Building for 2050: Homes of the Future

Tom Dollard
Head of Sustainable Design,
Pollard Thomas Edwards

AJ 100
Winner 2018
Sustainable
Practice of the Year

Pollard Thomas Edwards

@dollardtom
@ptearchitects

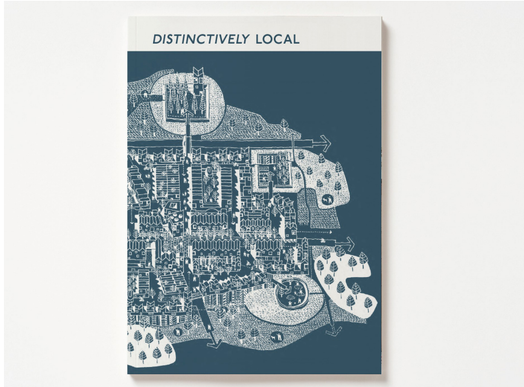
Introduction to Pollard Thomas Edwards

1974
Practice Established

13,184
Planning Approvals (2015-19)

5,961
Built (2015-19)

156
Staff



240
Awards

22
Languages Spoken

Lifting everyday places out of the ordinary

Architecture
Masterplanning
Urban Design
Property Development
Community engagement
Research
Branding & Wayfinding

2019 in numbers

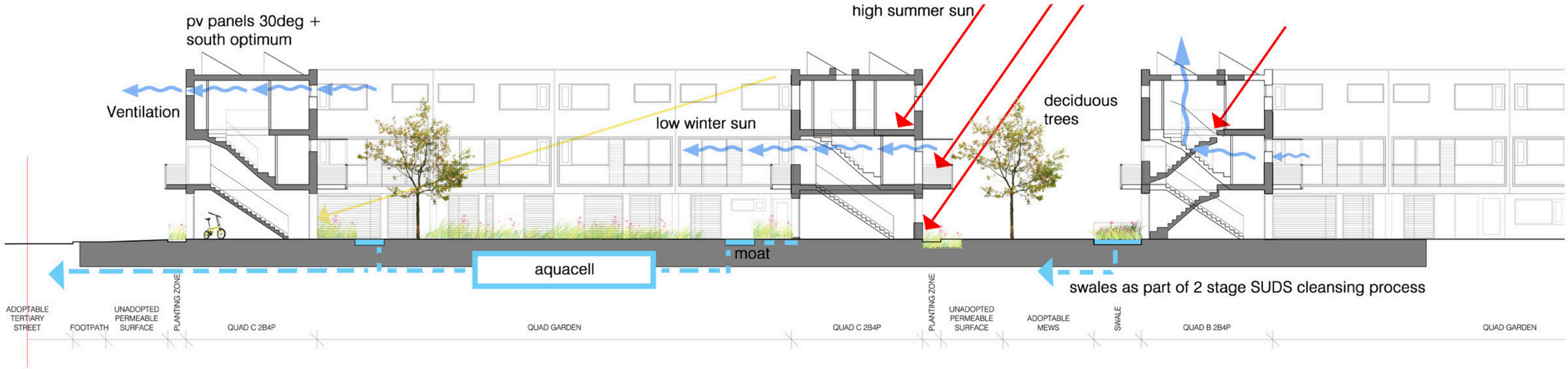
5,526
homes under construction

2,561
homes built

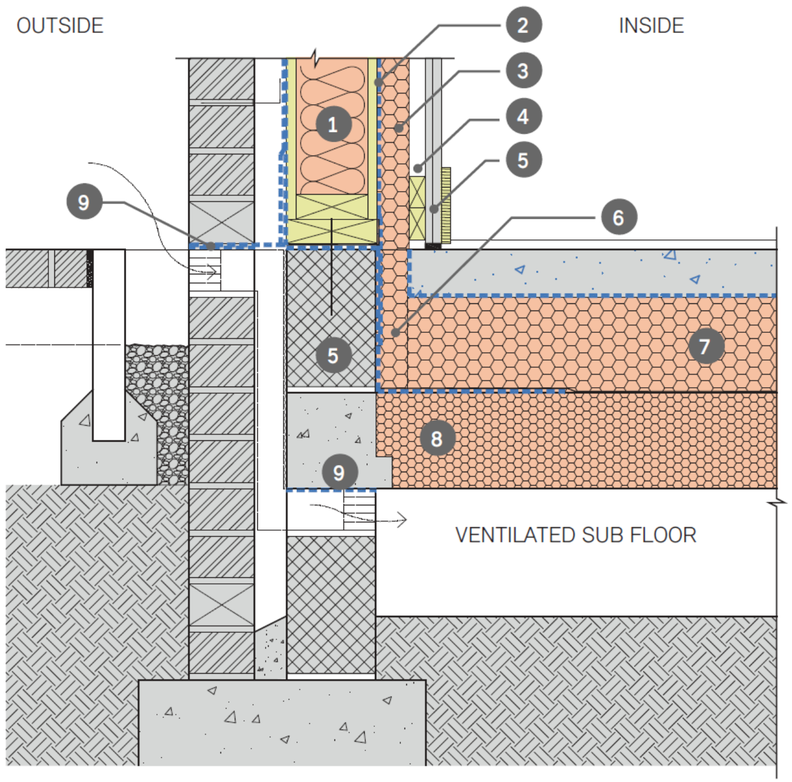
Planning permission for
1,243 homes

Virido, Clay Farm, Cambridge

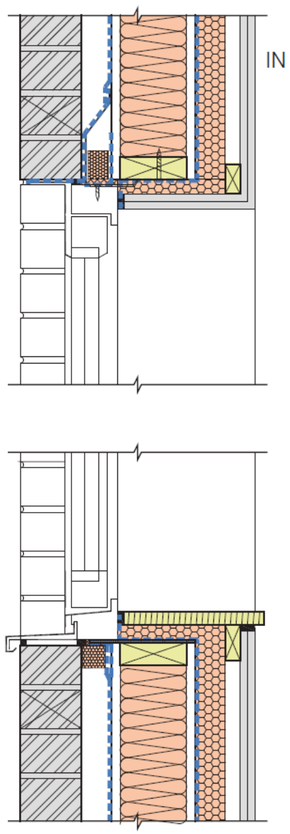
- Zero Carbon on site (code for sustainable homes code 5)
- 208 homes + mixed use (retail/community centre), complete 2016-17
- 50% affordable rent / 50% private – Cambridge City Council and Hill
- **LEAN:** Enhanced fabric (passivhaus spec. with SIPS but did not achieve PH airtightness or thermal bridging so not certified PH)
- **CLEAN** = Gas CHP district heating
- **GREEN** = Photovoltaic solar panels to make up to 100% reduction regulated energy.



Detail

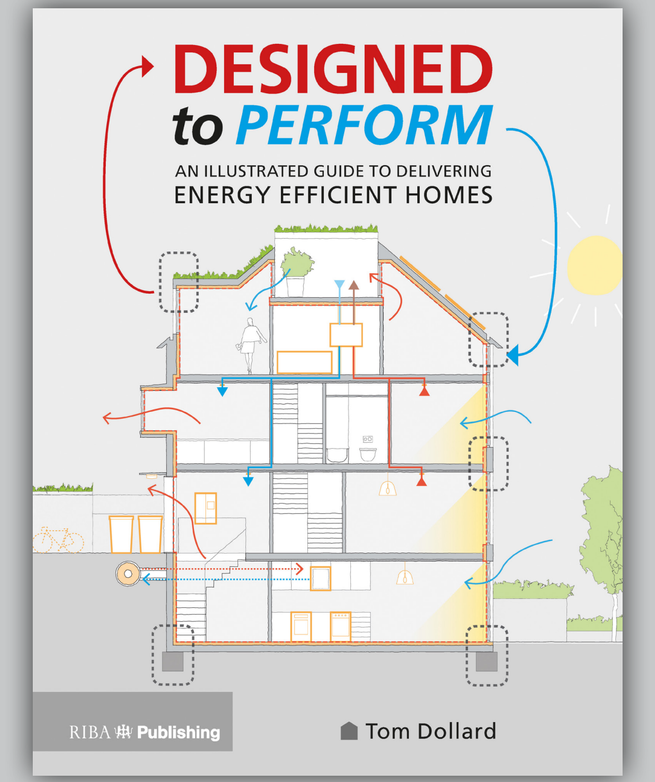


1. 142 mm SIP
2. Airtight membrane
3. 50 mm internal insulation
   λ = 0.022 W/m.k
4. Service zone
5. Aircrete block
6. Plasterboard finish
7. 50 mm perimeter insulation
8. Continuous floor insulation
9. Concrete beam with insulation block floor with airtight DPM below and separating layer above
10. DPC

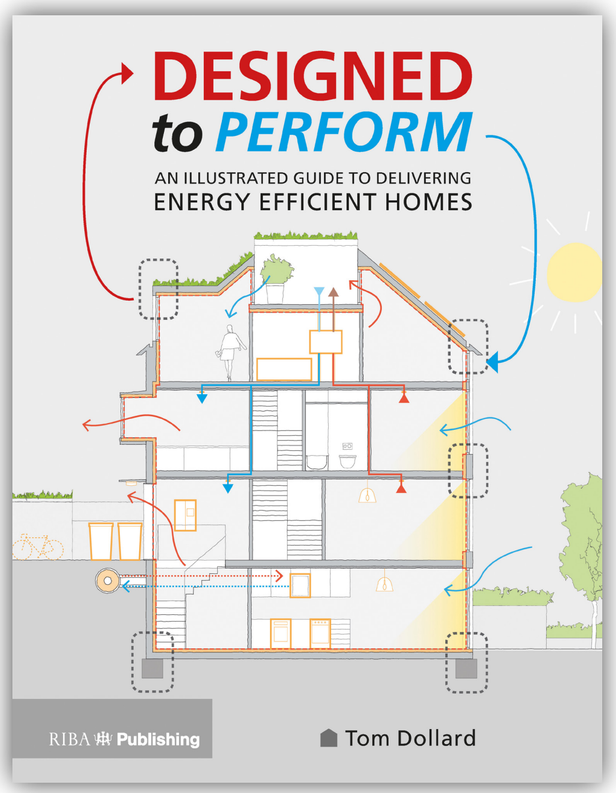


Section Detail

1. Service zone
2. Rigid insulation
3. VCL
4. SIP



Projects Research



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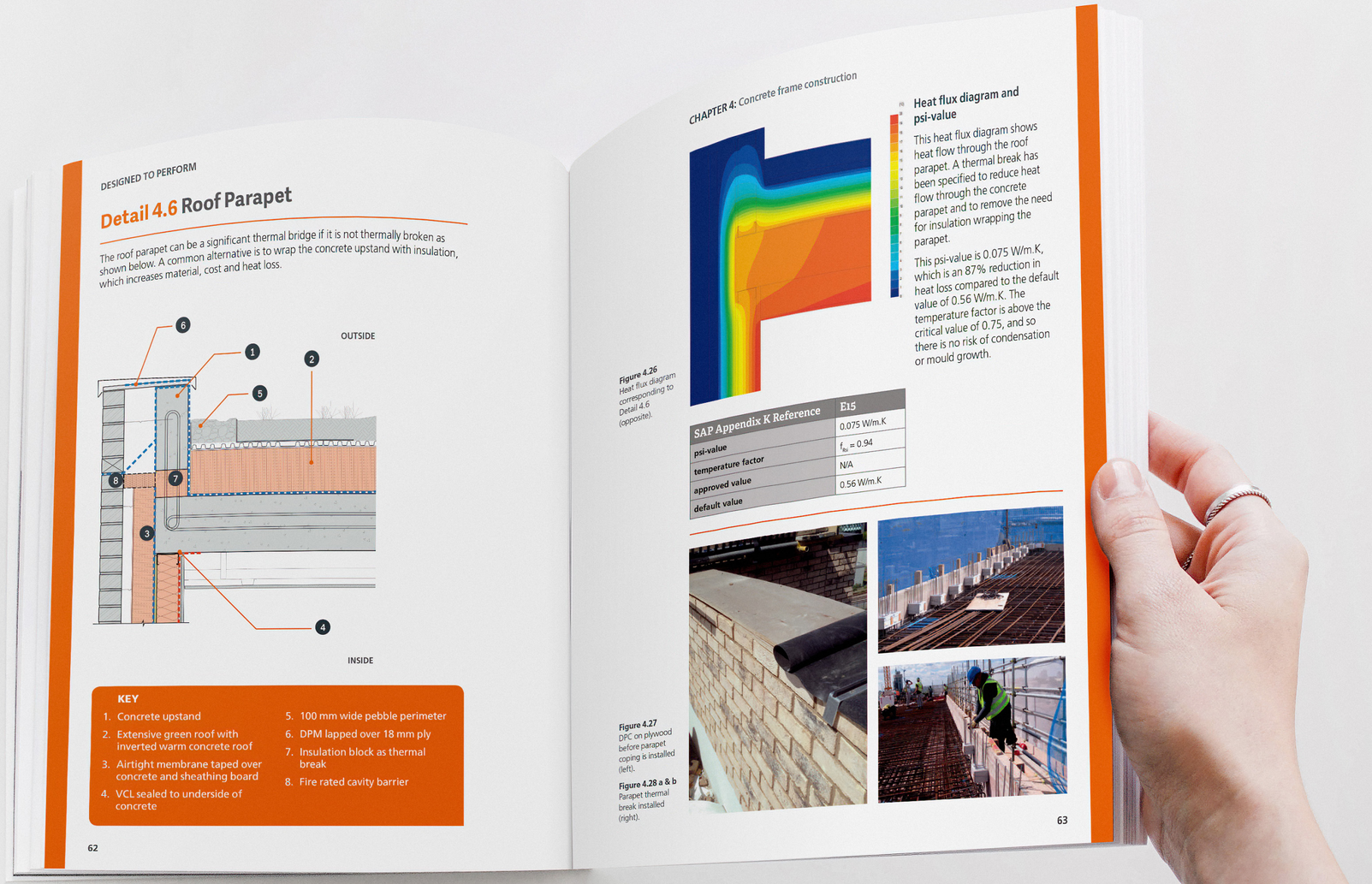

DESIGNED TO PERFORM

Detail 4.6 Roof Parapet

The roof parapet can be a significant thermal bridge if it is not thermally broken as shown below. A common alternative is to wrap the concrete upstand with insulation, which increases material, cost and heat loss.

KEY

1. Concrete upstand
2. Extensive green roof with inverted warm concrete roof
3. Airtight membrane taped over concrete and sheathing board
4. VCL sealed to underside of concrete
5. 100 mm wide pebble perimeter
6. DPM lapped over 18 mm ply
7. Insulation block as thermal break
8. Fire rated cavity barrier

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CHAPTER 4: Concrete frame construction

Heat flux diagram and psi-value

This heat flux diagram shows heat flow through the roof parapet. A thermal break has been specified to reduce heat flow through the concrete parapet and to remove the need for insulation wrapping the parapet.

This psi-value is 0.075 W/m.K, which is an 87% reduction in heat loss compared to the default value of 0.56 W/m.K. The temperature factor is above the critical value of 0.75, and so there is no risk of condensation or mould growth.

Figure 4.26 Heat flux diagram corresponding to Detail 4.6 (opposite).

SAP Appendix K Reference	E15
psi-value	0.075 W/m.K
temperature factor	f_{Rsi} = 0.94
approved value	N/A
default value	0.56 W/m.K

Figure 4.27 DPC on plywood before parapet coping is installed (left).

Figure 4.28 a & b Parapet thermal break installed (right).

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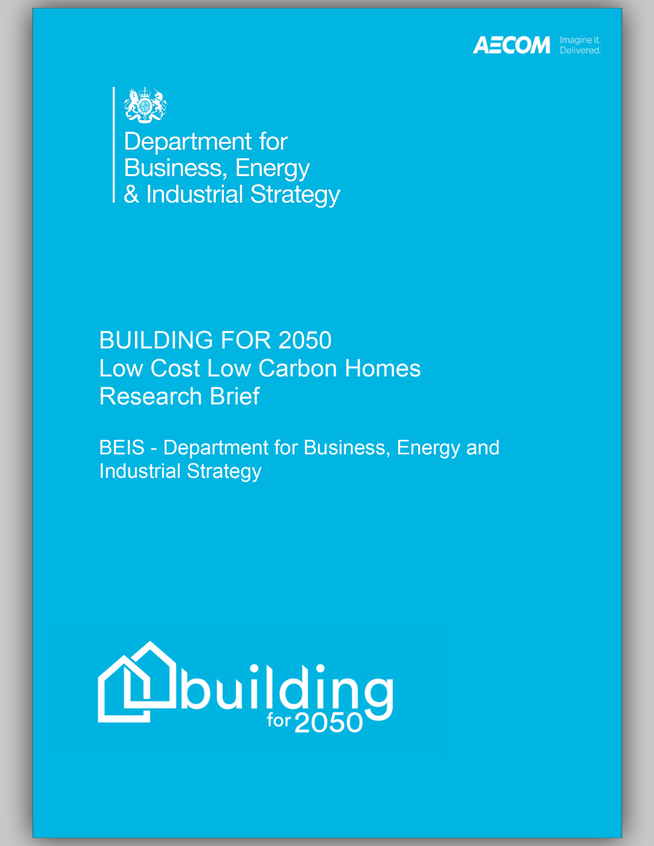
ARE WE READY FOR THE BOOM?
HOUSING OLDER LONDONERS
FUTURE OF LONDON
DELIVERING ESTATE RENEWAL
A briefing from London housing leaders
FUTURE OF LONDON
SEMI-PERMISSIVE
Pollard Thomas Edwards
savills
Nathaniel Lichfield and Partners
2015
BUILDING FOR 2050
Low Cost Low Carbon Homes
Research Brief
BEIS - Department for Business, Energy and Industrial Strategy
building for 2050
Thomas Edwards
DESIGNED to PERFORM
AN ILLUSTRATED GUIDE TO DELIVERING ENERGY EFFICIENT HOMES
RIBA Publishing
Tom Dollard
DISTINCTIVELY LOCAL
HAPPI
Housing our Ageing Population: Panel for Innovation
Communities
Department of Health
Levitt Bernstein
PTEa
THE BUILDINGS HUB
DESIGNER'S HANDBOOK
Designing comfortable low energy homes that perform as intended
NHBC
CITB
LABC
Pollard Thomas Edwards
Think Three
Levitt Bernstein
Pollard Thomas Edwards
PRP
Recommendations for living at Superdensity
SUPER DENSITY
THE SEQUEL
ALTERED ESTATES
How to reconcile competing interests in estate regeneration
ZERO CARBON HUB
BUILDERS' BOOK
ZERO CARBON HUB
SERVICES GUIDE

Research Building for 2050



Build Stage 4: First Fix

Inspection from weathertight to completion of first fix.

Description of construction:

No	Inspection Item	Findings on site	Photo reference + Drawing/specification reference
1.	Are any internal movement joints sealed fully with air tight expanding barriers (compriband)?	**N/A**	
2.	Has gap between staircase string and wall been packed out and sealed?	**N/A -floor is sealed.**	
3.	Has ventilation ducting been installed in line with design layout (type, location, number of bends)?	**250mm x 90mm insulated flat duct. Exhaust is 9m long with 5 bends. Supply is 1m long with 1 bend. Internal supply has a 3m high riser to floors below. Check design.**	
4.	Have service penetrations in the floor slab and wall for been sealed airtight?	**Not sealed in first floor, but sealed in wall.**	
5.	Have any 'other' holes in the structure been formed and sealed?	**Generally sealing of holes is adequate apart from services penetrations in loft. Check airtightness results.**	

Building for 2050

- BEIS funded research to investigate the attitudes, challenges, barriers and opportunities to low cost low carbon new building housing in England & Wales
- Encompasses literature review, case studies of low carbon developments, and wider stakeholder engagement
- Combines design review, site observations, interviews, post completion testing, and monitoring of energy and environmental conditions
- Delivered by an AECOM-led consortium
  - AECOM (technical and social research)
  - Pollard Thomas Edwards (technical and comms)
  - Fourwalls
  - Delta-ee
- Recommendations expected in 2020/21

building for 2050

Department for Business, Energy & Industrial Strategy

AECOM

Pollard Thomas Edwards

fourwalls

DELTA Energy & Environment

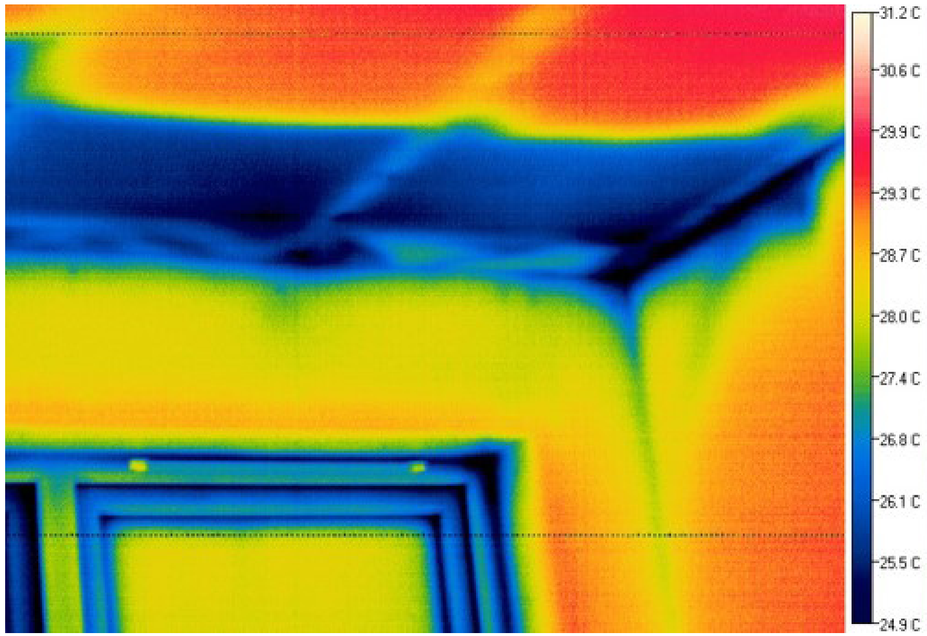
Project Objectives

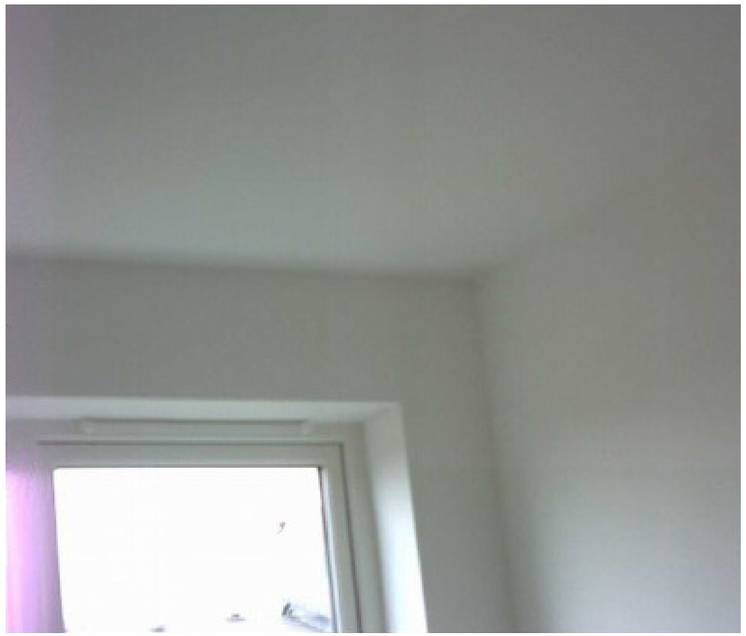
1. **Understanding the context** What is the effect of current policies on low cost, low carbon housing (regional and national)? What is the current market for low cost, low carbon housing?
2. **Understanding the drivers and barriers** What are the drivers, barriers, attitudes and challenges identified through case studies and wider stakeholder engagement?
3. **Understanding occupant experience** What are residents' desires and expectations of low cost, low carbon developments, and what has been delivered in practice.
4. **The role of technology** How easily the performance can be maintained to be fit for 2050? What is the potential for technology to drive efficiency improvements across the housing sector and to impact on the energy supply sector?
5. **Improving build quality** What are the factors with the greatest impact on both the build quality and the installation and operation of novel energy systems?
6. **Addressing the performance gap** How significant is the performance gap between the predicted energy performance and measured performance at the selected low cost, low carbon schemes and what could be done to address it?
7. **Accelerating change** What is needed to accelerate large-scale construction and uptake of low cost, low carbon housing?

Case Study Review practical implication through the build process

For the case studies:

- Undertake design review: which features make them low carbon?
- Carry out site interviews: a sample those involved in the low carbon aspects
- Site observations during construction: review work stages and aspects that contribute to the low cost performance
- Post-construction fabric and services performance Testing (2 homes per development)
- Monitor energy and environmental performance and occupancy behaviour (10 homes per development)





Cost and energy performance of LOW CARBON housing

- Monitor energy and environmental performance and occupancy behaviour (10 homes per development)
- Gather occupant views across developments on key aspects of living in low carbon housing
- Synthesis
    - Technical and social research findings
    - Initial barriers & challenges – have they been overcome?
    - Have the identified benefits been realised?
    - Recommend good practice and identify future development needs
- Develop a set of strategic industry recommendations
- Ongoing dissemination with final report and film in 2020/21

Case Study Active Homes in Neath, South Wales

16 social rent homes by housing association Pobl Group. They are designed as "Active Homes" or mini power stations using battery technology, TSCs and air source heat pumps and integrated solar PV to generate around 80% of the energy they consume and slash tenants' energy bills by at least 50%.

Case Study Active Homes in Neath, South Wales

Site progress: September 2019

Case Study Active Homes in Neath, South Wales

Key Design Principles:

1. **Conserve**
   Fabric first, based on passivhaus
2. **Generate**
   Transpired Solar Collectors (TSCs) and Integrated PV panels
3. **Store**
   Battery storage of electricity
4. **Release**
   Stored electricity used in home and sold back to Grid

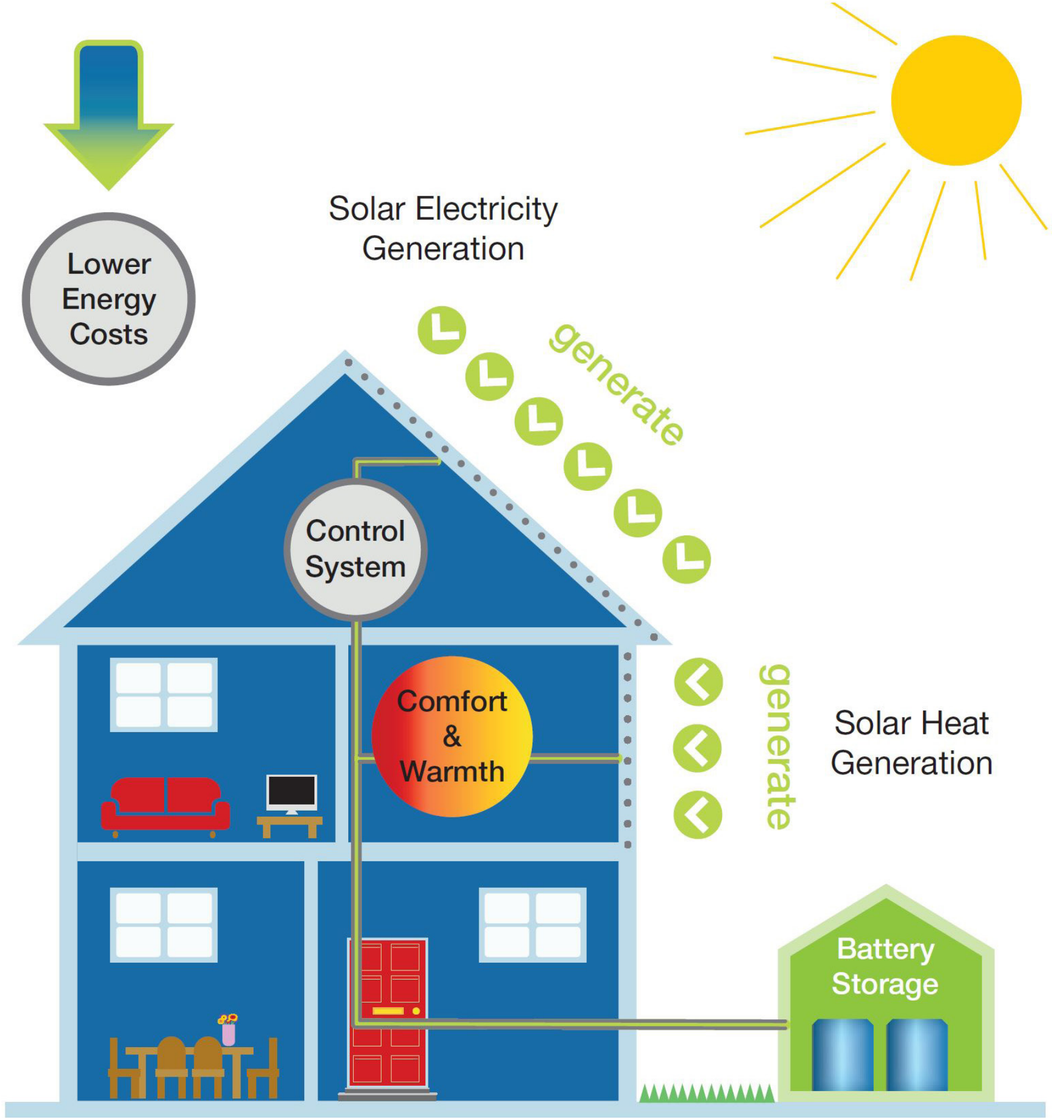


Image: Specific / Active Building Centre

Case Study ETOPIA Homes, Corby

Images: Staniforth Architects

A scheme of 47 modular homes that are equipped with energy saving technology: PVT (combined solar photovoltaic and thermal panel) heat pump, inter-seasonal storage and smart home equipment - to deliver a net zero carbon standard on site

Case Study ETOPIA Homes, Corby




Images: Electric Corby

Steel frame panellsied construction to BPS7014, the new BRE certification scheme.

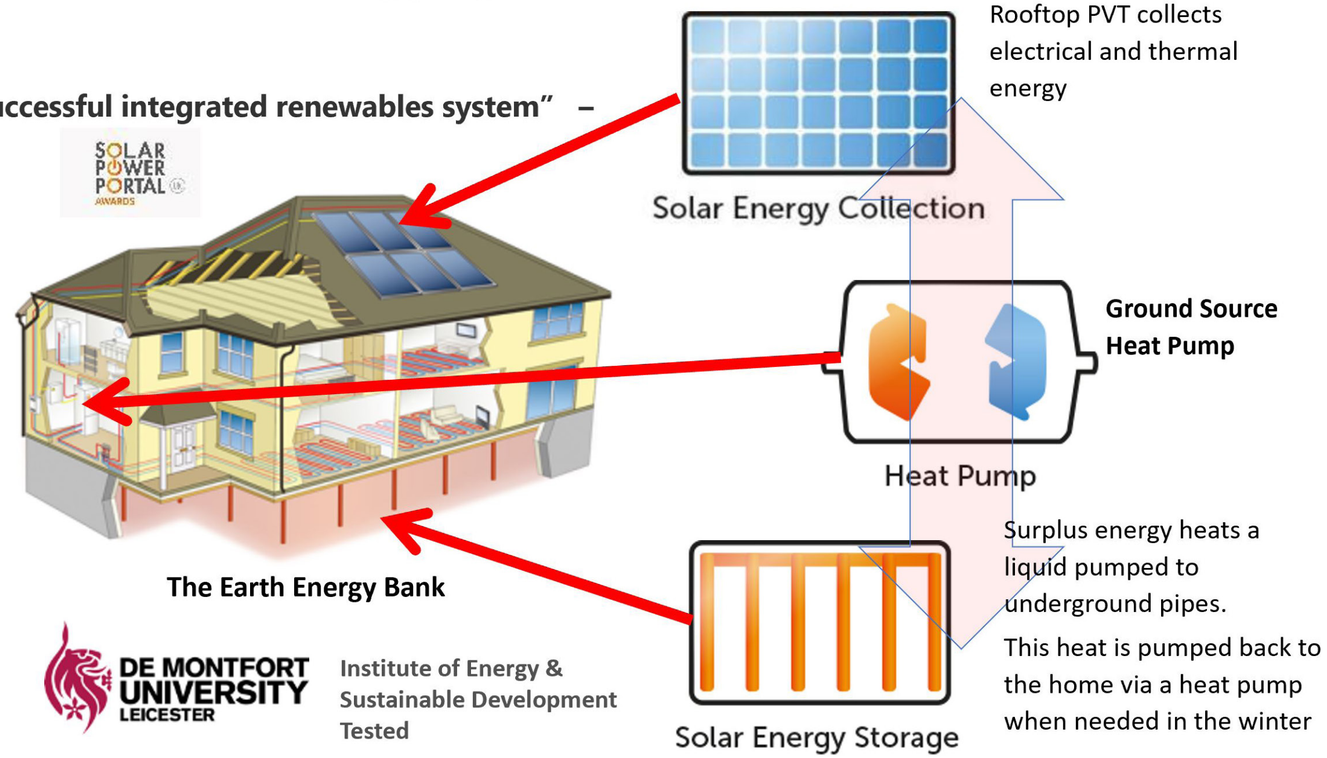
Case Study ETOPIA Homes, Corby

Design Principles:

- Net zero energy homes
- Fabric first + renewable heat and power
- Solar cladding
- Earth store heat pump heating and cooling
- Smart home system

The Renewable Energy System

"Most successful integrated renewables system" –



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Institute of Energy & Sustainable Development
Tested

Case Study K1 Co-housing, Marmalade Lane, Cambridge

42 custom build homes. Marmalade Lane has been designed with a fabric first approach delivered with offsite manufactured panels combined with heat pumps to supply heating and hot water.

Case Study K1 Co-housing, Marmalade Lane, Cambridge

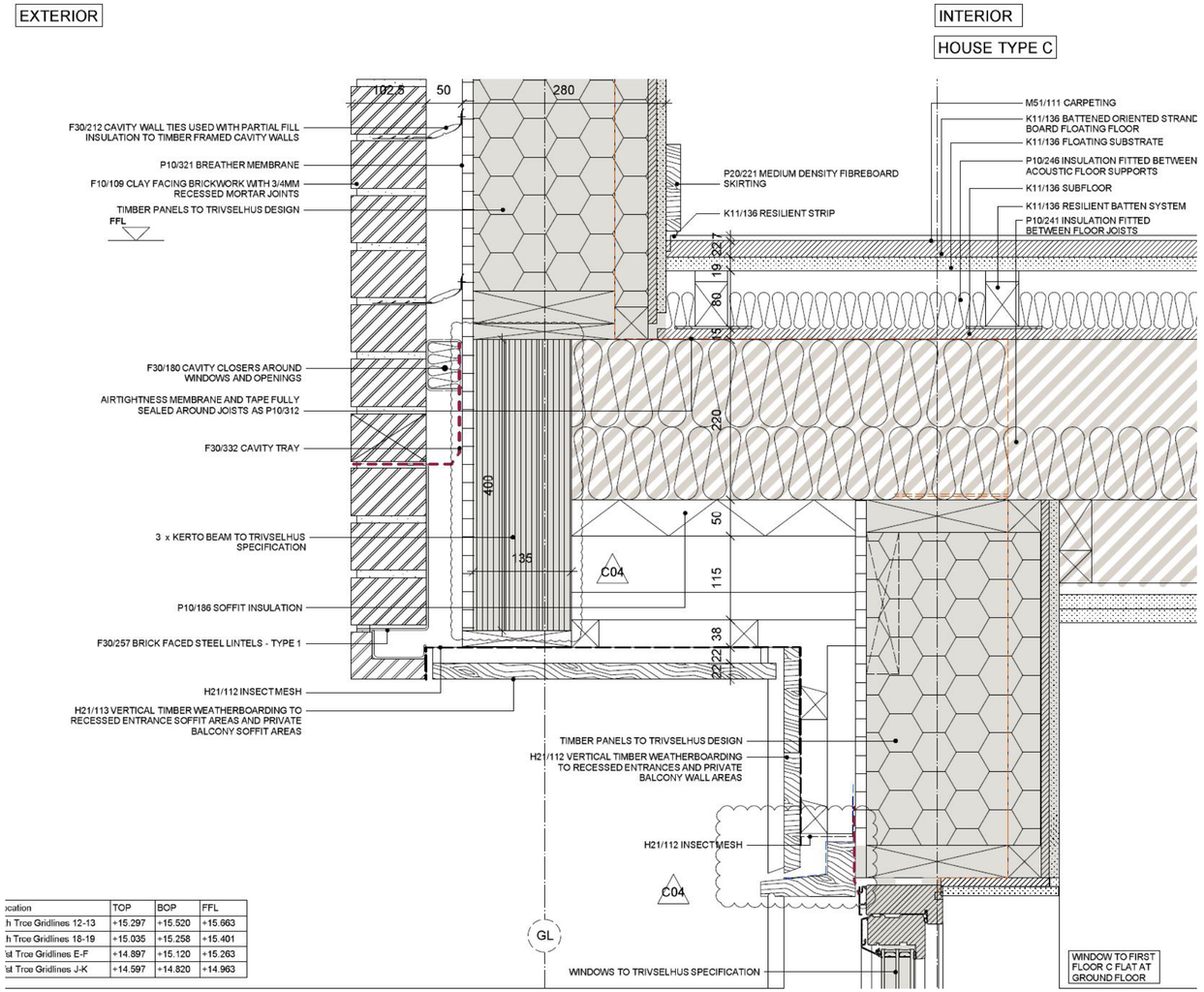
Images: Mole and David Butler

Closed panel timber frame with windows and plasterboard installed in factory.
CLT construction for apartments.

Case Study K1 Co-housing, Marmalade Lane, Cambridge

Design Principles:

- No gas
- Air source heat pumps for each house, and communal heat pump for flats
- Fabric First : max. 35 kwh/m2/yr heat demand
- Solar orientation, form, fabric (detailing)
- Offsite panellised timber construction



ocation	TOP	BOP	FFL
h Trce Gridlines 12-13	+15.297	+15.520	+15.663
h Trce Gridlines 18-19	+15.035	+15.258	+15.401
st Trce Gridlines E-F	+14.897	+15.120	+15.263
st Trce Gridlines J-K	+14.597	+14.820	+14.963

Recessed entrance detail
Drawing by Mole architects

Case Study Tallack Road, Leyton

50 new affordable and private flats and houses. The development is the first to use a large scale communal Air Source Heat Pump feeding an ambient temperature heat network and individual heat pumps, together with solar photovoltaic panels to provide a predicted 57% reduction in carbon emissions (part L 2013) on site.

Case Study Tallack Road, Leyton

Traditional masonry construction
Part L standard fabric targets

The Zeroth Energy System

2. Heat Pump and Cylinder in each apartment

Low temperature heat network (15-25 degrees)
Zeroth heat pump and hot water cylinder in each flat

Building for 2050

- Analysis of data in 2020: Completion of site observations, 100+ stakeholder interviews, residents feedback, post completion testing, energy and environmental monitoring.
- Looking for wider industry stakeholders and case studies
- Finding and recommendations expected in 2021

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Thank You, any questions?

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