Chelmsford Garden Community

BEAULIEU

Chelmsford Zero Carbon Ready Demonstrator Site Project

Learning Dissemination

7 November 2022

Chelmsford City Council

Workshop Agenda

1) **Welcome and Introductions**
2) **Project Background**
3) **Site and Proposals**
4) **Proposed Zero-Carbon Ready Report**

   Presentation from consultants Stroma Built Environment

5) **Discussion/Questions**

   Workshop Session

6) **Learning Conclusions and Finish**

COUNTRYSIDE Places People Love

L&Q

Homes England

Chelmsford City Council

The CGC Partnership

Chelmsford City Council

COUNTRYSIDE
Places People Love

Essex County Council

GREYCOAT

L&Q

PTARMIGAN LAND

Homes England

Chelmsford City Council

Homes England

Making homes happen

Homes England, the government's housing and regeneration agency, plays a central role in tackling the housing challenges the country now faces. We have the appetite, influence, expertise and resource to drive positive market change, and our mission is to ensure more homes are built in areas of greatest need, improve affordability and create a sustainable housing market.

Following the publication of the government's Levelling Up White Paper, Homes England has also been tasked with a core role in spearheading regeneration, partnering with places to reduce economic disparity, empower local leaders and create equal opportunities across the country to ensure comm ities reach their full potential.

COUNTRYSIDE
Places People Love

L&Q

- Commitment - Pathway to Net Zero by creating Places People Love while securing a better future for all of us
- Journey - Desire to be a leader in the moving a traditional industry forward
- Delivery - Real value in turning theory into practical understanding
- Output - Conclusions give encouragement that for our small part we can help achieve one of the key challenges of our time

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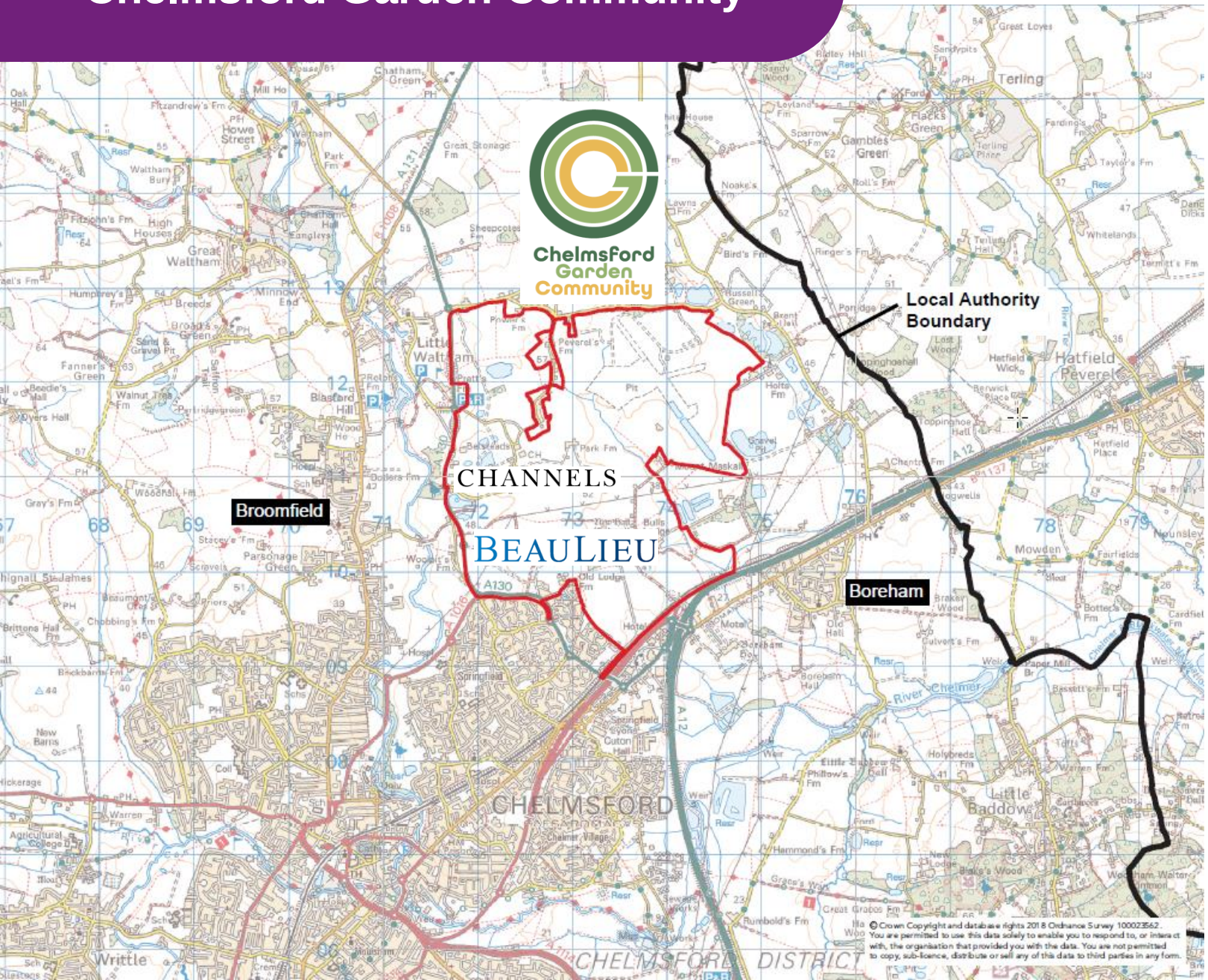

- Located north-east of Chelmsford
- Allocated in adopted Local Plan
- Comprises existing committed development (Beaulieu and Channels) and new Local Plan allocation
- 836 hectares
- 10,000 new homes and over 100,000 sqm of employment floorspace
- Awarded £218m HIF for new rail station and bypass

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What’s already been built?

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What is being proposed

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Purpose of the Zero Carbon Ready Project

- Assessment of the **practical and financial implications** of delivering net zero-carbon ready new homes as part of the construction of a strategic development site delivered by a volume house builder
- A focus on a materials and building-led approach i.e. maximising the energy efficiency of the building envelope in combination with zero-carbon power generation, heating and cooling whilst acknowledging the future de-carbonisation of the national power grid
- To assess the implications of delivery at scale by the private sector
- Share data and outcomes, in particular related to comparative CO^2emissions of different dwelling types, to enable replicability on other development sites.

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Project Stages

Stage 1	a)	Specify, Design and Cost a Net Zero-Carbon Ready Zone at the Beaulieu development ready for submission as a Reserved Matters planning application
	b)	Make available the specification, design and cost data
Stage 2	c)	The developer, in partnership with Chelmsford City Council, seeks to secure funding to allow the construction of permitted net zero carbon ready scheme.
Stage 3	d)	To construct the net zero carbon ready scheme by 2023
	e)	To monitor sales values and total home running costs
	f)	To promote the development as an exemplar net zero carbon ready housing scheme.

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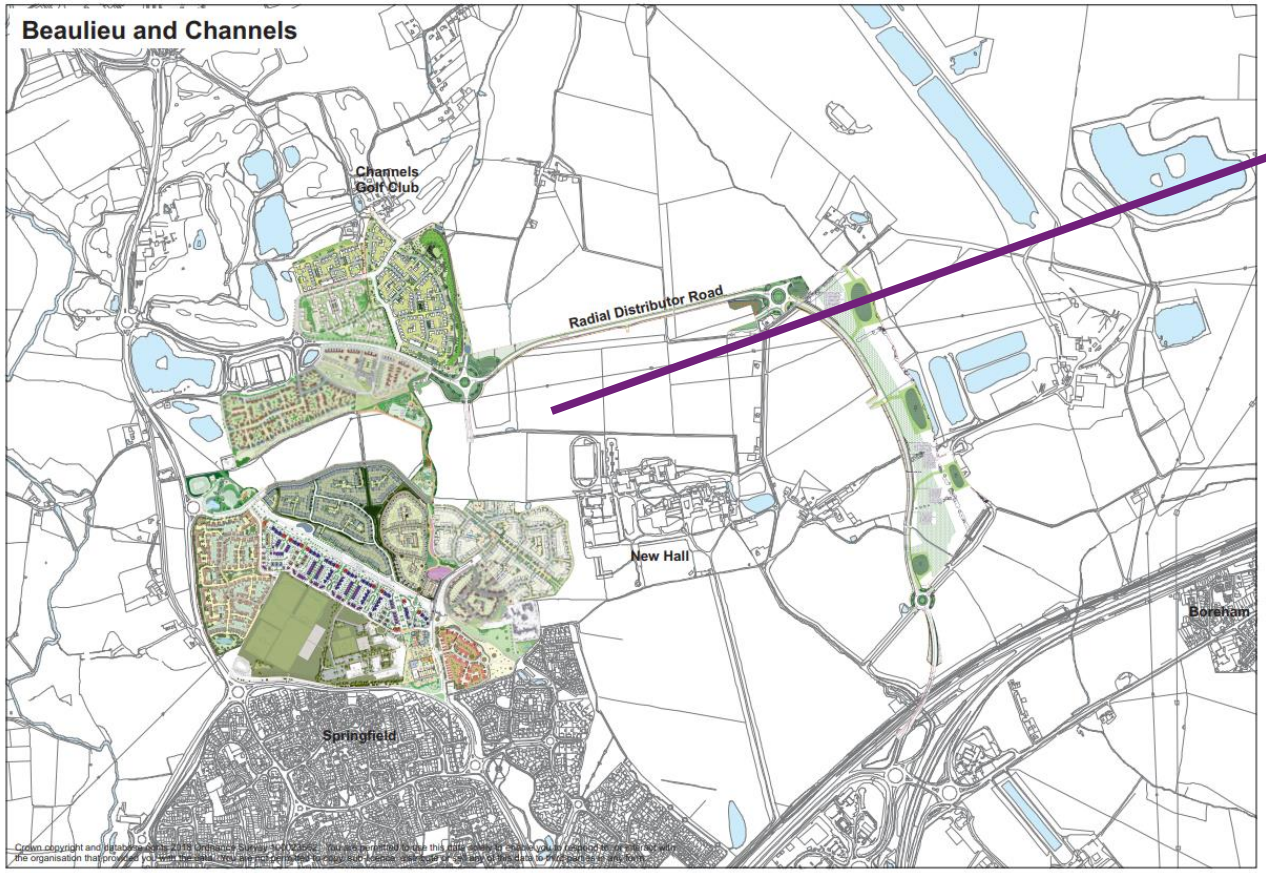
Zero Carbon Ready
Demonstrator Beaulieu Zone T



66 units - 1 and 2 bed apartments and 2, 3, 4 and 5 bed houses

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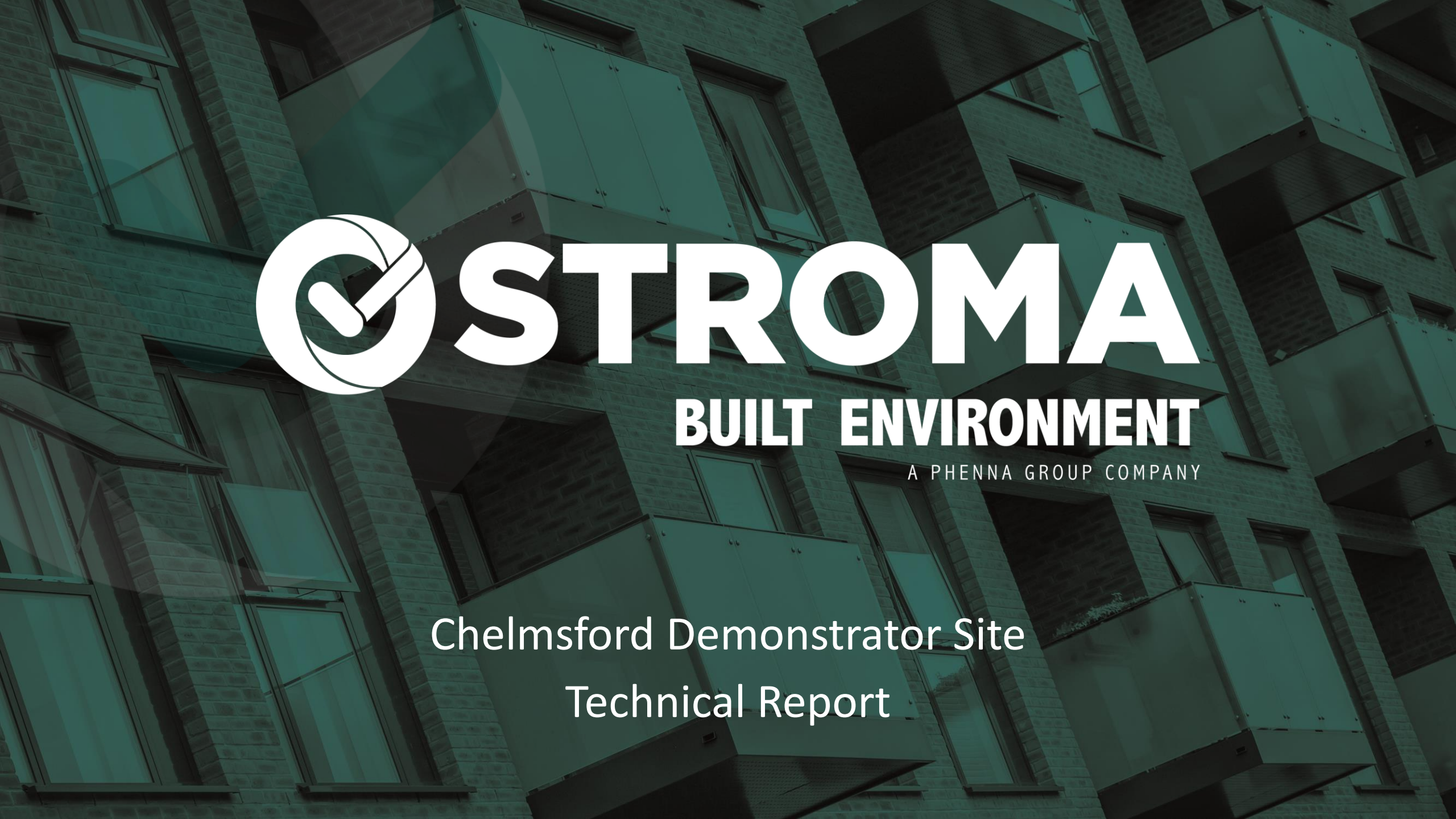

Chelmsford Demonstrator Site
Technical Report

Background / Context

- Government has committed to reducing greenhouse gas emissions to almost zero by 2050.
- Government has set a road map for the construction industry to achieve net-zero ready homes by 2025.
- This process has been defined within the Future Homes Standard (FHS)
- 2025 Building Regulations (FHS) to achieve approx. 75% fewer emissions than the 2012 regulations (current)
- Two Stages – 2021 (now in force) – 31% reduction, 2025 FHS, continued up to 75% reduction

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The Question

- How is a volume housebuilder likely to react to the 2025 requirements on a large site, or multi-phased site to be built across multiple sets of regulations?
- What technical specification shall be required to achieve compliance with the FHS – can this be accommodated by adapting a ‘standard’ design, or will it require complete redesign of dwelling typologies?
- What financial and technical challenges may present themselves in achieving compliance with the 2025 regulations on a live ‘site’

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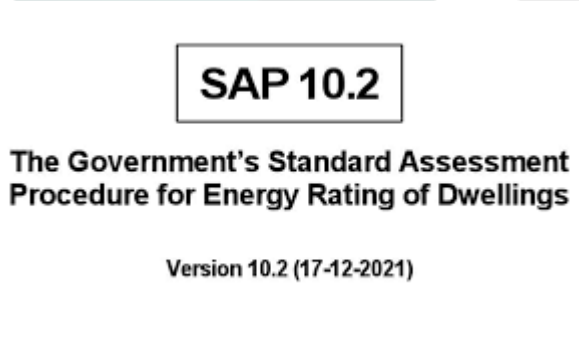
The Regulations

- Use National Calculation Method (NCM) - SAP (Standard Assessment Procedure)
- Three Key compliance metrics:
  - Primary Energy Demand
  - Carbon Emissions
  - Fabric Energy Efficiency
- SAP 10.2 – Current (2021 Interim Regulations)
- SAP 11 – Not yet in development – 2025 FHS compliance tool
- For this exercise, we have used the SAP10.2 tool, and uplifted the requirements in line with the FHS notional specification



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Notional Specification

- FHS notional specification is not defined. Closest available is the preliminary specification is within the FHS consultation response (Jan 2021)
- Published consultation represents a large improvement to thermal efficiency levels, alongside electrification of heating systems
- Floor and roof targets are achievable with minimal alteration
- Window target shall require triple-glazed units
- Wall targets shall require a **minimum** cavity of 125mm if using PIR insulation, and 185mm is using non-combustible insulation. Dependent on the insulation type, this will result in total wall thicknesses >400mm

	2021 Part L Standard	Indicative FHS specification
Floor U-value ($W/m^2.K$)	0.13	0.11
External wall U-value ($W/m^2.K$)	0.18	0.15
Roof U-value ($W/m^2.K$)	0.11	0.11
Window U-value ($W/m^2.K$)	1.2	0.8
Door U-value ($W/m^2.K$)	1.0	1.0
Air permeability at 50 Pa	5.0 $m^3/(h.m^2)$	5.0 $m^3/(h.m^2)$
Heating appliance	Gas boiler	Low-carbon heating (e.g. Heat pump)
Heat Emitter type	Low temperature heating	Low temperature heating
Ventilation System type	Natural (with extract fans)	Natural (with extract fans)
PV	40% ground floor area	None
Wastewater heat recovery	Yes	No
y value ($W/m^2.K$)	0.05	0.05

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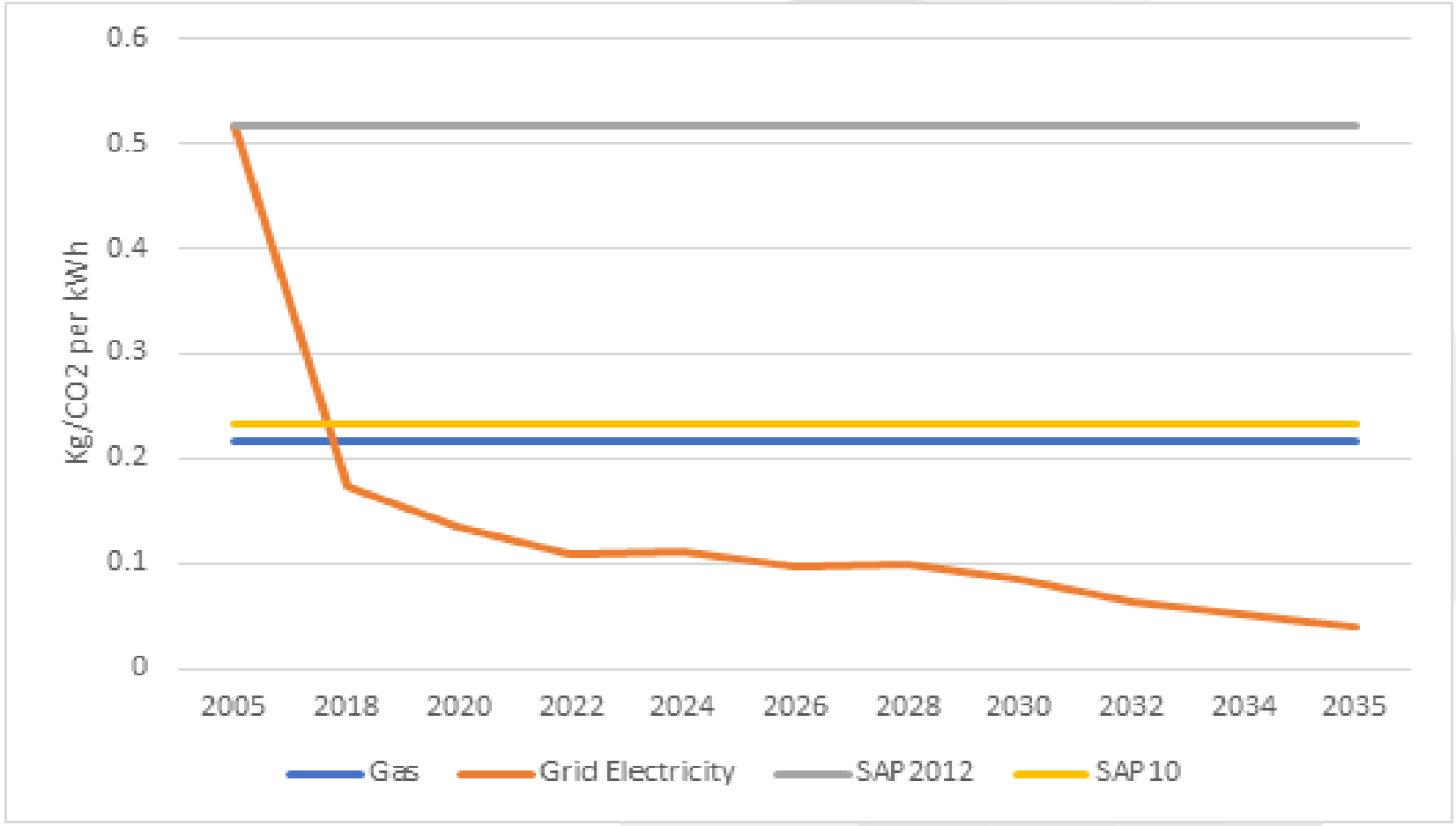
Grid Decarbonisation

- UK National Grid has been decarbonizing rapidly, and a switch to a 100% electric development shall result in the dwelling decarbonizing year-on-year, and capable of operating at net-zero, subject to renewable supply.
- The purchase of green electricity tariffs shall result in the scheme operating at net-zero from day 1



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Plant Selection - Houses

- Heat pump technology shall be required, in line with the FHS
- Monoblock ASHPs can deliver the required savings whilst de-skilling the installation, as all refrigerant etc is housed within the external unit, with only a water supply and return penetrating the building envelope
- Internal cylinder shall be required to supply DHW.
- UFH is the preferred distribution method owing to low flow temperatures, however, large radiators can also work. (Preferred flow temperature <40°C)

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Plant Selection – Apartments

- Likely unsuitable for the same approach, due to the housing of the external units.
- Potential Options include Exhaust Air Heat Pumps & Hot Water only Heat Pumps with direct electric heating
- EAHPs mimic a traditional heat pump, with the air source the wet air from bathrooms etc, instead of the external air. This allows a single unit to deliver heating, hot water and ventilation, situated within the dwelling.
- HWHPs can deliver the water heating via an internally located heat pump cylinder, ducted to the outside. This allows for a combination of direct electric heating and heat recovery ventilation to deliver space heating. Note the HWHP approach will negatively affect the EPC rating, which penalises direct electric heating
- HWHP approach, in conjunction with a PV array, has been selected for this exercise as the most cost-effective solution for the apartments

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CO_2 emissions

- Part L1A 2013 Baseline Emissions
  - Houses/maisonettes - 17.49 (kg/m²)/year — 107,076 kg/year
  - Apartment block - 19.68 (kg/m²)/year — 10,852 kg/year
  - Total Site - 17.67 (kg/m²)/year — 117,928 kg/year
- Part L1A 2025 (FHS) Emissions
  - Houses - 4.34 (kg/m²)/year — 26,570 kg/year
  - - Apartment block - 4.39 (kg/m²)/year — 2,425 kg/year
  - - Total Site - 4.35 (kg/m²)/year — 28,995 kg/year
- Site-wide percentage CO2 reduction – 75.06%

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Summary of Design Considerations

- The increase in external wall thermal performance has been achieved with the Countryside standard wall build-u which incorporates a 125mm cavity. As a result, the dwelling plot floor print or living space within does not change and no amendments to the Zone T site plan layout are required.
- Triple glazed window units shall need to be reviewed to ensure no structural amendments are required to accommodate.
- ASHP implementation requires internal space to house a DHW cylinder, and if radiators are to be used, these will need to be larger, potentially compromising usable floorspace.
- Standard ASHPs also need to be housed externally, which need to be located at the dwelling to limit losses, but with consideration of aesthetic, noise and security considerations.
- The site's electrical capacity will need to be reviewed, as the electrical demand of the site will likely double compared to a 'gas' site. This may require larger/more substations.
- If utilizing a direct electric space heating strategy for the apartments, EPC ratings will suffer, even though the strategy is potentially net-zero in operation.

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Cost Implications - Countryside

- Houses average uplift costs per fabric element:
  - Floor insulation £746 per unit (0.6% uplift)
  - External wall £5,127 per unit (4.3% uplift)
  - Glazing £1,437 per unit (1.2% uplift)
- Flats average uplift costs per fabric element:
  - Floor insulation £307 per unit (0.5% uplift)
  - External wall £2,374 per unit (3.7% uplift)
  - Glazing £910 per unit (1.4% uplift)
- The key plant variation within the house to deliver FHS energy performance is the replacement of the Gas boiler system with an Air Source Heat Pump. The strategy for the apartment differs, with all units to have direct electric space heating and a Dimplex Edel ASHP hot water cylinder, supported by a photovoltaic array.
  - Houses ASHP uplift cost £5,500 per unit (4.6% uplift)
  - Apartment Block electric heating, HWHP & PV £2,400 per unit (3.7% uplift)
- The estimated extra over cost to deliver from 2013 Part L to FHS within the current standard Countryside dwelling types proposed for Beaulieu Zone T is:
  - Houses £12,810 per unit which is 11% of total build cost *
  - Apartments £5,991 per unit which is 9% of total build cost*
  - Total estimated cost is £784,000 which is a 10% uplift of the total scheme build cost.
  - *The above costs exclude allowance for preliminaries & overheads and contingency costs. heating, HWHP & PV £2,400 per unit (3.7% uplift)

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Part O - Overheating

- Overheating was always considered within Part L
- This has now been replaced by new Approved Document O
- Two routes to compliance
  - Simplified Method
  - Dynamic Thermal Modelling

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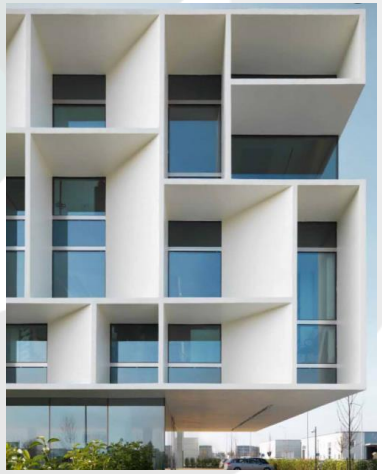
Compliance with Part O

- Two routes to compliance –
  - Simplified Method – set criteria of % of Glazing Area against floor area and set criteria of minimum free area of openings against floor area
  - Dynamic thermal modelling – CIBSE's TM59 methodology to predict overheating



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Conclusions

- Implementation of Part L could be achieved with existing technology.
- Cost average £12,800 for houses and £6,000 for apartments
- No fundamental changes required in the masterplan
- No fundamental changes required to the housing types
- The above will mean that compliance with Part L (2025) is realisable within the constraints of viability, planning policy and other technical considerations

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Questions and Discussion

Full report in document library:

www.chelmsford.gov.uk/cgc

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