



ZERO CARBON HUB

DEFINING ZERO CARBON HIERARCHY (FEES, CARBON COMPLIANCE AND ALLOWABLE SOLUTIONS)

North West Responding to Climate Change - Supported Learning Group
18th May, 2011

Alex Uregian



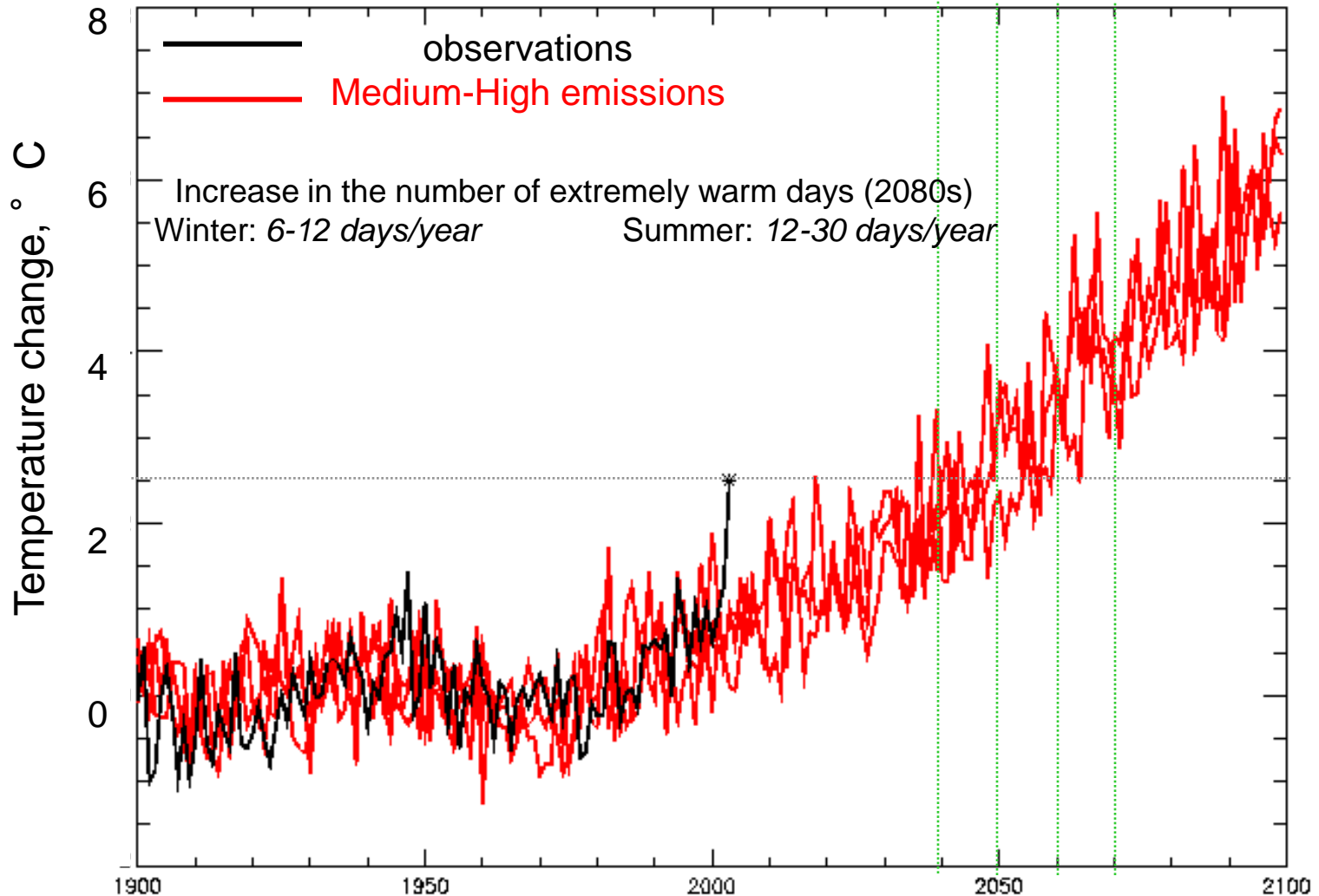


AGENDA

- The effects of Climate Change
- Government Policy & The Zero Carbon Hierarchy
- The Zero Carbon Hub
- Case Studies – Ventilation and Planning
- Energy Policy
 - Fabric Energy Efficiency Standard
 - SAP
 - Carbon Compliance Standard
 - Allowable Solutions

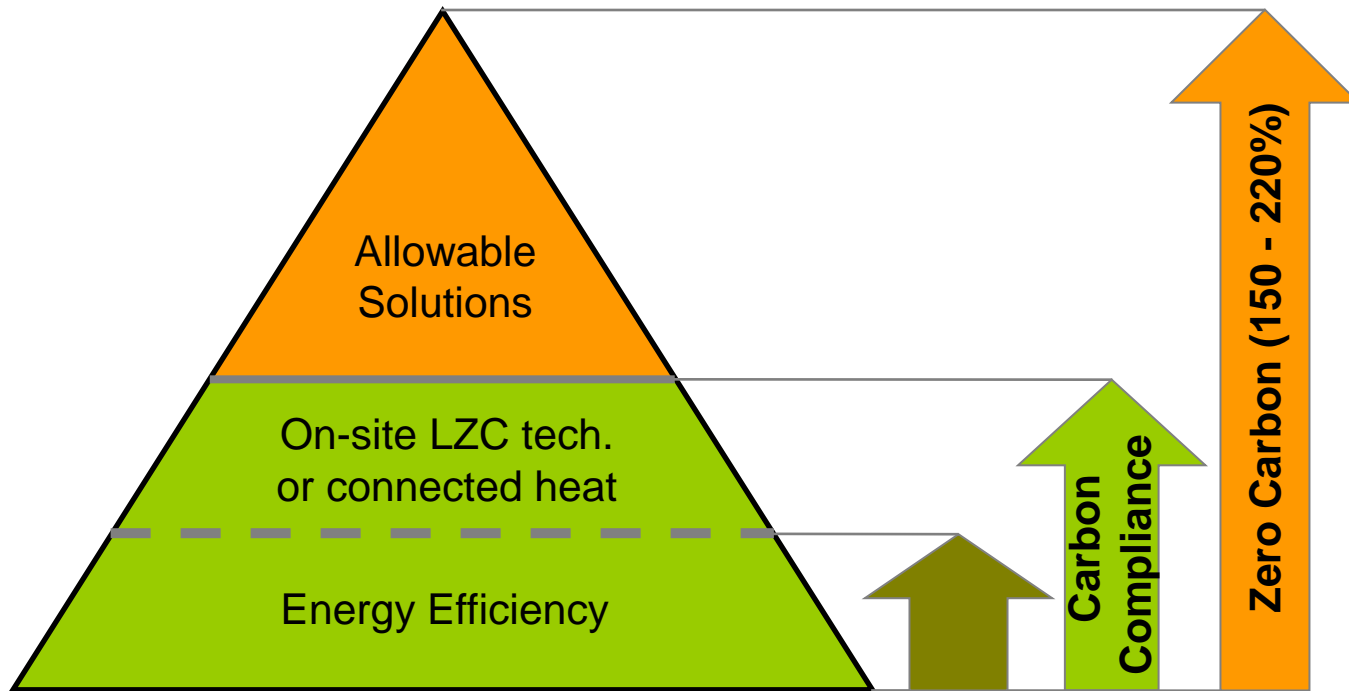


THE EFFECTS OF CLIMATE CHANGE





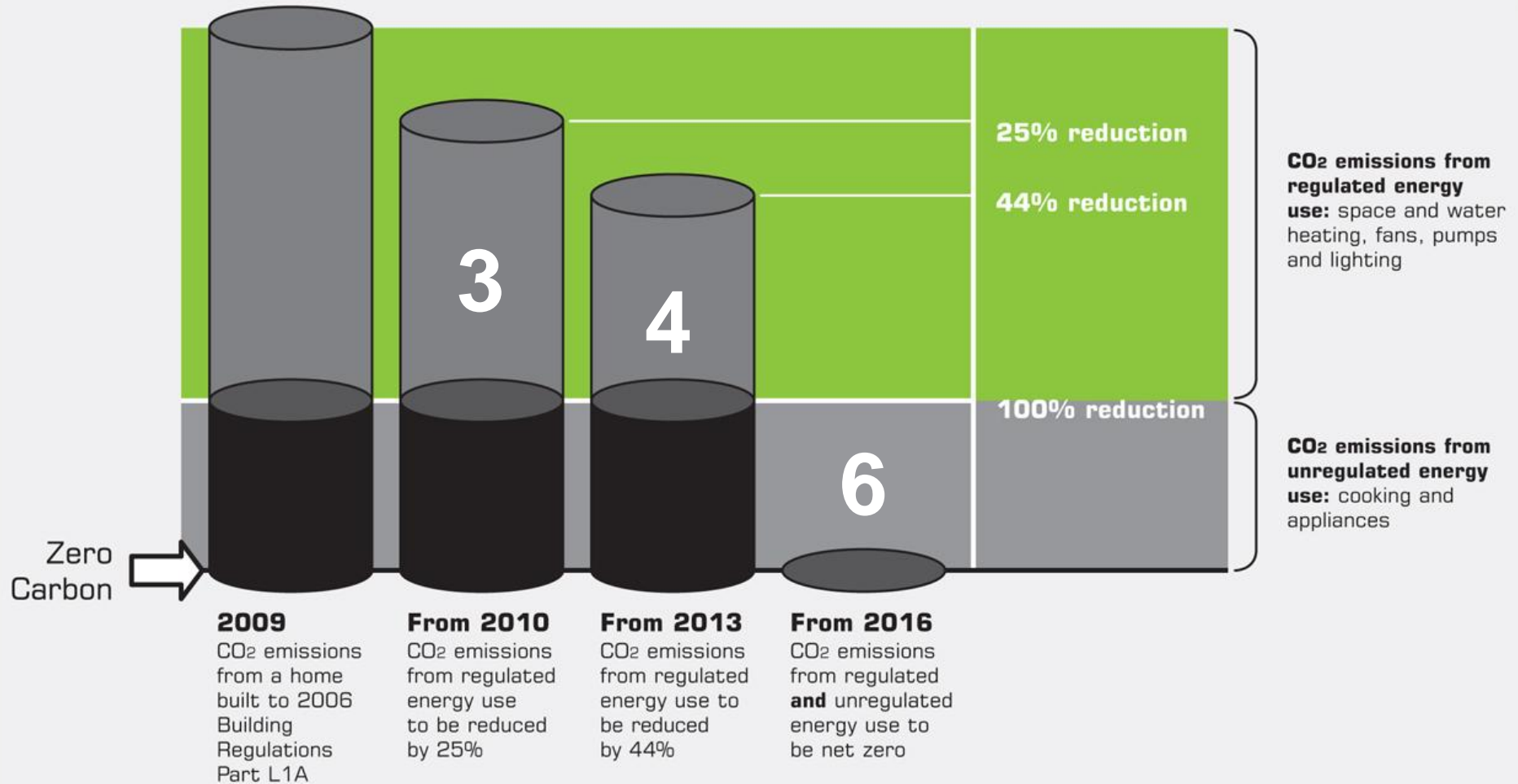
ZERO CARBON HIERARCHY



Zero Carbon Hierarchy



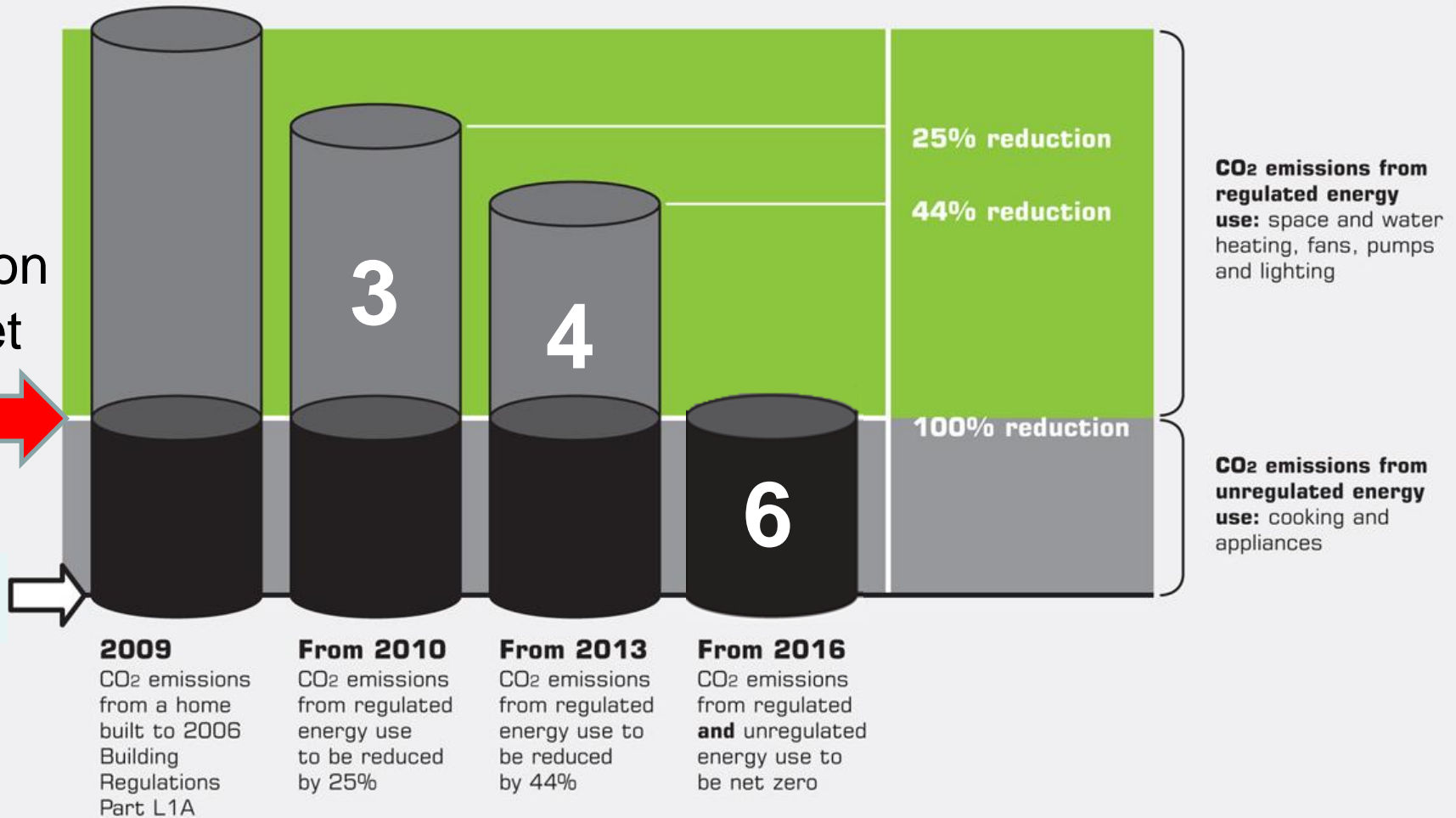
JOURNEY TO ZERO CARBON HOMES





JOURNEY TO ZERO CARBON HOMES

The new Zero Carbon Target





ROLE OF THE ZERO CARBON HUB

PURPOSE AND STRATEGIC OBJECTIVES

Facilitate the mainstream delivery of low and zero carbon homes

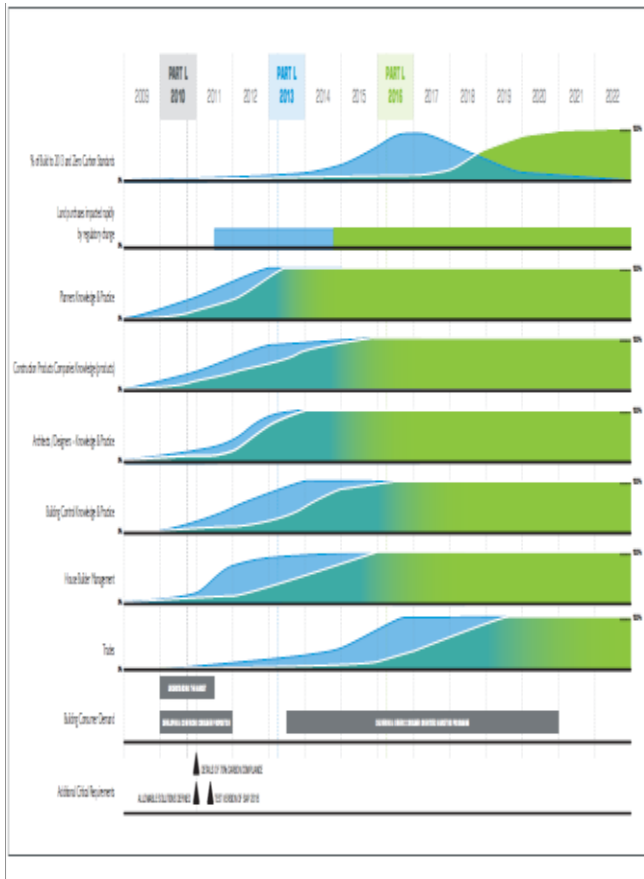
- Provide leadership and create confidence
- Reduce risk and clear obstacles
- Disseminate information

New Domestic	New Non - Domestic
Existing Domestic	Existing Non - Domestic



TIMELINE and HUB CORE ACTIVITIES

- The Timeline is used to report to the 2016 Taskforce



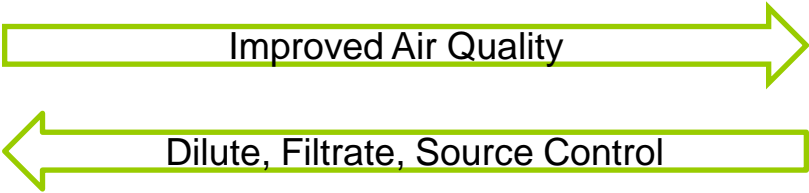


VENTILATION & INDOOR AIR QUALITY GROUP (VIAQ)

- OBJECTIVES**
- To generate knowledge for industry
 - To reduce risk by investigating unintended consequences
 - To investigate effective solutions
 - To assist in the development of building regulations

COLLATE, ANALYSE, & UNDERSTAND INFORMATION ON

Ventilation	
TYPES OF	
MVHR	Solar Hat
Passive Stack	MV
Natural Ventilation	



Indoor Air Quality	
IS AFFECTED BY	
Mould Growth	Gases
In/Outdoor Pollutants	
Humidity	Condensation

THEIR (POTENTIAL) IMPACT ON....	
Energy Use	Occupant behaviour
Humidity, Condensation, and Mould Growth	
Consumer Choice	Occupant Health



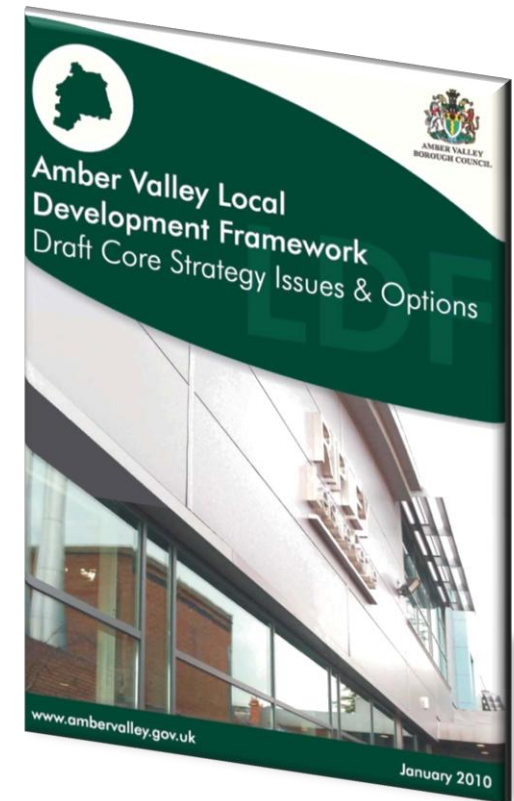
Planning Database

Creating the database...

- Reviewed existing research
 - CLG, TCPA, academia, industry professionals
- Built off existing work in collaboration with above.

Methodology

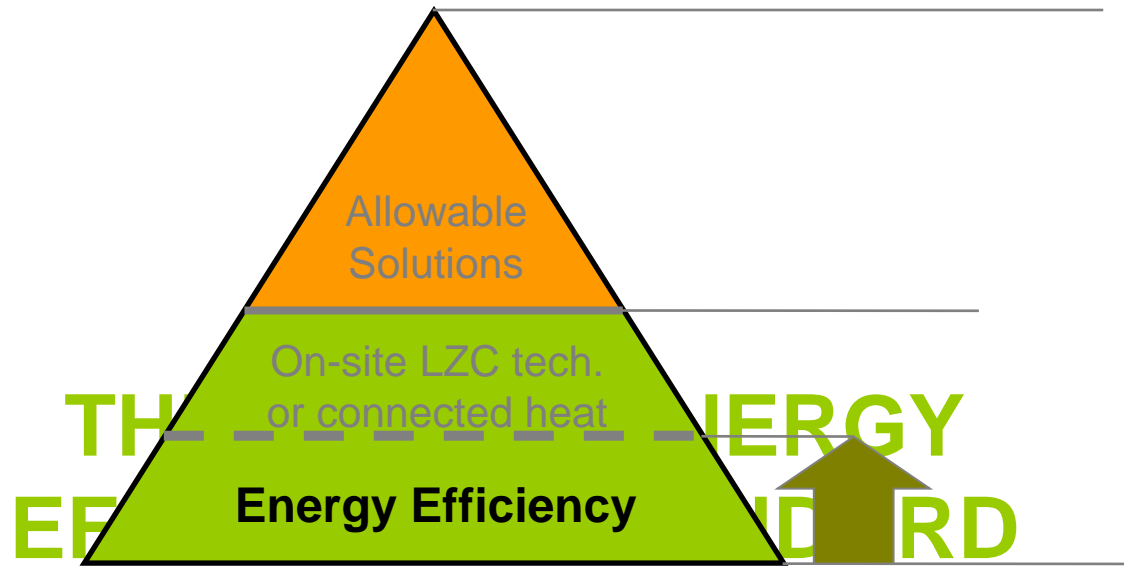
- Reviewed online planning documents of each local authority in England referencing CO2 reduction policies and other sustainability benchmarks.





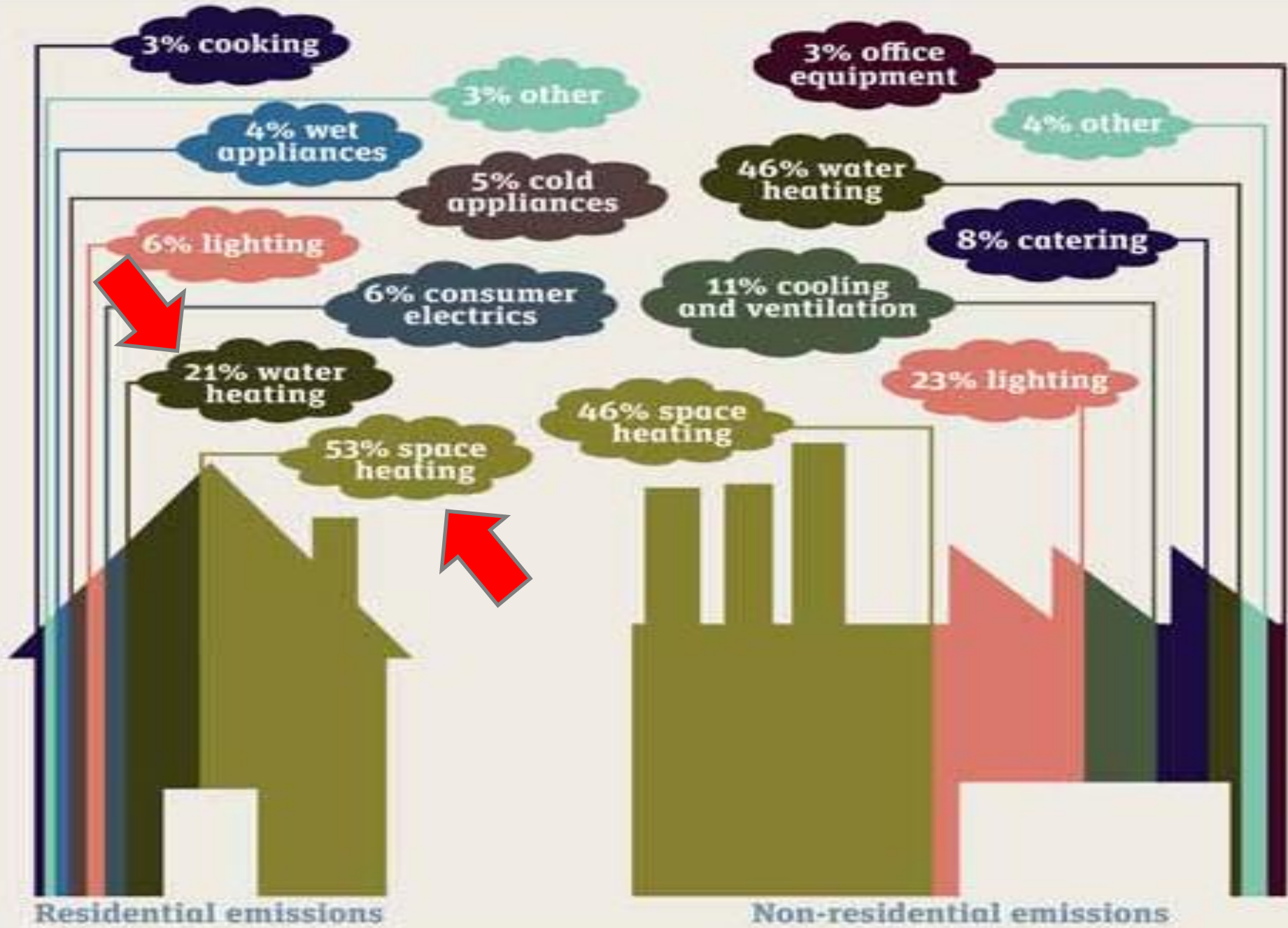
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Zero Carbon Hierarchy

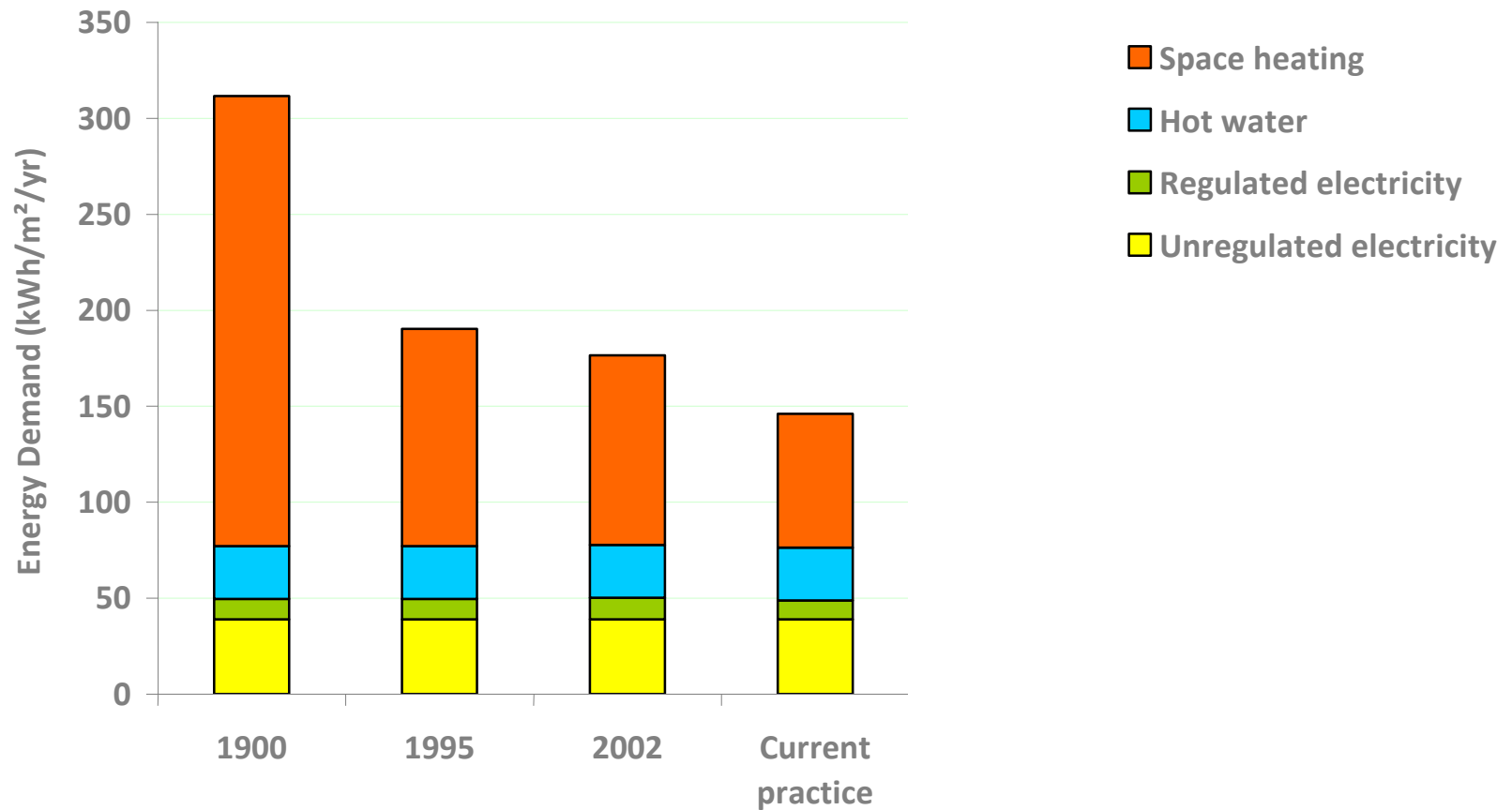




Culprits: most CO2 from buildings stems from heating. Houses are particularly energy-inefficient

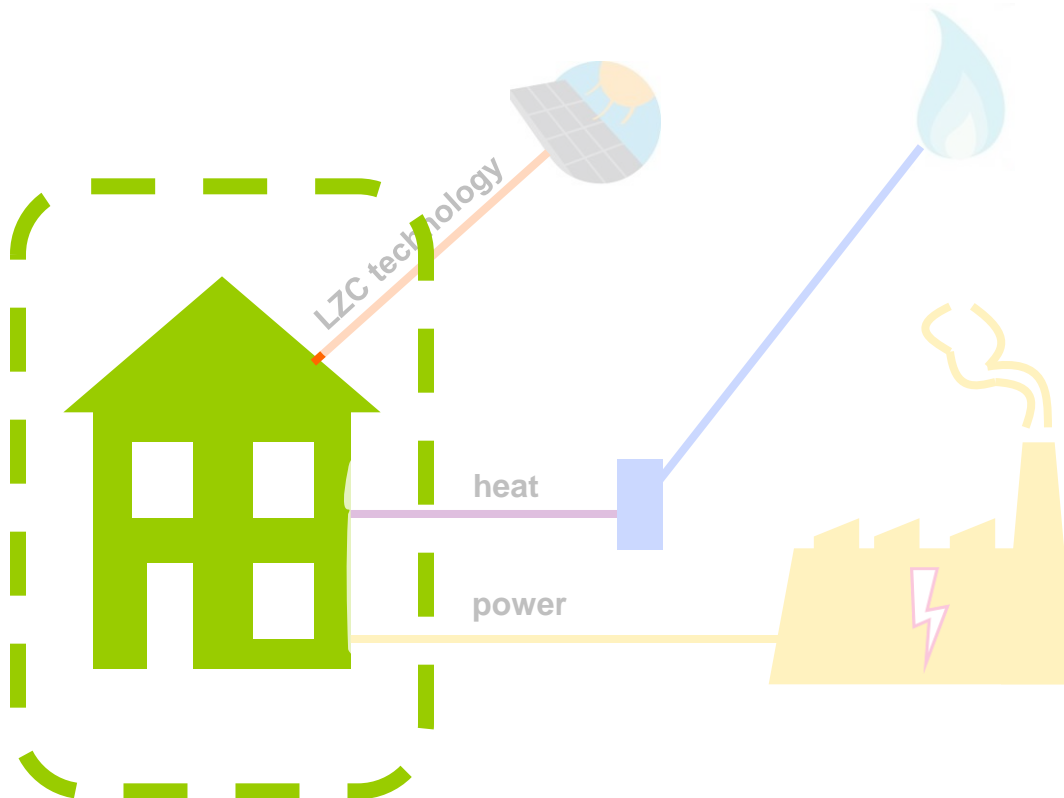


What this means Energy demand reduction





Scope of 'Energy Efficiency'



Energy Efficiency Standard

- Building fabric U-values
- Thermal bridging
- Air permeability
- Thermal mass
- Solar, metabolic, lighting & appliance gains

- kWh/m²/yr
- Space heating + Space cooling demand



Wall Sections



Concrete



Brick and Block



SAP Beyond 2010

Thermal modelling & overheating

CO₂ Emission factors

Building Performance

OVERVIEW

Overview of findings and recommendations

The Task Group's summary of the Topic Work Group reports

THIS REPORT

TOPIC 1

Carbon compliance tools considerations

Looking at modelling tools currently available both here and abroad and considering key characteristics, what they assess and the trade off between accuracy and ease of use.

TOPIC 2

Carbon intensity of fuels

Considering the implications of, and an appropriate response to, the changing carbon intensity of electricity and other fuels.

TOPIC 3

Future climate change

Setting out how projected national and local climate changes could affect energy demand. Exploring for example how the compliance tool should embrace overheating risk.

TOPIC 4

Closing the gap between designed and built performance

How the compliance tool should accommodate (and help reduce) any performance gap between design performance and what is achieved on site.

TOPIC 5

How the performance standard should be expressed

This looks at whether carbon compliance should be expressed as an improvement versus a notional building (as now) or in absolute terms (kg CO₂ emissions per unit area).

The work of the Topic Groups was informed by modelling commissioned on a range of house types, climate assumptions and compliance tools. The aim was not to provide accurate predictions, but rather to identify which, of a range of factors, have the greatest impact on the carbon performance of a new home.

MODELLING

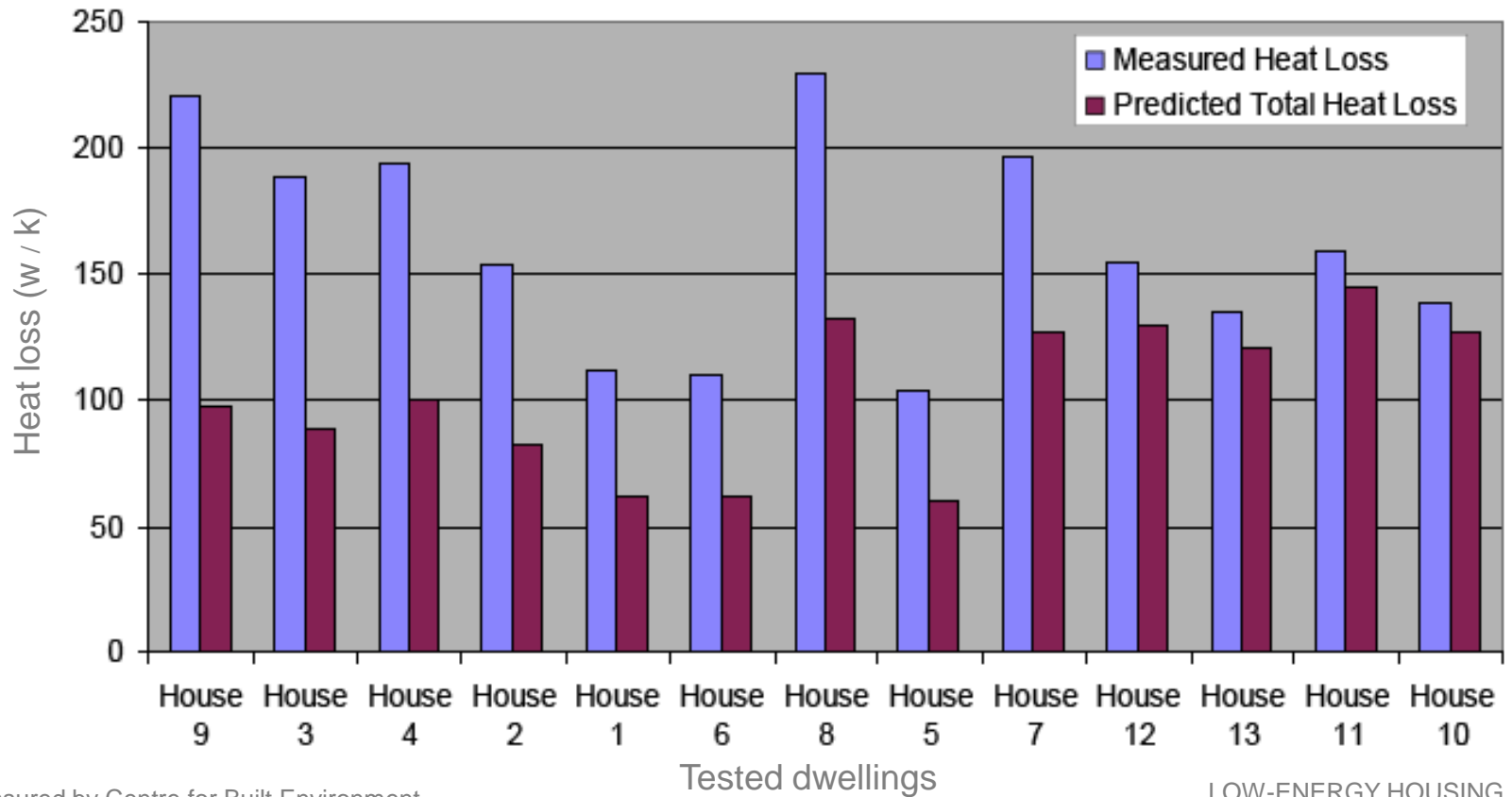
The modelling supporting this review

Sets out the modelling undertaken to support this programme of work.



Design versus Built

Whole house heat loss - Measured Co-heating versus Predicted

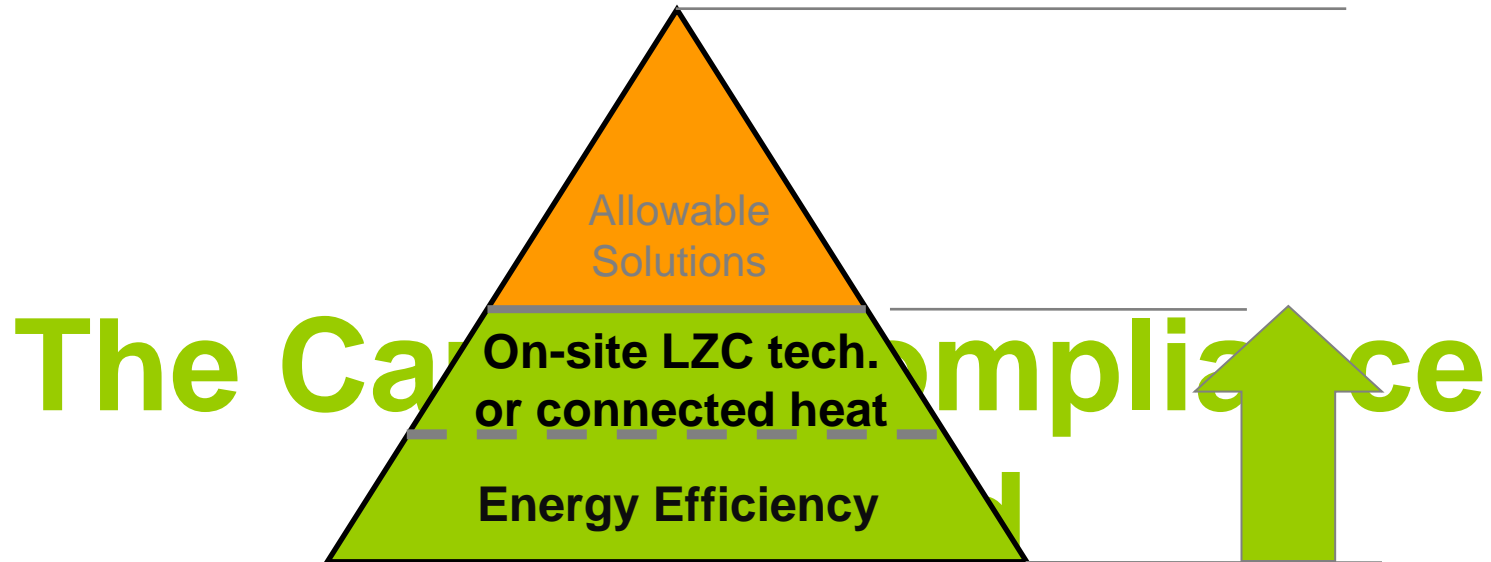


Houses measured by Centre for Built Environment
Leeds Metropolitan University

LOW-ENERGY HOUSING
Joseph Rowntree Foundation



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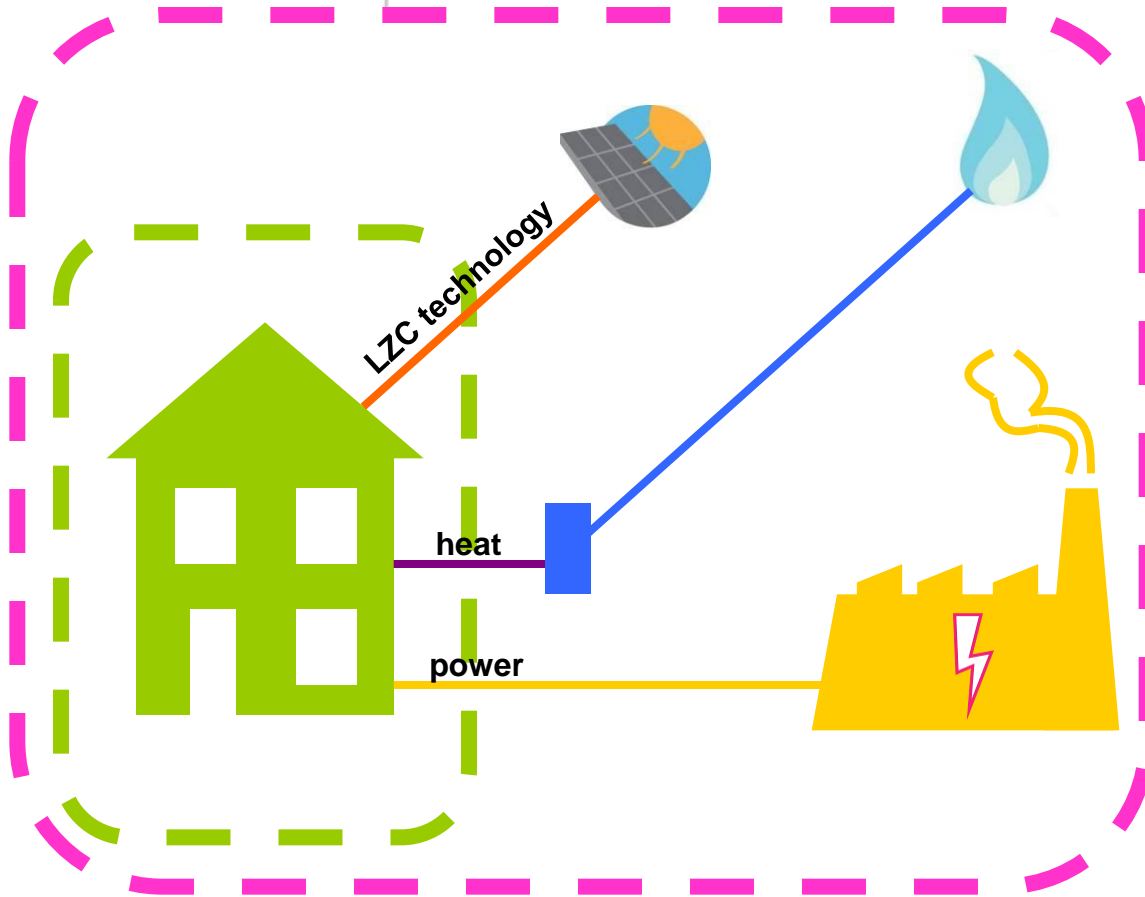


Zero Carbon Hierarchy





Scope of 'Carbon Compliance'



Energy Efficiency Standard

- Building fabric U-values
- Thermal bridging
- Air permeability
- Thermal mass
- Solar, metabolic, lighting & appliance gains

Carbon Compliance Standard

- Heating / cooling appliances (boilers, etc)
- Mechanical ventilation
- Hot water
- Active controls
- Fixed lighting
- **All LZR technologies**



TASK GROUP STRUCTURE

**Carbon Compliance Standard
Task Group**



Evidence and insight

Technical



Policy



Commercial



Carbon modelling work

Main variables

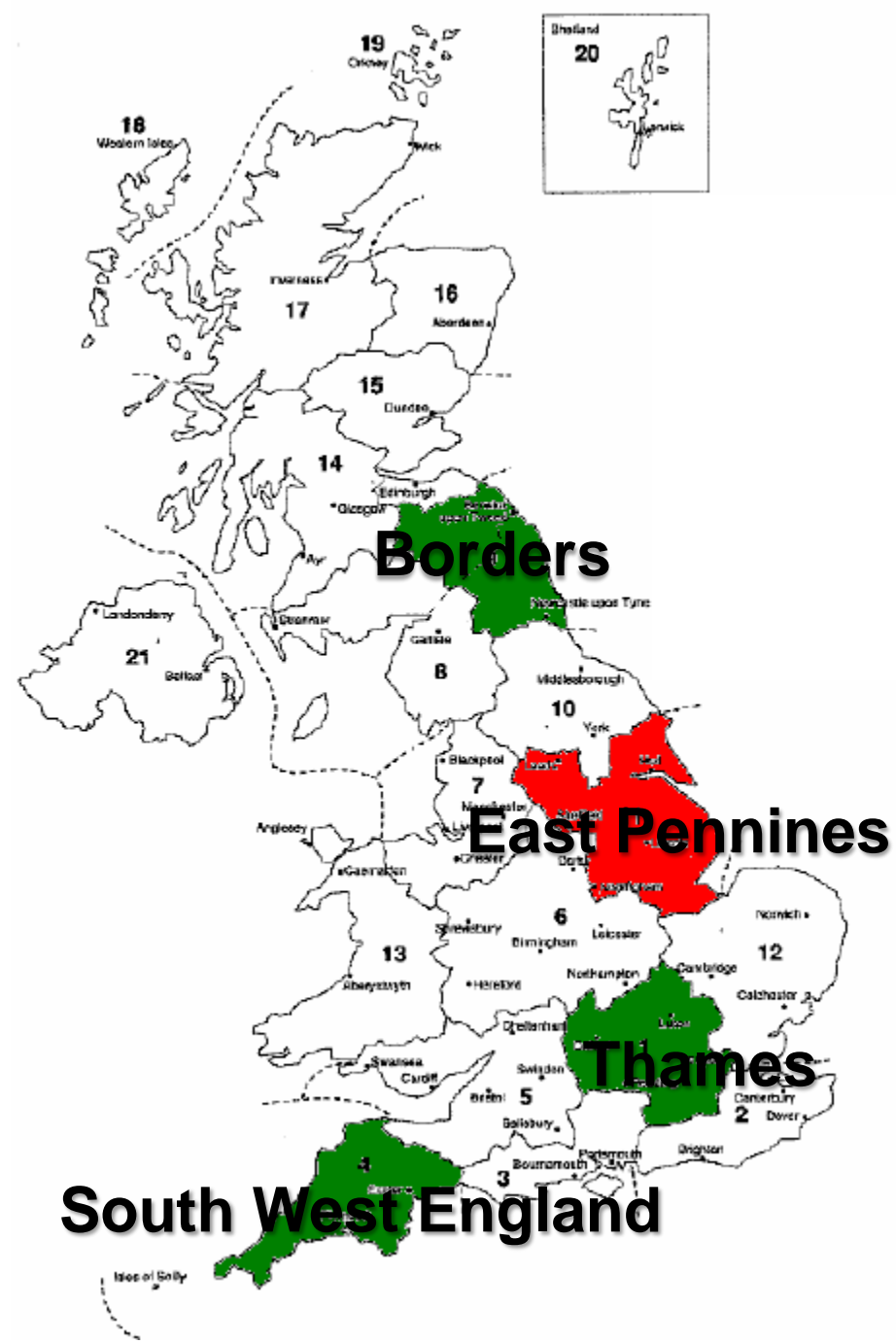
- Dwelling type (x9)
- Fabric specification (x2)
- Technology options (x8)
- Carbon target (x6)
- Location (x4)

Modelling using mSAP

- SAP2009 with the following modifications:
 - 2016 emissions factors
 - Ability to change location



Locations





Translation into Carbon Target (2016 emission factors)

Carbon Target kgCO _{2(e)} /m ² /yr	Approx. % reduction from 2006 Part L BR	Approx. % reduction based on assumptions in Zero Carbon ConDoc
14	44%	
12	52%	
10	60%	
8	68%	
6	76%	70%
4	84%	
2	92%	
0	100%	

2010 BR Compliant = 20 kgCO_{2(e)}/m²/yr

2006 BR Compliant = 25 kgCO_{2(e)}/m²/yr



Development scale

Layouts

Additional Considerations



Site Conditions:

- Access
- Location (regional weather)
- Ground conditions
- Flood risk
- Existing trees, water bodies etc
- Local energy resource – source for biomass, wind conditions etc
- Existing district heating network

Planning:

- Dwelling type mix/ density
- Built form considerations - roof pitch, building height etc
- PV and solar panels
- Local Renewable targets

Site Layout:

- Dwelling types
- Design for solar technologies:
 - Orientation for solar technology
 - Roof pitch
 - Over-shading

Other:

- Localism

Solar technology potential: Medium density site (74 dwellings)



PV Potential:



Within 45 degrees of South
(30%)



Within 45 to 90 degrees of South
(29%)

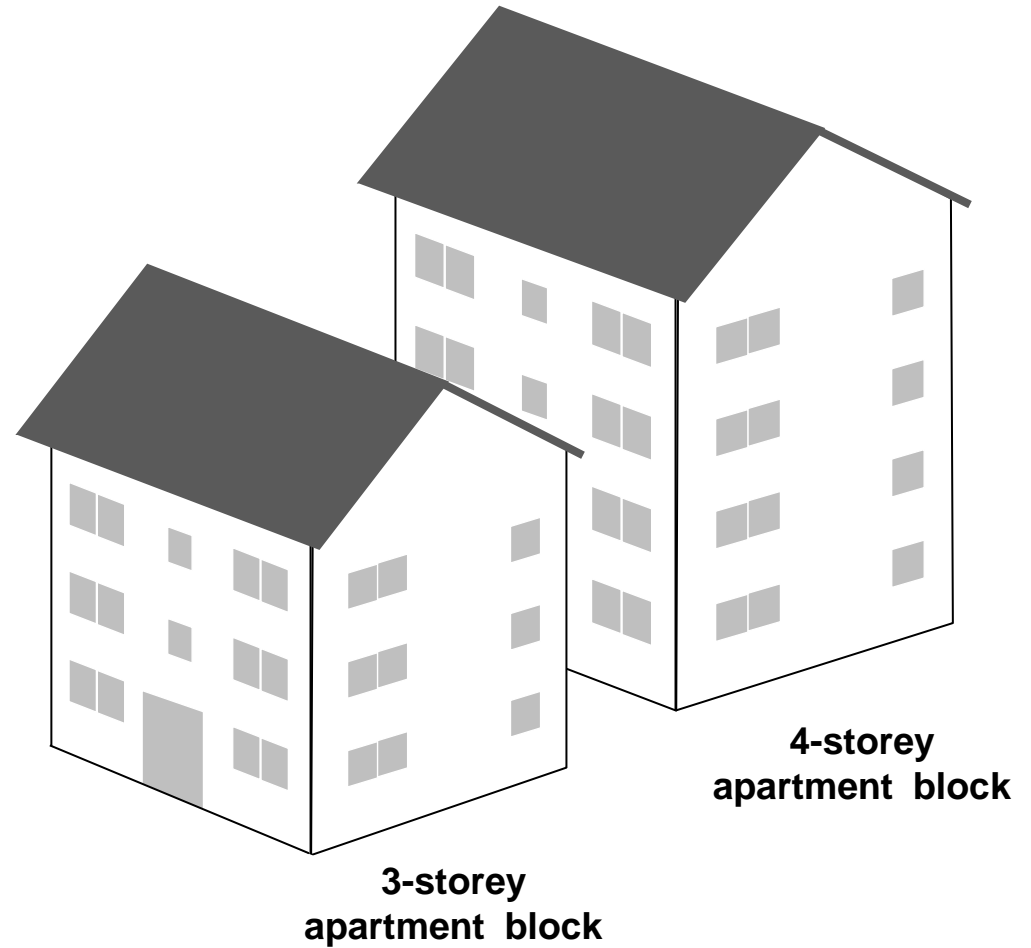
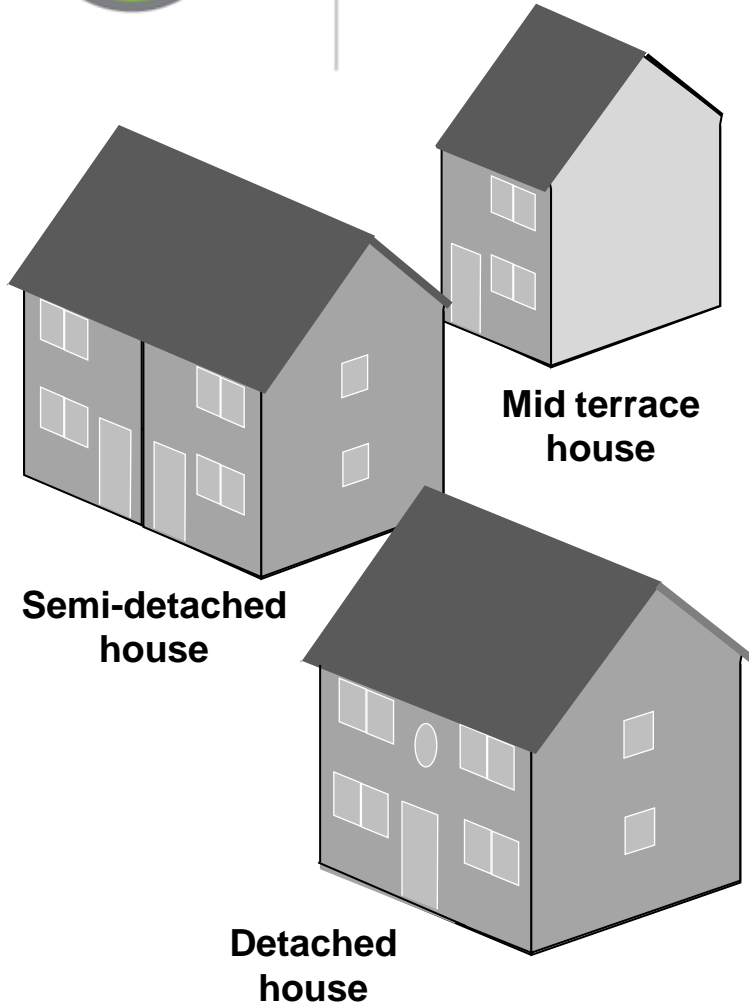


On additional site structures,
e.g. garages (8%)

- Technical feasibility is defined as requiring maximum panel area of 40% ground floor area
- A practical limit for a national minimum performance standard



PV areas (@ 40% ground floor area)



Solar technology potential: Medium density site (74 dwellings)



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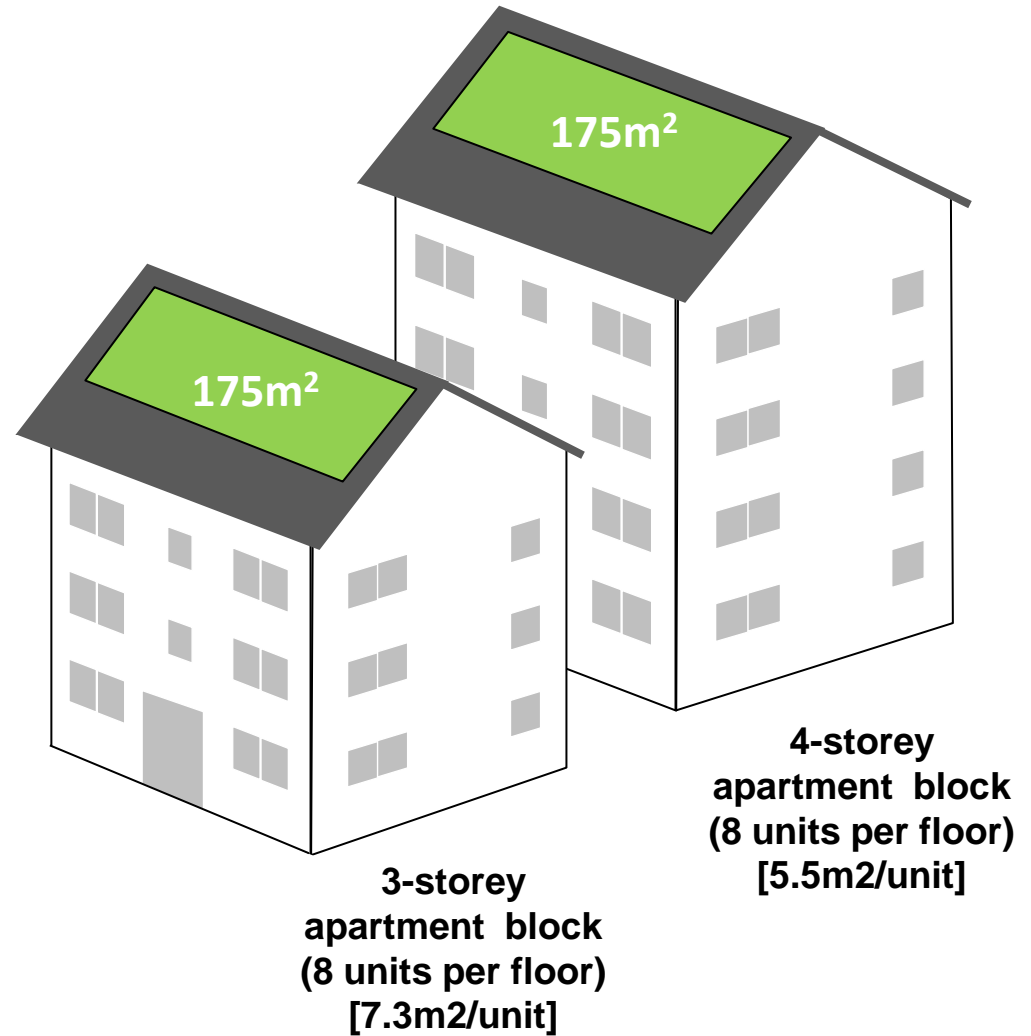
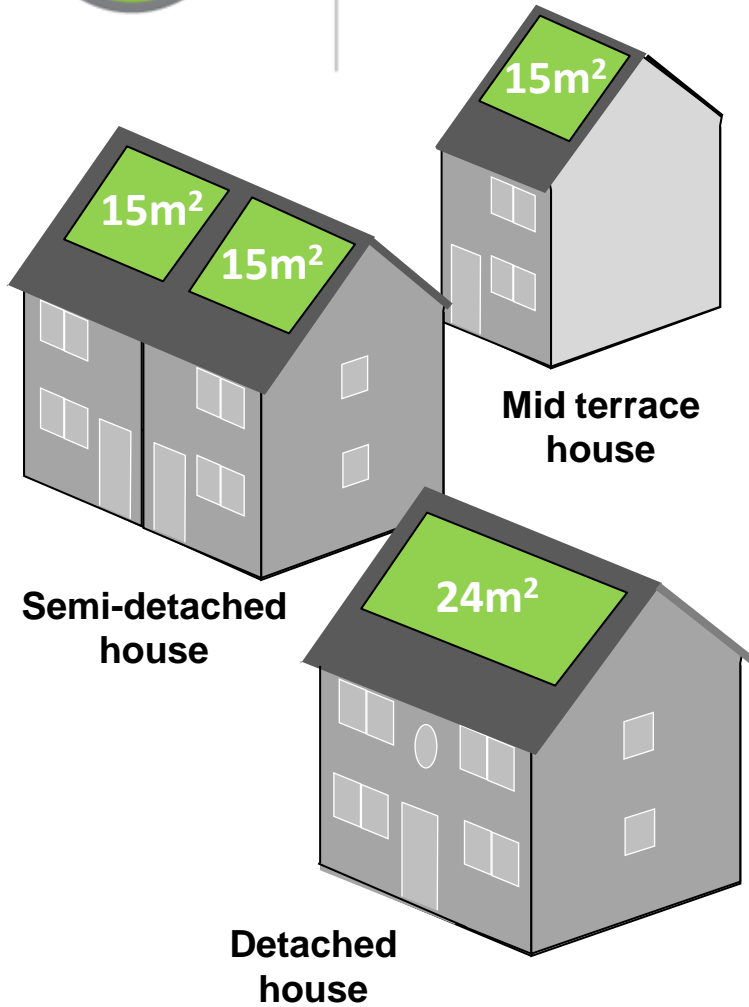


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PV areas (@ 40% ground floor area)



PV figures assume output from SE/SW facing panels at 45° pitch
Not optimal orientation of South at 30° pitch



Averaging across a development

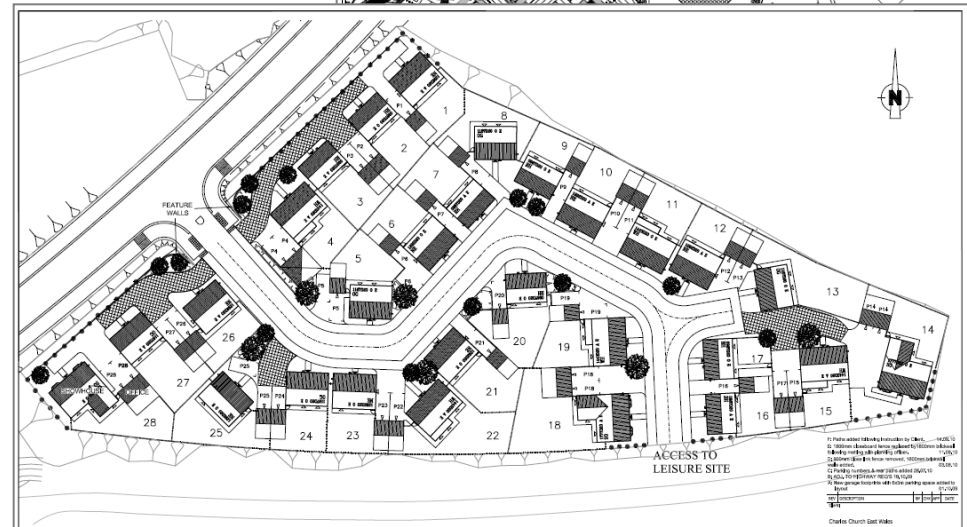
■ Single dwelling versus development

Wider planning issues
Public realm / streetscape
Local shading / geography



■ Balanced approach?

Disadvantaged plots balanced
by others
EPCs will be different?
Phased build out?

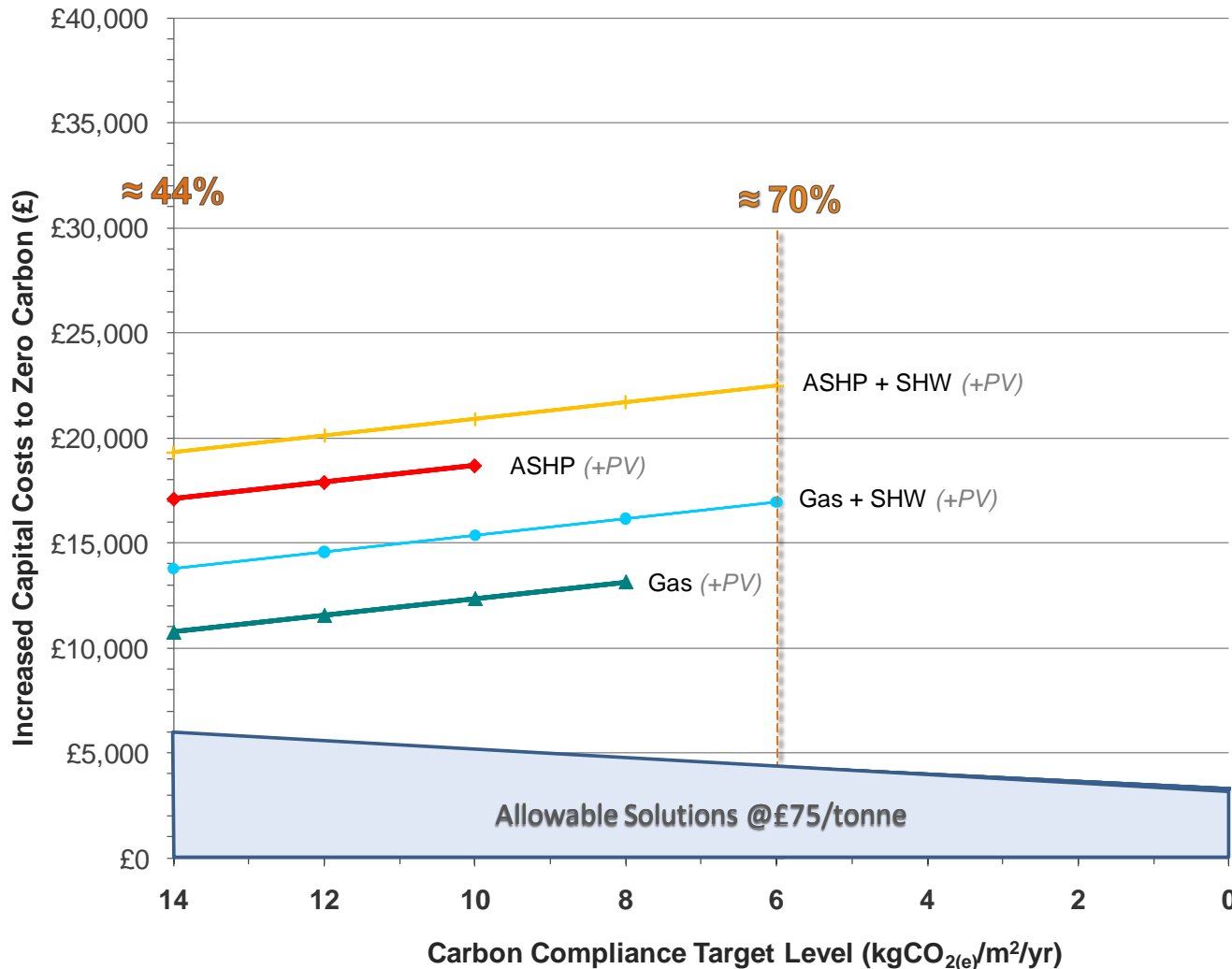




Capital Costs 2010 Costs (excl. Learning Rates)

End of Terrace (FEES) - AS @ £75/tonne

Uplift from Part L 2006 to Part L 2010 ~ £1890



Assumptions:

- Dwelling size TFA ≈ 76m²
- Dwelling Build Cost c£72k
- 2010 Part L Baseline (£1,890 uplift from 2006)
- Based on 2016 Emissions Factors

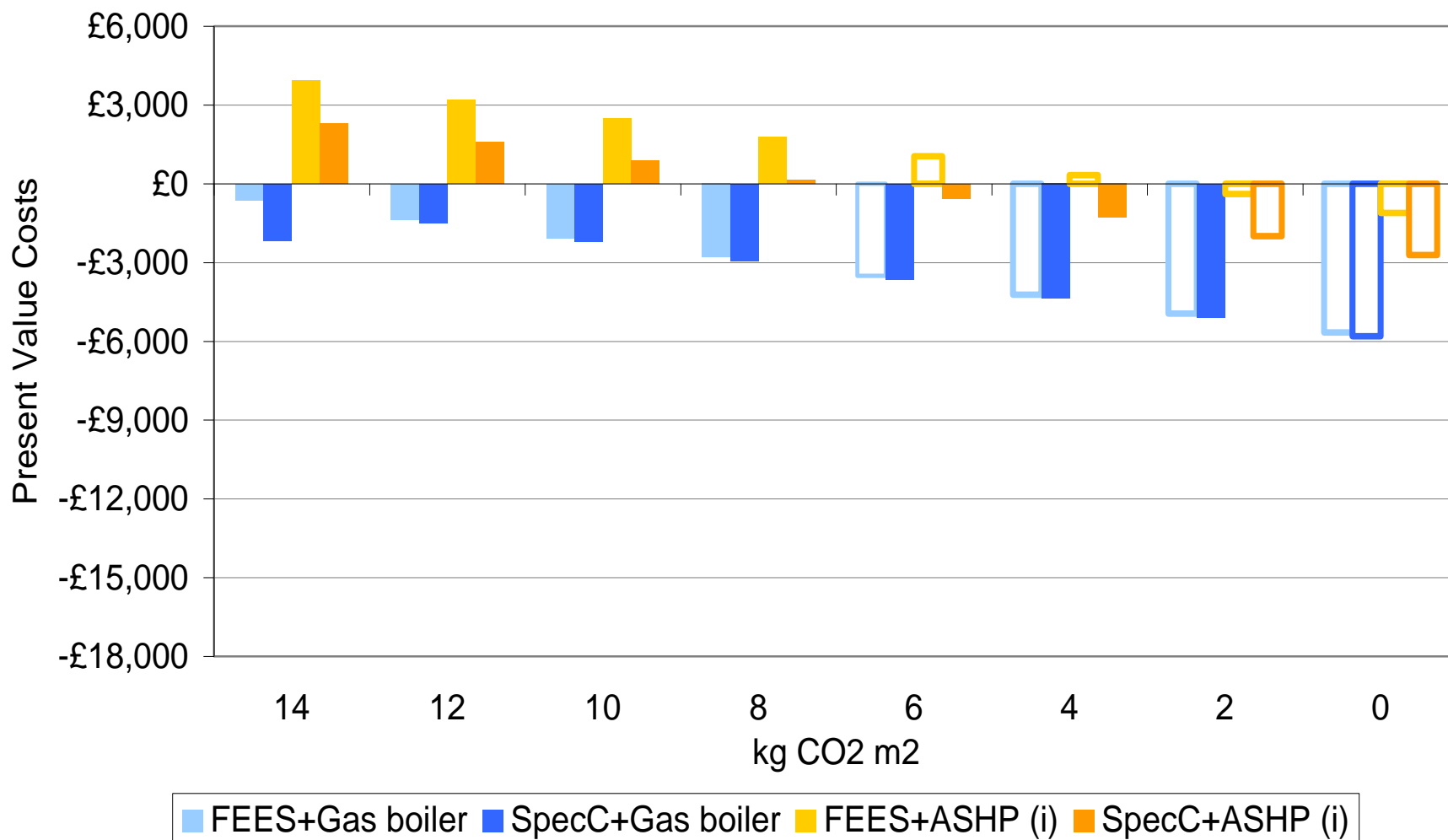
Observations:

- Plot shows capital costs per technology required to reach zero carbon.
- The greater the onsite carbon reduction the smaller the 'AS' sum.
- Marginal Cost per 1kgCO₂ = c£400.



Householder perspective

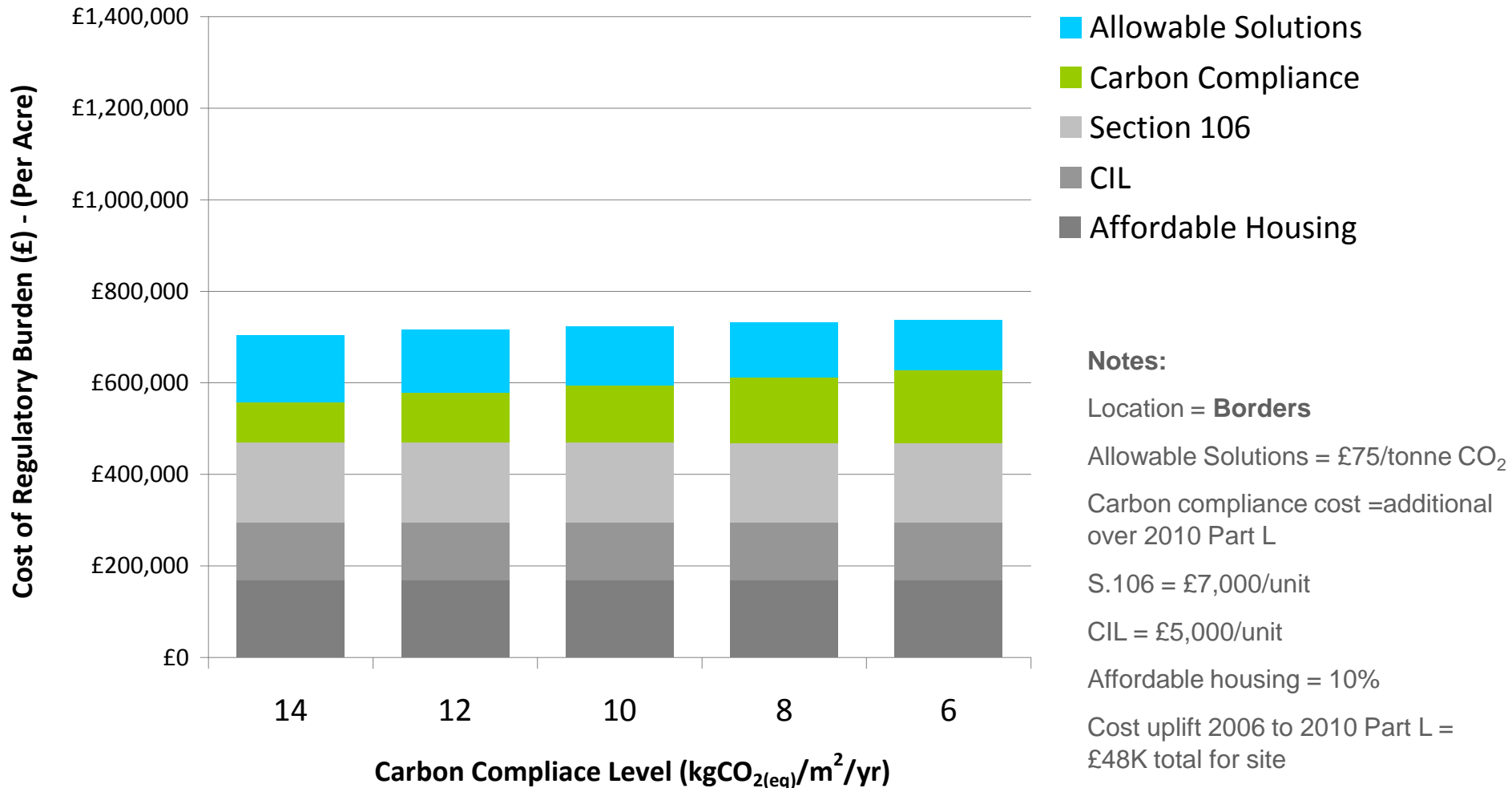
End Terrace
Running costs over 60 years (excl FiT/RHI)





If Affordable Housing req. are low (10%) & £7K/unit s.106 contribution

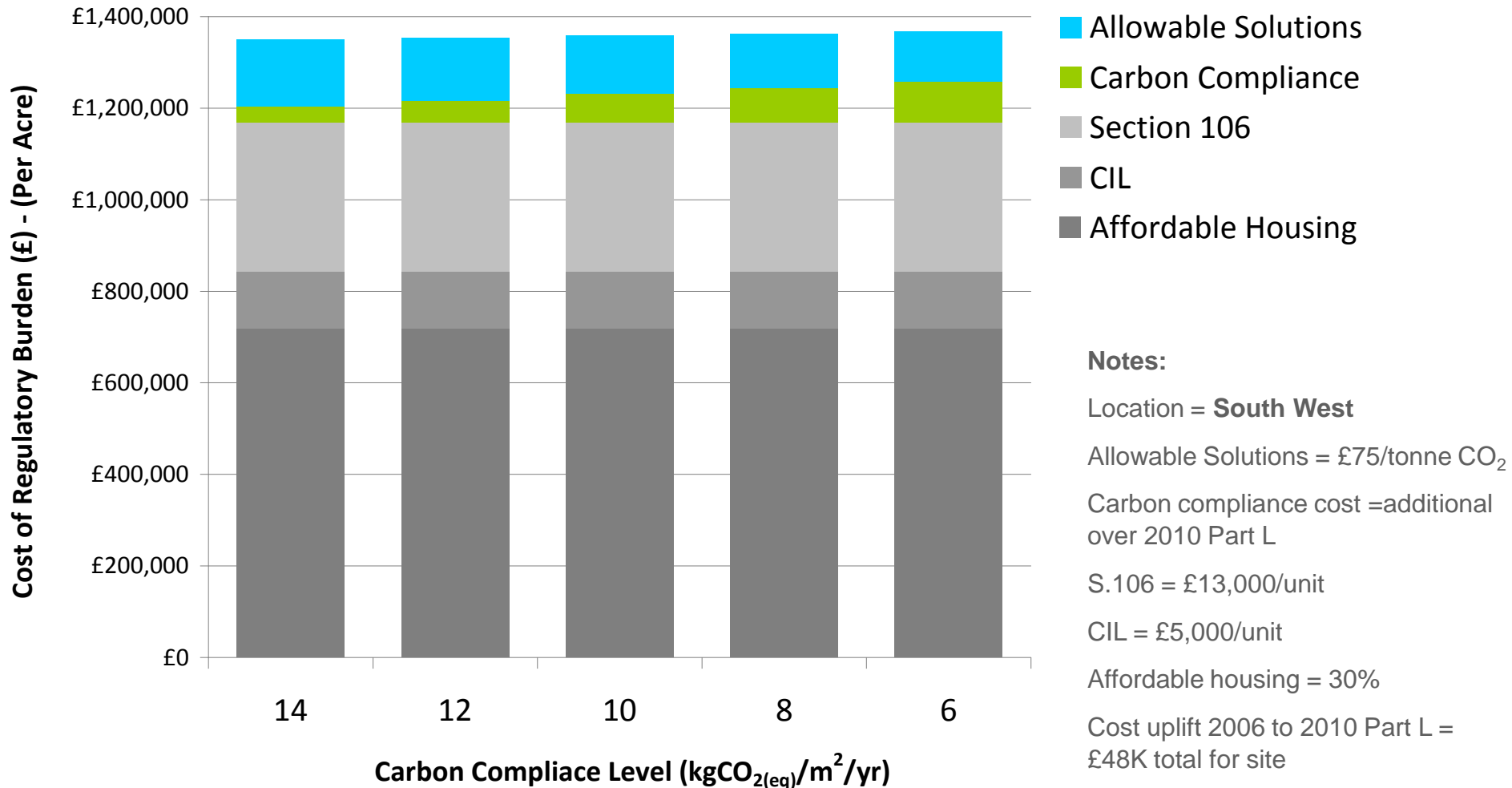
Zero Carbon Costs (CC+AS) in relation to other Regulatory Burdens





Affordable Housing Requirements @ 30% & £13K/unit s.106 contribution

Zero Carbon Costs (CC+AS) in relation to other Regulatory Burdens



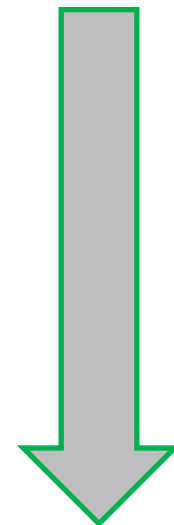
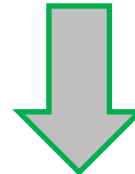
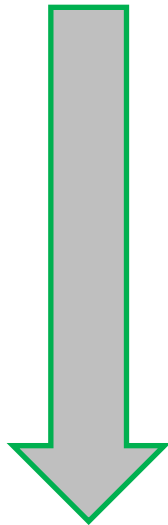


Exploring the impact of Localism (Discussion)

Biomass

Housing availability
pressures

Land values



Offsite/community energy infrastructure value and role



Allowable Solutions (AS) considerations

Work on Allowable Solutions is underway, the report to Government will include industry's recommendations on AS:

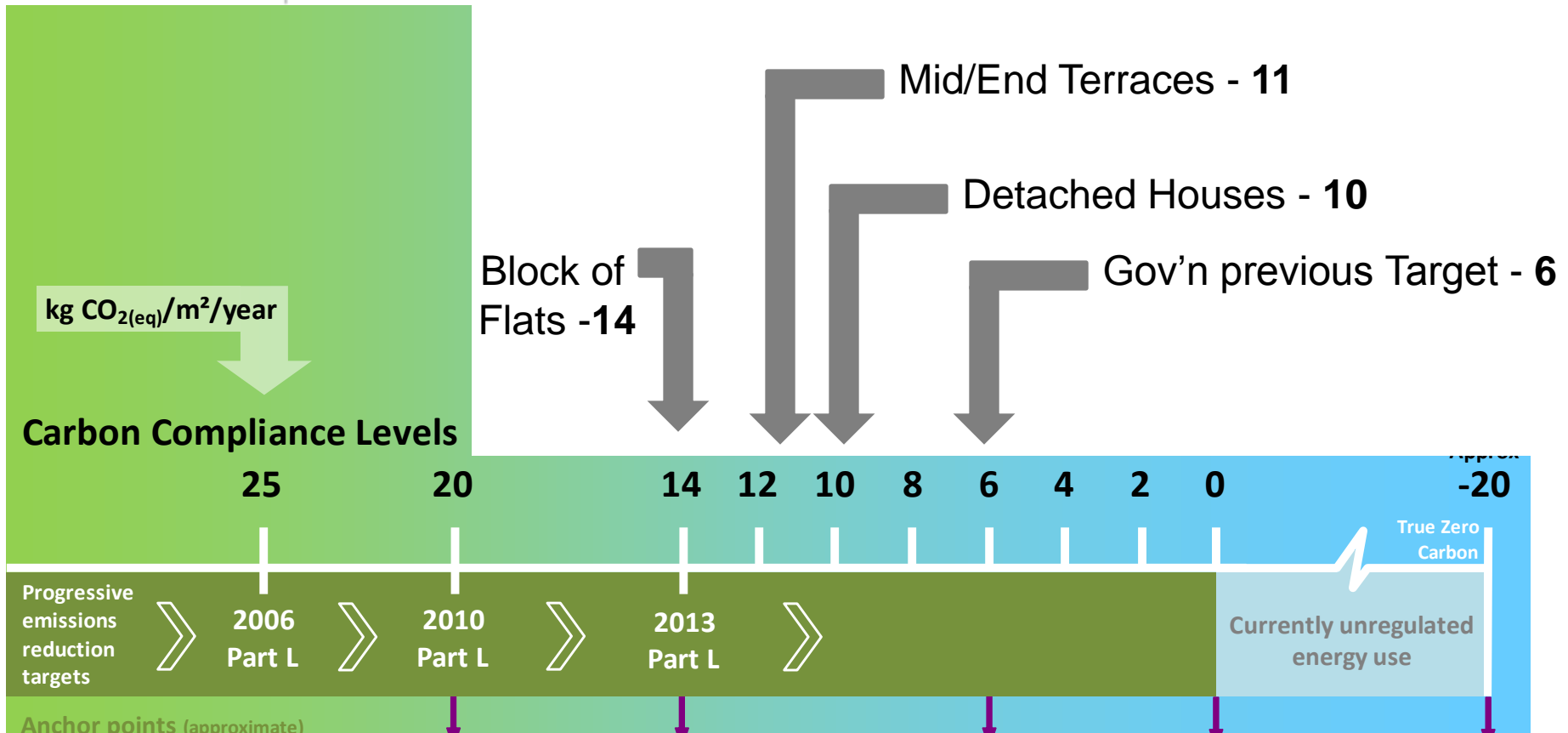
- Report to government due by May 2011

To include Industry's take on:

- Scope
- Delivery Mechanism
- Recommended Framework



Task Group Recommendations



Reduction from Part L 2006

25%

44%

70%

100%

circa 150%

Code level

3

4

5

6

Carbon Compliance levels proposed for zero carbon homes from 2016.

As Built Performance

14 kg CO₂ m²/year - Low rise apartments

11 kg CO₂ m²/year - Smaller homes

10 kg CO₂ m²/year - Detached homes

40

20

0 Zero regulated emissions

-20 Zero emissions



2010 home



Code Level 5 home



Code Level 6 Zero Carbon Home

CO₂ Emissions from Regulated Energy Use

CO₂ Emissions from Unregulated Energy Use

Budget position

Allowable Solutions



ZERO CARBON HUB

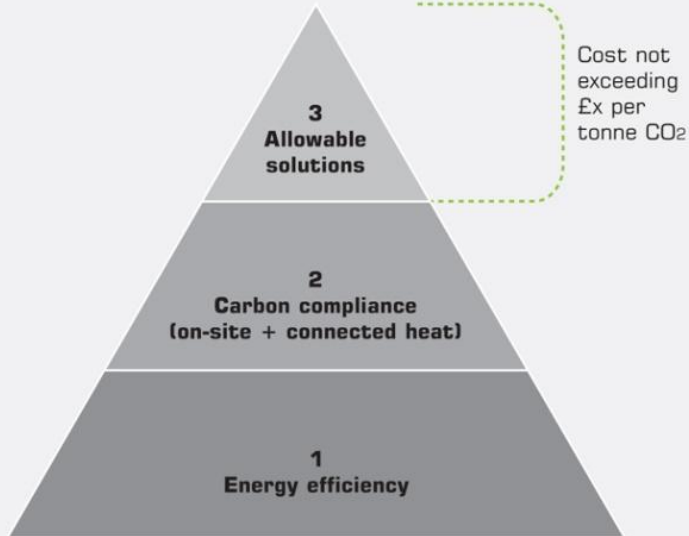
Introducing a proposed framework for Allowable Solutions

Marco Marijewycz





Budget Announcement: Definition of Zero Carbon Homes



- **Regulated energy only:** "... the Government will hold housebuilders accountable only for those carbon dioxide emissions that are covered by the Building Regulations, and will provide cost-effective means by which they can do this." (*HM Treasury & BIS, The Plan for Growth, March 2011*)
- **Allowable Solutions price:** "... cost effective options for off-site carbon reductions, relative to the Government's pricing of carbon..." (*HM Treasury & BIS, The Plan for Growth, March 2011*) . No official announcement has been made by Government on the price of Allowable Solutions although we understand that the likely range is £50 - £100/tCO₂



Cost of achieving Carbon Compliance and size of Allowable Solution contribution

Allowable Solutions price @ £50/tonneCO ₂ over 30 years													
		@ 2010 prices						@ 2016 prices					
Dwelling Type	Carbon Compliance Level kgCO ₂ (eq)/m ² /yr	Fabric ('06 to '10)	Fabric (over 2010)	Carbon Compliance (excl fabric)	Allowable Solutions	TOTAL over 2010	TOTAL over 2006	Fabric ('06 to '10)	Fabric (over 2010)	Carbon Compliance (excl fabric)	Allowable Solutions	TOTAL over 2010	TOTAL over 2006
Low-rise Apartment Block, ave per unit	14	£1,071	£51	£2,600	£1,146	£3,797	£4,868	£760	£36	£1,332	£1,146	£2,514	£3,275
		Base build cost: £60,000											
Mid Terrace House	11	£1,194	£0	£5,752	£1,259	£7,011	£8,205	£848	£0	£3,004	£1,259	£4,263	£5,111
		Base build cost: £67,820											
End Terrace House	11	£1,804	£80	£6,632	£1,259	£7,971	£9,775	£1,281	£57	£3,444	£1,259	£4,760	£6,041
		Base build cost: £71,820											
Detached House	10	£3,153	£1,913	£7,809	£1,769	£11,491	£14,644	£2,239	£1,358	£4,033	£1,769	£7,160	£9,398
		Base build cost: £107,380											



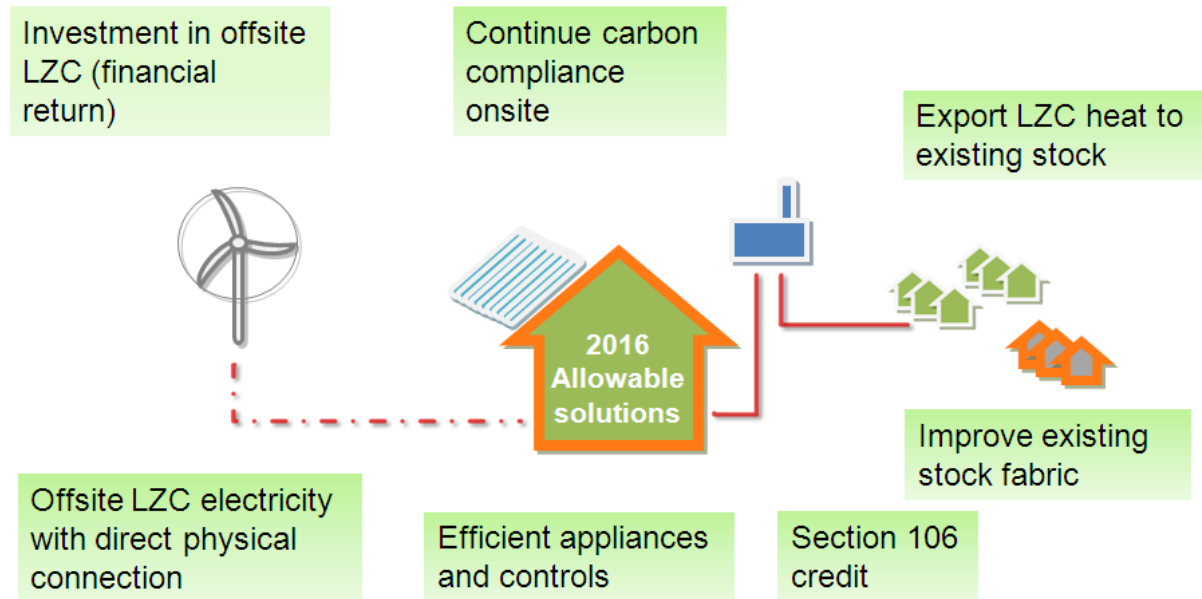
What are Allowable Solutions?

Government is seeking an Allowable Solutions approach that:

- **Incentivises house builders to explore all technically and commercially feasible on site solutions** beyond the minimum Carbon Compliance level before engaging in Allowable Solutions
- **Enables housebuilders to reach zero-carbon** where they are not able to do so solely through on-site measures
- Delivers additional and verifiable carbon savings in a cost-effective manner
- **Reduce emissions from energy used by the development**, where that is appropriate
- **Promote innovation** in a low carbon built environment
- **Encourage local authorities to reduce emissions** by looking at their area's built environment and energy supply holistically



Allowable Solution options



What constitutes an Allowable Solution option?

- A this stage no formal announcements have been made by the Coalition Government in relation to what should constitute an Allowable Solution.
- However, for the purposes of understanding how this conceptual framework could operate, options put forward in the December 2008 Consultation on the definition of Zero Carbon should be considered along with additional solution families such as, energy storage and low carbon transport (EVs)



Where are we now and what is influencing the potential shape of Allowable Solutions?

Recent Ministerial Statements:

Challenge to industry to come up with:
"Allowable Solutions which delivers real, additional carbon savings in a cost-effective manner"

Community Infrastructure Levy (or CIL) highlighted as a vehicle to raise funds for local renewable energy projects

Looking into the idea of Community Energy Funds

Exploring idea of a possible Green Deal for New Homes

What else will influence the shape of Allowable Solutions?

Allowable Solutions

• Localism

• National Planning Policy Framework

• Electricity Market Reform

• CCL reform



Responding to key principles

In addition to seeking to respond to the following key governing principles, the proposed framework also seeks to:

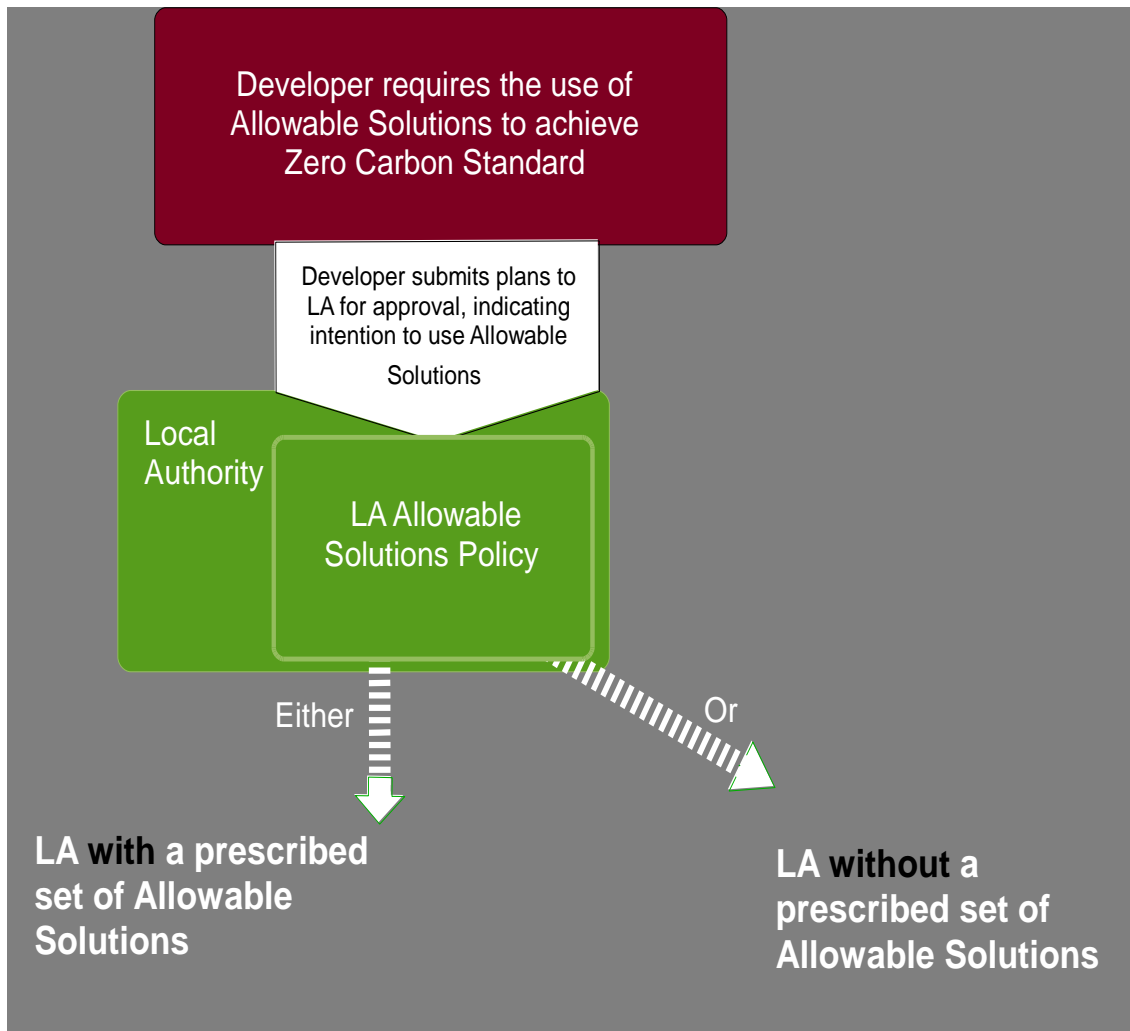
- **Simplicity**
- **Transparency**
- **Flexibility**
- **Additionality**
- **Viable pricing**
- **Support innovation**
- **Deliver local carbon savings wherever possible**
- **Cost effectiveness**

- *Avoiding the creation of unnecessary additional cost burdens on the house building industry*
- *Provide Local Authorities with 'first bit of the cherry'*
- *Provide choices to all actors involved*
- *Allowable Solutions as a capital lever*
- *Not reinventing the wheel*



Introducing a proposed framework for Allowable Solutions

Stage 1:

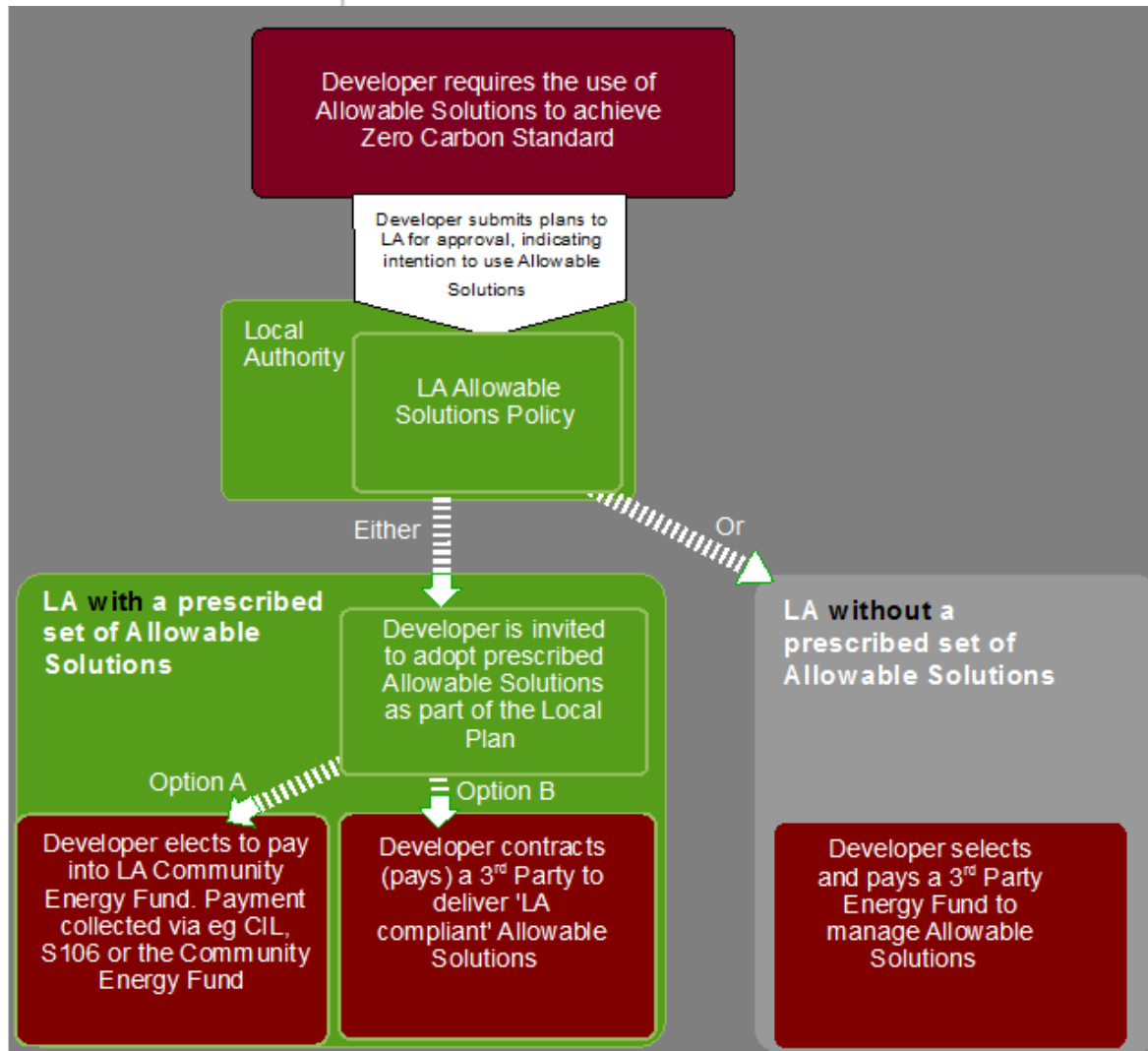


- Anticipated on most developments that AS will be required
- A national carbon price ceiling will be set to provide clarity to all actors
- Developer would need to inform LA of the amount of CO₂ they need to abate with AS to achieve compliance with Building Regulations



Introducing a proposed framework for Allowable Solutions

Stage 2:

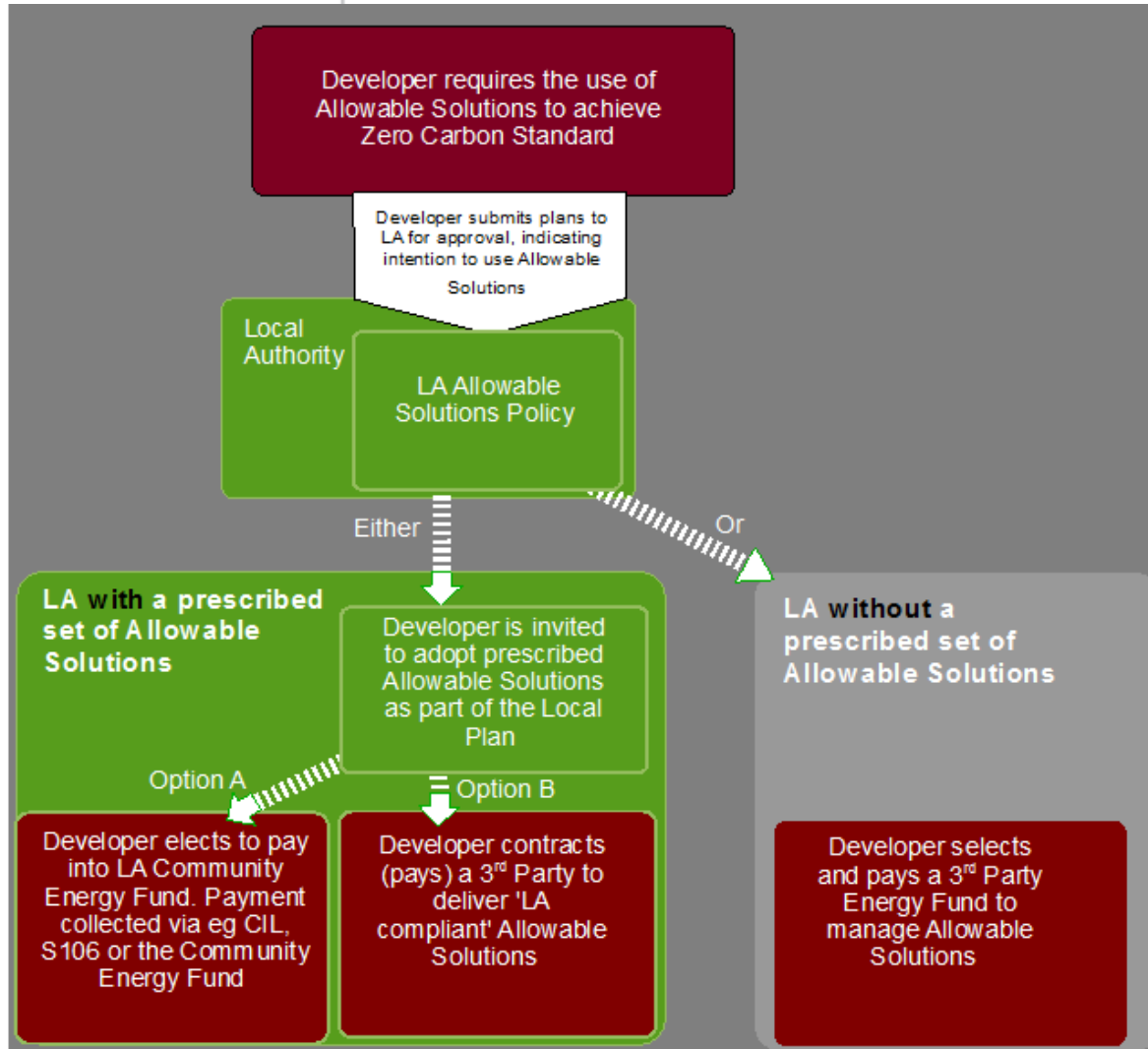


- One of the key principles behind this proposal is **'local choice and flexibility'**.
- So the LA is given the first bite of the cherry as to how Allowable Solutions monies are spent. However...
- They must specify policies in Local Plan on what AS will be invested in
- LA must cite an evidence based relating to its local list



Introducing a proposed framework for Allowable Solutions

Stage 2: - OPTION A

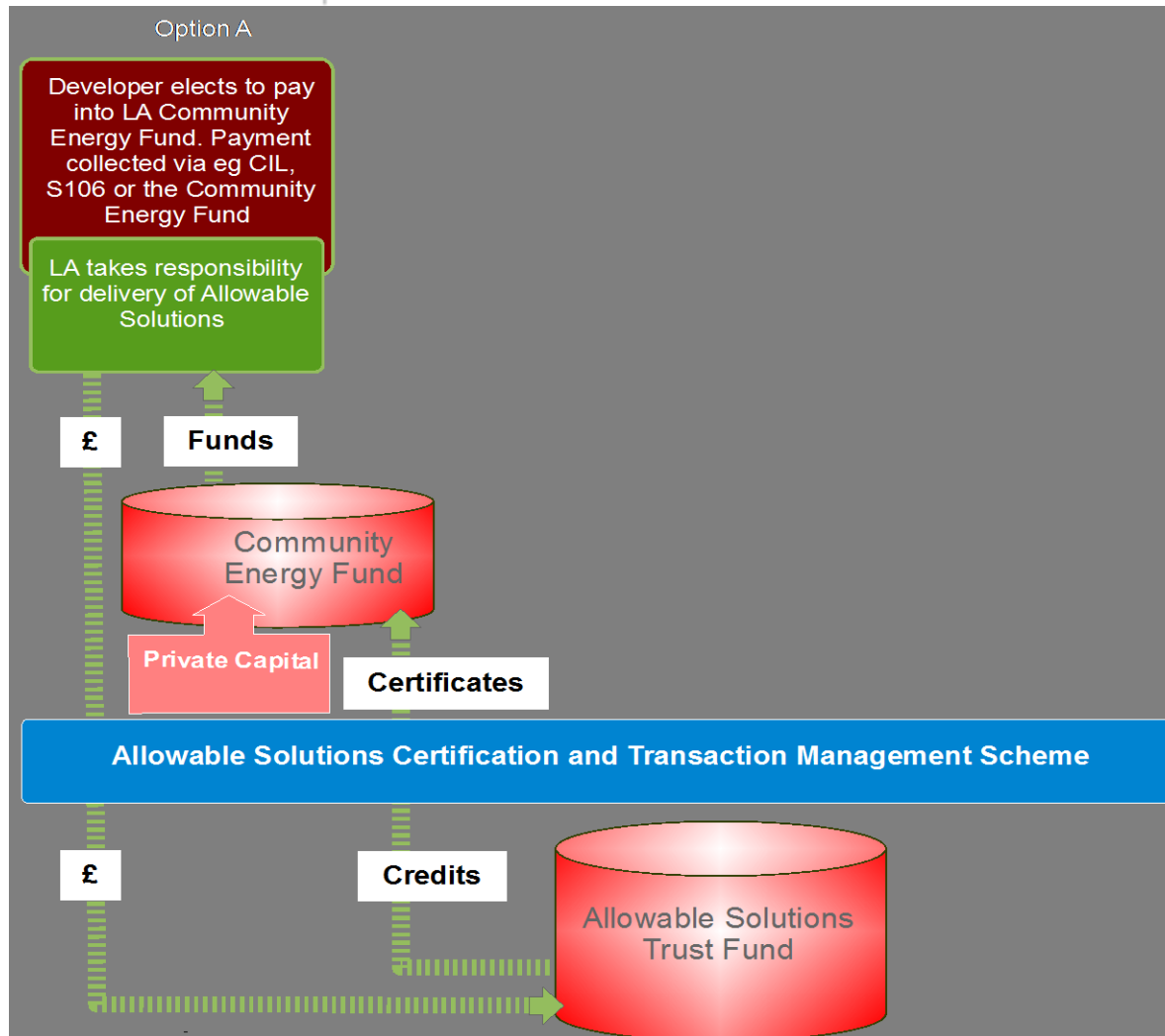


- Developer can opt to pay LA to take ownership of resolving their remaining emissions through AS (@ a price $< / =$ £ ceiling)
- Payments directed to privately managed AS Trust Fund
- A credit note sent to LA by Trust Fund (with payment ref #)
- A certificate provided to developer as evidence of compliance (sharing payment ref #)



Introducing a proposed framework for Allowable Solutions

Stage 2: - OPTION A

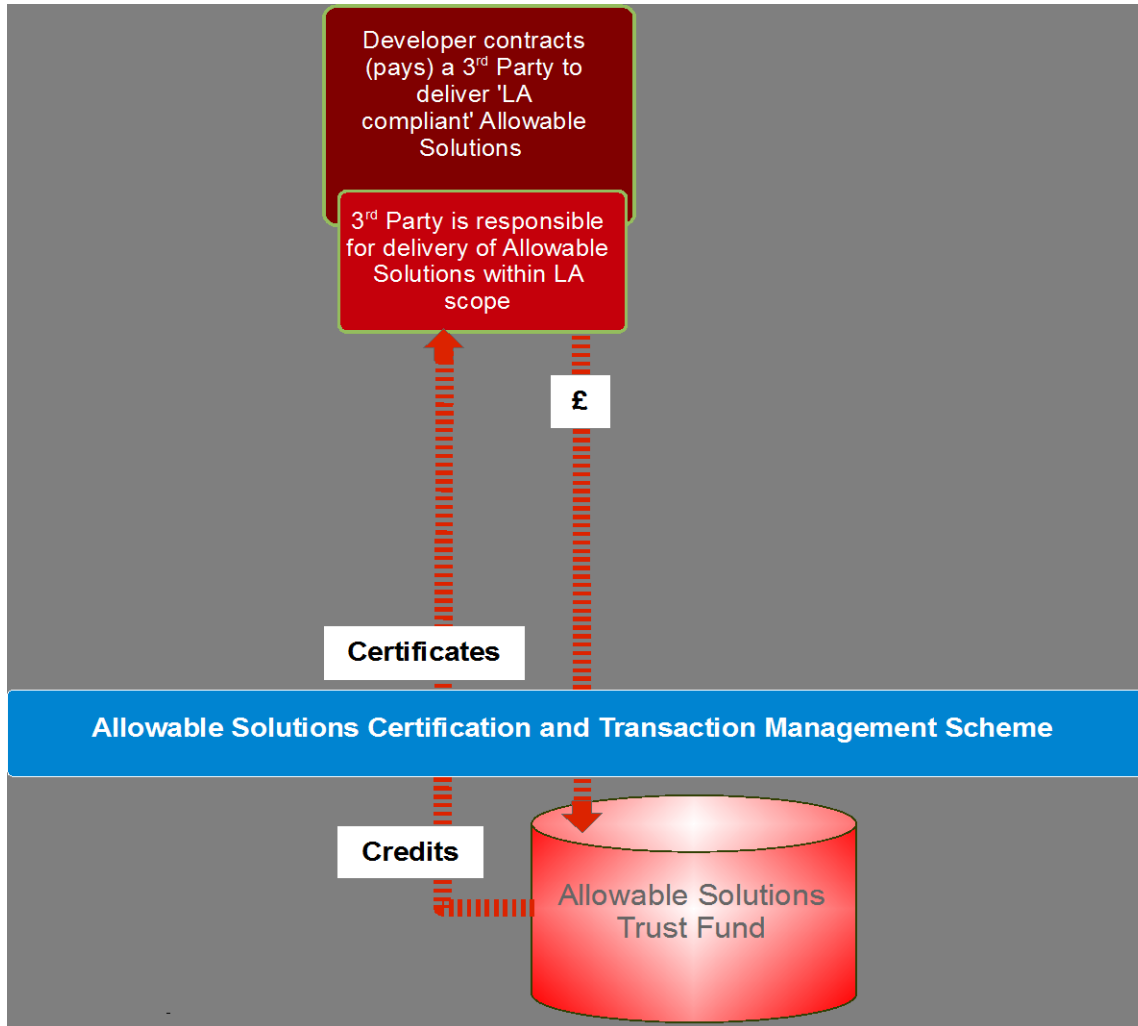


- Anticipated that funds and credit notes collected by LA will be held in a Community Energy Fund and act as levers for additional private investment to fund locally planned carbon saving initiatives
- Credits in the **Community Energy Funds will assure other** investors that the LA has secure ring-fenced capital to contribute to a project. **Private investors will secure an equity stake in future revenues**



Introducing a proposed framework for Allowable Solutions

Stage 2: - OPTION B



- But the developer may be able to deliver the locally prescribed option more cheaply...
- The developer can opt to contract with an accredited 3rd party supplier who can deliver one or more of the LA locally prescribed Allowable Solutions
- Payment made to Trust Fund, certificate and credit notes produced, monies released when project is delivered



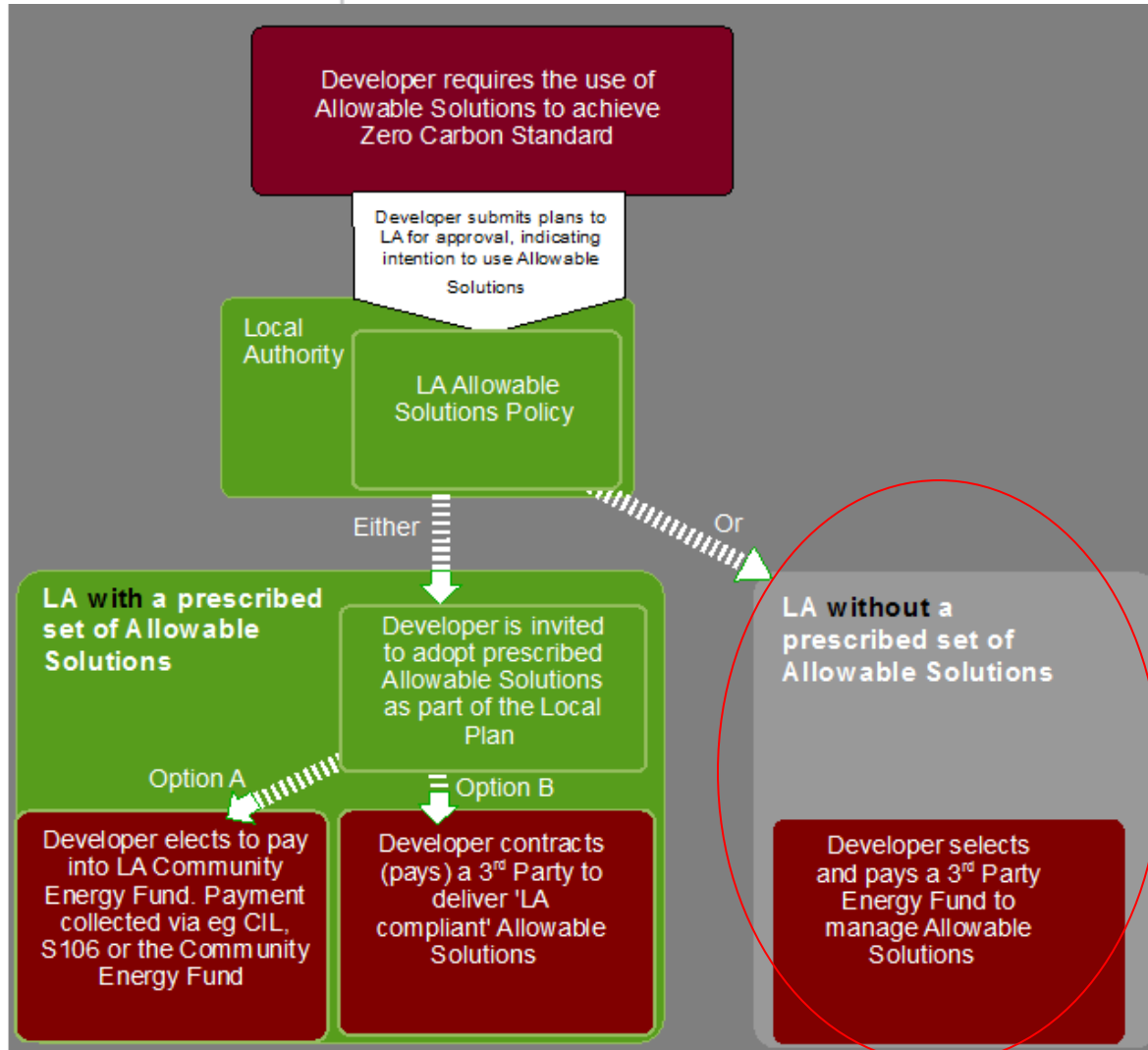
Introducing a proposed framework for Allowable Solutions

- However, not every Local Authority across England will be in a position to determine local Allowable Solution options and polices from Day 1 (e.g. Due to lack of capabilities...)
- ...but they may still want new homes to be built
- ...as elsewhere the homes will typically require use of Allowable Solutions in order to meet Building Regulations
- **Therefore, another route to resolving emissions through Allowable Solutions will be required**



Introducing a proposed framework for Allowable Solutions

Stage 3:

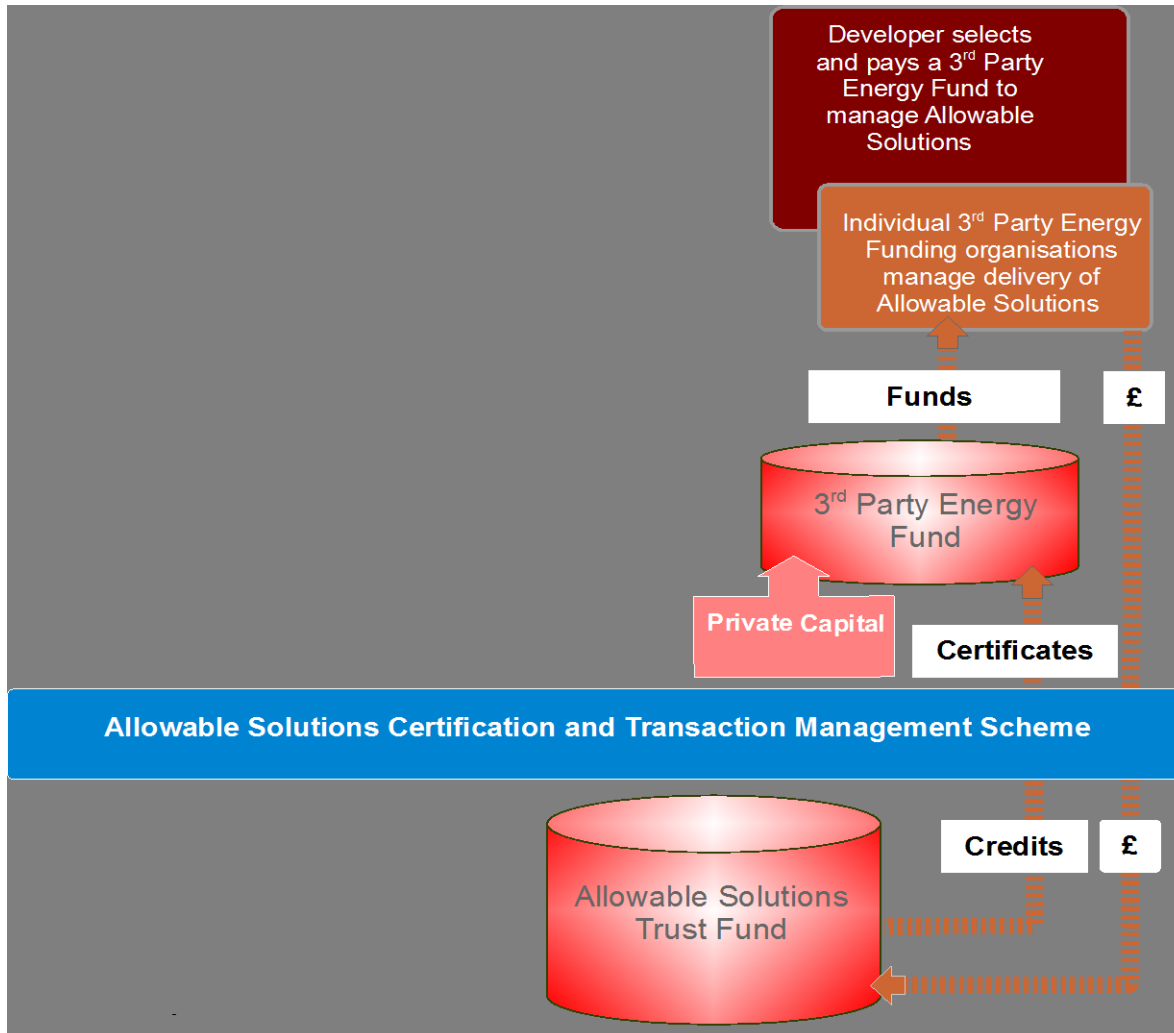


- Where an LA is without a prescribed set of Allowable Solutions the Developer can select and pay a 3rd Party Energy Fund to manage Allowable Solutions and absolve them of the responsibility for their remaining emissions
- The maximum a fund will be able to charge is the national market ceiling price
- However, to attract payments, some 3rd party fund managers may opt for lower prices



Introducing a proposed framework for Allowable Solutions

Stage 3:

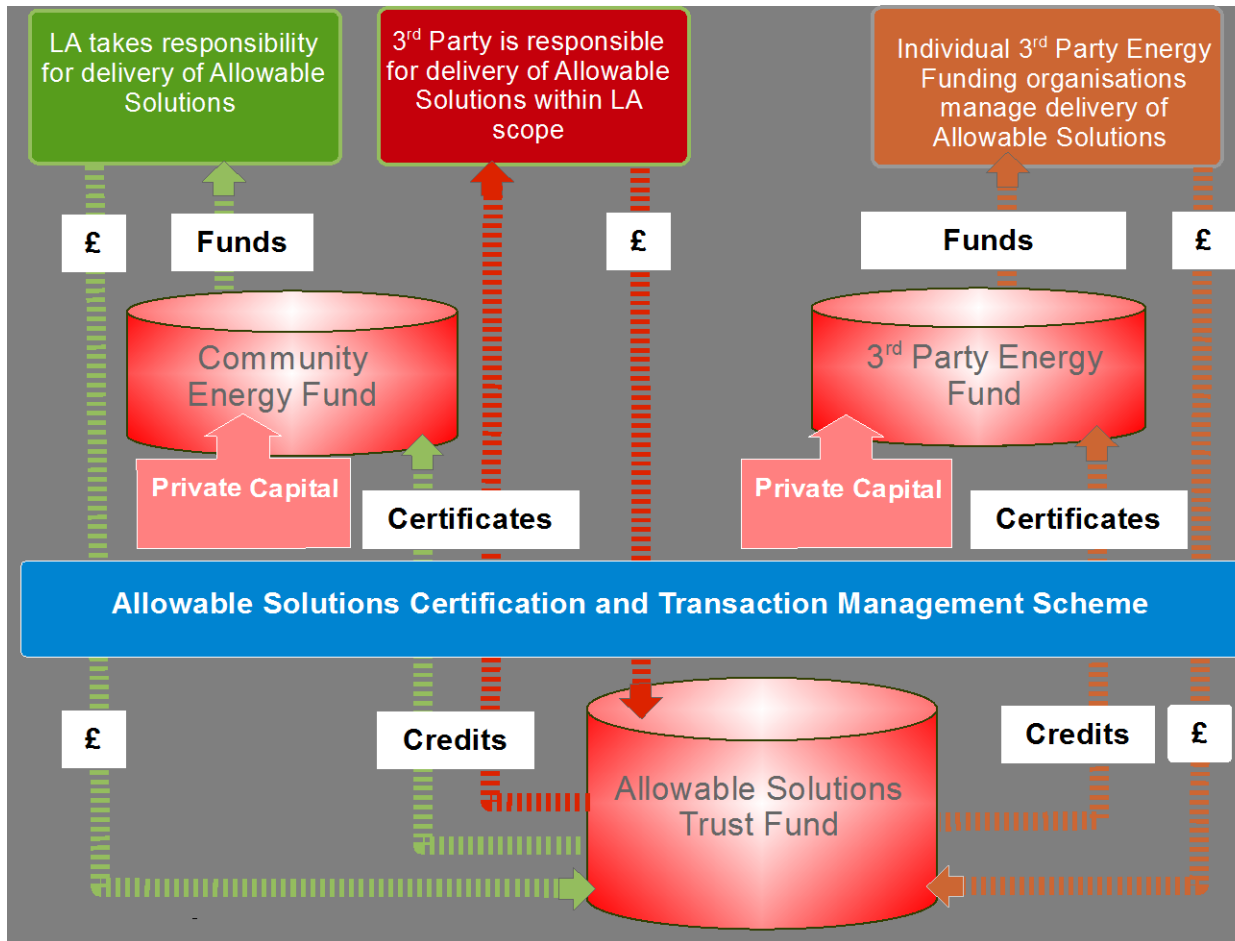


- These payments will be paid directly into the Allowable Solutions Trust Fund. A credit note will be issued by the Trust Fund. A certificate will then be issued to the developer
- 3rd Party Energy Funds will be able to fund carbon saving projects which have a regional or national significance, not necessarily those of local significance (subject to rules)
- Capital leveraged from other private investors and mixed with AS funds



Introducing a proposed framework for Allowable Solutions

Stage 4: Allowable Solution Certification

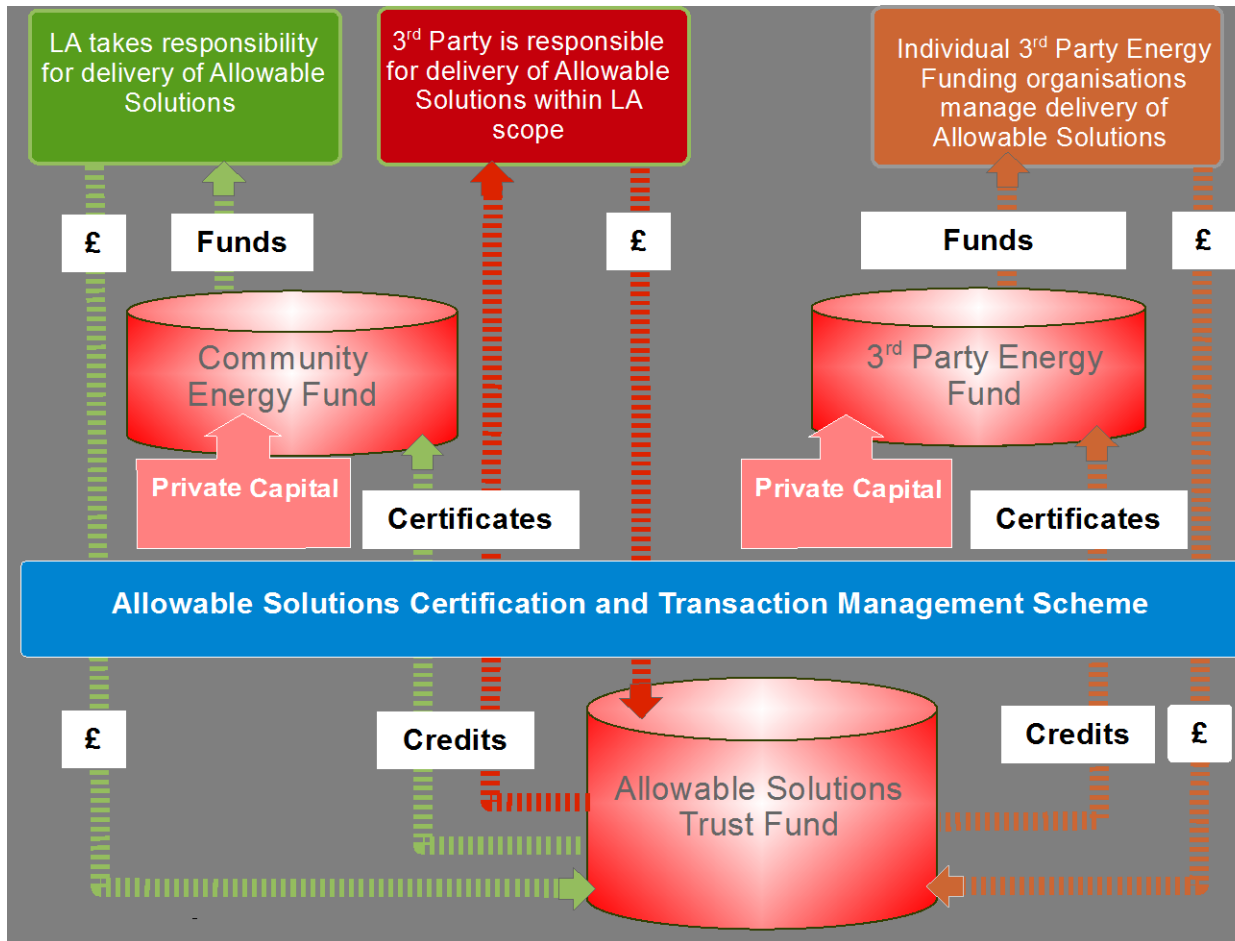


- Proposal is that a number of Allowable Solutions Certification and Transaction management 'ASCTM' organisations are set up to manage transactions and certify/verify that projects are performing and saving carbon
- Where possible, existing certification mechanisms will be harnessed – to avoid reinvention of the wheel



Introducing a proposed framework for Allowable Solutions

Stage 5: Role of Allowable Solution Trust Fund



- Proposal is that the Allowable Solutions Trust Fund is a **repository for payments made by developers, ensuring that capital is ring fenced** and held securely until projects (or project milestones) have been verified, at which point credits can be released.
- Privately managed on behalf of Government and subject to contract period



Questions and Feedback Welcome