

Workshop 2a

# NetZero MMC Homes

**Speaker:** Audley English FRSA, RIBA, AA Dipl

**Chaired by:** Andrew Burke

**Room:** 2A



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**Conference**  
**2022**

# NetZero MMC Homes Delivered Defect-Free & Future-Proofed

- My commitment within the built environment spans over decades in design and projects that build back greener, inspired by Buckminster Fuller & Walter Segal.
- Modern Methods of Construction (MMC), recently recognised for its many sustainable benefits, supports my early belief in sustainability

## WHAT IS NetZero?

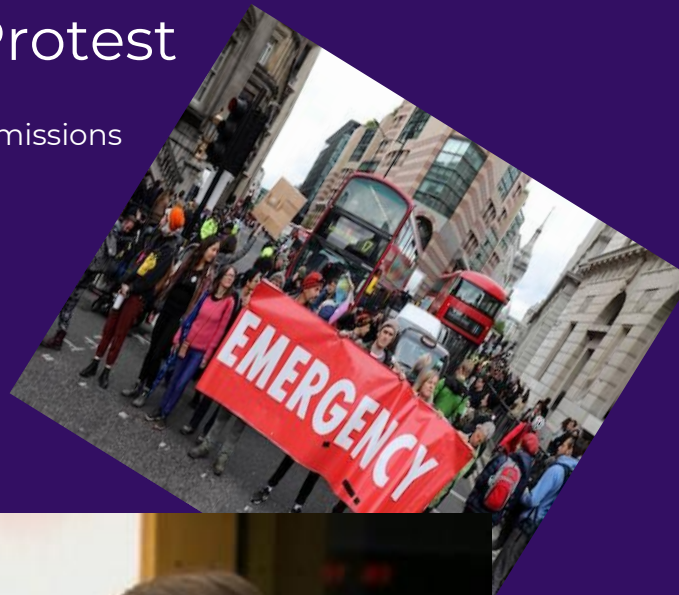
‘Balancing the elements of human needs’

I gave this some further thought and I coined the phrase

“HUMANS must Reduce *CARBON* or *CARBON* will Reduce HUMANS”

# Climate Change Protest

buildings account for 40% of emissions



16-year-old Swedish activist schoolgirl  
Greta Thunberg  
at the Houses of Parliament

2008 Climate Change Act  
to cut CO2 by 80% and  
reach 'net zero' by 2050



New York Mayor plans to ban  
'glass and steel skyscrapers'



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The recent Cop26 conference representing 120 world leaders and delegates from nearly 200 nations was tasked to save the planet, but reached disappointing agreement.

Due to weak proposed targets, they will all have to return to the negotiating table in 2022 with agreements of improved flexible solutions to address climate change.

The construction industry can play its part, as 30- 40% of carbon emissions are emitted from within this sector. Similarly, flexible collective solutions are required to ensure that future developments are NetZero and future-proofed, including their end of life use and their deconstruction.



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The Scene



13 years on

Development Board of London HA  
(now retired)



The Cube



In LB Hackney, the HA commissioned this hybrid Cross Laminated Timber structure, at 10 stories high MMC.



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# A Selection of Practice Projects

forefront of innovation



Shared ownership (Purchased 3B @ £260k  
Recently sold @ £800k



The Walter Segal system  
Self-build Bungalow in the 90's

## LIKE A THERMOS

In the current year, Hyde Housing Association anticipates completing approximately 1400 dwellings, almost exclusively in traditional construction. In its Annual Review for 1994/5, the traditionally built experimental scheme of 13 houses in Adamsrill Road, Lewisham is described as Hyde's 'most energy efficient development to date'. Completed earlier this year, the three-bedroom houses, grouped in three terraces, have all achieved an NHER of 10 and a BREEAM rating of 'excellent'.

As the Review points out 'suitable development is a key consideration for housing associations. Hyde has a clear responsibility not only to conform to published guidelines and standards for environmentally friendly housing and services but also to try to develop new ways to provide these.



'Our aim is to take the lessons we learned at Adamsrill Road and incorporate them into our already stringent design guide for new and existing buildings'. In common with Fox House, described above, insulated beam and block ground floors, condensing boilers, passive stack ventilation and blown cellulose roof insulation have been incorporated.

### WALLS

External walls have an outer leaf of new or second hand London Stocks, a 90mm cavity partially filled with 40mm of CFC and HCFC-free insulation and an inner leaf of low density aerated blocks.

Space heating costs are estimated at £170 per year – half those of homes built in accordance with the Building Regulations.

The development was built by Rydon Homes with Audley English Associates as novated architect and Norman Beddington as novated environmental consultant. In the words of Hyde's Review, it has 'the insulation of a Thermos'.



Running costs £170 per year



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Refurbished Territorial Army building into Hostel

First combined housing and business start-up initiative in London as part of the government's 'Housing Plus' scheme.

Ground floor fully wheelchair-accessible to allow rental of work units from desk space to suites, with shared secretarial and conference facilities



Shortlisted Housing Design Award **2002**

BEST REGENERATION PROJECT 2004



NHMF Maintenance Conference **2022**





the civic trust

BBC NEWS

AEA eco-functional architects

GRAND DESIGNS MAGAZINE AWARDS WINNER

BARNET LONDON BOROUGH

First Social Housing grass roof scheme in London



Garage site

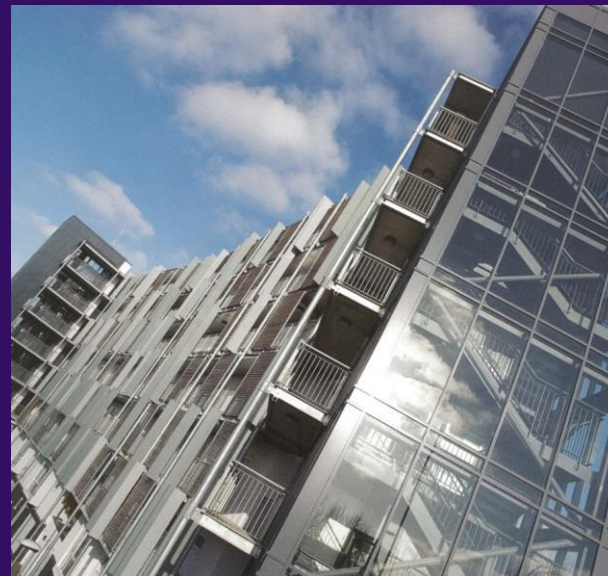
nhmf National Housing Maintenance Forum

NHMF Maintenance Conference 2022





Board of Trust Thamesmead “It very much changed the look of Thamesmead”



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< | HOME

## Audley English Associates

1 JUNE, 2000



London-based practice Audley English Associates has received planning permission for a £1.3 million social housing project on Helena Road in Newham, London. The four-building scheme for the Ujima Housing Association uses modular building techniques and consists of eight three-bedroom apartments and 12 two-bedroom apartments. Materials include a long-lasting zinc roof and low-maintenance cedar cladding. The blocks look out onto a communal garden.



The first architectural published scheme to use the term 'Modular building' was attributed to an AEA project in June 2000



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# Learning From Other Industries

**bdonline.co.uk**

What can housebuilders learn from the car industry?

High Precision Build +/- 0.5mm



Jaguar C-X75



Daimler 1892



A Citroen C1 is seen on the joint assembly line of the new TPCA (Toyota Peugeot Citroen Automobile) factory near the town of Koilin



A newly assembled Toyota Aygo being washed at the joint assembly line of the new TPCA factory

Toyota capacity  
10m vehicles a year



Ford Model T 1908 – 15M by 1927



Sir John Egan 1998



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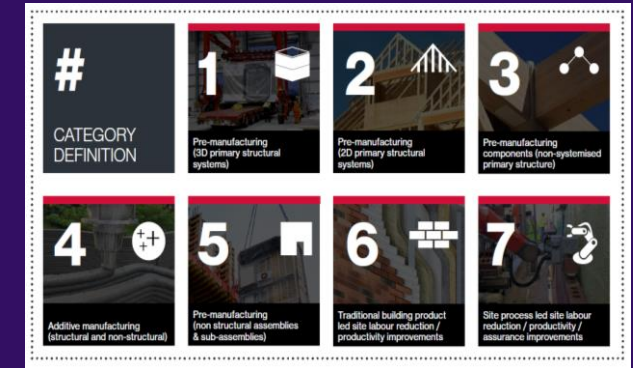
# Transports Minimal CO2 Typical Requirements For 3 Bed House Delivery Comparison

Flat-pack  
2 Lorry Loads

Volumetric  
7 Lorry Loads

Traditional  
6 Lorry Loads

Timber Frame  
5 Lorry Loads



Category 1 (3D)

Category 2 (2D)

Category 1



Volumetric Solution

Flat-pack Solution

## Buildeco Support Bubble

Fully integrated end-to-end  
delivery solution



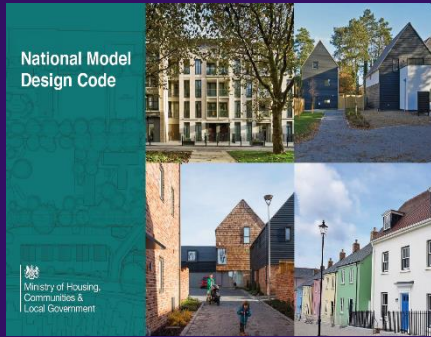


# Build Net Zero Now, Why Wait?

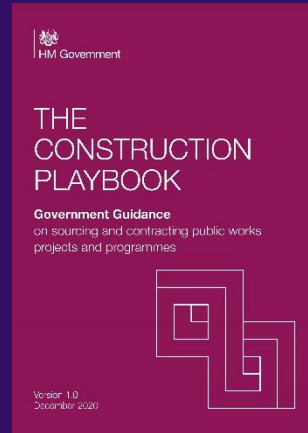
# Zero defects

## External Wall System (EWS) non-combustible materials

## Support the creation of new green jobs



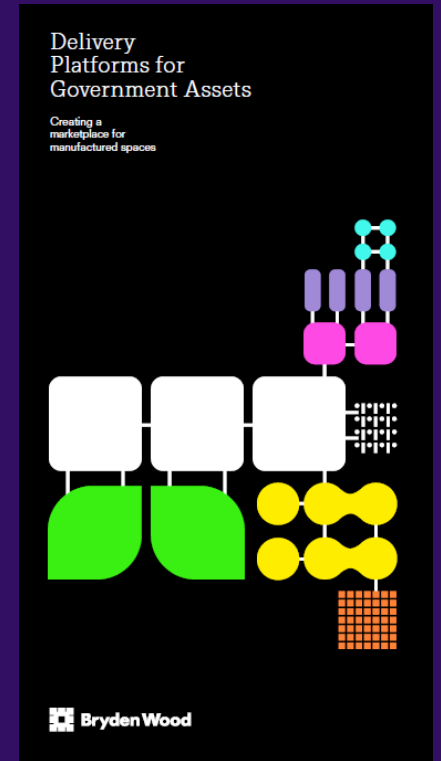
Local authorities encouraged to create their own local design codes



Identifies the use of digital tools and modern methods of construction (MMC)



BUILD NET ZERO NOW



P-DfMA



## Fabric first solution



Energy bill prices to rise 50% for 15 millions households across the UK



Avoid errors & save £5 billion per annum



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# 2006 Atlantis launch



Leonardo 'Permanent Multipurpose Module'

Alan Bean, flew to the Moon on Apollo 12

SpaceX's 2002 private company commercial humans into orbit 2020



Hydrogen fuel cell (FCEV)



Hydrogen boiler



Installed on International Space Station March 2011

# Future Innovation

Digital twin originated from NASA for Advanced Manufacturing by Michael Grieves

## Hydrogen Fuel Cells

- Power the International Space Station
- Space Station also uses solar arrays

## Commercially

- Hydrogen fuel cell cars (2013)
- Hydrogen boiler (2019)



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# Simple Platform Solutions (P-DfMA) for MMC Delivered using standard kit-of-parts



Five-classroom building (C24)



Modular Rear Extension (LVL)



Demonstration House (C24)



Home Garden Room (LGS)



Active classroom 'Swansea' (LGS)

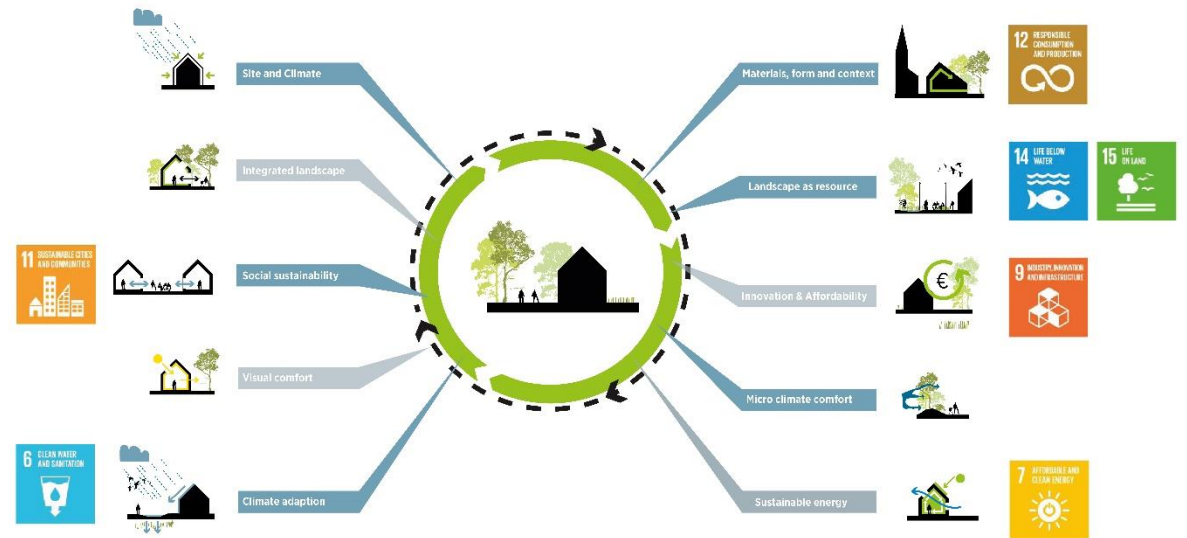
Circular Economy  
"a model of production  
and consumption"

Panelised Construction

## LANDSCAPE DESIGN ADDED VALUE



## INTEGRATED DESIGN APPROACH



CF MØLLER  
ARCHITECTS



# Multi Generation Garden Villages



Delivering one million homes

Harlow & Gilston  
10,000 Homes



Dunton Hills  
2500 Homes

Oxford / Cambridge Arc Requires 40 Garden Villages



Covered solar canopies to cycleways and walkways

Panelised Construction



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# FlexiHouse Generational Living



## Panelised Construction



Supported by the Ministry of Housing Communities & Local Government (MHCLG)



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# Social Value Local Employment & Training

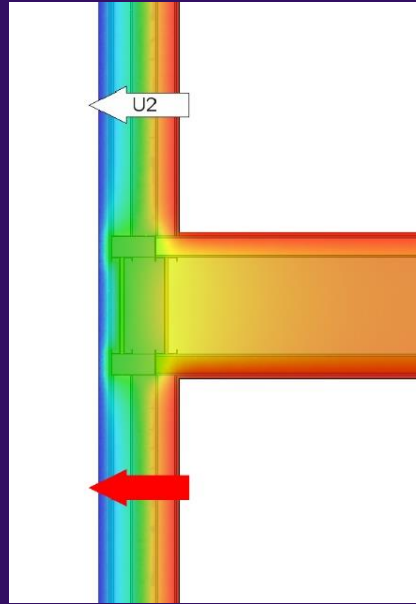
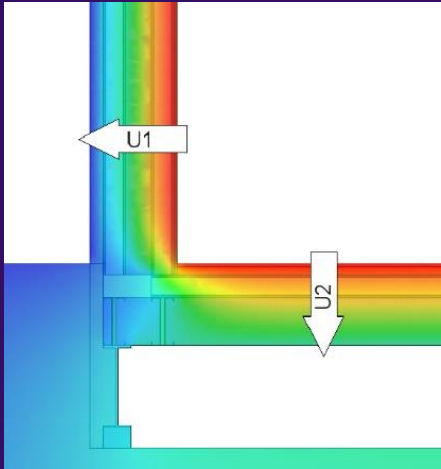
## Panelised Construction



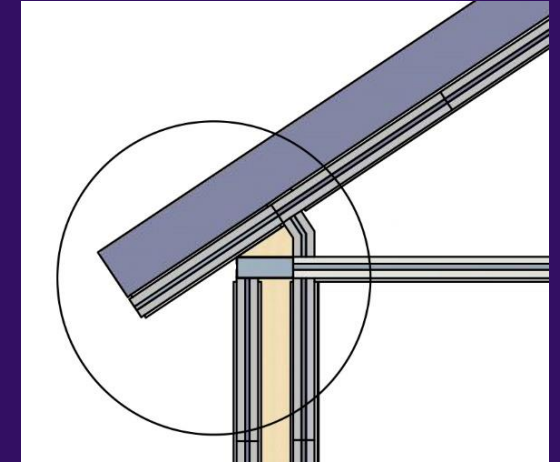
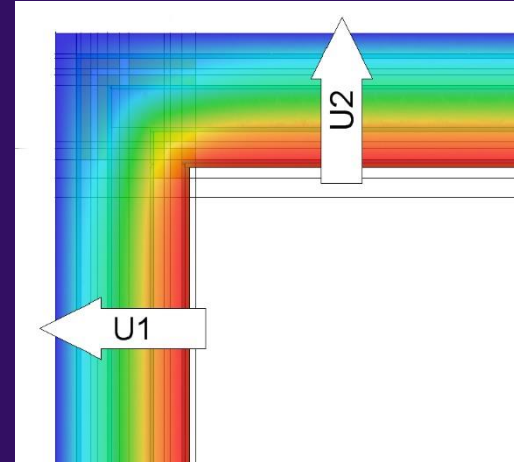
Jobs for all post Covid-19

# The future challenge is addressing NetZero

Fabric first approach  
Futureproofed



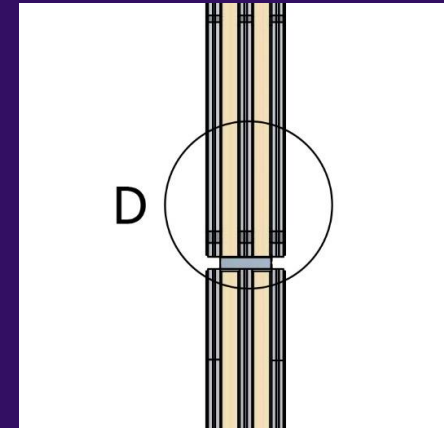
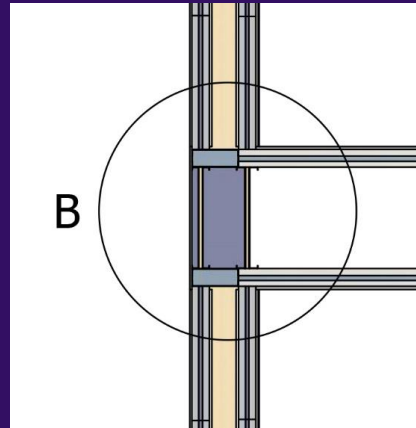
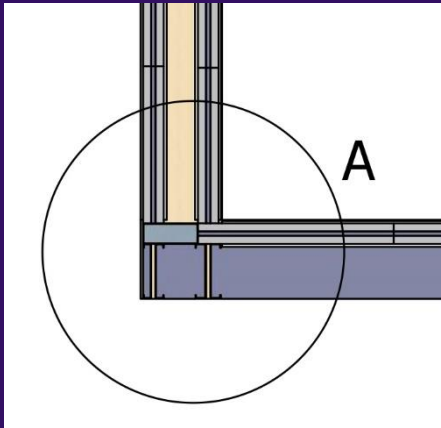
Disassemble reused and reconfigured  
Minimum waste throughout



Thermal Bridging Details

Typical corner detail

Roof detail



Panelised Construction

Ground floor

Typical upper floor

Party wall



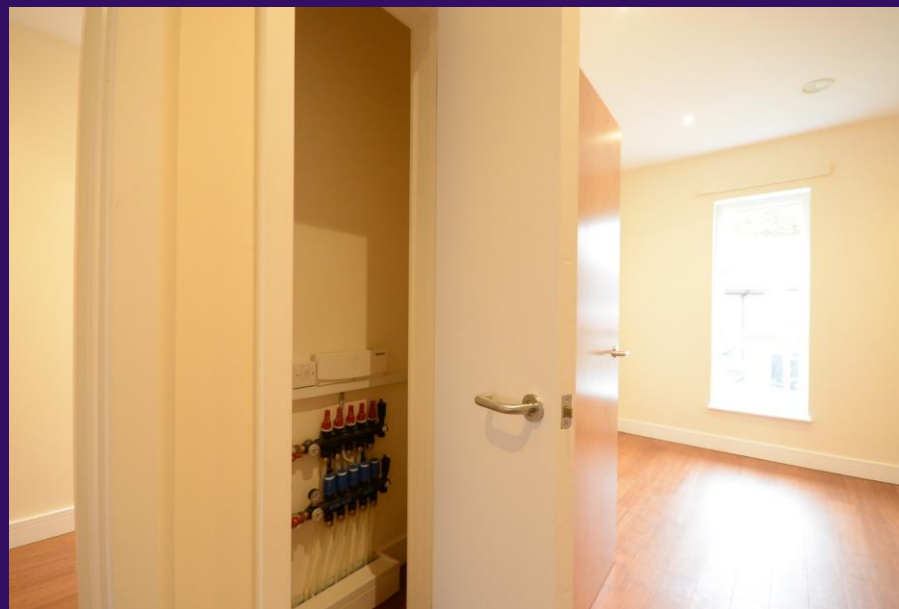
# The future challenge is addressing NetZero



MVHR unit



GF UFH Controls



FF UFH Controls

- MVHR unit
- Underfloor heating (UFH)
- Airtightness
- Wheelchair lift shift



Airtightness test with Open Roof Hatch  $2.9\text{m}^3/\text{hr}/\text{m}^2@50\text{Pa}$



Panelised Construction

# 3B5P Social Rent House 101m2



all components are delivered to site in the back of a white van and assembled on site

Panelised Construction

Net Zero EPC 'B' without renewables



# Race to NetZero & ESG Investors

## ⚡ Energy performance

- Energy Use Intensity (EUI): 53 kWh/m<sup>2</sup>/yr
- EPC rating: B
- Space heating demand: 22.7 kWh/m<sup>2</sup>/yr
- Dwelling Fabric Energy Efficiency (DFEE): 42.3 kWh/m<sup>2</sup>/yr
- U values:
  - Roof – 0.14 W/m<sup>2</sup>K
  - Ground floor – 0.13 W/m<sup>2</sup>K
  - Suspended floor – 0.16 W/m<sup>2</sup>K
  - Walls – 0.14-0.15 W/m<sup>2</sup>K
  - Door – 0.45 W/m<sup>2</sup>K
  - Windows vary between 0.8-1.6 W/m<sup>2</sup>K, g-value 0.52-0.64
- The tenant reported that to date their monthly bill in the coldest winter month was just £23
- MVHR installed



MMC Demonstration Project

## ♻️ Whole life carbon/resource efficiency

- The buildings can be disassembled at end of life, with panels being able to be reused and reconfigured. It is designed in such a way it can be disassembled in reverse order
- Use of MMC to minimise material waste
- Carbon reductions of between 30-50% were achieved due to the lightweight structure requiring shallower foundations and fewer site deliveries
- Only 2 skips were used for waste material throughout project delivery



Reduce Fuel Poverty

Zero defects



## Environmental Social & Governance (ESG)

Investors interest in ESG would form fundamental role in the credit process underpinning future investment decisions. ESG considerations are becoming central to investors credit process on company's balance sheet or profit and loss profile.



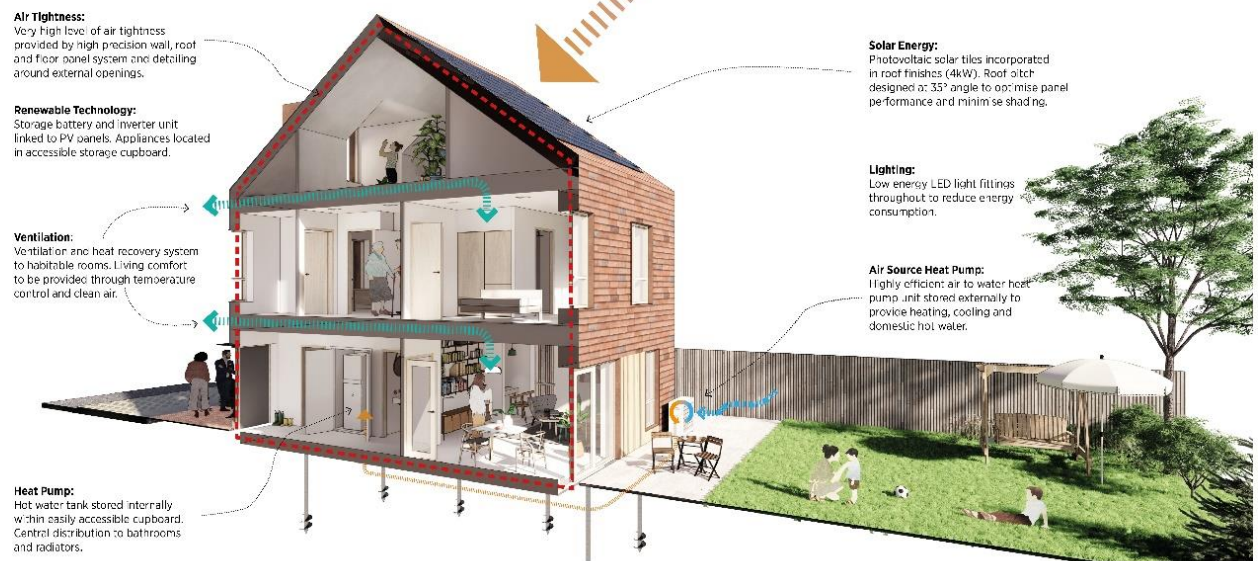
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# Oxford City Housing Ltd (OCHL) has selected seven developers to help build more than 2,500 low carbon homes across Oxfordshire

## FABRIC FIRST ENERGY MEASURES



## LOW CARBON ENERGY MEASURES



Futureproofed

SECTION 8

SUSTAINABLE HOUSING DEVELOPMENT FRAMEWORK

SECTION 8

SUSTAINABLE HOUSING DEVELOPMENT FRAMEWORK

13

- A 40% carbon reduction from the 2021 building regulations which come into effect this June or a 70% reduction below current standards, whichever is greater
- Passivhaus equivalent standard
- zero carbon for regulated and unregulated energy, with a preference for low embodied energy



# FlexiKeyWorkers Multigenerational Complex



Street Elevation



Ground Floor Flat For Over 55s



Communal Rear Garden Elevation



Double Height Space - Upper maisonette

We Clapped Now Let's  
Build For Them  
(New Housing Concept)



# Overseas MMC Homes

Panelised Construction



Garden Village  
for the Caribbean, African &  
Asian markets

Rapid Sustainable Urbanisation Off-grid Housing



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# Thank you.

See you at the  
next conference!

**build**eco  
offsite architecture



w: [build-eco.com](http://build-eco.com)

Flat-Pack  
Modular Buildings  
Future Proofed



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