

The logo for BRE, consisting of the lowercase letters 'bre' in a light green, sans-serif font.

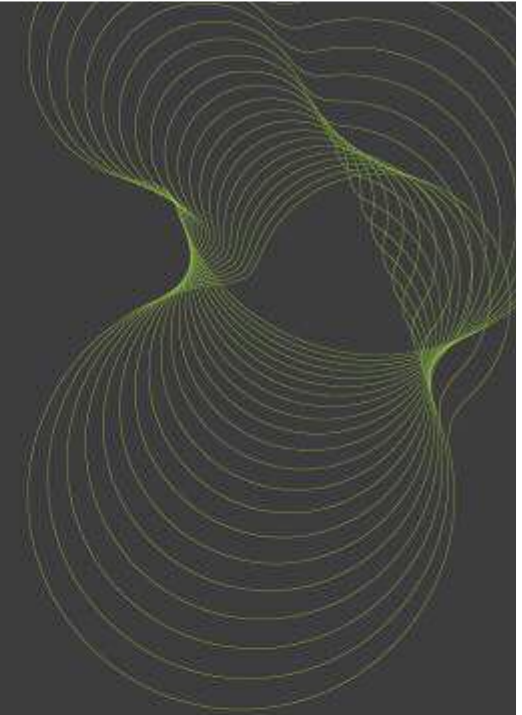
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Sustainable Retrofit

Wayne Ward

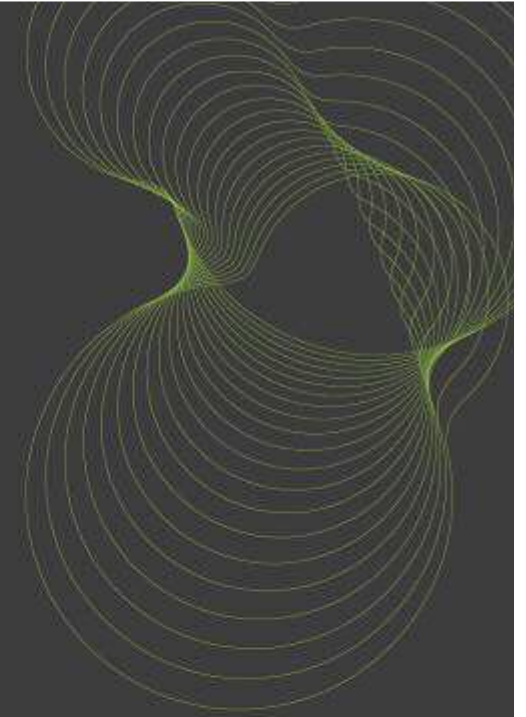
Director – BRE Highlands

10th October 2008



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Background



Compliance

- UK and Scotland must show compliance with Euro commitments
 - Energy performance certificates
 - European Climate Change Programme
 - Emissions Trading
 - Environmental technologies action plan
 - Eco Labelling
 - The Greening on Public Procurement
 - End of life vehicles
- Scottish Government policy implementation in substantial delay due to change to SNP but substantial work now being done

Increased Legislation

- Climate Change Bill
 - 80% reduction in Carbon Emissions in Scotland
 - No nuclear
 - Would require a step change in how we live
 - Strong focus on how existing properties are treated
 - Substantial investment required
 - Planning would have to change
 - Carbon taxes
- Building standards changed in 2007 but expect further changes in 2010, 2013 and 2016 leading towards carbon zero buildings (Euro commitment)
- The intention is to subvert local practices, such as the Edinburgh standards, by more stringent controls through building standards.
- Increasing focus on refurbishment provisions



Increased Legislation

- Development of community and household generation with decentralisation of generation capacity and the development of local heat and power grids
- Making better use of public procurement to recognise environmental and community aspects, with a particular emphasis on sustainability
- Taxing polluters and incentivising carbon savers
- Changes in the way Building Standards are delivered (ACD the first step)

Sullivan Report

Eventual and Staged Standards

We recommend for new buildings:

- ✓ Net zero carbon buildings (i.e. space and water heating, lighting and ventilation) by 2016/2017, if practical.
- ✓ Two intermediate stages on the way to net zero carbon buildings, one change in energy standards in 2010 (low carbon buildings) and another in 2013 (very low carbon buildings).
- ✓ The 2010 change in energy standards for non-domestic buildings should deliver carbon dioxide savings of 50% more than 2007 standards.
- ✓ The 2010 change in energy standards for domestic buildings should deliver carbon dioxide savings of 30% more than 2007 standards.
- ✓ The 2013 change in energy standards for non-domestic buildings should deliver carbon dioxide savings of 75% more than 2007 standards.
- ✓ The 2013 change in energy standards for domestic buildings should deliver carbon dioxide savings of 60% more than 2007 standards.
- ✓ Backstop levels of U-values and airtightness for building fabric should be improved in 2010 to match those of Nordic countries, but consideration must be given to the social and financial impact of measures that would necessitate mechanical ventilation with heat recovery in domestic buildings.
- ✓ The ambition of total-life zero carbon buildings by 2030.

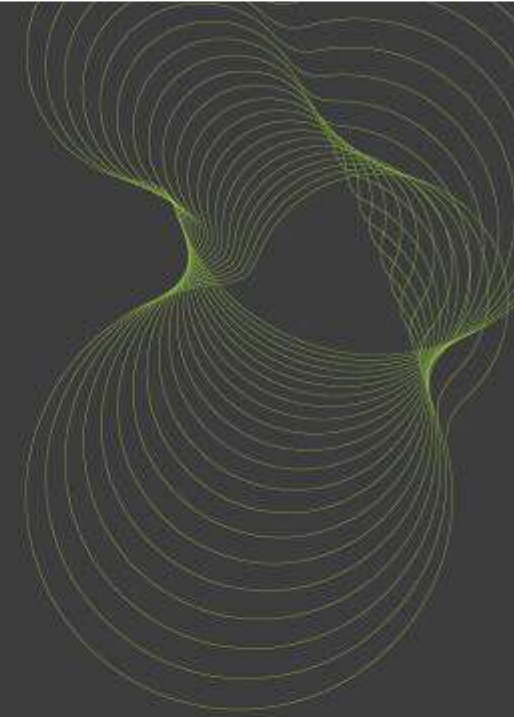
Change the way we build?

- Increased construction legislation
- Thermal performance regulation
- Design for carbon savings
- Design for solar gain
- Modern methods of construction
- Implementation of low carbon & renewable energy technologies



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Why?



What are your drivers

- Cost in use?
- Carbon emissions/carbon footprint?
- Fuel for heating, ventilation, Hot water, lighting?
- Well being?
- CSR?
- Capital over running costs?
- Local materials?
- Environment?



Procurement?

- Needs to be client driven
- Be specific with what you want
- If you write a good brief you are more likely to get what you want
- Set targets
 - Best practice
 - KPI's
 - Performance standards
- Base against what you are trying to achieve
 - Sustainable materials
 - High level of recycled materials
 - Cheap to run
 - Whole life cost



Monitor delivery

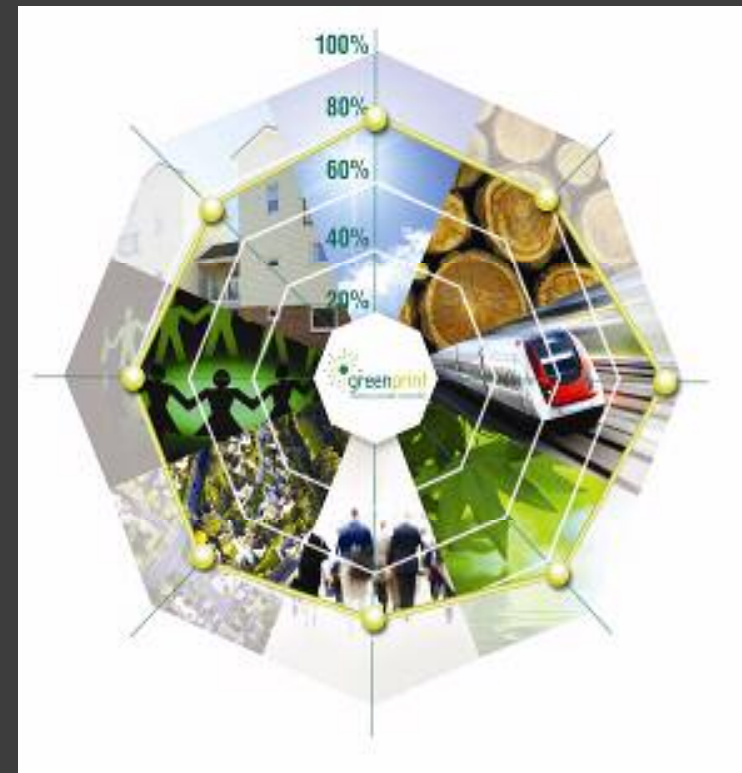
- Did you get what you want
- Quality assessment
- Third party assessment
- KPI's



Make sure the measurement process is built into brief so tenderers know that they are going to be assessed on the delivery of the brief

Risk Transfer

- If you don't know what you want ask tenderers to provide against a robust third party procedure such as BREEAM
- Monitor delivery
- Allocate to a specific person within organisation to take ownership of delivery
- Implement reporting procedure
- Assess against peer projects
- Make part of contractual agreement



Where do you get information

- Best practice guides

- BRE
- Carbon Trust
- EST
- CIBSE
- RICS
- CIOB
- Web



- If you decide on a measurement system make sure procurement team understand the requirements and implement in the documentation

Examples of Specification content



Water

- The design needs to maximise the number of measures to reduce mains water consumption. It must also include sustainable drainage (SUDS) techniques to deal with storm water.
- Adherence to Scottish Executive PAN 61 Planning and Sustainable Urban Drainage Systems is required.
- Consideration must be given to the following
 - a) water efficient low flush toilet (i.e. 6/4 litre dual flush or less)
 - b) water efficient spray / aerated taps in all sinks
 - c) water efficient shower
 - d) water efficient washing machine if provided (energy A rated)
 - e) water efficient dishwasher if provided (energy A rated)
 - f) minimised pipe runs to hot taps

Energy



- The design of the building should minimise operational energy consumption. All sustainable technologies should be considered including renewable energy generation and building integration.
- The following target must be met as a minimum (assuming key operation between 07:30 and 18:30 Monday to Friday):
 - 6 kg/Carbon/m² per annum
 - Or -
 - an EPC rating of C or better
- The developer will be expected to project the annual energy consumption as an amount of carbon produced by the buildings, expressed as carbon/m² per annum. This figure includes all gas, oil or other fuel for heating and all electricity consumption.

Policy requirements

- The Developer shall take account of the Government's policy on land – use and planning matters as contained in their National Planning Policy Guidelines (NPPGs) and Scottish Planning Policies (SPPs) together with the Planning Advice Notes (PANs) and in particular the following:
 - SPP6 Energy
 - SPP7 Planning and Flooding
 - SPP17 Transport and Planning Maximum Parking Standards Addendum to NPPG17
 - Regulatory Impact Assessment for SPP17
 - NPPG Natural Heritage
 - NPPG Renewable Energy Developments
 - NPPG Transport and Planning
 - PAN Design Statements
 - A Policy Statement for Scotland Designing Places





- PAN 61 Planning and Sustainable Urban Drainage Systems
- PAN 60 Planning for Natural Heritage
- PAN 58 Environmental Impact Assessment
- PAN 57 Transport and Planning
- PAN 56 Planning and Noise
- PAN 51 Planning & Environmental Protection
- PAN 46 Planning for Crime Prevention
- PAN 45 Renewable Energy Technologies
- PAN 33 Development of Contaminated Land

Be specific about what not to use

- No material generally known within the Building Industry to be deleterious or hazardous to health or safety or to the durability of the property in the circumstances in which they are used should be specified including:
 - Asbestos or asbestos based products
 - Urea formaldehyde or materials which may release formaldehyde in quantities which may be hazardous with reference to the limits set by the HSE
 - Material containing fibres less than three microns diameter or 200 microns long
 - Lead or any material or product containing lead which may be ingested, inhaled or absorbed
 - Polychlorinated biphenyl
 - Fibres not sealed or otherwise stabilised to ensure that migration is prevented
 - Vermiculite containing fibrous dust
 - Polytetrafluoroethylene (PTFE) except for pipework jointing
 - Calcium silicate bricks or materials
 - Brick slips



- High alumina cement and/or concrete
- Wood wool slabs used as permanent shuttering or wood wool cement slabs
- Admixtures for use in concrete and mortar including Calcium chloride admixtures
- Sea-dredged aggregates for use in reinforced concrete which do not comply with current British Standards
- Aggregates for use in concrete which do not comply with current British Standards
- Alkali reactive aggregates
- The Developer shall check with the manufacturers and/or suppliers of products and materials that any specified product contains such material. If any specified product contains such material, the Developer shall request an alternative specification of product or manufacturer.

During Construction



- Most activities associated with construction have the potential to pollute the environment. Consequently, the health and safety plan, which is required as part of the CDM Regulations should be expanded on to address these risks to the environment along with measures that will be taken to either avoid or mitigate them.
- Require Developers to report regularly and provide evidence of working towards or meeting the sustainability benchmarks set for the project.
- Require reporting throughout the design, construction and operation process.
- Make it a requirement to establish environmental management system for the project to ensure compliance with and accountability in the team for the sustainability targets set (Especially on large projects)
- Promote a green supply chain and require the Developer to influence its supply chain and to monitor and minimise environmental impacts.

During Construction

Require the developer to:

- Register with the Considerate Contractors Scheme (or alternative local or nationally recognised scheme) and adhere to their Code of Practice and regular monitoring through the Scheme.
- Show good practice is adopted on site including monitoring CO2 emissions and transport emissions, sorting and recycling construction waste, adopting best practice in air and water pollution prevention.
- Construction and demolition waste must be minimised through careful design and efficient construction/ demolition. The waste hierarchy must be followed to reduce, re-use and recycle construction materials.
- Maximise changes in ecological value, enhancement and protection of ecological value, long term bio-diversity.
- If an Environmental Statement is required for the site and mitigation measures required these must be fulfilled and documented.

Post Construction

- Post occupancy evaluation
- Did you actually get what you asked for
- Base against KPI's and targets set in the
 - Brief
 - Tender documentation
 - Contractors offer.
- If you do not get what you ask for take steps of redress



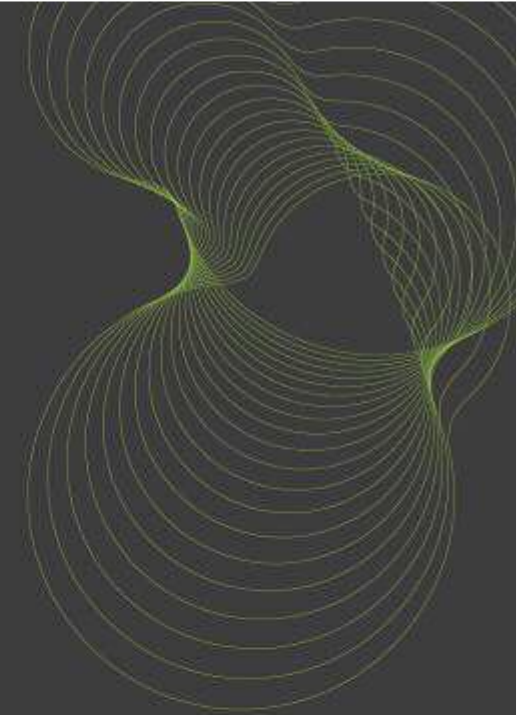
Benefits

- It's a good thing
- CSR opportunity
- Marketing exercise
- Comparison against peer group
- Operation savings
- Lower running costs
- Healthier building
- Less sick days
- better productivity
- Lower maintenance costs
- Meet future legislation/fiscal policy
- Easier to let, sell, promote (EPC's)



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Upgrade Opportunities



No cost measures

- Turn off equipment when not in use
 - Lighting
 - IT
 - Phone chargers
 - Printers
 - Faxes
 - Photocopiers
 - Industrial plant
 - Manufacturing machinery
- Have a heating strategy focusing on areas where most required
- Use battery operated equipment as intended
- Get bills based on meter readings rather than estimates to aid in use assessment

Building Services Improvement Measures



- Space layout and zoning
 - Effective use of AC and heating installations
- Lighting
 - Maximise natural daylight
 - Include effective lighting controls
 - Consider time control, occupant control, Passive infra red (PIR) and photo electric control strategies
 - Use most efficient luminaires, control gear
 - Avoid too much artificial lighting
- Reduce Solar gain, consider:
 - Internal and external shading
 - Overhangs
 - Glazing orientation and scale



Control Systems

Consider:

- Enhanced time control
- Optimise heating switching
- Compensation controls for heating and cooling against internal external temperatures
- Zone controls, effective use and load strategies
- Occupant controls
 - Easy to understand
 - Easy to use
 - Location in relation to point of need
 - Feedback mechanisms



Motors

- High efficiency replacement motors
- Optimise fan or pump efficiency within the system design
- Variable speed controllers
- Direct drive rather than belt drive where possible

- Hot water

- Minimise consumption
- Insulate pipework and storage tanks
- Effective controls
- Consider require volume



- Avoid air conditioning
- Minimise heat gains through building fabric improvements
- Passive cooling & ventilation strategy
- Passive solar strategy
- Consider heat recovery within services strategy
- Optimise free cooling

Interaction between building services

Heating	Avoid simultaneous heating and cooling				
Electric lighting	Reduce incidental gains from lights to minimise cooling	Include contribution of lighting towards heating			
Daylight / glazing	Minimise solar gains to reduce cooling loads	Minimise heat loss and maximise useful heat gain through glazing	Use suitable switching and daylight linking controls to minimise use of electric lighting		
Natural ventilation	Consider mixed-mode to use natural ventilation and avoid mechanical cooling where possible	Account for effect of open windows		Balance solar gains from glazing with increased natural ventilation. Avoid conflicts between	
ventilation and air	Use free cooling and 'cool' recovery	Use heat recovery	Reduce electric lighting to reduce loads on air conditioning	Solar gains from glazing may increase loads on air conditioning. Heat loss may require simultaneous perimeter	Use natural ventilation instead of air conditioning where possible, or consider mixed-
	Cooling	Heating	Electric lighting	Daylight / glazing	Natural ventilation

Source: CIBSE Energy Efficiency in Buildings Guide

Low and Zero carbon Technologies (LZCT)



- Solar thermal
- Photovoltaic's
- CHP Biomass
- CHP Gas
- Wind
 - Heat Pumps
 - Ground Source
 - Air Source
- Water Source
- Biomass
- Ground water cooling

Building Fabric Improvement Measures



- Draught Stripping
- Loft/ceiling insulation
- Floor insulation (suspended floors)
- Double/secondary/Triple glazing
- Wall Insulation
- Layout and Design Improvements
- Other Factors

Draught Proofing

- Draught proofing is one of the most inexpensive yet effective ways of making efficient use of energy in all types of building. It will often pay for itself within a year.
- Building regulations require draught proofing on all windows and external doors in new buildings. Existing properties should be to the same standard.
- Fit also to Letter boxes, access hatches, loft hatches
- Check regularly
- Products should conform to the standard BS 7386.
- Adequate ventilation is as important as draught proofing, ensure working extractors in toilets, kitchens and plant rooms.

Loft/Ceiling Insulation

- Check if access available
- Normally only suitable for horizontal installation
- Fitted in Rolls, batts or beads to depth of at least 270mm
- Ensure ventilation maintained at eaves
- When adding loft insulation it is essential to insulate any water tank and/or pipework in the void - do not insulate under the tank.
- Can be fitted above suspended ceilings
- Check loadings to ceiling grid

Floor Insulation

- Fitted between suspended floor joist or under raised access floors
- Ensure DPM in place
- Ensure ventilated airspace maintained
- Vapour barrier required in some instances
- Consider plumbing and what happens if it leaks, how will water affect choice of insulation
- Might involve lifting floor boards unless adequate crawlspace
 - A must if underfloor heating to be considered

Double/Secondary/Triple glazing

- The best performing wall is ten times better than the best performing window
- Secondary glaze if curtain walling, hard to treat/access elevations, consider shutters (insulated if possible).
- A-G rating system now in place
- Single glazed steel casement windows one of worst performers- recommend replacement if at all possible (listed building issues)
- Inert gas filled units only last around 5 years before gas leaches out
- Additives to glass and emissivity coating aid performance
- May be planning consideration
- Huge heat loss/gains on 'trendy' office buildings – restrictions now in place through standards

Solid Wall Insulation



- Internal
 - Insulated plasterboard
 - Lining out with insulation between studwork
 - Problems with skirtings and architraves (especially listed/Victorian properties)
 - Potential for interstitial condensation – do calculation
- External
 - Insulated render most common but various panel systems available
 - Great for eliminating cold bridging
 - Ensure ventilation apertures maintained
 - Check eaves detailing
 - Planning considerations
 - Movement joints on large elevations
 - insulates external walls to produce the desired U-value without condensation risk.
 - allows the fabric of the building to act as a heat store, increasing thermal efficiency, condensation and mould growth.
 - provides a decorative external envelope, giving lasting weather performance.
 - stabilises the structural fabric preventing movement due to thermal shock.
 - contributes to sound reduction.
 - Damage issues at lower level

Cavity Wall Insulation

- Cost effective to install
- Up to 85% improvement in wall performance
- Uncommon in commercial applications
- Check for tell tale drill marks on external elevations
- Potential for severe issues if installed within timber frames structures
- Potential for voids/cold bridging
- Issues with as built cavity fill, mortar snots, wall ties, other debris

Layout and Design improvements

- External shading, blinds and shutters
- Draught lobby's where heated space opens directly to outside
- Positioning of desks (close to radiators?)
- Thermal mass – consider if structure allows and internal revisions proposed
- Provide adequate natural daylighting
- If extensions planned make best use of orientation and passive solar design
- Make airtight with proper ventilation

Whole Life Thinking: WLC of 30 year ownership

- **1 : 5 : 200***
- **Office building – 30 year life**
- 1 = Construction Cost
- 5 = Maintenance and Building Operating Costs
- 200 = Business Operating Costs

**source: The Royal Academy of Engineering*

In Summary



- Reduce demand
 - Improve the building performance first, this will generally not break down and require maintenance
 - Encourage to switch things off or have it done automatically
 - Put in less to meet same requirements
- Performance orientated installations
- Low Carbon technologies
- Services installations – energy efficient design – be explicit in specification.
- Sources of information
 - CIBSE
 - Carbon Trust
 - BRE
 - Building magazine and Journals



Questions?

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