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Glass & Glazing Roadmap

10th CAB Technical Conference & Exhibition

"Fit for the Future"

14th May 2015

CAB
Council for Aluminium in Building

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How far could more energy efficient windows reduce energy use in existing buildings by 2050?

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The NEF Glazing Supply Chain Group

www.glazingsupplychaingroup.org.uk

With additional input from:

- British Blind and Shutter Association (BBSA)
- Department for Business, Innovation & Skills (BIS)
- Glass for Europe (GfE)
- National Federation of Glaziers (NFG)
- The British Plastics Federation (BPF) – Windows Group
- The British Woodworking Federation (BWF)
- Zero Carbon Hub (ZCH)

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Background

- Energy Efficient Partnership for Buildings (EEPB) Glazing Group
- Glazing Supply Chain Group established to
  - Establish a collective and united voice;
  - Provide a forum for key stakeholders and a single point of contact with the Government;
  - Produce an independent report on the sector's potential in line with the government's 2050 decarbonisation goals.
- Project started Oct 2014, workshops and conference calls held; report to be launched May 2015;
- Dissemination + launch for the new MPs

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Research questions

1. How much energy can be saved if more existing domestic and non-domestic buildings in the UK install the most energy efficient commercially available glazing?

2. How can the uptake of energy efficient glazing and energy efficient glazing technologies be encouraged and incentivised?

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Operational energy/carbon reduction assessment

Contents

1. **Domestic sector**
   - Methodology
   - Scenarios
   - Roadmap to 2030/2050
   - Closing the performance gap
   - Eliminating the need for cooling
2. **Non-domestic sector**
   - Methodology
   - Scenarios
   - Roadmap to 2030/2050
3. **Total energy savings**

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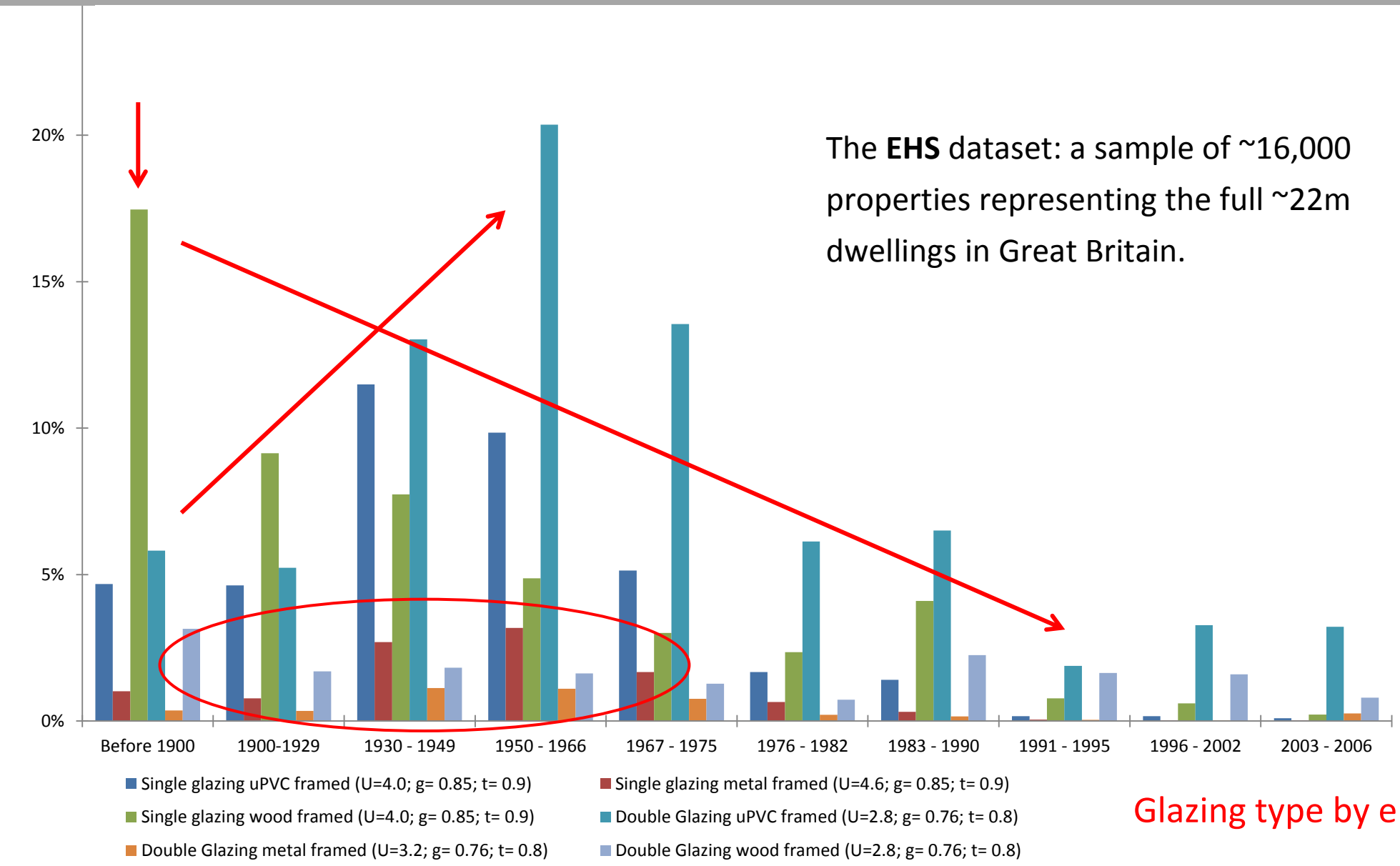
Domestic sector – Methodology



The **EHS** dataset: a sample of ~16,000 properties representing the full ~22m dwellings in Great Britain.

Glazing type by era

Domestic sector - Scenarios

Baseline - 2015

BUSINESS AS USUAL:

Approximates what will happen to operational energy should **existing** trends continue.

ENHANCED UPTAKE:

Approximates what will happen to operational energy use with **'improved adoption'** of glass and glazing technology whilst accepting **limitations** as to exploitation with technologies associated with, for instance, listed buildings.

TECHNICAL POTENTIAL:

Maximum reduction potential based on the **best** currently available technology.

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Domestic sector - Scenarios

Baseline - 2015

BUSINESS AS USUAL *:*

Single glazing wood/metal framed **to**:

- Single glazing (25%)
- Secondary glazing (25%)
- Low-e double glazing (50%)

Single glazing uPVC framed **to**:

- Low-e double glazing (100%)

Double glazing wood/metal/uPVC framed **to:**

- Air filled double glazing (50%)
- Low-e double glazing (50%)

ENHANCED UPTAKE*:*

Single glazing wood/metal/uPVC framed **to**:

- Single glazing (25%)
- Conservation glass (50%)
- Low-e triple glazing (25%)

Double glazing wood/metal/uPVC framed **to:**

- Low-e double glazing (50%);
- Low-e triple glazing (50%)

TECHNICAL POTENTIAL*:*

All **to**:

- Best triple glazing (100%)

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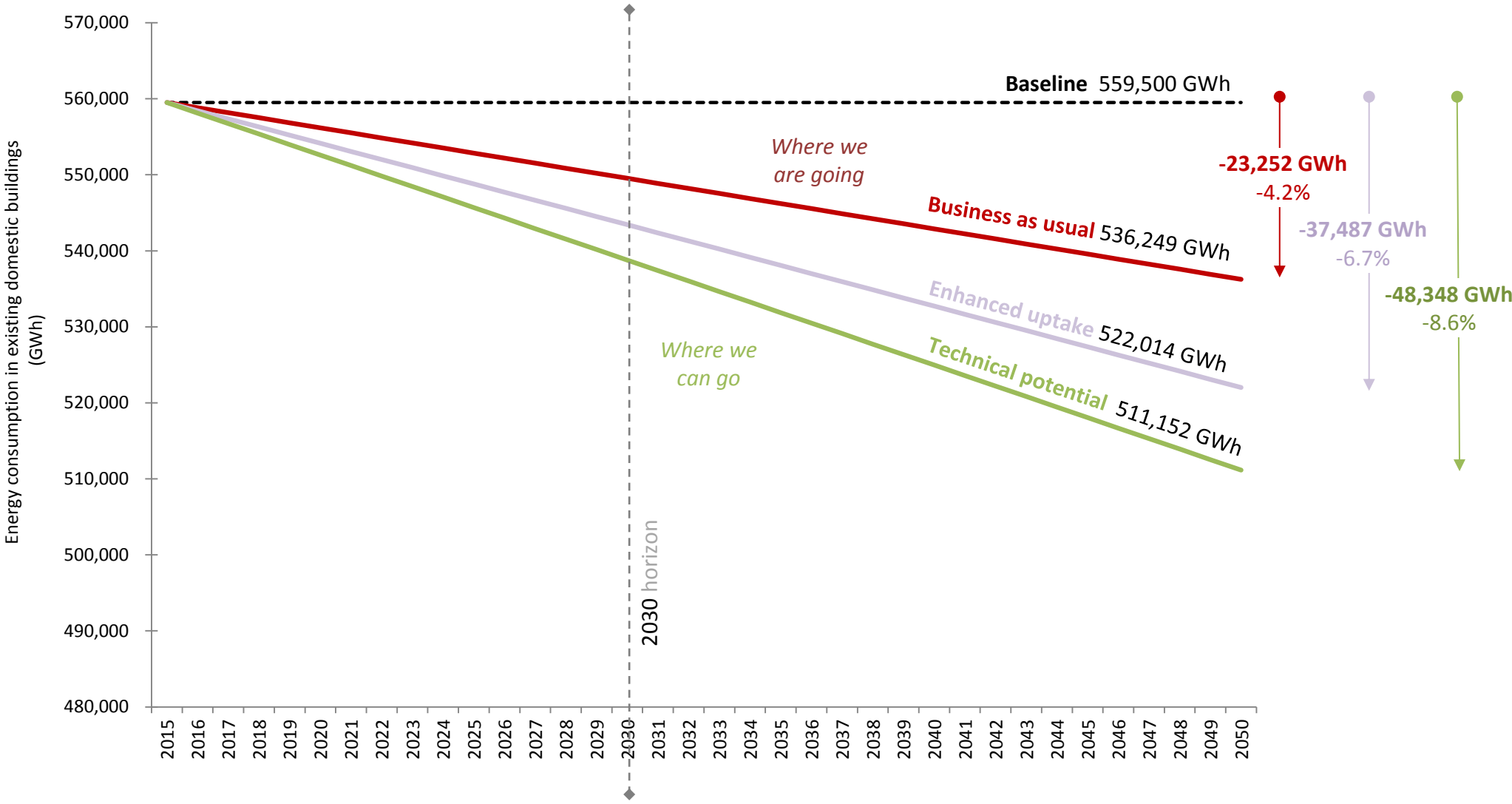
Domestic sector – Roadmap to 2050



Closing the performance gap - Methodology

- The Cambridge Housing Model
- Interface issues
  - BRE study on impact of thermal bridging in solid wall homes
  - Heat loss through windows' jamb, head and sill junctions
  - Uninsulated vs Typical vs Best Practice detailing
- Space cooling requirements

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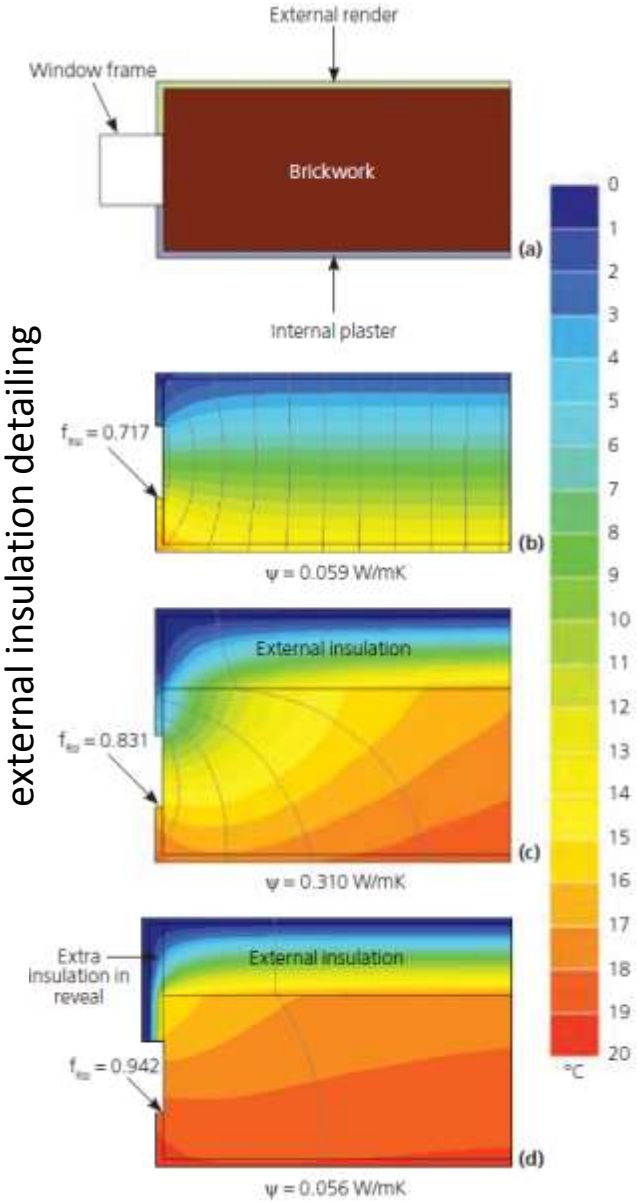
Closing the performance gap - detailing

Window Jamb

external insulation detailing



Ref. Weeks, C., Ward, T., King. C., 2013. *Reducing thermal bridging at junctions when designing and installing solid wall insulation.* BRE Trust publications, IHS, Bracknell.

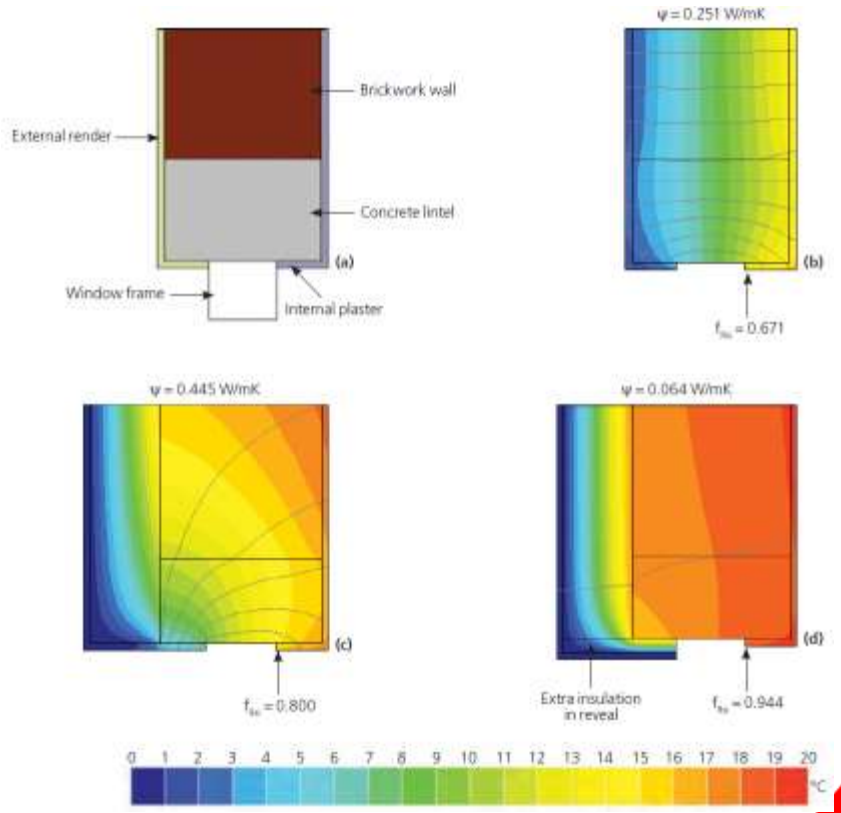
Window head

(**a**) Uninsulated detail

(**b**) Uninsulated case study

(**c**) Typical external insulation

(**d**) Optimal external insulation



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Closing the performance gap – Reference building

	Energy consumption through window/fabric interface (kWh)
Current situation: **"Typical external insulation"**	1015
Current situation: **"Typical internal insulation"**	672
Best practice: **"Optimal external insulation"**	187 (-82%)
Best practice: **“Optimal internal insulation”**	142 (-86%)

Ref. Weeks, C., Ward, T., King. C., 2013. *Reducing thermal bridging at junctions when designing and installing solid wall insulation.* BRE Trust publications, IHS, Bracknell.

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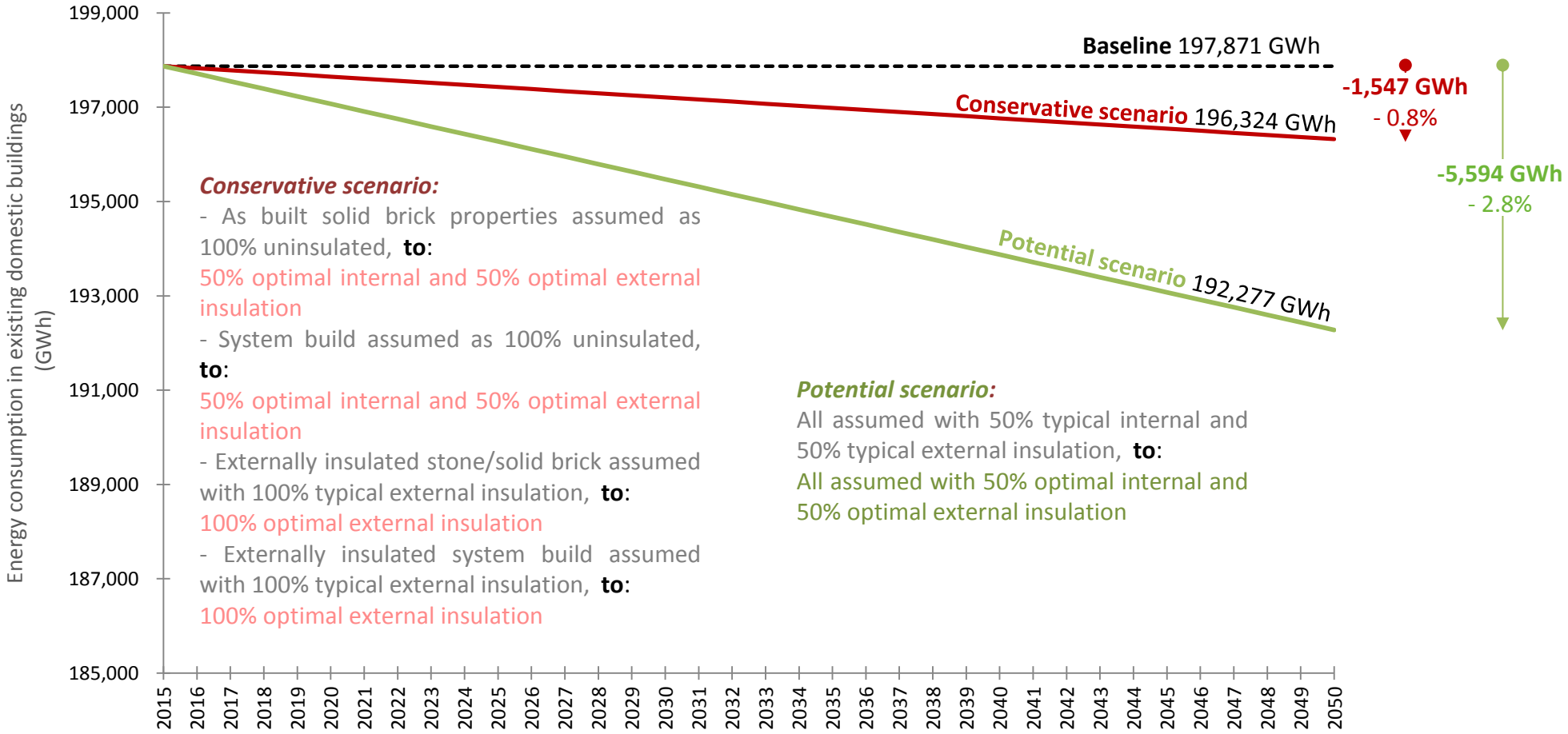
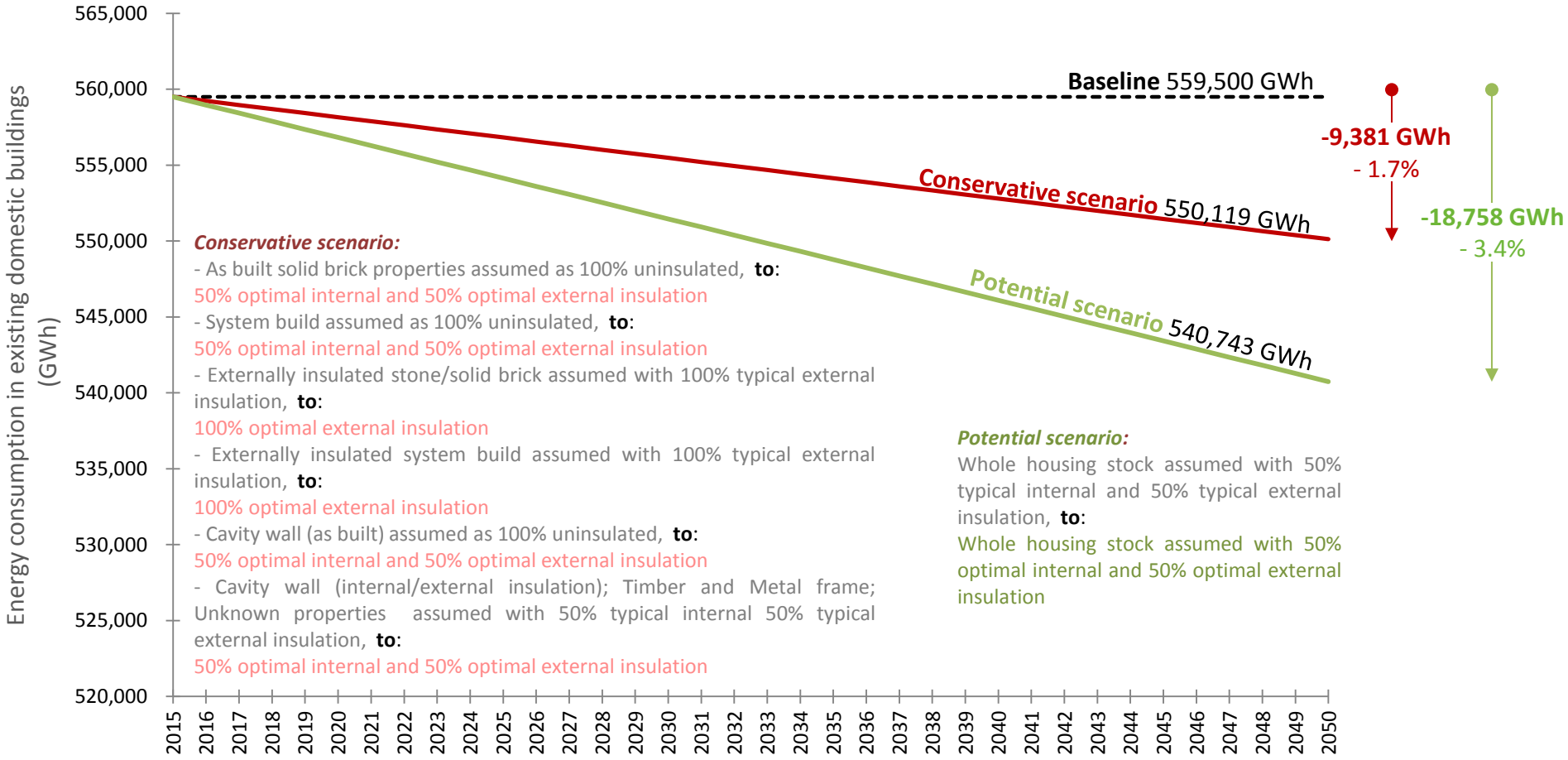
Closing the performance gap – Roadmap to 2050

Solid wall & 'system build' properties only



Closing the performance gap – Roadmap to 2050

Whole housing stock scale-up



Space cooling requirements - Methodology

- The Cambridge Housing Model
- Interface issues
- Space cooling requirements
  - Sensitivity analysis – space cooling vs total energy demand
  - CHM stock modelling simulations
  - All to 1.1 U; g-values of 0.30; 0.40; 0.50; 0.60; 0.70 and 0.80

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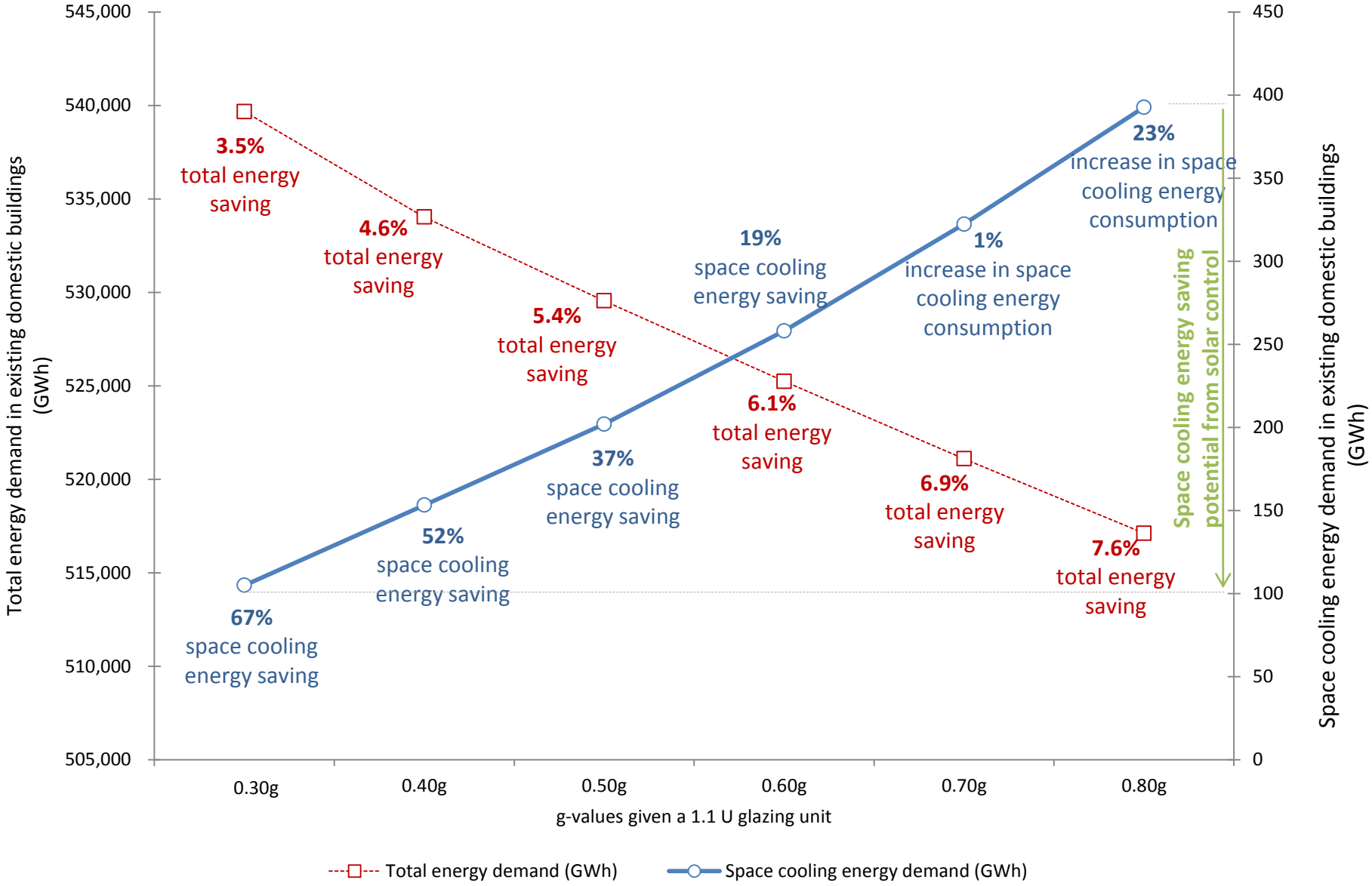
Space cooling requirements – Sensitivity analysis



Domestic - Summary

- Domestic
  - Business as usual = 4.2% saving, 23,252 GWh
  - Enhanced uptake = 6.7% saving, 37,487 GWh
  - Technical potential = 8.6% saving, 48,348 GWh
- Interfaces
  - Business as usual = 1.7% saving, 9,381 GWh
  - Technical potential = 3.4% saving, 18,758 GWh

Equivalent to the annual output of **5x Sizewell B power stations!**

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Operational energy/carbon reduction assessment

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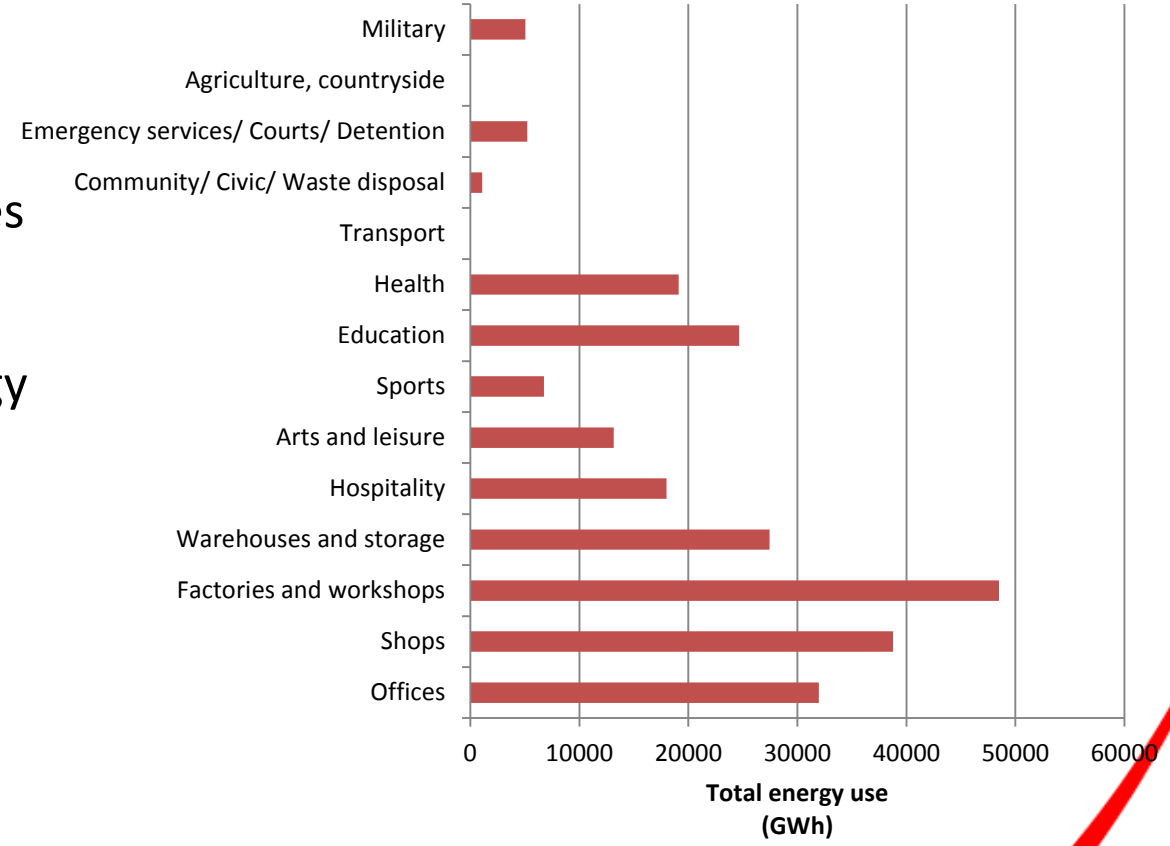
Methodology - The CaRB2 model

- University College London (UCL) for DECC's National Energy Efficiency Database
- Cover most of England and Wales non-domestic building premises
- Records of floor areas and energy consumption
- Energy intensities disaggregated into fossil fuel and electricity
- Seven post-1980 reference buildings selected – large office; medium office; small office; stand-alone retail; warehouse; primary school; and hospital



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Non-domestic sector - Scenarios

Baseline - 2015

BUSINESS AS USUAL:

All **to**:
U = 2.0 W/m^{2}K
g = 0.45

ENHANCED UPTAKE:

All **to**:
U = 1.60 W/m^{2}K
g = 0.35

TECHNICAL POTENTIAL:

All **to**:
U = 1.10 W/m^{2}K
g = 0.30

- Building regs – U_{max}= 2.2 W/m^{2}K
  - reasonable g to limit solar gain = 0.68

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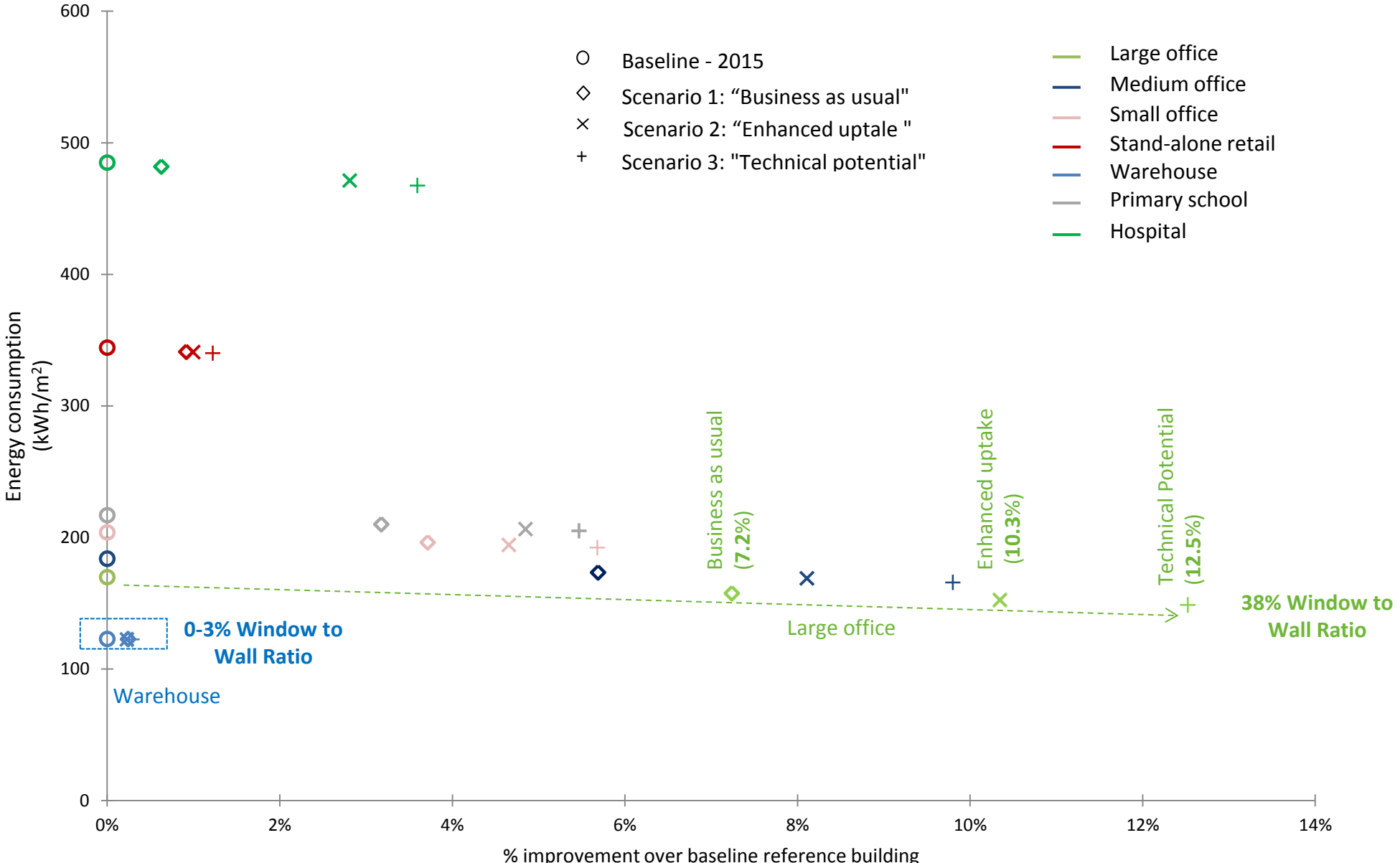
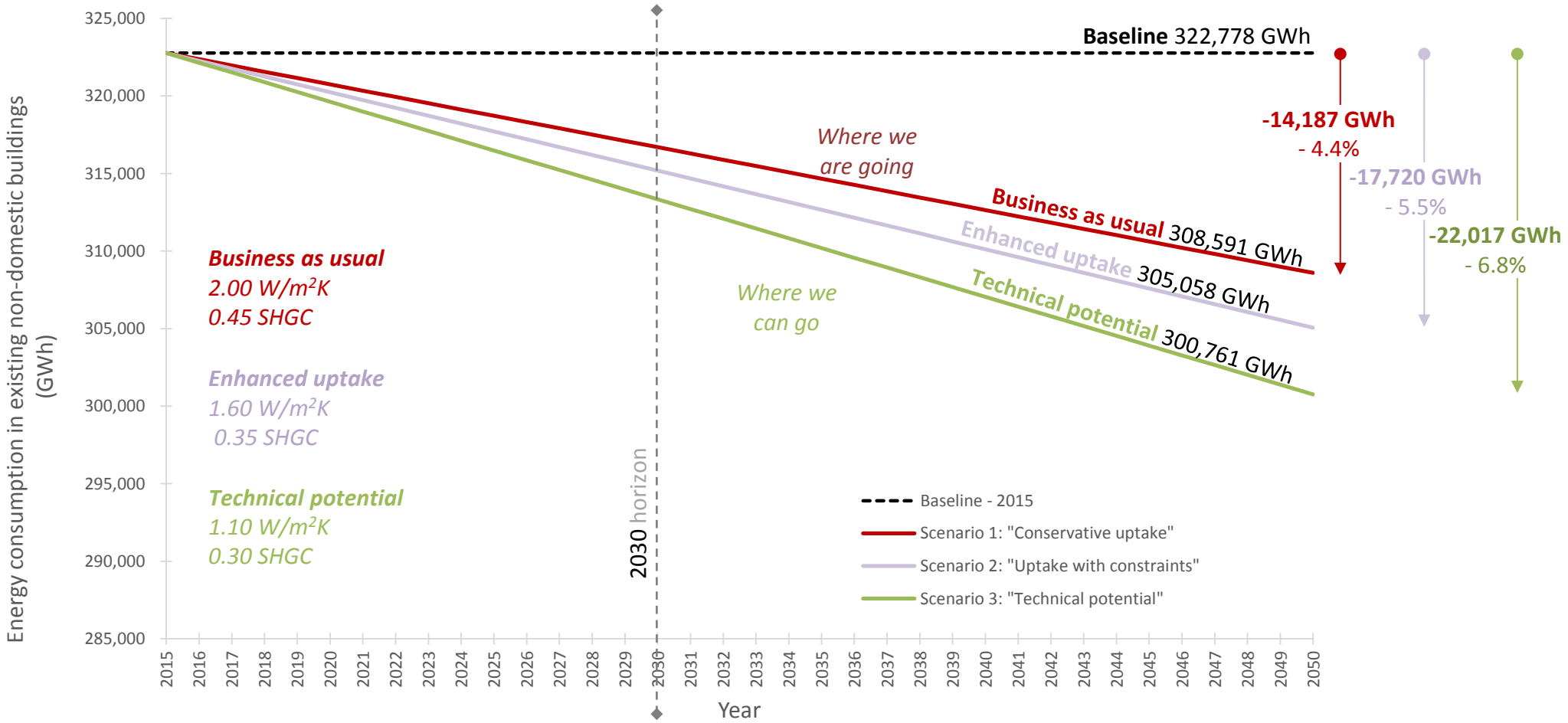
Energy savings – Reference Buildings



Non-domestic sector – Roadmap to 2050



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   - Carbon analysis
3. **Total energy savings**

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Total energy savings in UK – Final results

Scenario	Energy consumption - domestic buildings (GWh)	Energy consumption - non-domestic buildings (GWh)	Total energy consumption (GWh)	Total energy savings (GWh)	Total energy savings (%)
Scenario 1: **“Business as usual"**	536,249	308,591	844,839	37,439	4.2%
Scenario 2: **“Enhanced uptake"**	522,014	305,058	827,072	55,207	6.3%
Scenario 3: **"Technical potential"**	510,875	300,761	811,636	70,642	8.0%

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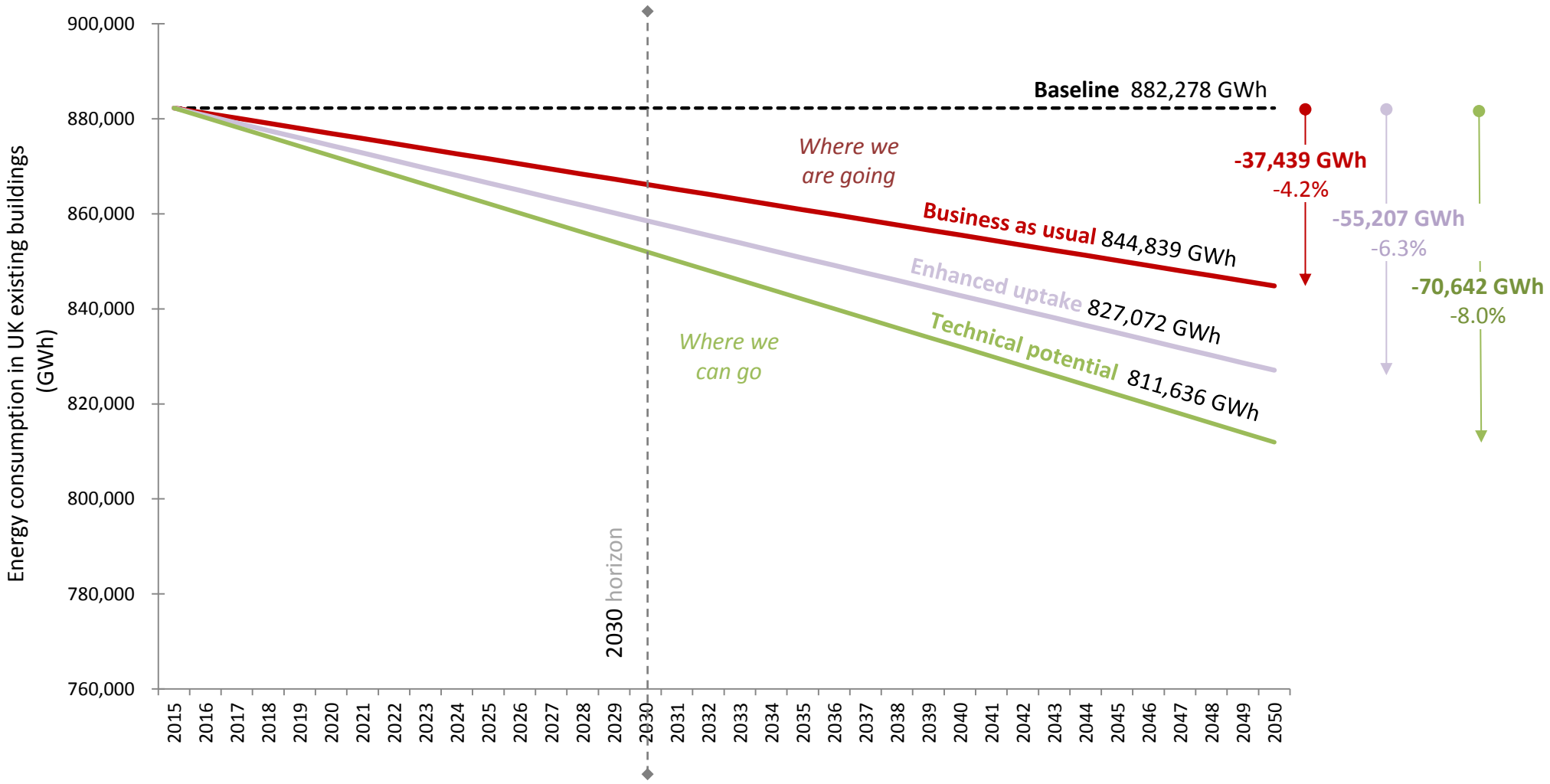
Total energy savings in UK – Final results



Domestic and Non-Domestic Summary

- Domestic
  - Business as usual = 4.2% saving, 23,252 GWh (+interfaces at 1.7% saving, 9,381 GWh
  - Enhanced uptake = 6.7% saving, 37,487 GWh
  - Technical potential = 8.7% saving, 48,625 GWh (+ interfaces at 3.4% saving, 18,758 GWh)
- Non Domestic
  - Business as usual = 4.4% saving, 14,187 GWh
  - Enhanced uptake = 5.5% saving, 17,720 GWh
  - Technical potential = 6.8% saving, 22,017 GWh
- Overall
  - Business as usual = 4.2% saving, 37,439 GWh
  - Enhanced uptake = 6.3% saving, 55,207 GWh
  - Technical potential = 8.0% saving, 70,642 GWh

Equivalent to the annual output of **7.3x Sizewell B power stations!**

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How can this be realised in practice?

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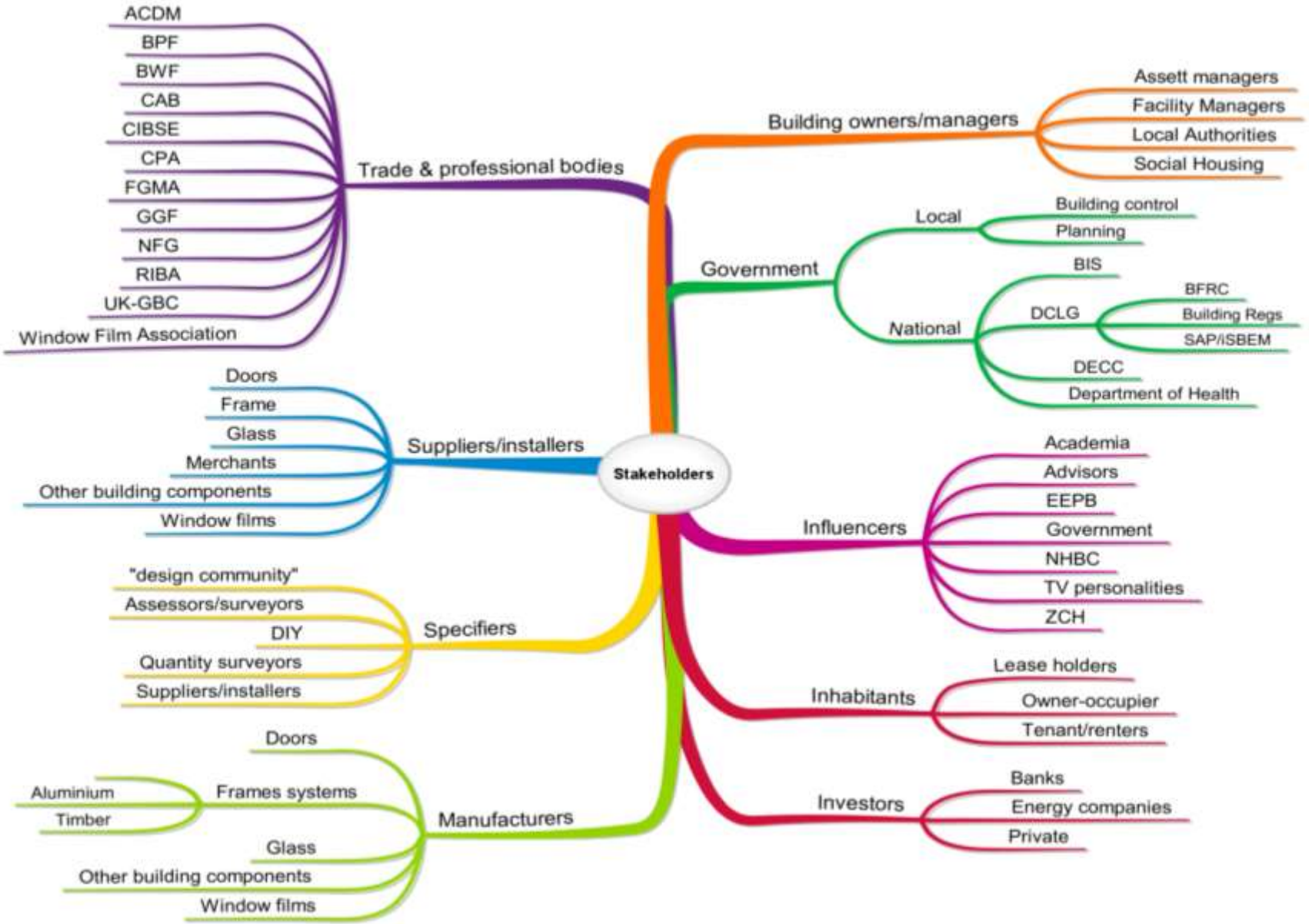
Stakeholders



Strategic vision

Home Owners

- Take advantage of the value of glazing and the whole life benefits that they can deliver when specified and installed correctly;
- Landlords, registered providers, developers and other informed clients should work with industry to set new standards and make best use of available technologies.

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Strategic vision

Industry

- Identify and promote best practice, showcase case studies and champions;
- Consider glass from a whole building perspective;
- Provide and request performance feedback - particularly to specifiers, architects and cladding installers;
- Work in partnership with Government to develop a more supportive regulatory framework.

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Strategic vision

Industry (Aluminium)

- Whole life and whole building approach – glazed areas, U and G values, cooling, operability (natural ventilation), interaction with walls/cladding systems
- Design vs. As Built – validation and feedback
- Product innovation - Long term operational benefits of composite solutions/thermal breaks etc. vs. End of life recycling
- SAP and EN ISO 10077-1 fixed window-to-frame ratio assumptions (20% for metal frames and 30% for wood and uPVC frames)

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Strategic vision

Governments

- Work with the glazing supply chain to help people buy high performance glazing systems, for instance with 5% VAT and a more effective Green Deal;
- Encourage and ensure quality and glazing specification based on the entire service life through regulation;
- Increase consumers' awareness; support industry "best practice".

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Key Findings

1. Domestic:
   - Significant energy savings from optimal use of glazing in existing buildings.
   - To achieve energy efficiency savings requires consideration of glazing in the context of the building as a whole.
   - Additional significant savings through minimisation of thermal bridging
2. Non-Domestic:
   - Significant savings
   - Huge variation across archetypes studied
   - “g” more sensitive than “U” in many instances

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Key Findings

3. Life Cycle Assessment:
   - Complex with high uncertainties
   - “Operational” energy savings from optimal selection of glazing outweigh marginal manufacturing energy use

4. Skills & Training:
   - Achievement of optimal selection and installation of glazing will require increase in awareness and skills across the supply chain.

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Key Findings

5. Leadership:
   - Need leadership from glass and glazing industry to engage with supply chain; identify and promote cast studies, champions &best practice; make the business case

6. Carbon:
   - Dependant on assumptions about fuel, generating mix & source
   - Energy savings significant

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A free copy of the report and the Headline Findings of the research soon available at

www.glazingsupplychaingroup.org.uk/publications/

Thanks for your attention

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