



Department  
of Energy &  
Climate Change

# Building Energy Efficiency Survey (BEES)

Maxine Willitts and Robert Cohen  
1 October 2015



# Overview

- Why does BEES matter?
- Research aims
- Scope
- Methodology
  - Survey
  - Modelling



## Why does BEES matter?

- Economic studies show that improved energy efficiency can save money, bolster productivity, increase growth, reduce inflation and improve health outcomes.
- The energy use of UK non-domestic buildings is responsible for 12% of UK end-use greenhouse gas emissions (non-domestic buildings use 25% of all energy consumed).
- Currently, DECC relies on data collected in the 1990s in the Non-Domestic Energy and Emissions Model (N-DEEM), to provide information on energy end-use in non-domestic sectors.
- As an important user of energy and contributor to emissions stronger up to date and accurate evidence of energy use in this sector is needed to inform DECC's important strategic decisions.



# Research Aims

## Aim:

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

## Research Questions:

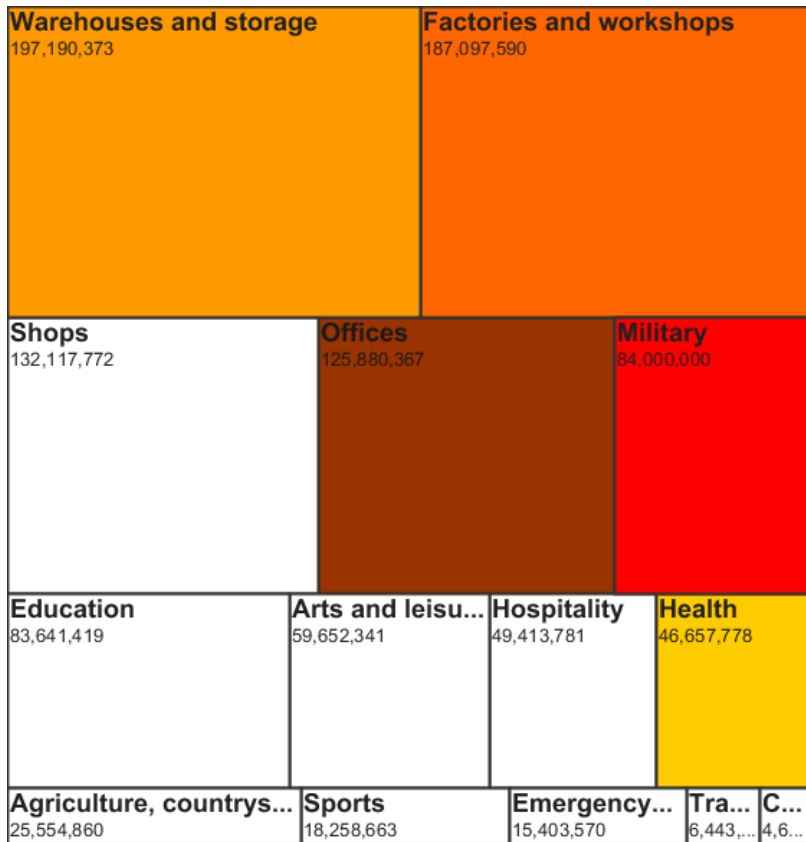
- Update understanding of how energy is used (for different end uses in each building type and in aggregate), for a snap-shot in time
- Update understanding of how energy use can be abated
- Understand qualitatively the barriers and facilitators of energy abatement



# Scope

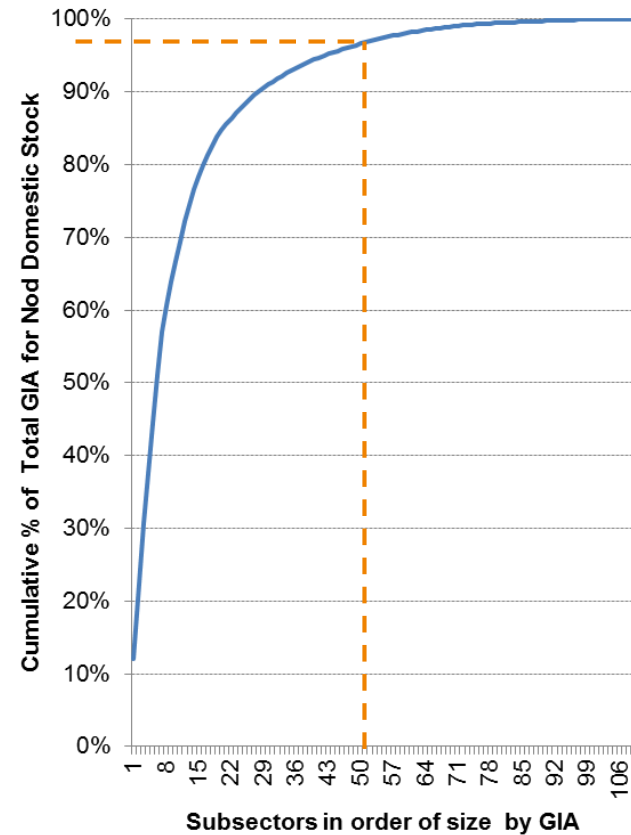
## Floor area (m<sup>2</sup>) by sector

(Adapted from UCL, 2012)



## Cum. Floor area (m<sup>2</sup>) by subsector

(Adapted from UCL, 2012)





# Scope

Sector	Sub-Sector	Sector	Sub-Sector	
<b>Education</b>	Nursery	<b>Retail</b>	Small Shops (Food & Non-Food)	
	Primary School		Large Shops (Food & Non-Food) (>750m <sup>2</sup> )	
	Secondary School		Hypermarket/Superstore (>2,500m <sup>2</sup> )	
	University (residential & non-residential)		Showrooms (Vehicle & Non-Vehicle)	
<b>Health</b>	Health Centres		Retail Warehouse	
	Hospitals (NHS & Private)		Hairdressing/Salon	
<b>Emergency Services</b>	Police Stations		<b>Community</b>	Community Halls
	Prisons			Places of Worship
	Courts	Nursing Home		
	Fire/Ambulance Stations	<b>Leisure</b>	Libraries/Museums/Galleries	
<b>Military</b>	MOD Buildings		Theatres/Cinemas/Concert Halls	
<b>Offices</b>	Commercial Offices (inc Central & Local Gov)	<b>Sports</b>	Clubs (not sports)	
			Sports Centres (with/without pools)	
<b>Hospitality</b>	Restaurant	<b>Storage</b>	Stores, Warehouses	
	Pub		Cold Stores	
	Hotel	<b>Factories &amp; Industrial Buildings</b>	Workshops	
	Takeaway		Factories	
	Café		Large Industrial Buildings	



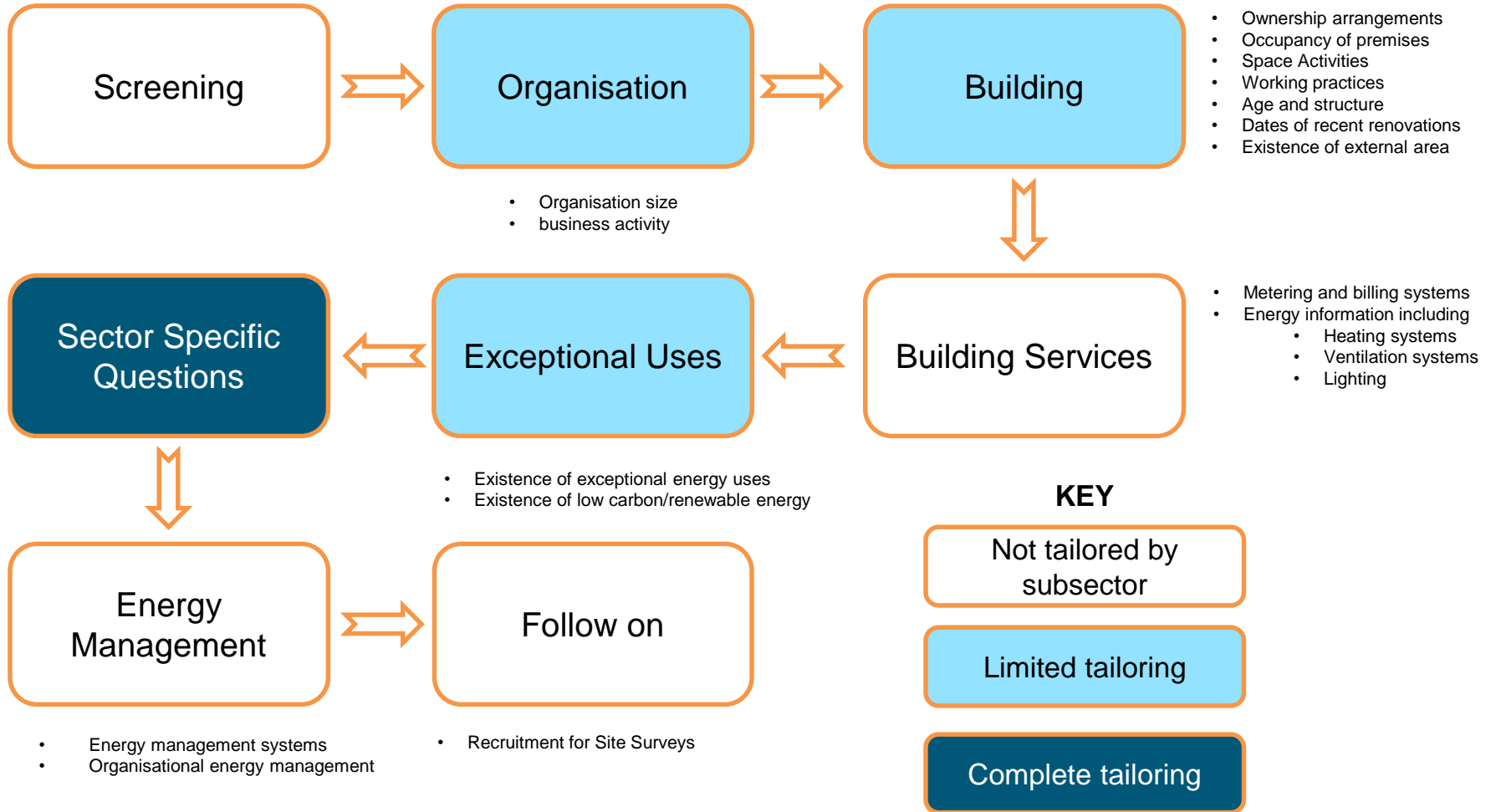
# Methodology

- Informed by 2013 pilot study into different methodology options

Component	Purpose
<b>4,000 Telesurveys</b>	<ul style="list-style-type: none"><li>- 20-25 minutes</li><li>- Aimed at Energy/Facilities managers</li><li>- Collects basic data on building, equipment, usage &amp; energy management</li><li>- 'Core' questions and 'Sector Specific' questions tailored to building type</li></ul>
<b>300 Site Audits</b>	<ul style="list-style-type: none"><li>- Recruited from telesurvey respondents</li><li>- 0.5 - 1.5 days depending on building type/complexity</li><li>- Validates data and collect more detailed building energy data and is basis for abatement calculation</li><li>- 1hr qual interview on barriers and drivers to Energy Efficiency</li></ul>
<b>Modelling</b>	<ul style="list-style-type: none"><li>- Converts Survey answers into estimate of consumption via end use (heating, lighting, cooling etc.)</li><li>- Calculates abatement &amp; grossing</li></ul>



# Methodology - Survey



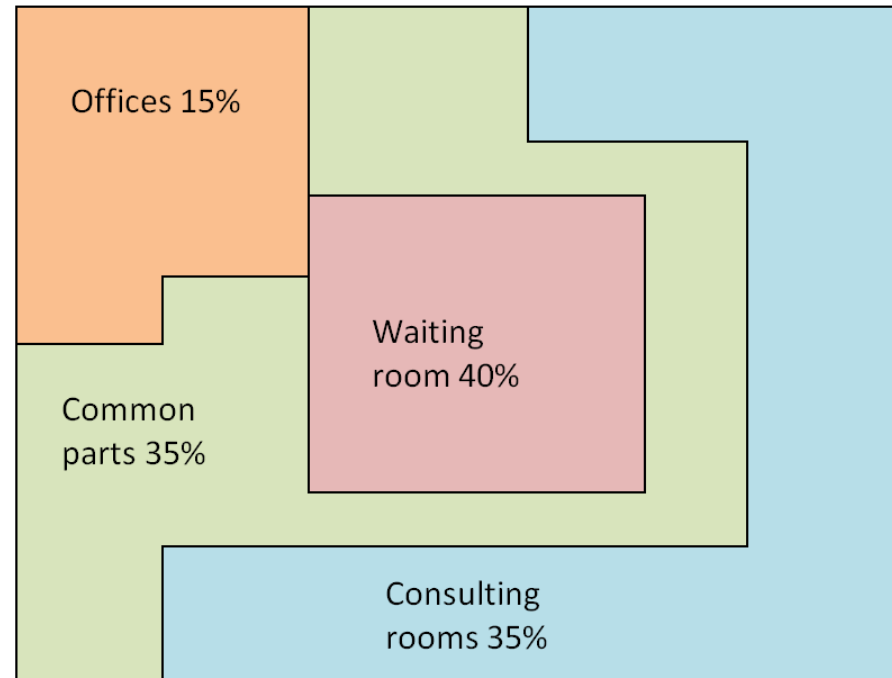




# Modelling

- **Energy intensity is defined & calculated on a space by space basis & aggregated to building level**
- Based on a floor area breakdown of m<sup>2</sup> of each **space type** (50-60 in model)
- Each **space type** is a dataset of **tree diagram parameters** for each energy end use & servicing level

Example: Clinic  
Floor area: 300m<sup>2</sup>

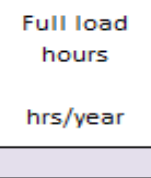
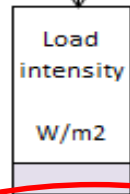
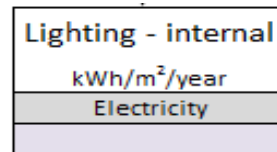




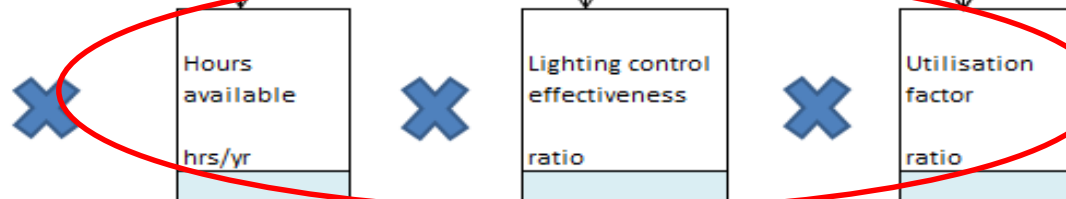
# Building Energy Hypothesis Model

- The model uses a **tree diagram basis** to generate an energy use prediction at an **end use level of resolution** (26 end uses heating, lighting, ventilation, etc.)
- The hypothesis calculation shares a common basis with the energy calculations used to generate predictions from survey responses.
- Abatement calculation through manipulation of tree diagram variables.

BEES - Modelled End Uses	
Lifts	Heating
Catering	Hot water
Distributed catering electric	Space cooling
Cooled storage	Ventilation
Entertainment lighting	Pumps
Entertainment equipment	Controls
Laundry electric	Humidification
Medical	Internal lighting
Laboratory	Display Lighting
Pool/leisure	External lighting
Other Normal	Small power
ICT equipment	



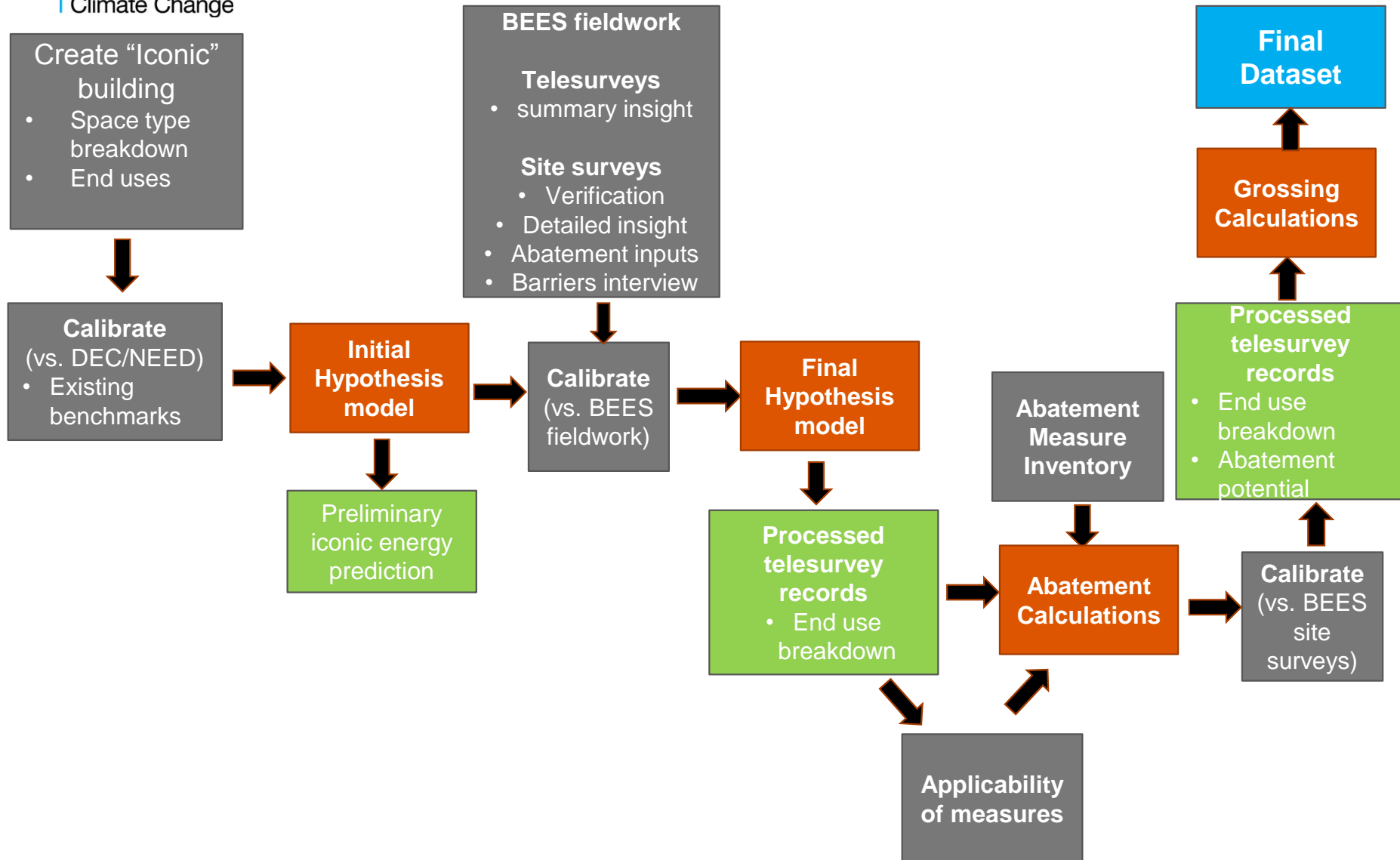
Questions on lighting type (e.g. LEDs)



Questions on usage & controls



# Methodology – energy prediction & abatement





# Next steps

- The project has been in the field since summer 2014 with **fieldwork nearing completion**.
- Currently undertaking a range of **quality assurance** activity including comparison to non-domestic NEED consumption data together with “shadow” modelling by using a University’s model.
- Need to **disclosure check** results as some sites will be influential, some sub-sectors are based on small samples and some organisations contribute a high proportion of sites in some sub-sectors.
- Plan to **publish** full report together with sector specific reports by Spring 2016.