Department for
Business, Energy
& Industrial Strategy

THE UK BUILDING ENERGY EFFICIENCY SURVEY (BEES)

Julian Prime
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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

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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:

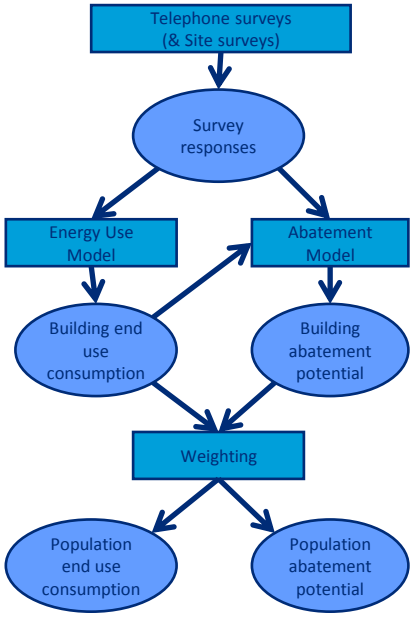
- Validated data and collected more detailed building energy data to help calibrate sub-sector specific parameters in the energy use model.
- 1 hour qualitative interview on barriers to and drivers of energy efficiency.

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



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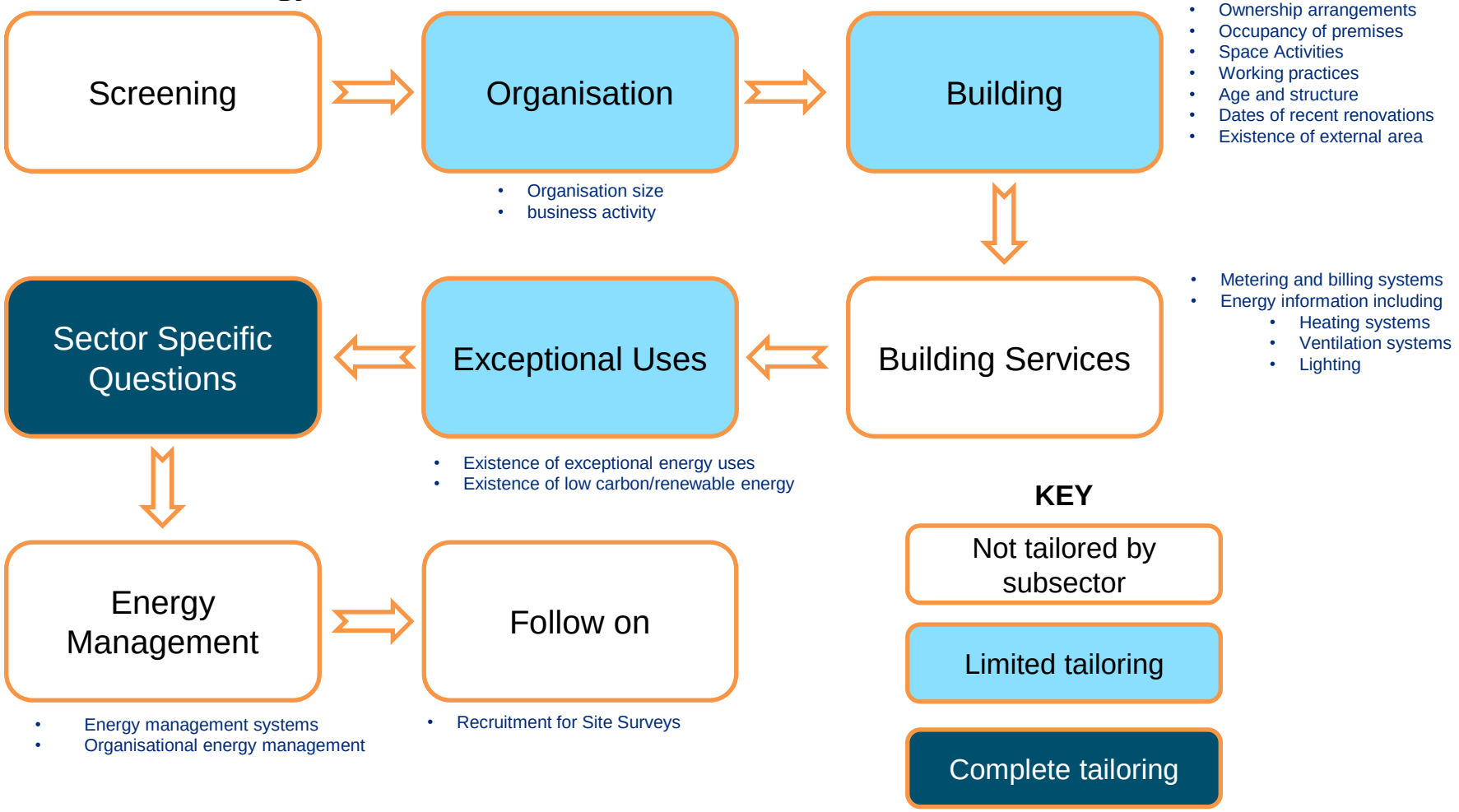
Surveys



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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**	Clubs & community centres
Health	Health centre		Leisure centre
	Hospital		Museum, Gallery, Library
	Nursing home		Place of worship
Hospitality	Cafe		Theatre, Concert hall, Cinema
	Hotel	**Industrial**	Factory
	Pub		Workshop
	Restaurant and Takeaway	**Storage**	Cold store
Military	MOD Accomodation		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.

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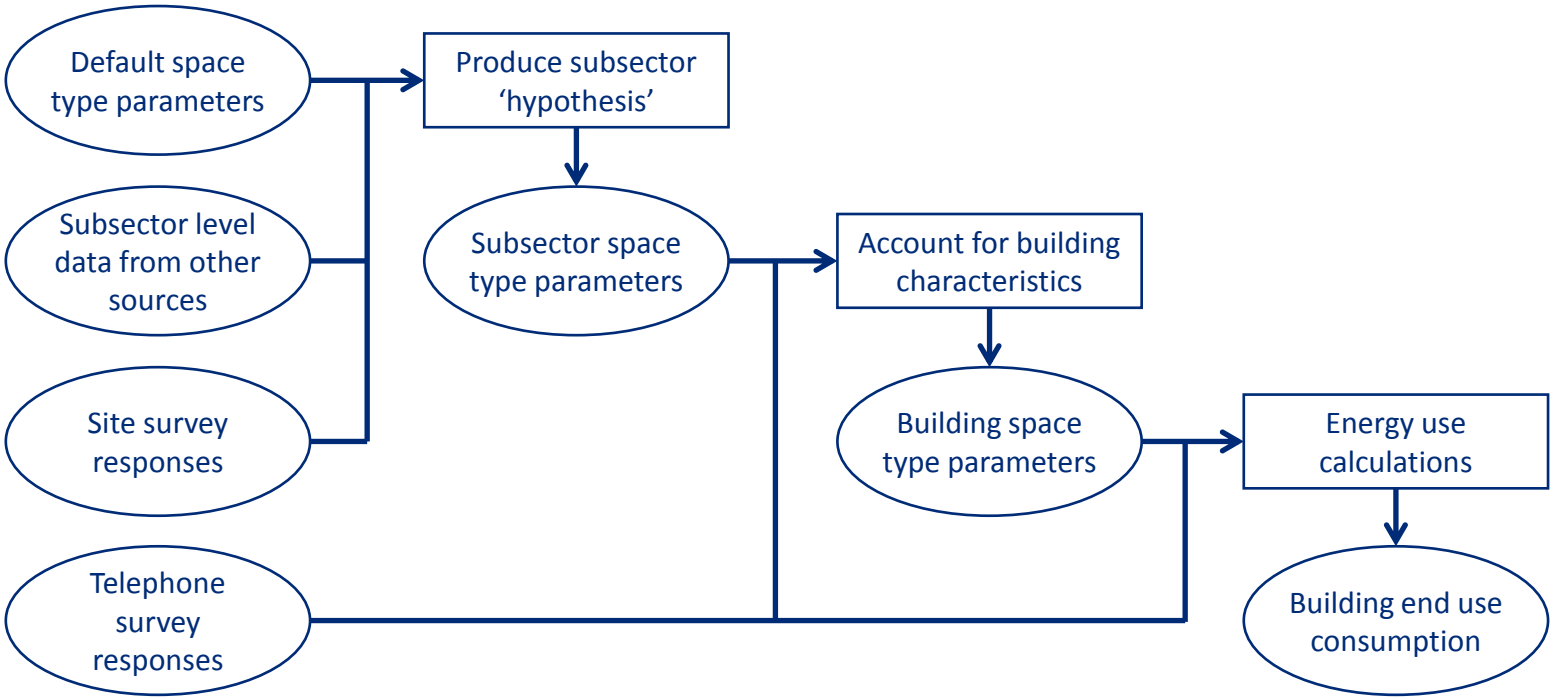
Energy demand modelling

- 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.



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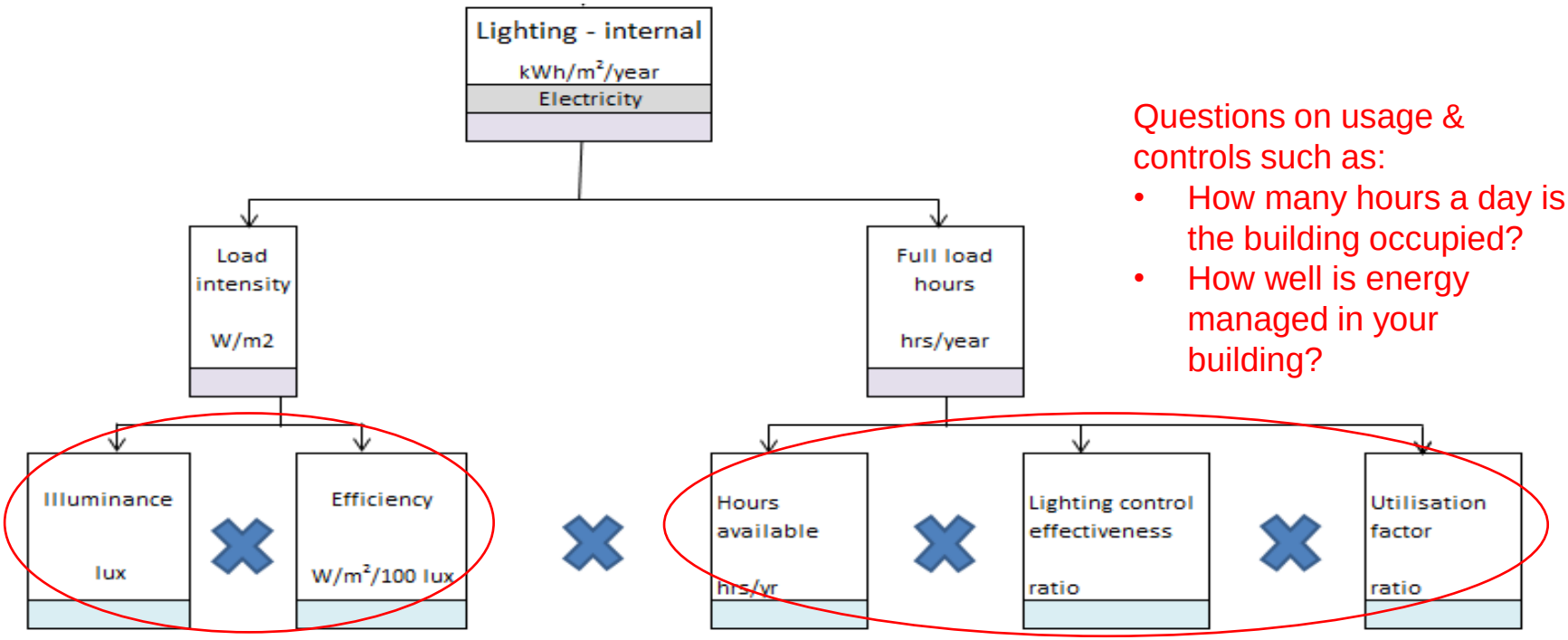
Energy demand modelling

- 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?

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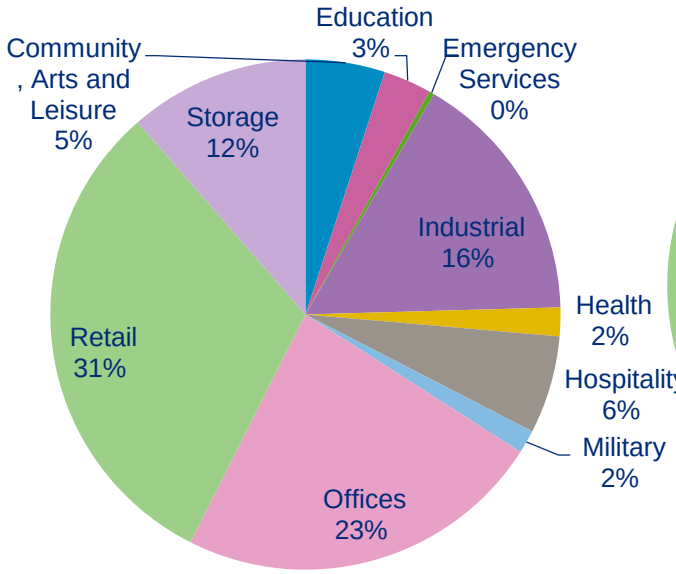
Segmentation of the Non-Domestic Stock

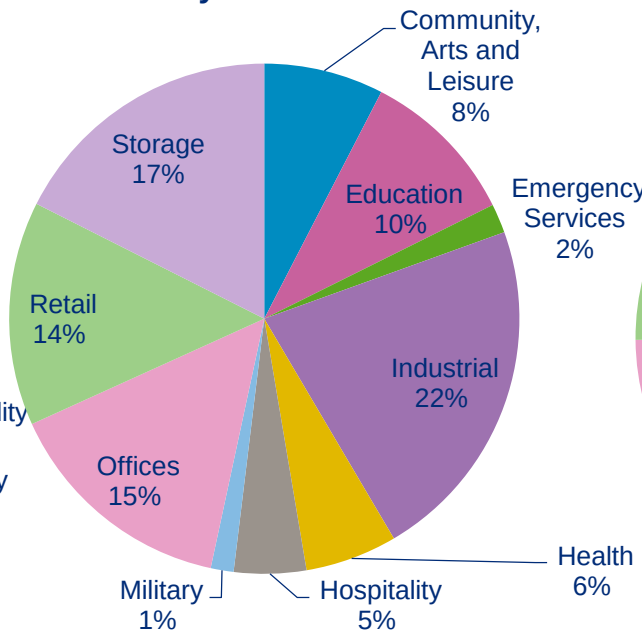
Sectors look different across the non-domestic stock according to the measure used

By Number of Premises



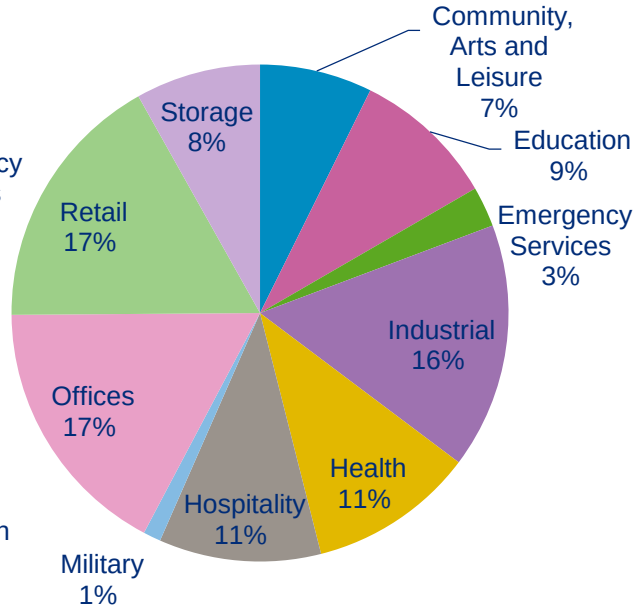
- **The total estimated number of premises in the non-domestic stock is 1,595,300 premises.**
- **The 4 largest sectors are storage, industrial, retail and offices** (account for 82% of the total number of premises).

By Floor Area



- **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).

By Energy Consumption



- **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).

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Energy Consumption by Electrical and Non-Electrical Use

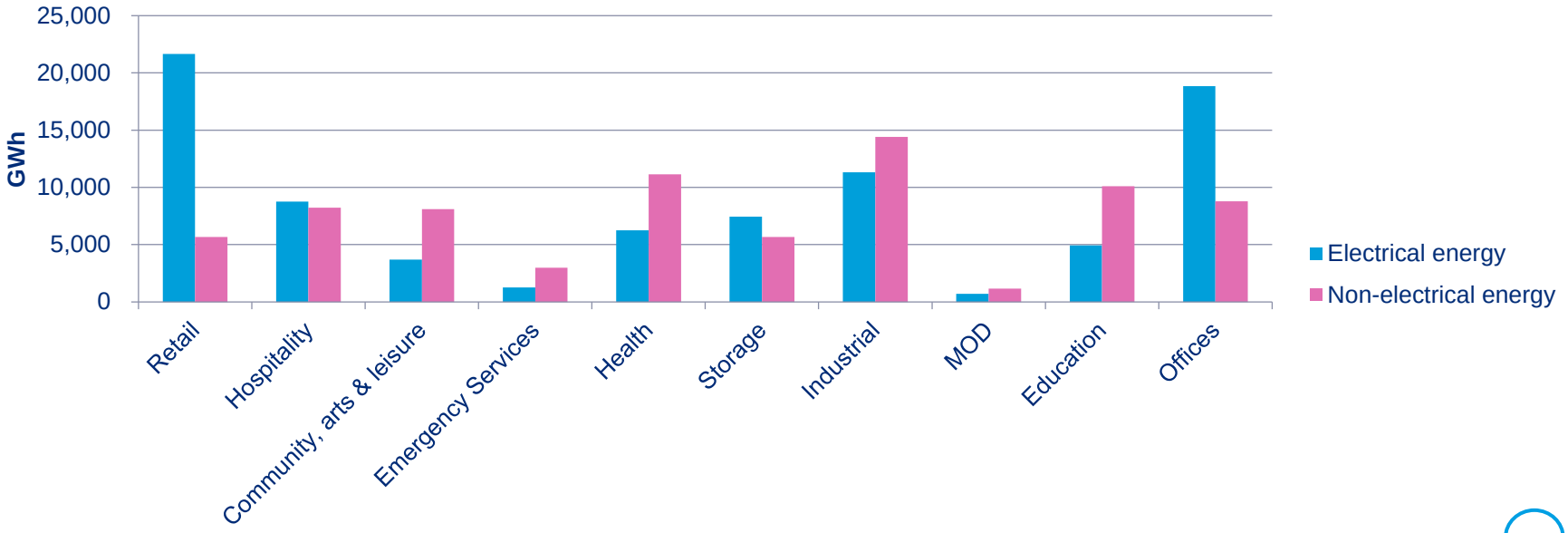
There is more electrical use than non-electrical use and this varies across sectors

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).



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GHG Emissions

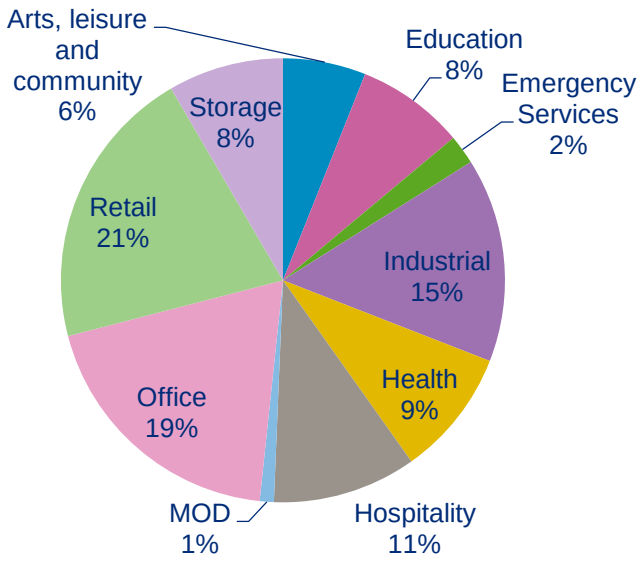
Retail and Offices had the highest levels of emissions, these sectors also have the highest levels of energy consumption.

Total GHG Emissions
53 $MtCO_2e$ per year:
The annual emissions from total energy of the non-domestic stock.

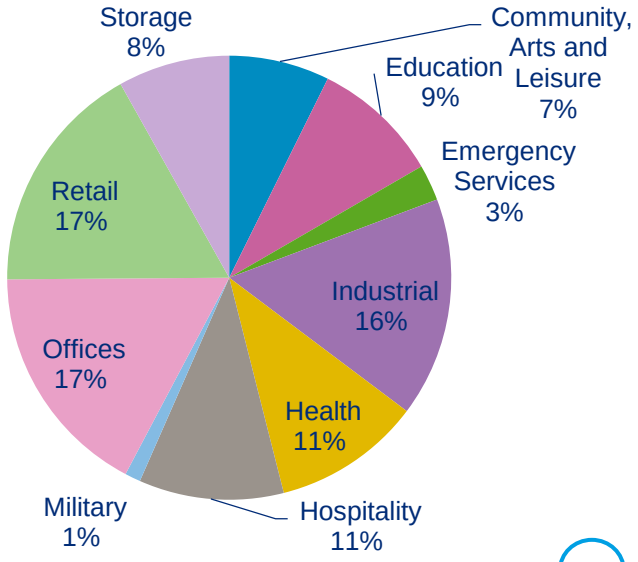
Electric GHG Emissions:
38$MtCO_2$ per year:
The annual emissions from electrical energy of the non-domestic stock.

Non-Electric GHG Emissions:
14 $MtCO_2e$ per year:
The annual emissions from non-electrical energy of the non-domestic stock.

Total emissions ($MtCO_2e$)



Total energy (GWh/year)



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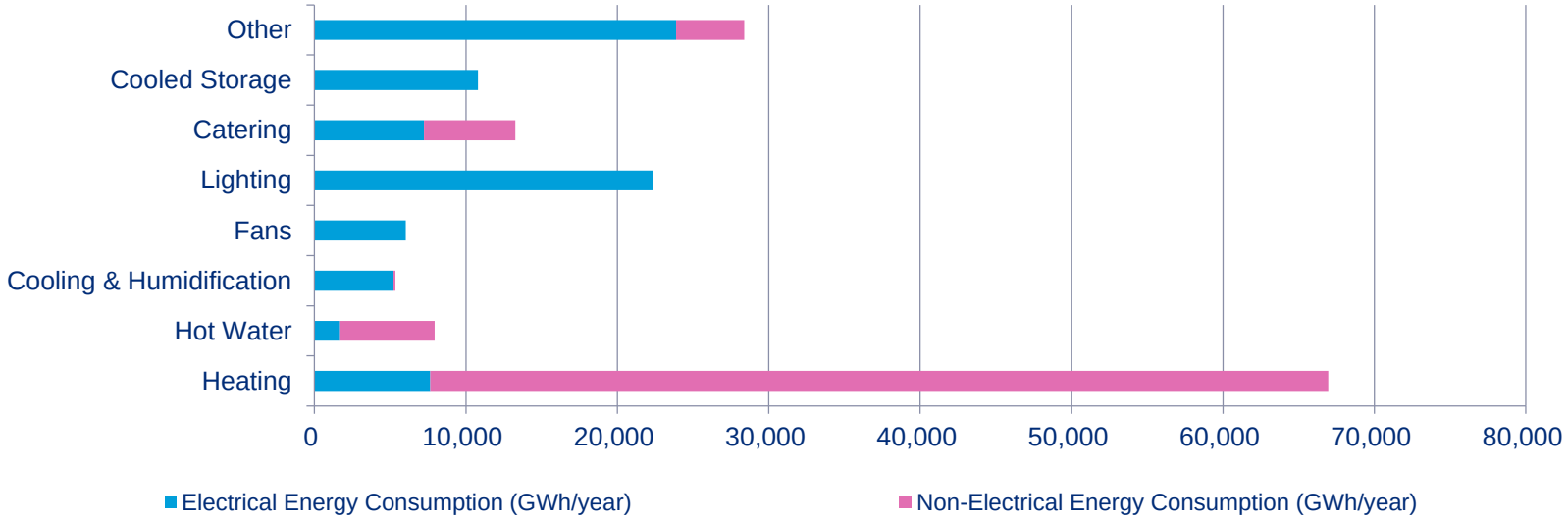
Energy Consumption by End Uses

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%).

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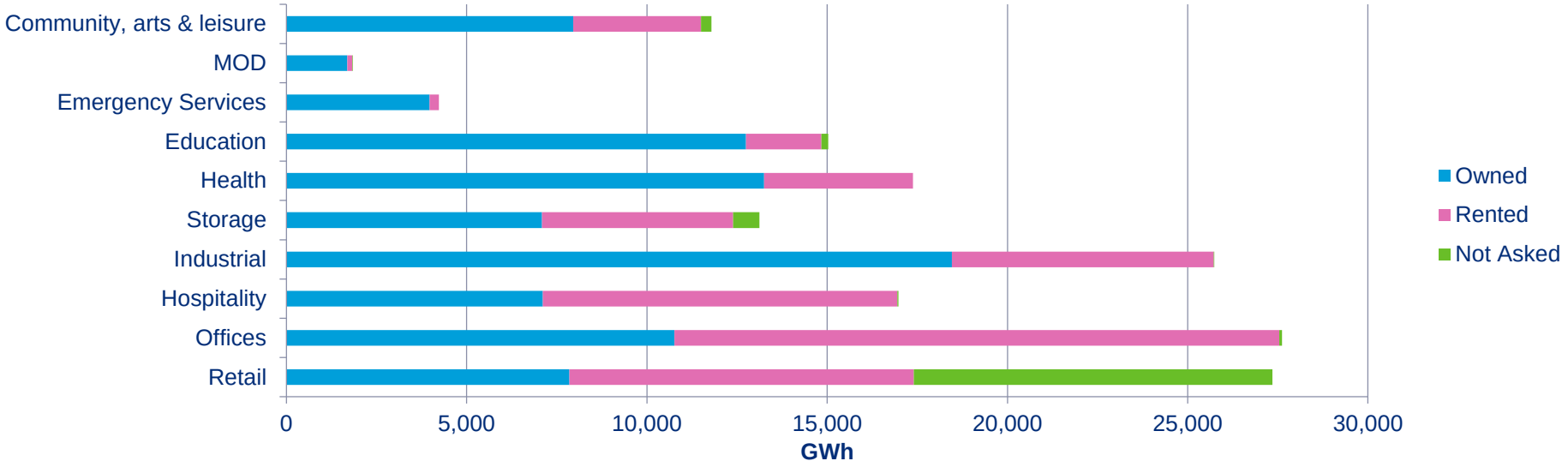
Sector Energy Consumption by Tenure



- 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 or Mystery shopper methods. (‘Not asked’) (36%).

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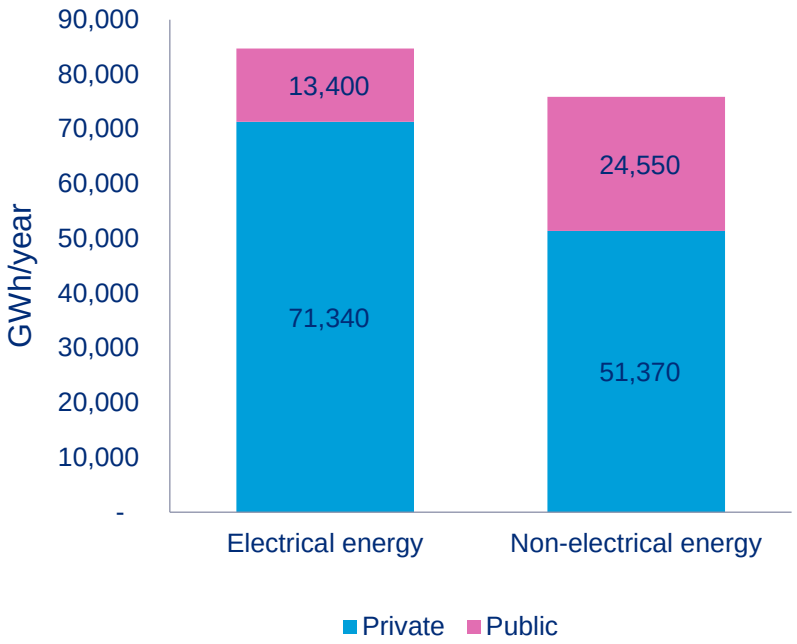
Energy Use - Public / Private split



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.

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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)

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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).

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What can BEES help us do?

- Understand better how to target policies to different customers and how they might react to various policy levers
    - **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

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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