Spatial implications of developing Zero Carbon Local Plans: Modelling the carbon from proposed growth

Good Homes Alliance, 24 January 2023

Bioregional

mode transport planning

Currie & Brown

Etude

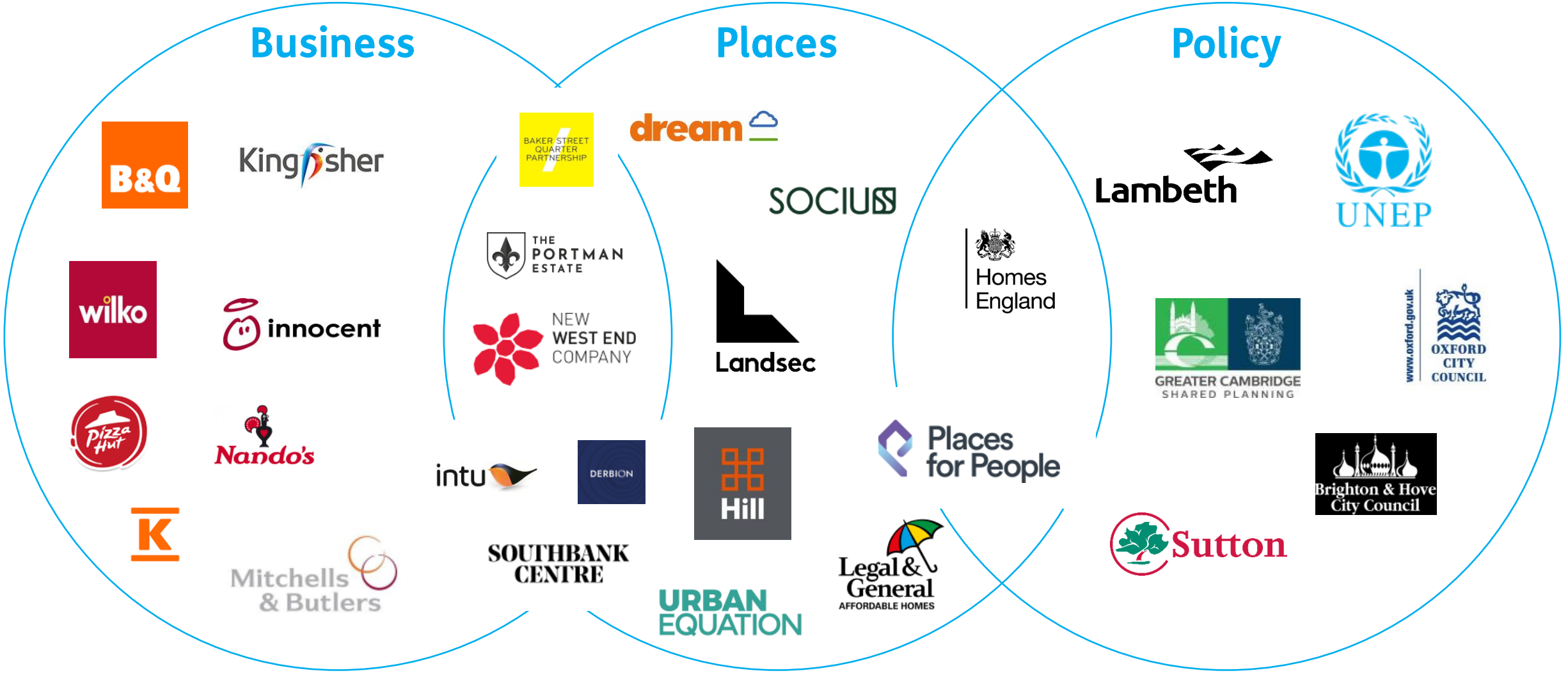
About Bioregional

Championing a sustainable future for all

Bioregional is a purpose-led, not-for-profit sustainability consultancy.

We work with developers and local authorities to create homes, workplaces, and communities that enable sustainable living.

Who we work with



Why we need net zero carbon local plan policy

IPCC Special Report on 1.5C Climate Change

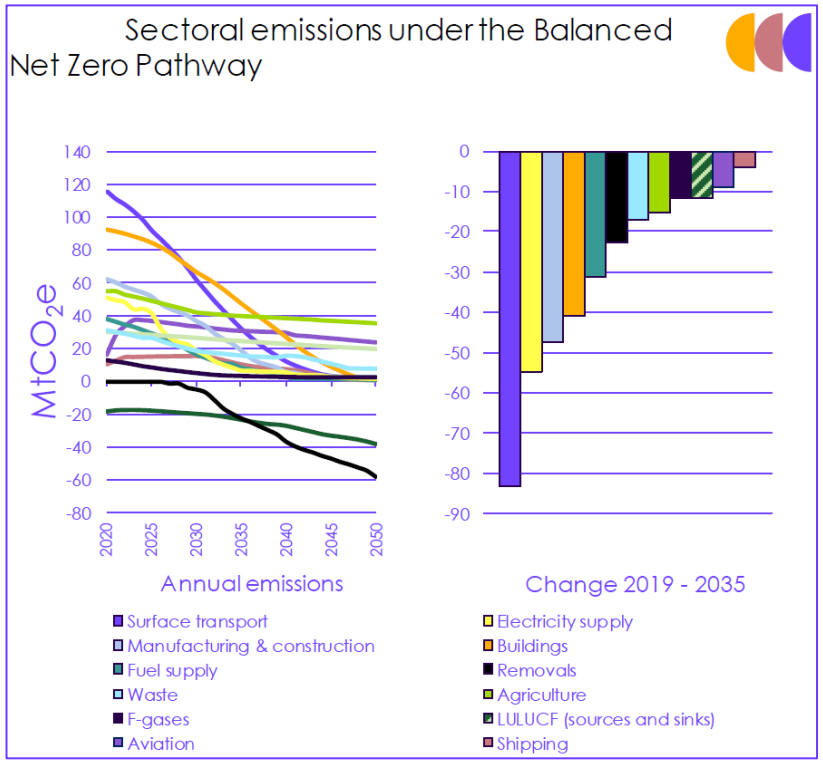
Paris Agreement:
- 2C limit
- 1.5C aim
- Current trajectory: 4C

Climate Change Act
- Net Zero 2050
- Interim 5-yearly carbon budgets

Committee on Climate Change pathways to net zero
- Low carbon heat 2025
- Space heat demand 15-20kWh/m^2/yr
- Upscale renewables
- Transport – less car use; electrification
- Agriculture & aviation will need offsets

Gaps in legislation & regulation to deliver the sector pathways

Current national policy will not deliver this



Zero Carbon Local Plan Policy - case study

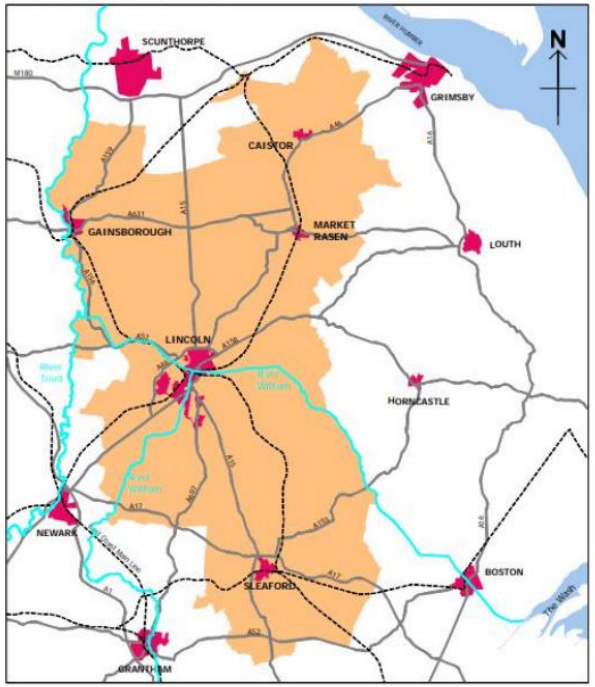
Central Lincolnshire

Currently under examination

Matter 5 – Energy, Climate Change and Flooding

Friday 18 November 2022 – 09:30

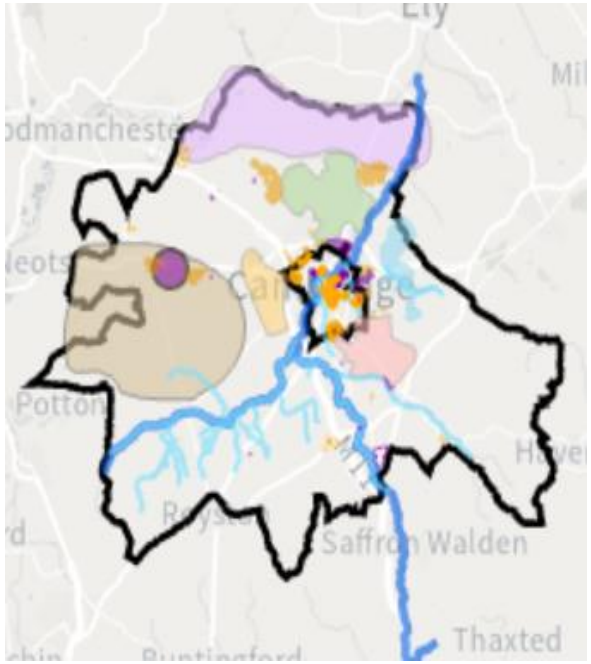
https://www.n-kesteven.gov.uk/central-lincolnshire/local-plan-review-examination/examination-latest-news/



Greater Cambridge

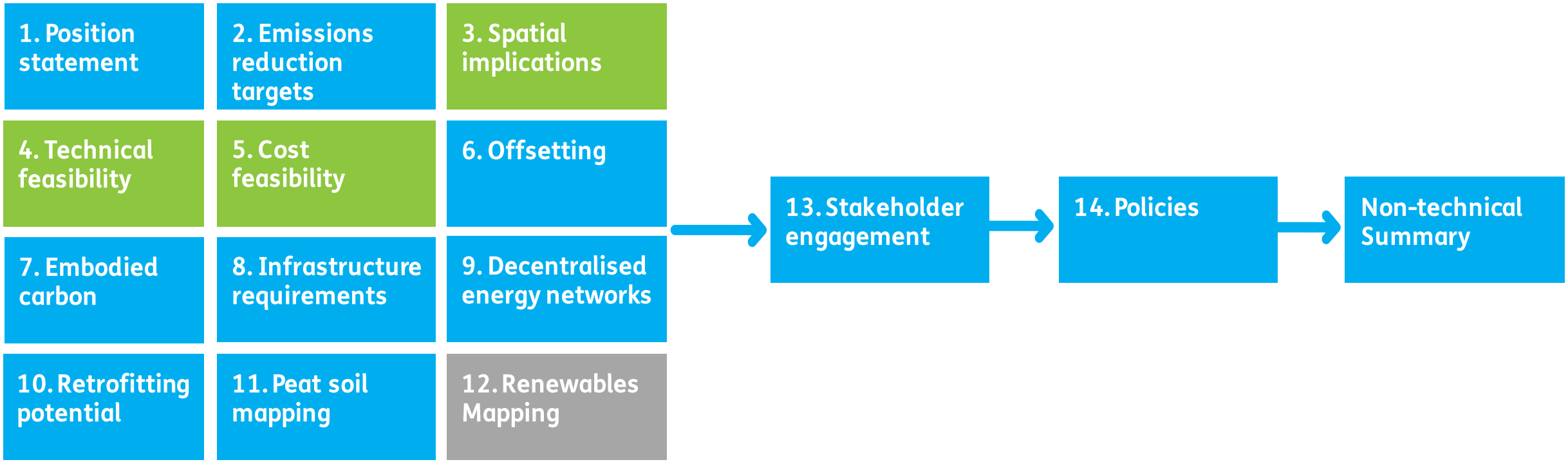
Draft plan consultation will likely be in 2023.

https://consultations.greatercambridgeplanning.org/greater-cambridge-local-plan-preferred-options/supporting-documents



Building an Evidence Base for Net Zero Carbon

for Greater Cambridge and Central Lincolnshire



Spatial Implications

Spatial implications

Modelling the carbon from growth

TASK B: 2 - Spatial model summary page

Bioregional | mode transport planning | Etude

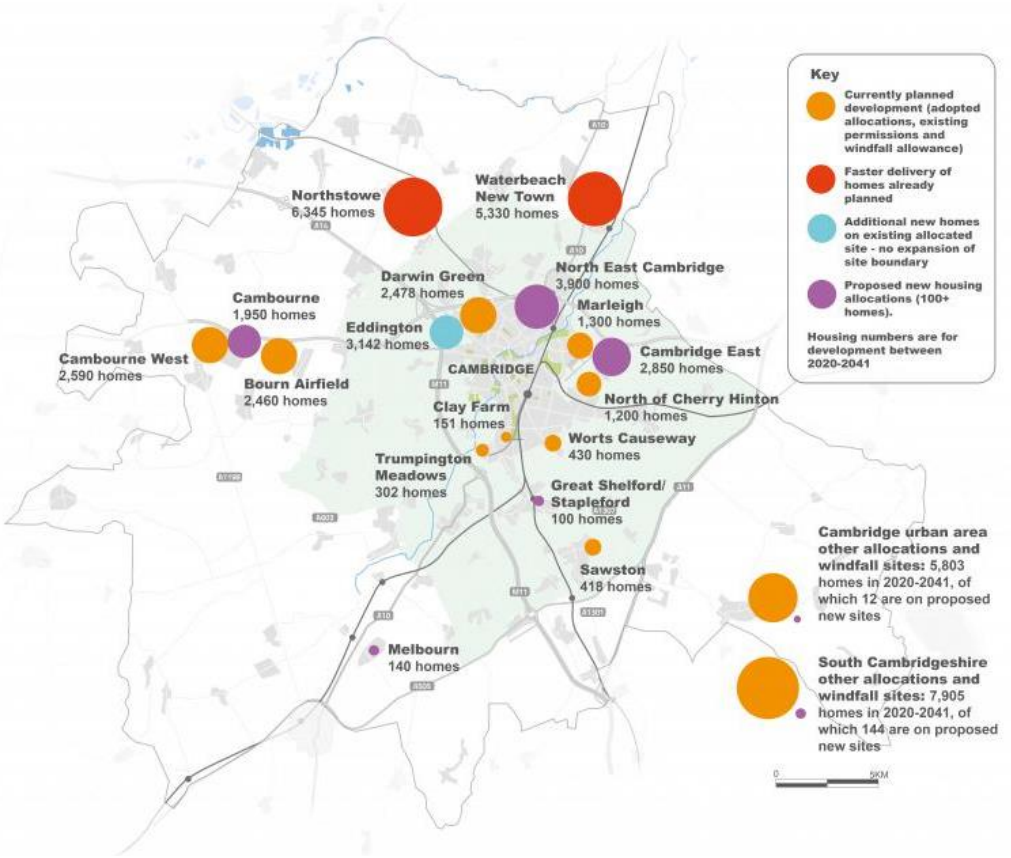
This page contains the summary results of the four spatial models

Total cumulative impact of new development in all four spatial locations combined, based on development sizes set out in row 12:

44,241 tCO2e

Reference year - 2030

	Category 1: Urban – densification	Category 2: Edge of city – inside	Category 3: Edge of city – outside	Category 4: Dispersal – new settlements	Category 5: Dispersal – villages	Category 6: Dispersal – public
Specify the development size	27	0	0	0	72	144
Assumed development density	71	40	40	40	30	40
Toggle to zero to adjust density manually	1	1	1	1	1	1
Manually enter density (check row 16 is zero)						
Apply best in class domestic space heating standard	1					
Apply best in class non-domestic space heating star	1					
Replace all domestic gas boilers with heat pumps	1					
Replace all non- domestic gas boilers with heat pump	1					
On site renewable energy generation - PV	1					
Embodied carbon reduction over LETI baseline	40%					
Performance gap impact - level of mitigation	Part mitigation					
Select the year of assessment to adjust carbon facto	2030					
Transport: Business as usual and potential	Potential - increased sustainable travel initiatives					
EV vehicle ownership assumed - private sector only (	10% EV					



Spatial implications

Modelling the carbon from growth

Spatial Categories

1. Densification of existing urban areas
2. Edge of Cambridge: Outside Greenbelt
3. Edge of Cambridge: Greenbelt
4. New settlements
5. Villages
6. Public transport corridors

Data required

1. Typical development typologies, mix and density
2. Associated non-residential building and infrastructure
3. Transport options across modes – walk, cycle, public, private
4. Locally specific operational carbon emissions for
   a. Transport
   b. Buildings
5. High level embodied carbon data

Spatial implications

Modelling the carbon from growth

Spatial Categories

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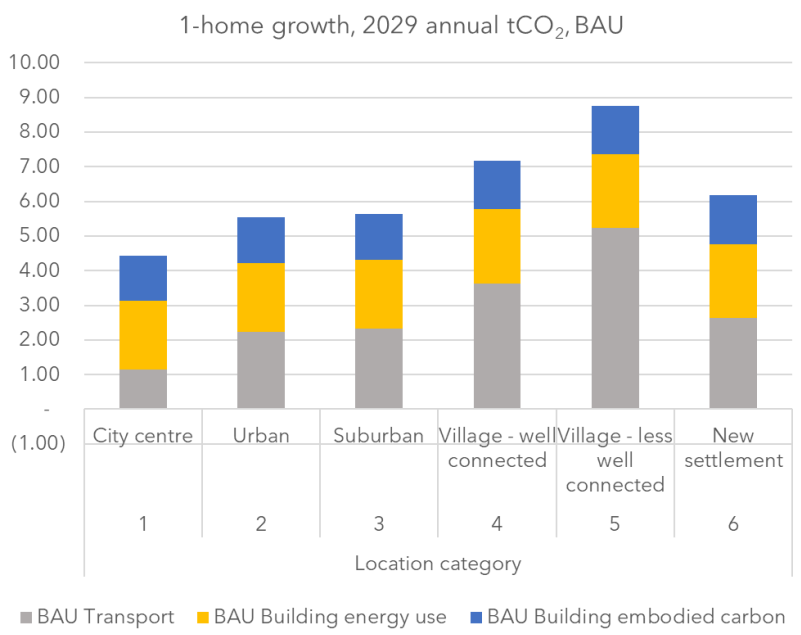
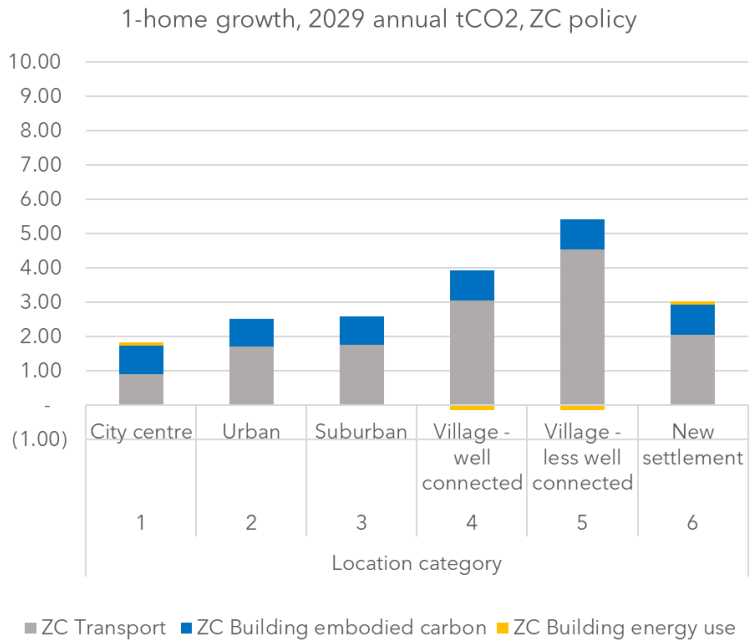
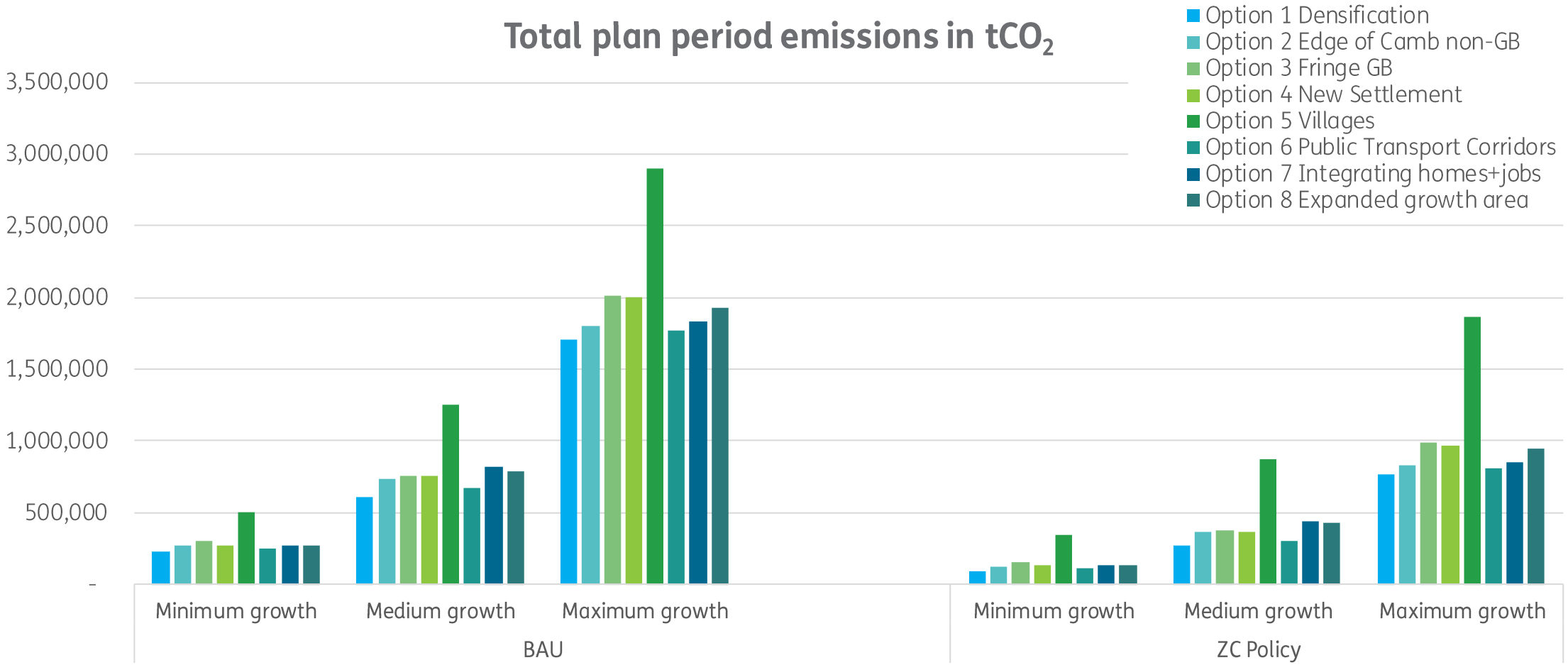




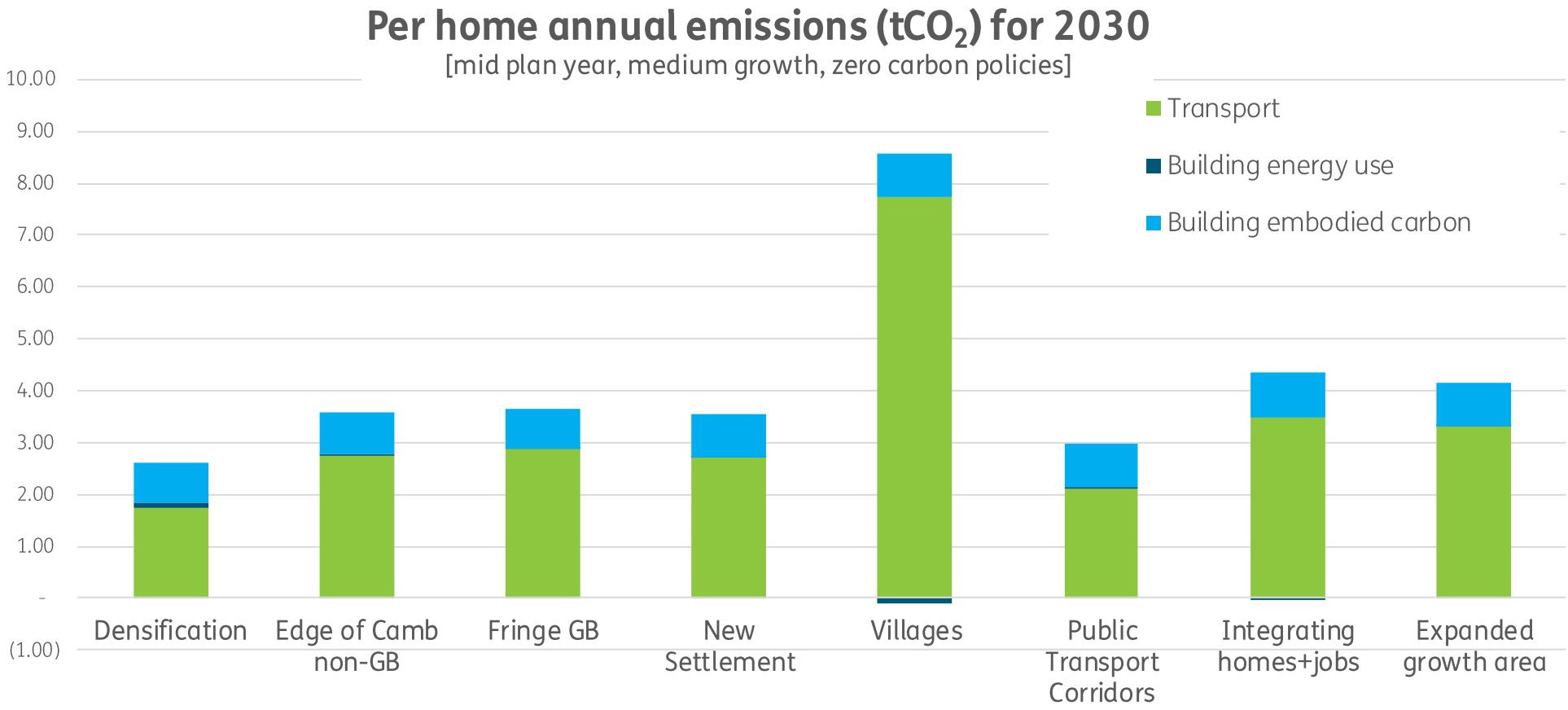
Spatial implications

Modelling the carbon from growth



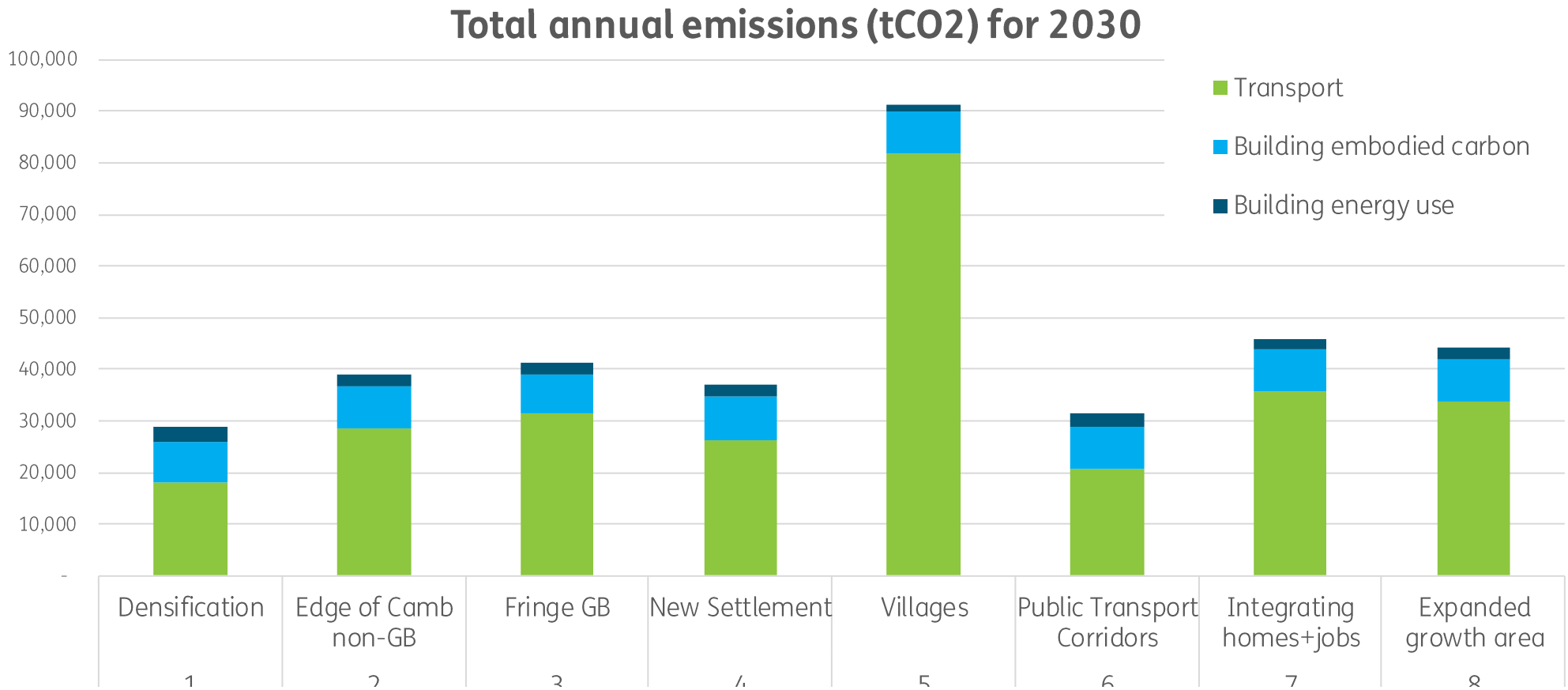
Spatial implications

Modelling the carbon from growth



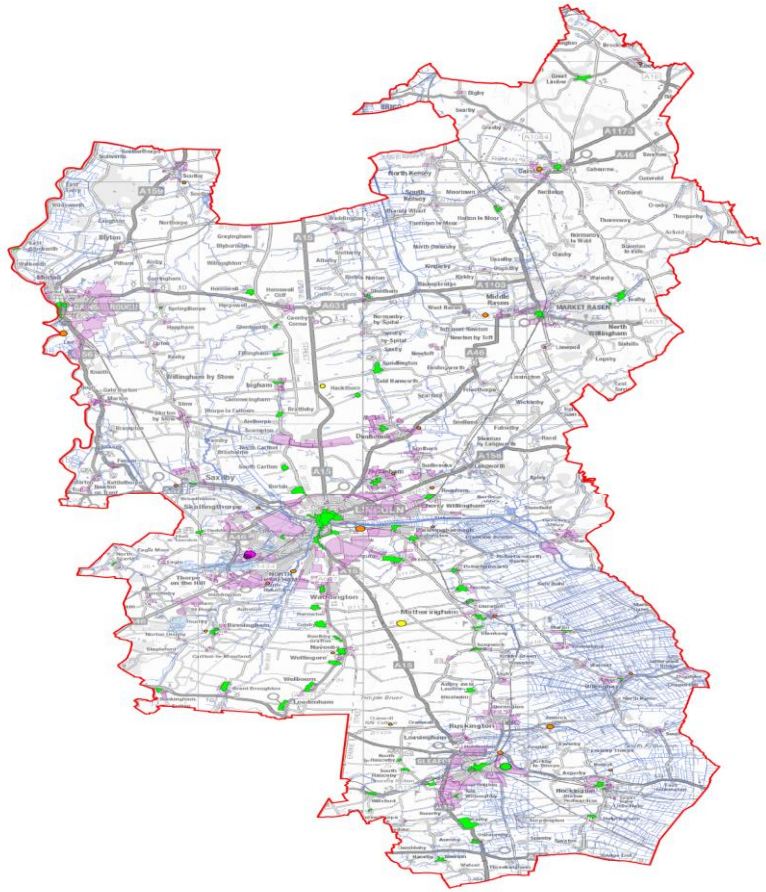
Spatial implications

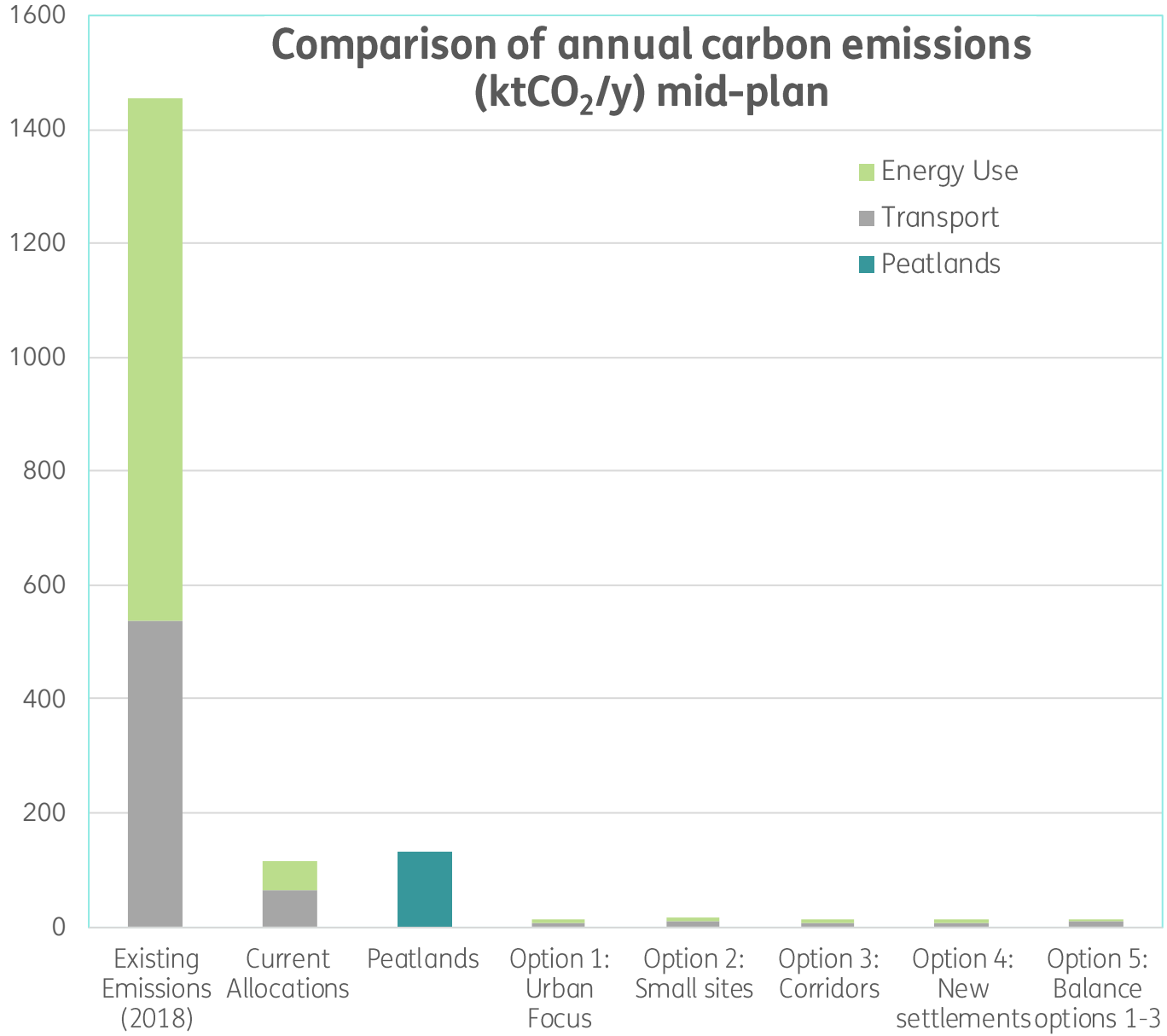
Modelling the carbon from growth



Spatial implications

Modelling the carbon from growth





Technical and Cost feasibility

Technical and Cost feasibility

Building level carbon and cost

1. Energy efficiency

New buildings must use energy efficiently if they are to achieve net zero carbon emissions. This can be measured using two key metrics:

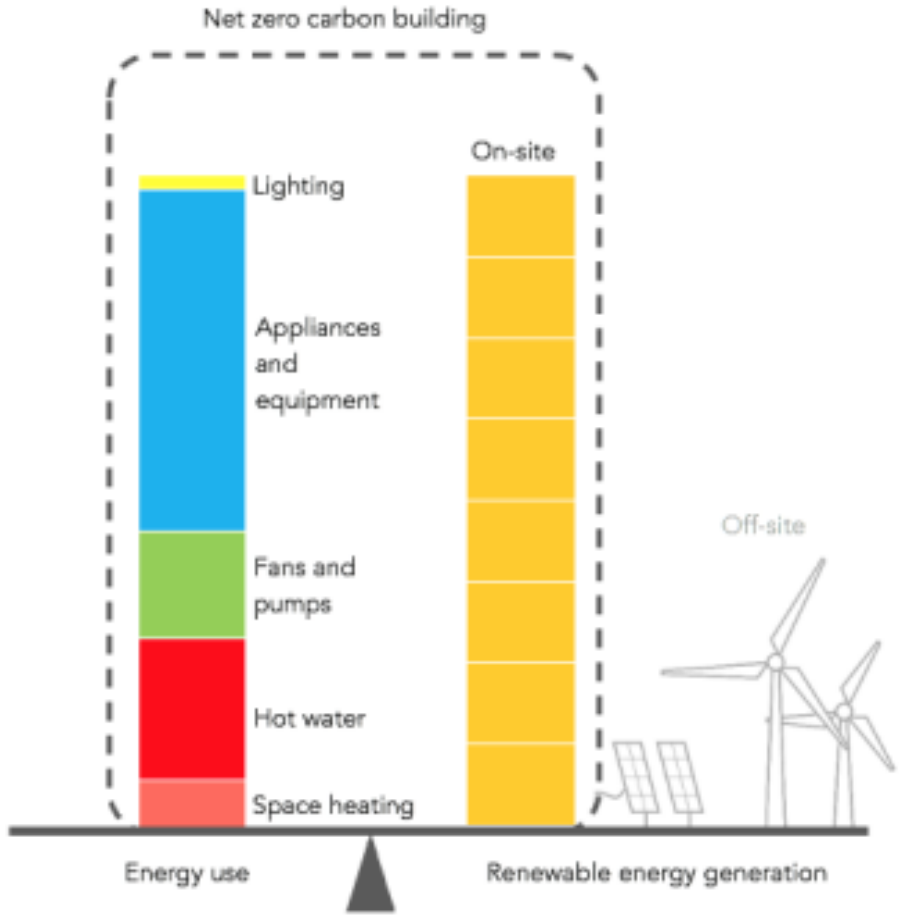
- **Space heating demand**, which is a measure of the thermal efficiency of the building. For a net zero carbon building it should be around 15-20 kWh/m^2/yr.
- **Metered energy use**, which is a measure of the total energy consumption of the building including the heating system, hot water, ventilation, appliances and lighting. For most buildings it should be around 35-65 kWh/m^2/yr, though this varies by type.

2. Low carbon heating

Low carbon heat sources are clearly a fundamental requirement of any net zero carbon building. In practice this means space heating and hot water should be provided by heat pumps and/or direct electrical heating. No combustion of carbon containing fuels to produce heat should take place.

3. Renewable energy

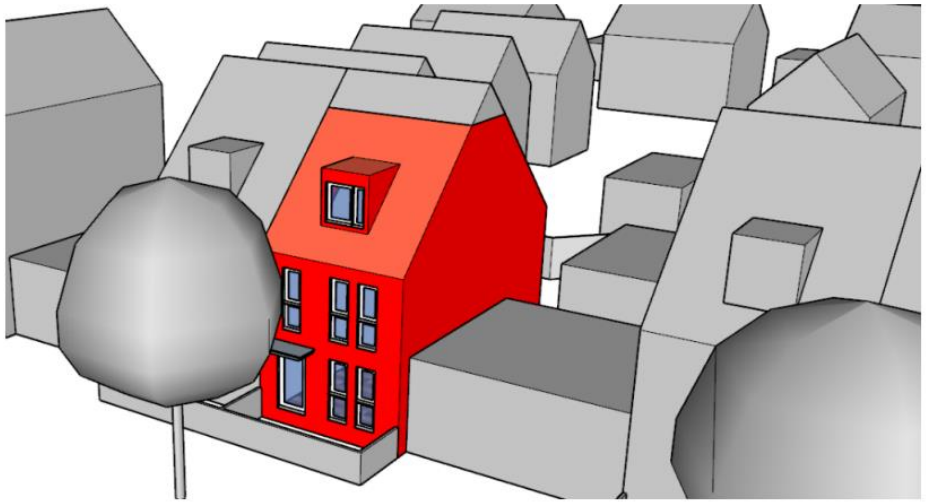
Renewable energy generation should be at least equal to energy use of the building for a building to qualify as Net Zero Carbon. This is straightforward to achieve on site for most buildings through the use of solar photovoltaic panels, though some buildings will need to invest in additional off-site renewable energy generation.



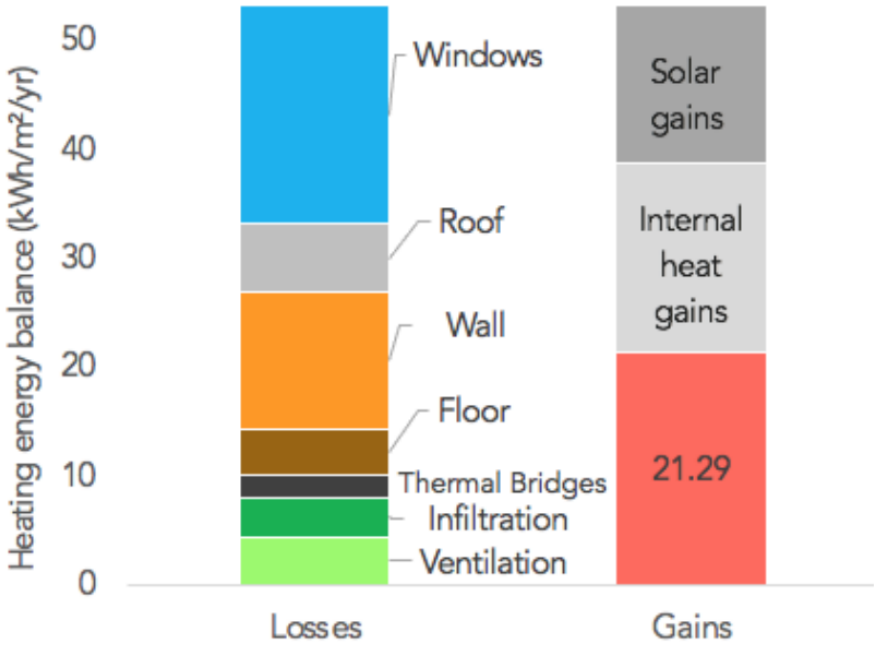
Technical and Cost feasibility

Building level carbon and cost

1) Model representative consented buildings using PHPP



2) Improve the fabric to acceptable performance



Technical and Cost feasibility

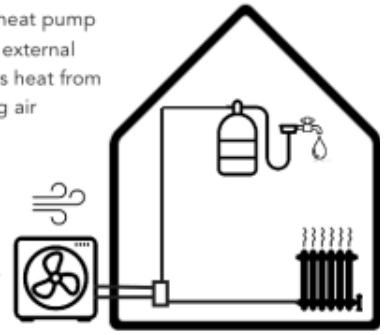
Building level carbon and cost

3a) Apply low carbon heating – heat pump

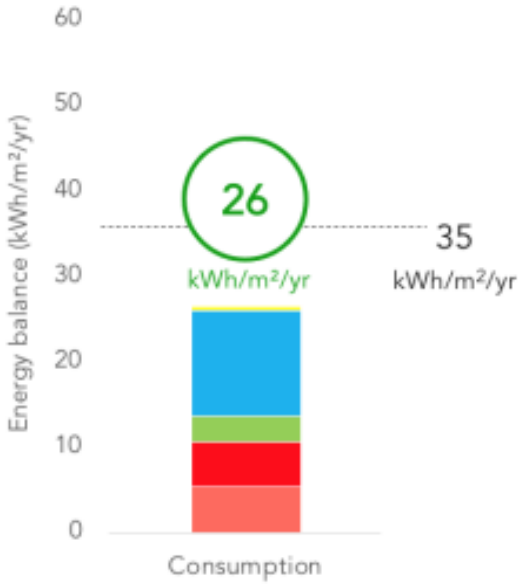
Air source heat pump

Air source heat pump located on external wall gathers heat from surrounding air

The heat pump alternates between providing space heating and hot water in the dwelling.



Heating system	Air source heat pump	e.g. 5kW Mitsu Ecodan
Hot water cylinder	150 litres with losses < 1.0 kWh/day	e.g. Mitsubishi cylinder
Emitters	Wet heating system 2 radiators	e.g. Stelrad Softline K2

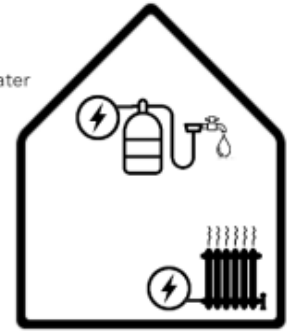


3b) Apply low carbon heating – direct electric

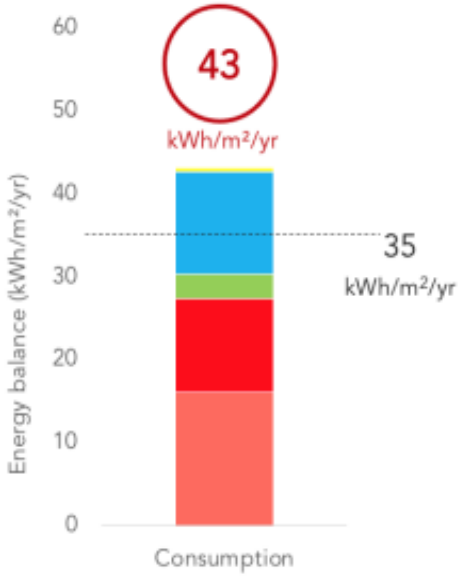
Direct electric heating

Domestic hot water is provided through an electric immersion heater in a hot water tank.

Space heating is provided by direct electric radiators.



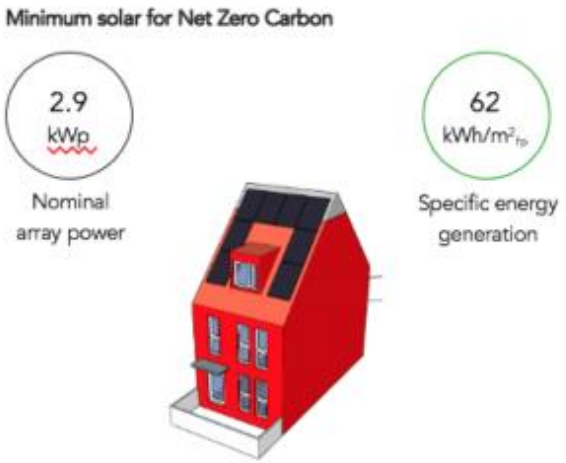
Heating system	Direct electric heating	
Hot water cylinder	100 litres with losses < 0.8 kWh/day	e.g. Dimplex ECSd
Heat Emitters	3 panel heaters	



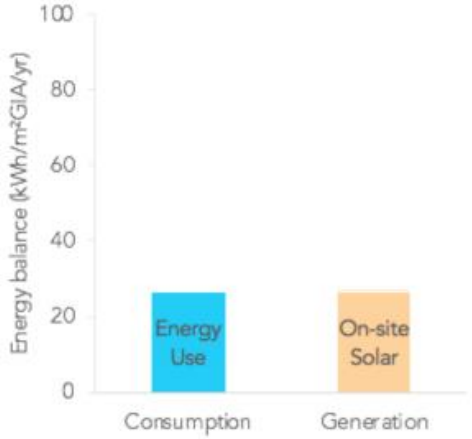
Technical and Cost feasibility

Building level carbon and cost

4a) Apply PV on current layout

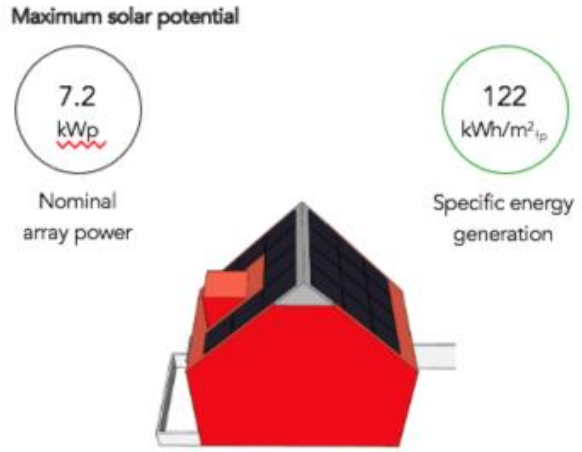


8 x 380W solar photovoltaic panels would be sufficient to generate 28 kWh/m2/yr and therefore achieve Net Zero Carbon

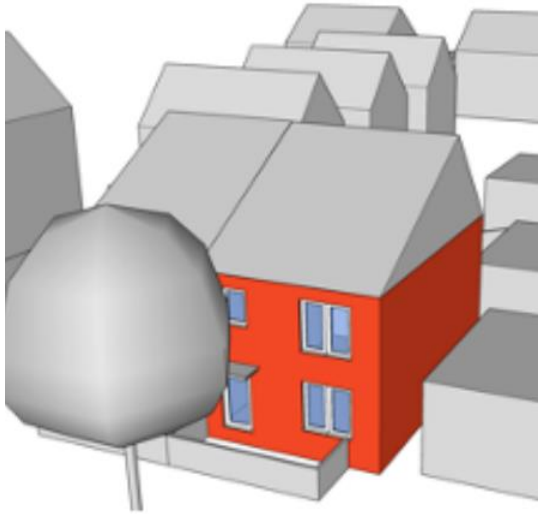


Net zero energy balance: *The house can generate as much solar electricity as it consumes with a South West facing 8 panel solar array.*

4b) Sensitivity analysis – orientation and form factor

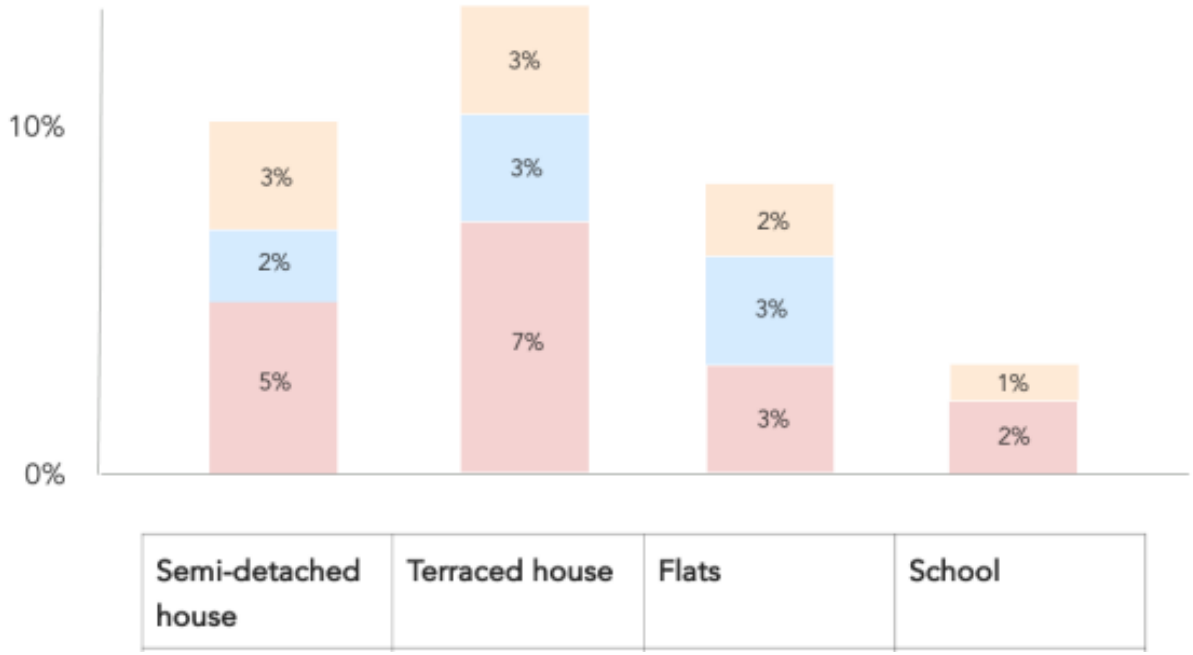


20 x 360W solar photovoltaic panels would enable the house to be energy positive if in an East-West orientation. Solar generation would be 195% of annual energy use.



Technical and Cost feasibility

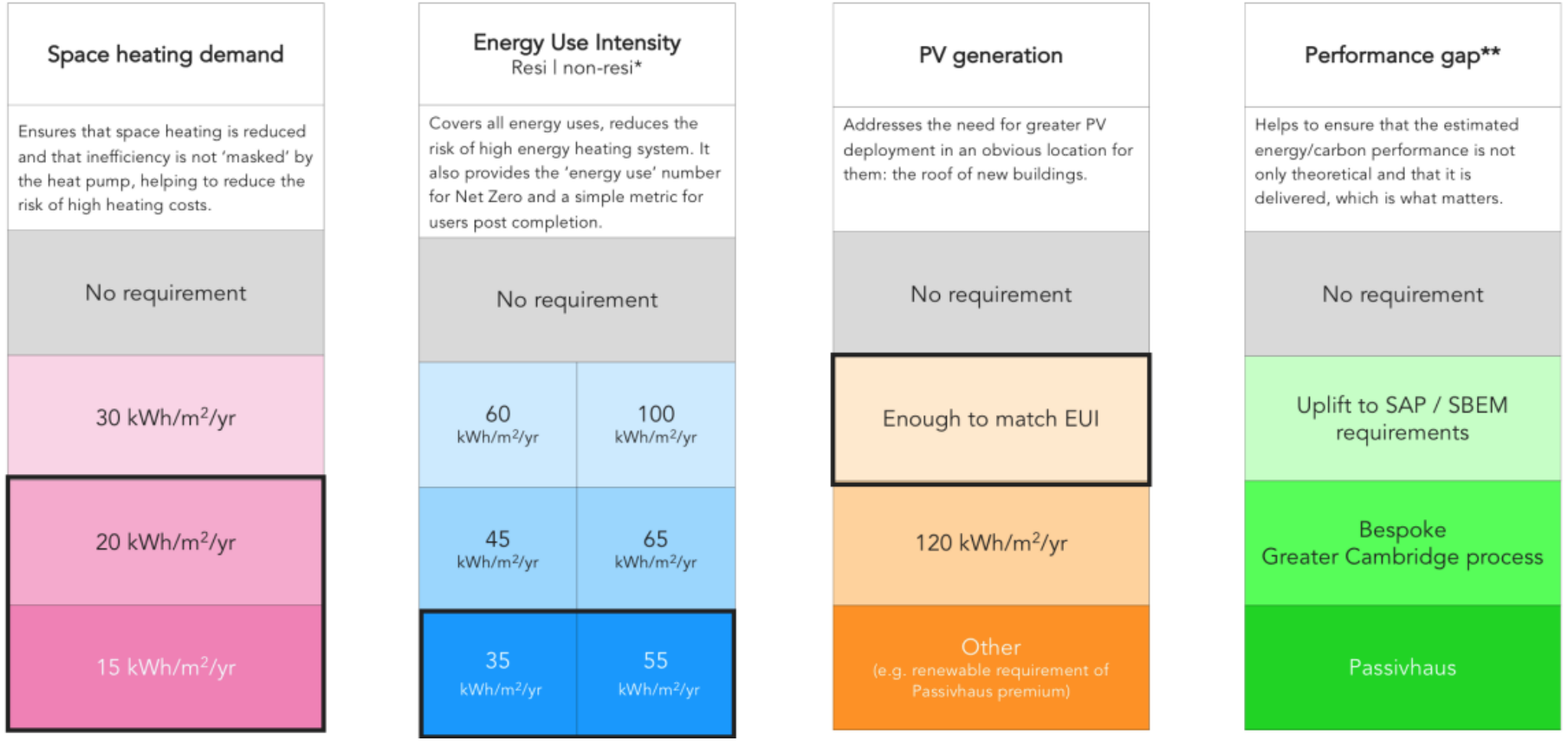
Building level carbon and cost



	Semi-detached house	Terraced house	Flats	School
Total capital cost uplift	10%	13%	7%	3%
Building fabric and ventilation	5%	7%	3%	2%
Heating system	2%	3%	2%	0%
Renewable energy generation with PVs	3%	3%	2%	1%
Running costs/yr	-68%	-63%	-58%	-63%

Figure 5.2 - Summary of modelled cost uplifts for four modelled typologies: by building fabric and ventilation, heating system and renewable energy provision. Uplifts are relative to the baseline building and reflect the cost of additional materials required to meet specs. Running costs are relative to running costs of the baseline building, and include for savings and returns from photovoltaic panels.

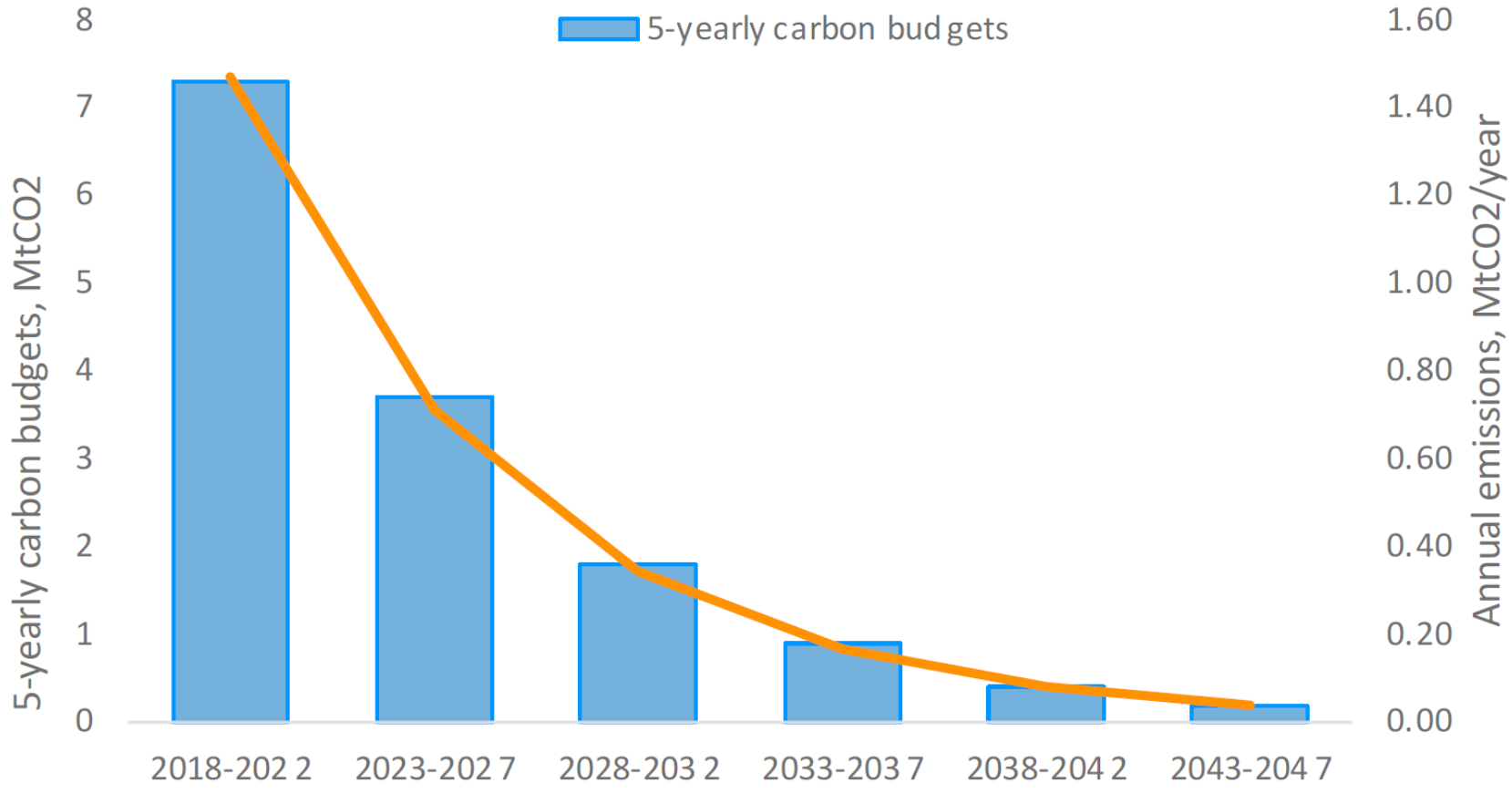
The right mix of policy requirements



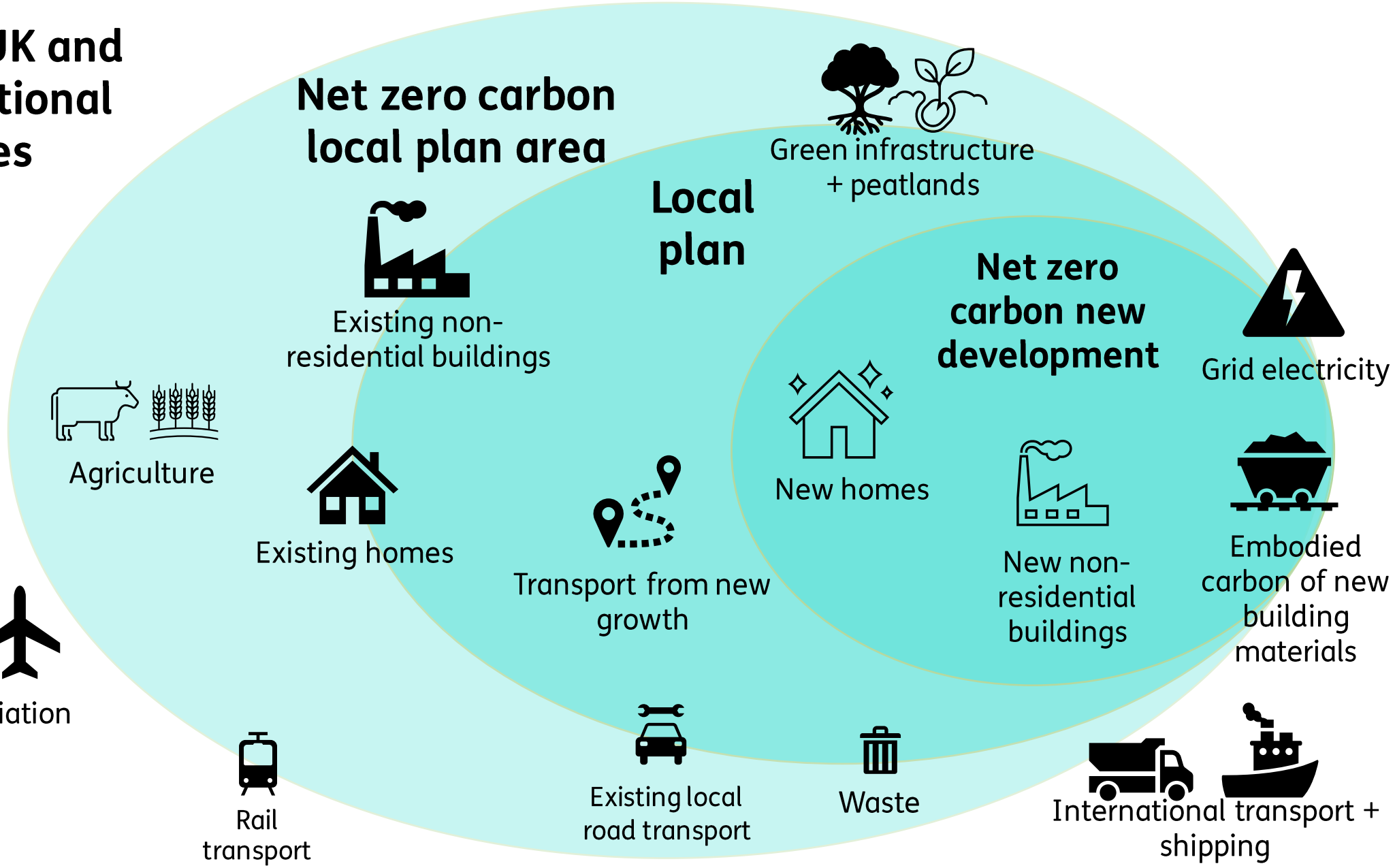
Carbon reductions and scope of influence

Carbon Reductions and Plan Making

Rate of reductions vs scope of influence and control



Wider UK and international activities



How can a local plan act on net-zero buildings?

Powers

Planning & Energy Act 2008

"Energy efficiency standards" that exceed those of building regs

"Reasonable" requirements for a proportion of energy used … to be from low-carbon or renewable sources "in the locality"

Town & Country Planning Act 1990

S106 Planning Obligations

Used in several precedents to deliver carbon offsetting.

Local Development Orders

Can bring forward renewables, low- carbon energy networks, existing building energy efficiency retrofit

National Planning Policy Framework (2021)

Location, orientation & design of new development

Positive strategy for renewable energy (do not require demonstration of need for this energy)

Planning Practice Guidance

Reduce need to travel; sustainable transport

Create opportunities for renewables ≤50MW

Promote low-carbon energy efficient design in new buildings

(unrestricted in non-residential)

How can a local plan act on net-zero buildings?

Potential Constraints

Planning & Energy Act 2008

"Energy efficiency standards" means standards that are "set out or endorsed" by Sec of State

Likely to mean Part L SAP calculation methods

Now being tested by emerging precedents

Written Ministerial Statement 2015

Local carbon reduction requirements should be no more than Code for Sust Homes Level 4 (19% reduction on Building Regs 2013)

BUT: already exceeded by London, Reading, Milton Keynes, and new Part L

AND: Statement was written in relation to legislation that was never enacted

NPPF (2021)

Requirements should "reflect the Government's policy for national technical standards"

Feasibility and viability are valid reasons to not comply with local requirements for decentralised energy

Planning Practice Guidance

Repeats NPPF re 'national technical standards'

Local standards should be:

- **Based on robust credible evidence**
- **Paying careful attention to viability**

How can a local plan act on net-zero buildings?

Emerging evidence...

NPPF consultation response 2018

“To clarify, the Framework does not prevent local authorities from using their existing powers under the Planning and Energy Act 2008 or other legislation where applicable to set higher ambition.

In particular, local authorities are not restricted in their ability to require energy efficiency standards above Building Regulations.

FHS 2019 Consultation Gov Response 2021

"To provide some certainty in the immediate term, we will not amend the Planning and Energy Act 2008...

... which means **that local authorities will retain powers to set local energy efficiency standards for new homes**."

Examination of the Salt Cross Garden Village Area Action Plan, West Oxfordshire

PINS/D3125/429/7

“we are not satisfied that Policy 2 is either consistent with national policy or justified”

“Redraft the remainder of Policy 2 to remove references to absolute requirements and KPIs that must be met and instead to reframe as standards for consideration as part of an energy statement.”

Ongoing examinations:

LB Merton New Local Plan

Cornwall Climate Emergency DPD

B&NES Partial Update

UK Net Zero Carbon Buildings Standard

UK Net Zero Carbon Buildings Standard

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UK Net Zero Carbon Buildings Standard

The UK's first Net Zero Carbon Buildings Standard. Leading industry organisations BBP, BRE, the Carbon Trust, CIBSE, IStructE, LETI, RIBA, RICS, and UKGBC have joined forces to champion this initiative.

Whilst significant progress has been made in defining what 'net zero' means for buildings in the UK, a process of market analysis showed a clear demand for a single, agreed methodology. The UK Net Zero Carbon Buildings Standard will enable industry to robustly prove their built assets are net zero carbon and in line with our nation's climate targets.

Call for Evidence
Read More

Call for Evidence Webinar

17th November
09.30

BBP Better Buildings Partnership · bre · Carbon Trust · CIBSE · The Institution of Structural Engineers · LETI · RIBA Architecture.com · RICS · UKGBC

Thank you

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