Practical Implications of Zero and Low Carbon Housing

CIFAL

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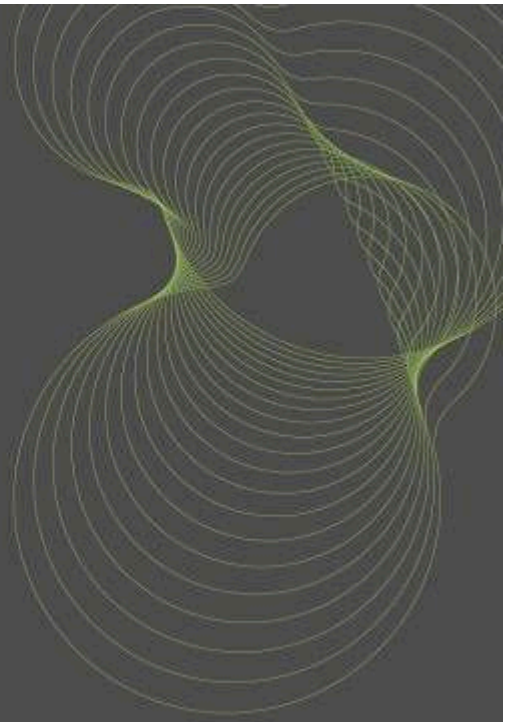

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Issues

Issues

- Government targets (80% reduction)
- Lack of guidance
- Compliance
- Technical delivery
- Increasing energy use against a backdrop of efficiency measures
- Measurement process

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Issues

- ‘Normalisation’
- Knock on effects
- Training
- Confidence
- Cost
- Commercial delivery/ Incentives

Common problems

Common problems

- Over engineered design solutions
- Poor integration of Low and Zero Carbon Technologies
- Poor workmanship
- Post construction evaluation
- Future upgrading?
- Research and investment
- Resourcing materials
- Resourcing

Low and Zero Carbon Technologies

- Over estimation of performance of technology. improper, inconsistent calculation methods adopted
- Improper design / integration of renewables into any 'non-standard' or 'non-traditional' design. i.e. improper application of products resulting in poor efficiency. i.e. one size does not fit all.
- Quality of workmanship, and its effects on the life of system components and efficiency, thus payback.
- Poor handover information / instructions to occupants regarding controls and efficient operation
- Poor formation of contract with customers, lack of detail in quotes, poor administration of amendments to contract etc

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Solar Thermal

- Improper / inadequate fixing of solar collector to roof structure or no consideration of loadings (static and wind) taken into account.
- Poor understanding of system operational temperatures - i.e. compression fittings or hard solder required, high temperature insulation, non plastic pipe clips etc.
- External pipework and penetrations through roof - insulation to be weatherproof, UV resistant (+ bird resistant). Proper flashing kits should be used, as opposed to drilled tiles and mastic seal which will not last.

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Heat Pumps

- Ground Source serving underfloor heating - historically very problematic due to no one taking overall responsibility for the system but rather independent parts i.e. 1) ground loop, 2) heat pump 3) underfloor heating system / system internals.
- Lack of communication between the heat pump designer (most efficient at approx 35 degC) and underfloor heating system designer (typically designed for 50-55degC). comprise should be reached regarding system design (typically approx 40-45 degC)
- Ground loop specification typically passed to occupant and works arranged by occupant - no supervision by main contractor that works have been undertaken to a suitable standard.

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Wind

- Mis-selling of performance of building mounted turbines
- Improper foundation specification for stand alone turbines (including size/ volume, spec of cement, degree of required reinforcing etc) - again can be typically passed to the customer to arrange with no supervision / responsibility by main contractor
- Obtaining permissions e.g. planning and G83 (notification of export to the grid, 2 way meter etc)

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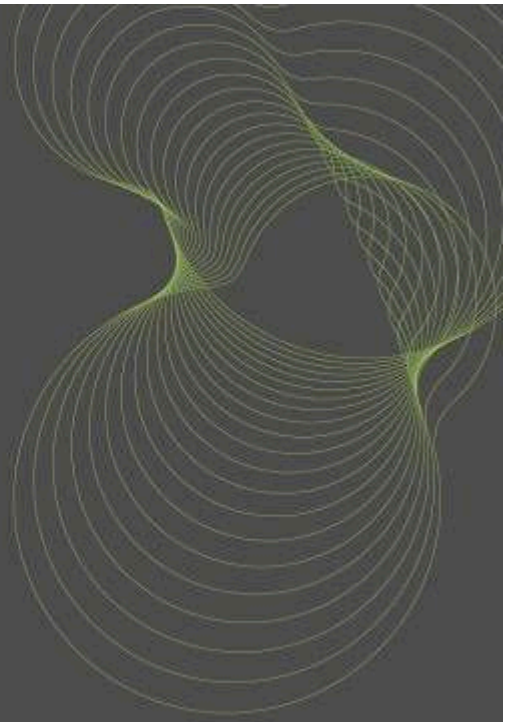

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BRE Innovation Park

Developer Brief

- Achieve a CSH rating of greater than 3
- Utilise MMC within the process
- Provide a facility to allow private sector to showcase what they can do
- Facilitate knowledge transfer
- Provide an environment for testing and monitoring innovative technologies
- Create an environment to exploit business opportunities.

Code Thresholds – Points Scores

Level 1	36 Points (Mandatory + 33.3 Points)	• Above Regulations • EcoHomes 2006 Pass • EST Good Practice
Level 2	48 Points (Mandatory + 43.0 Points)	• EcoHomes 2006 - Good
Level 3	57 Points (Mandatory + 46.7 Points)	• EcoHomes 2006 Very Good • EST Best Practice • Conventional Water fittings
Level 4	68 Points (Mandatory + 54.1 Points)	• Grey water/Rainwater • Passive House (approx)
Level 5	84 Points (Mandatory + 60.1 Points)	• Zero SAP • Significant Renewables
Level 6	90 Points (Mandatory + 64.9 Points)	• Zero Operational Carbon • Most Code Credits achieved

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BRE INNOVATION PARK

Re-Thinking's School of the future

Re-Thinking have built part of a school to demonstrate how an inspirational school design can meet the needs of students and teachers and support personalised learning in an environment that invites the users to say 'how do I want to work today'.

The school is both sustainable and affordable and is built using Ecobuild's solid timber system, which consists of recycled cross-piled off-cuts that would otherwise go to waste.

ecoTECH's Organic house

Swedish house manufacturer ecoTECH have built a full scale modular home called Organic. The house is designed for clean, simple living in collaboration with nature and is designed to make thoughtful, sustainable homes accessible to more people.

Future proofed, with the inclusion of full IT infrastructure with their partner Cisco Systems, it offers an affordable, low maintenance, well designed low energy green housing alternative that can be mass produced.

Hanson's eco-House

Hanson's second house on the BRE Innovation Park combines traditional building materials with an innovative design to address the issues relating to environmental performance and climate change. It tackles concerns such as overheating and solar gain and how best to mitigate against them with a concrete and masonry structure.

The house has excellent sustainability credentials and also demonstrates smart ventilation system and enhanced thermal mass.

Hanson's House 1

Hanson's first house on the BRE Innovation Park is a three storey building with a basement. The wall construction is packed with innovative features comprising prefabricated, thin-joint blockwork and the Handerwall insulated composite panel system with brick slip facings.

Located inside the garage in the new Digital Community Centre built by Open Hubs The Centre provides a range of innovative community services to each of the builds on the park via a network of fibre-optic broadband connections and digital infrastructure.

Stewart Milne's Sigma Home

The Stewart Milne Group have built two four-storey homes using their innovative timber frame system. Leading-edge in design and highly energy efficient, both homes push the boundaries of sustainability and work towards a zero carbon rating.

With up to four bedrooms and flexible internal layout, these homes are a clear pointer to the next generation in house building.

Osborne's Affordable home

The Osborne demonstration house pushes the boundaries of sustainable affordable housing and supply chain integration. It was constructed in one and a half days using the Jabhouse Structural Insulated Panel System, and exceeds current Part L requirements for carbon emissions by 40%.

The house needs two thirds less energy for heating and cooling than a house constructed to 2006 Building Regulations.

Kingspan Off-site's Lighthouse

The innovative, sustainable home from Kingspan Off-site has been built using the Kingspan TEK® Building System. Called the Lighthouse, the 90m2, two-and-a-half storey, two-bedroom house features renewable technologies such as a biomass boiler and building integrated photovoltaics.

It also includes mechanical ventilation with heat recovery and smart metering and monitoring, which will allow occupants to see how much energy they are using.

DuPont's Innovations in Building Science

DuPont are at the forefront of building science with brand names like Tyvek, Kevlar, Teflon, Corian and Sentrylas. Several of DuPont's products are on display in each of the buildings on the Park, including their latest innovation 'Energain', which is a new phase-change material that moves from a solid to a liquid state at 21°C.

The Energain system, which is built into the plasterboard of Stewart Milne's Sigma Home, is able to absorb large amounts of ambient heat and thus prevent overheating in the lightweight structure.

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Osborne House

Osborne House - Key Message

Modern Methods of Construction

- Innovative Panelised System
- Speed of delivery
- Factory production quality
- On-site Build Quality

Sustainable

- EcoHomes Excellent Standard
- 40% greater then new Part L
- Renewable technologies
- Aligns with the Code for Sustainable Homes

Affordable

- Cost of build
- Average fuel bill

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Hanson

Hanson's EcoHouse

- **Code Level 4 – Design**
- 3 bedroom house
- Factory made brick and block walling system
- High thermal mass and passive ventilation
- Wall U Value 0.18
- Roof lantern - utilises the 'stack effect' to naturally ventilate
- Solar water system
- Under-floor heating
- Smart technology and Digital communication
- Ground source heating
- SUDS - Includes a rainwater harvesting and geo thermal heating and cooling system

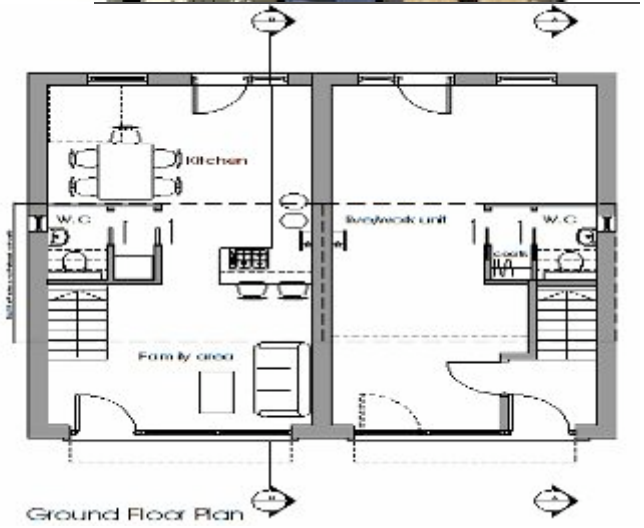
Kingspan®

OFF-SITE

Kingspan Offsite's Lighthouse

- Code Level 6 – Design & Post Construction
- Two bedrooms
- SIP (Kingspan TEK system)
- Wall U value: 0.11
- Mechanical Heat Recovery Ventilation
- PV panels and solar water heating
- Rainwater harvesting and greywater recycling

STEWART Milne GROUP



Ground Floor Plan

Stewart Milne's Sigma Home

- Code Level 5 – Design
- Three bedroom house
- Split floor design
- Closed panel timber frame system
- Wall U value: 0.15
- Bathroom pods
- Windturbines, solar water heating and PV panels
- Dupont's Energain system

ecoTECH

building a sustainable future

ecoTECH's Organics House

- Code Level 4 – Design
- Three bedroom
- Factory made closed panel timber frame/panel walling system
- Steel volumetric units (bathroom and kitchen pods)
- Wall U value: 0.18
- Viessman ventilation and heating system

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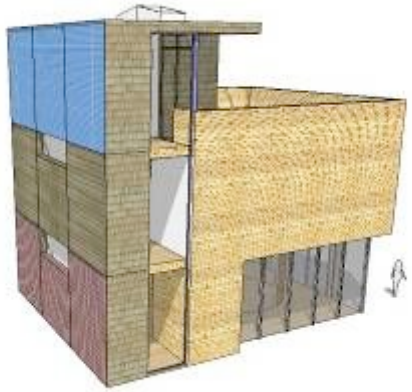
Re-Thinking

WILLMOTT DIXON
CONSTRUCTION



Willmott Dixon's Rethinking School

- Eurban solid timber construction (gluelam waste timber)
- Velux roof light and lightwells
- Selection of Claddings (including a recycled mobile phones panel)
- Seedam roof
- Integrated toilets
- ICT infrastructure (flexible & adaptable)

The Mail ON SUNDAY

BHA British Homes Awards 07

NHBC

Winning Design: **GREEN HOUSE**
Architect: **Gaunt Francis Architects**

Lessons Learnt

Key Lessons Learnt

- Code level 4 – Commercially viable
  - can be achieved with good design
  - Minimal use of renewable and low carbon technologies
- Energy Strategy
  - Building vs. Development Approach
  - Onsite vs. Offsite renewable energy for level 5 & 6
- Systems Integration is critical
  - Systems integration failure
  - Reliability & Longevity
- Buildability
  - Quality Control
  - Workmanship skills
- Integrated Team
  - Supply Chain Integration
  - Value engineering & Risk management

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Added Value

- 6 build partners investing £500k + in each plot
- 50 innovations/design solutions per plot
- 300 Business partnerships
- ICT and visitors centre (EEDA investment), piloting remote and wireless visitor technology
- Next phase includes 4 additional houses, including 1 commissioned by Prince Charles
- Next phase over subscribed as success recognised by existing build partners and wider industry
- Brand exposure through roll out of innovation parks nationally
- International aspects being considered

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Added Value

- 10,000 Professional visitors in 2007
- Business linkages with increased knowledge of product integration
- Product improvement
- Increased sales
- Product showcase and market exposure
- 40 TV crews have showcased the site
- R&D investment
- Knowledge transfer

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What Next

- Scottish innovation park
- Integration of LZCT
- Meeting the 2013 regs by 2009
- Regional/Rural issues
- Demonstrate innovative methods of construction and renewable technologies
- Test and measure policy impacts
- Low Carbon Technologies
- Affordability
- Climate Proofing
- Process Innovation
- Refurbishment/Retrofit
- Lifetime Homes

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INNOVATION PARK PHASE II

PLAN
SCALE: N.T.S

Summary

- Keep it simple
- Maximise fabric thermal performance
- Eliminate thermal bridging
- Eliminate condensation
- Ventilate but maximise air-tightness
- Integrate Low Carbon Technologies
- Affordability
- Climate Proofing
- Process Innovation
- Refurbishment/Retrofit ?
- Lifetime Homes

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Questions?

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