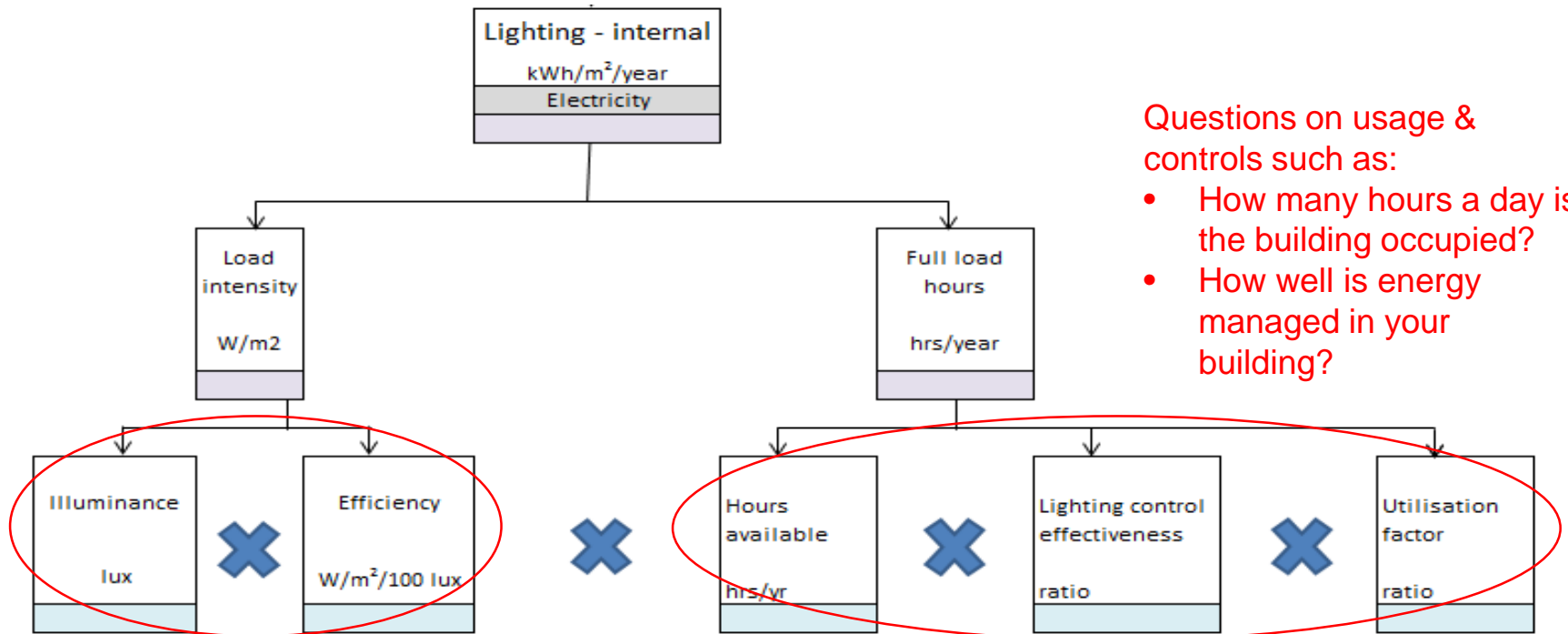
- Converts telephone survey responses into estimated end use energy consumption.
- Splits buildings up into a series of space types, each with their own parameters for the energy use calculations.
- Tailors default parameters to the subsector using various data sources, and tailors subsector parameters to the building using the telephone survey responses.





Energy demand modelling

- Example energy use calculation for internal lighting. Similar calculations carried out on approximately 20 end uses (heating, cooling, etc...)



Questions on usage & controls such as:

- How many hours a day is the building occupied?
- How well is energy managed in your building?

Questions on lighting type such as:

- Is the lighting in the building generally too bright, too dim, or about right?
- How old is your lighting system?

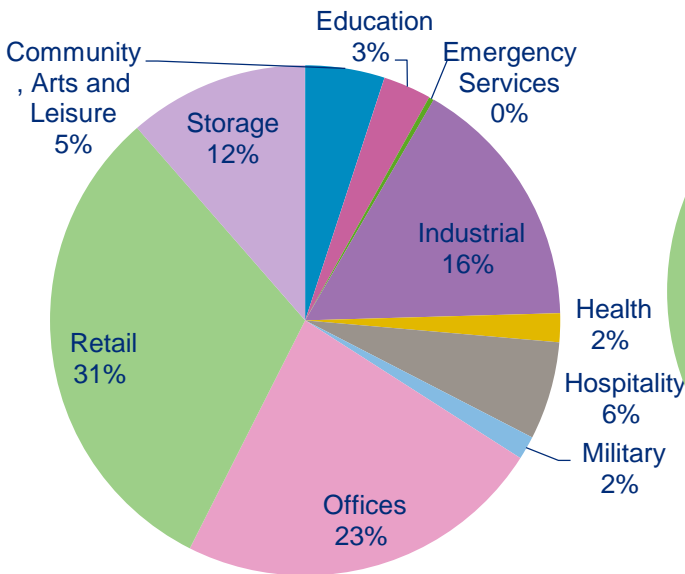




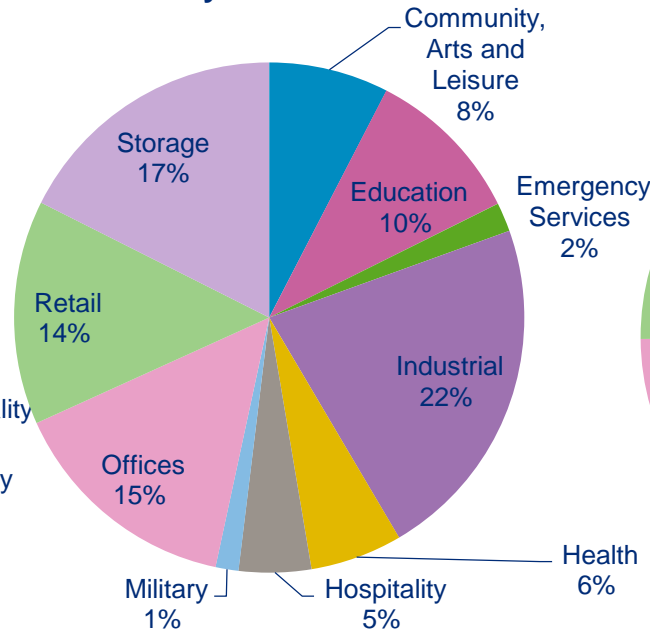
Segmentation of the Non-Domestic Stock

Sectors look different across the non-domestic stock according to the measure used

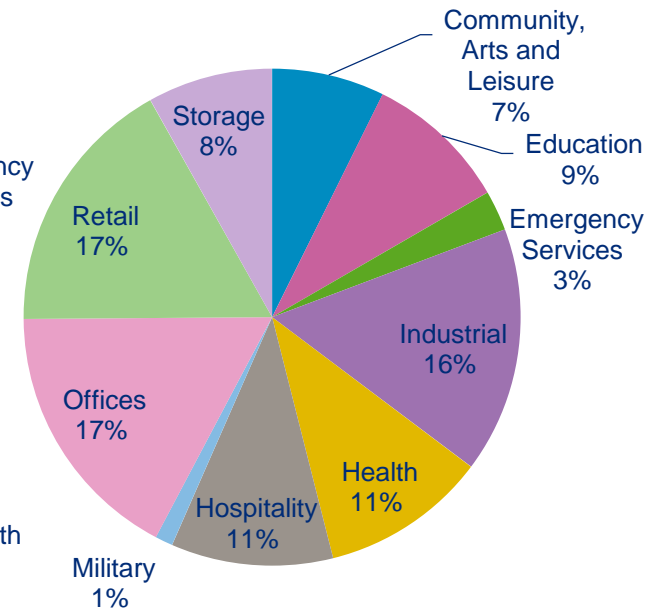
By Number of Premises



By Floor Area



By Energy Consumption



- The total estimated number of premises in the non-domestic stock is 1,595,300 premises.
- The 4 largest sectors are storage, industrial, retail and offices (account for 82% of the total number of premises).

- The total estimated floor area in the non-domestic stock is 800 million m² (gross internal area, GIA).
- The 4 largest sectors are storage, industrial, retail and offices (account for 69 % of the total floor area).

- The total estimated annual amount of energy consumed by the non-domestic stock is 161,060 GWh/ per year.
- The 4 largest sectors are Retail, Offices, Industrial and Health (account for 60% of total energy consumption).





Energy Consumption by Electrical and Non-Electrical Use

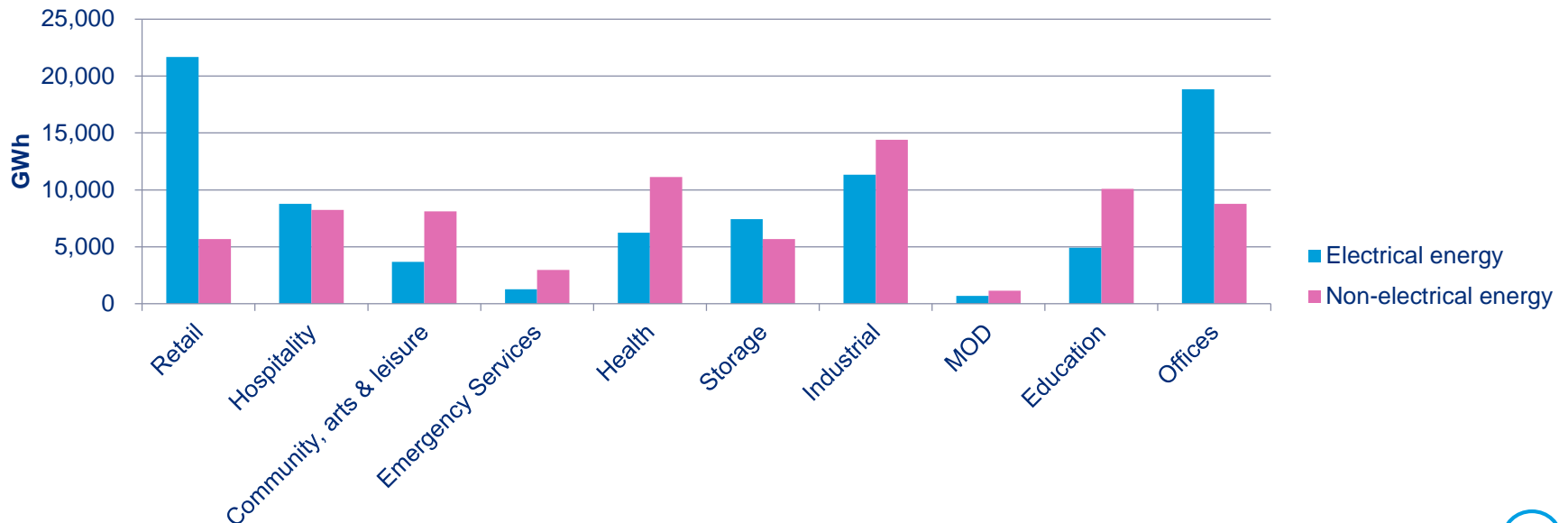
There is more electrical use than non-electrical use and this varies across sectors

Total
161,060 GWh:
Is the total amount that the non-domestic stock consumed of total energy.

Electric
84,820 GWh (53%)

Non-Electric
76,240 GWh (47%)

- The total estimated annual amount of energy consumed by the non-domestic stock is 161,060 GWh/ per year. Of which 53% is from electrical use and 47% non-electrical use.
- In **4 sectors electricity use is dominant: retail** (79 per cent), **offices** (68%), **storage** (57%) and **hospitality** (52%).
- In **all the others, non-electrical energy was a greater** proportion of overall energy consumption, **especially emergency services, community, arts & leisure and education** (70%, 69% and 67% of sector total consumption respectively).





GHG Emissions

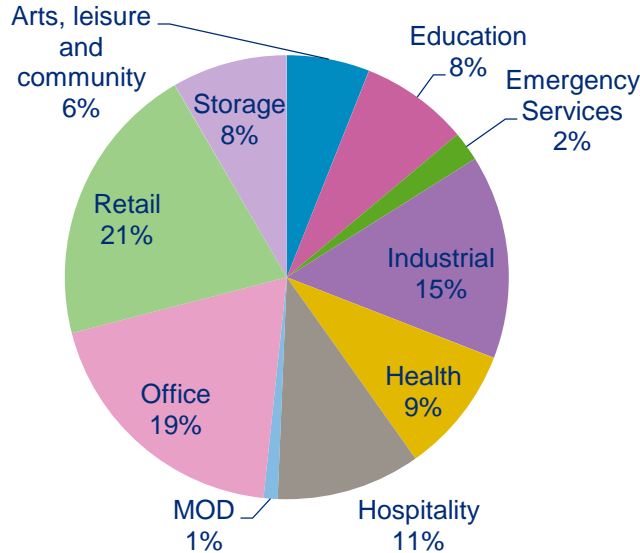
Retail and Offices had the highest levels of emissions, these sectors also have the highest levels of energy consumption.

Total GHG Emissions
53 MtCO₂e per year:
The annual emissions from total energy of the non-domestic stock.

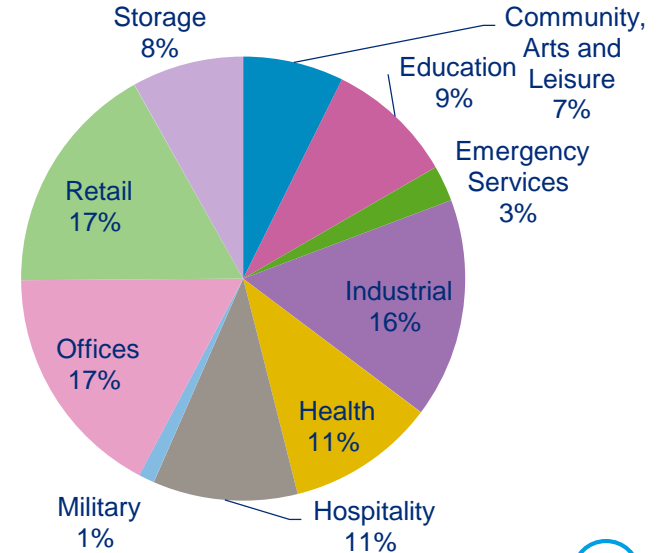
Electric GHG Emissions:
38MtCO₂ per year:
The annual emissions from electrical energy of the non-domestic stock.

Non-Electric GHG Emissions:
14 MtCO₂e per year:
The annual emissions from non-electrical energy of the non-domestic stock.

Total emissions (MtCO₂e)



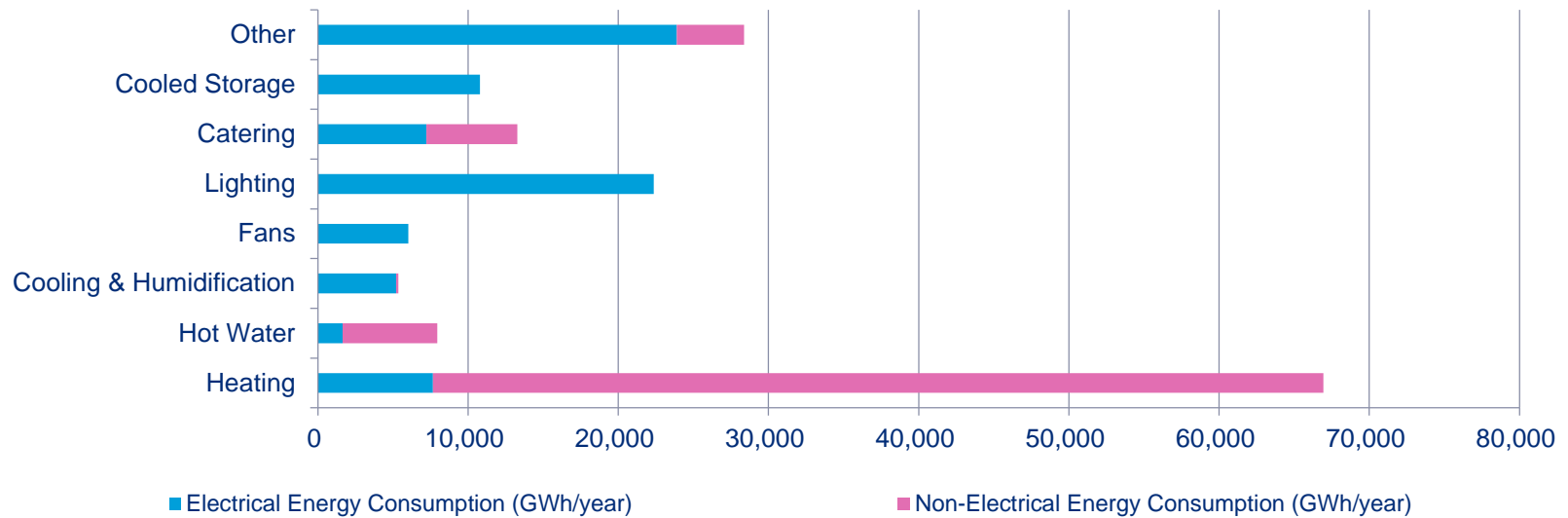
Total energy (GWh/year)





Energy Consumption by End Uses

Heating, lighting, catering and cooled storage dominate

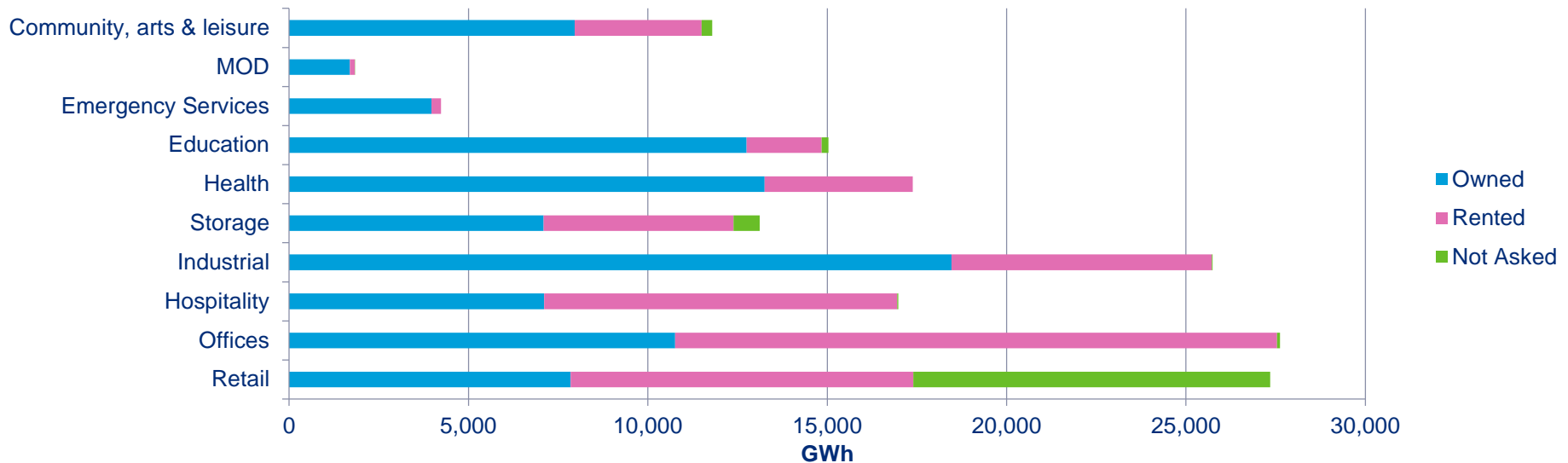


- **Heating was the most dominant end use, accounting for 42% of the non-domestic stock's energy consumption.** This was followed by **lighting (13%)** and **catering (8%)**.
- **The most common end uses of electrical energy were internal lighting (25%),** followed by cooled storage (13%), ICT equipment (9%) and space heating (9%).
- **The most significant non-electrical energy end uses were space heating (86%)** followed by hot water (8%) and catering (8%).





Sector Energy Consumption by Tenure

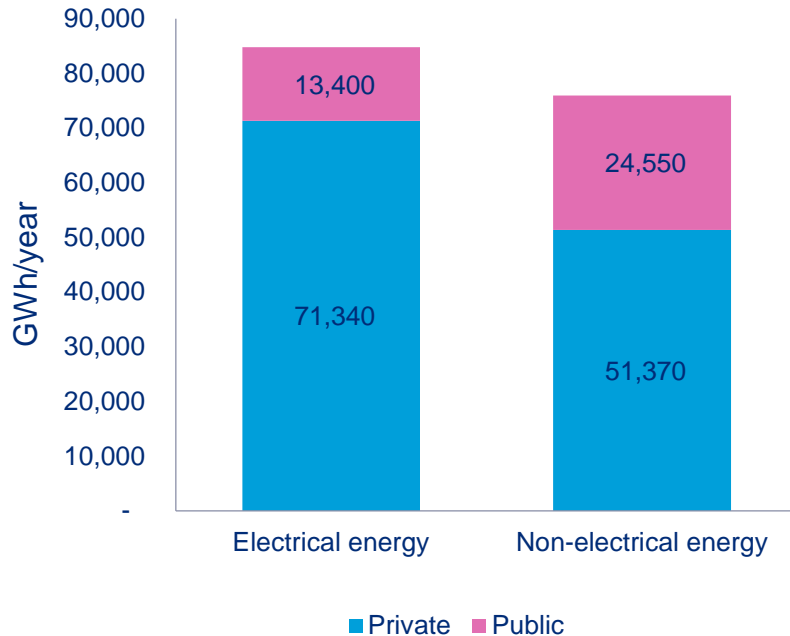


- 56% of energy consumption was owner occupied premises, while rented premises accounted for 37% of energy consumption (7% of energy consumption was “Not Asked”).
- There were a number of sectors where energy consumption was primarily in owner occupied premises . This was the case for the sectors within the public sector - emergency services (94%), military (92%), education (85%) and health (76%)– as well as industrial (72%) and community, arts & leisure (68%).
- In offices and hospitality energy was consumed in predominantly rented premises (61% and 58% respectively).
- In retail the split between consumption in rented and owner occupied premises was reasonably equal although it should be noted that there was a significant proportion of retail premises where the tenure status had not been determined due to the use of Mystery shopper methods. (‘Not asked’) (36%).





Energy Use - Public / Private split



Public/Private Split By Energy Consumption:

- 76 per cent of the non-domestic stock energy consumption was in the private sector. 84 per cent of electrical consumption and 68 per cent of non-electrical consumption related to private sector activities.
- In comparison, 24 per cent was in relation to those premises solely in the public sector of which 16 per cent was electrical consumption and 32 per cent was non-electrical consumption.

Energy Management Resource by Public/Private Split:

- In terms of energy management resource and energy management ambition, **organisations in the public sector were more likely to have active energy management policies and specialist resources to manage energy.**
- The majority of **public sector** energy was used in premises where the organisation has an **active policy towards energy management (64 %)**, and **72 % of energy was used in premises where specialist energy management resources** are available. This compared to **53 per cent and 43 per cent in the private sector** respectively.



Lessons learnt

- **Resource intensive**

- Challenging research that has taken much longer than hoped.
- Diversity of non-domestic stock requires a heavily tailored approach.

- **Securing response**

- Resource intensive/complex data collection:
 - 50 surveys; Non-standard approaches to data collection; Maximising response; and Respondent appetite/burden on organisations.
- Sub-sectors dropped e.g. banks, post offices; and sub-sectors not achieved e.g. data centres.
- Some quotas not reached.

- **Project handling** (and resource intensive - on both sides).

- Contractor skills (consultancy and market research organisation)





Lessons learnt

- **Complex data processing**

- Models for each sub-sector.
- Data validation and QA discoveries.
- Weighting complexity and contractor skills

- **Reporting issues**

- How to communicate the right information in such a wealth of data.

- **Data and documentation production**

- Agreeing an early specification on requirements, and scrutinising interim data.

- **High cost** to conduct research of this nature, and changing costs (price increase).





What can BEES help us do?

- Understand better how to target policies to different customers and how they might react to various policy levels
 - **For example:** the role of energy managers, the relative merits of targeting owner occupiers vs private rented sector
- Understand better the impact of policy proposals
 - For example: better understanding of what measures might be used to improve energy efficiency in particular segments e.g rented sector, SMES...
- Start to understand how various policy levers might interact
 - **For example:** How Buildings level policy levers such as building regulations overlap with organisational level policies such as reporting





Thank you for your attention!

- A full suite of reports, tables and methodological reports is available at:

<https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees>

