

# Delivering Zero Carbon Buildings in Wales

## A pragmatic route to lowering the carbon footprint of our buildings

### Introduction

This paper sets out a slight modification to the final goals proposed in England to deliver zero carbon. This paper does not deal with the intermediate steps towards these goals in any detail. The proposal is not the only way forward and requires detailed review and research to prove or disprove this method. I do believe, however, that it provides a pragmatic means of delivering lower carbon buildings in Wales.

For those unfamiliar with the currently proposed English approach, a brief summary of the concerns that this strategy raises is included at the end.

### Background

Wales has some known differences to its larger neighbour that merit a review of the approaches to carbon reduction in the built environment being applied in England. Wales has a rich potential for renewable power generation through its geography, with much of this potential located away from populated areas. Wales also has a smaller average scale of development undertaken by typically smaller builders. South Wales also has a considerable population in north-south valleys that do not present considerable opportunities for renewable power on site. These points provide some of the key background for the following proposal.

### Summary

This proposal puts forward two basic principles: Drive the construction of more efficient building fabric further; and balance the impact of this on construction by optimising the efficient use of renewables regardless of their location.

There are recommendations at the end of this paper.



### Delivery of Zero Carbon in Wales

It is suggested that a slight rebalancing of the route mapped out in England should be considered to address some concerns. There is no proposed change to the definition of Zero Carbon, nor any major changes to the tools or measures used to assess this. It is not intended to be a radical change, but rather a modification to suit the context of Wales.

### Wales emphasises Fabric First for all development

This proposal is to push the energy performance of the fabric of the built environment in Wales to achieve a very low energy demand, achieving 30%+ energy reduction compared to current regulations through the fabric alone and possibly approaching levels of c.40%. The precise figures would require detailed consideration for each section of the new and refurbished built environment.

The proposed strong emphasis on high performance building envelopes ensures buildings are constructed that require less energy to operate. A fabric approach can be achieved on practically any development site in Wales, regardless of orientation or geography.

High fabric performance delivers the reduction in energy demand reliably for the life of the building through passive components rather than active mechanical systems. This reduces the risk of future failures in maintenance that result in higher energy demands and higher carbon emissions.

As a point of clarity, it is not envisaged that the fabric standards would be introduced in a single step, but rather (perhaps) three steps in 2012, 2014 and 2016, with considerable advanced notice to industry.

For new housing, this proposal could equate to thermal performances in the region of 0.15 W/m<sup>2</sup>K. Identifying the target energy reduction level should be undertaken alongside the proposal to work with housebuilders to trial new, high performance homes (as put forward by Nick Tune, Director of BRE Wales).

### Fabric First is Practically Deliverable

High performance building fabric can be regulated at completion of construction comparatively effectively through Welsh Building Regulations. This uses established checking and enforcement procedures that only require appropriate training and resources for Building Control Officers to enforce the standards. Unlike mechanical systems, building fabric performance would not be expected to significantly vary over the buildings' life.

To aid deliverability, it is suggested that the minimum fabric performance standards be presented to Welsh construction industry in two ways:

A 'fast track' assessment is proposed that avoids complex calculations, probably through a single sheet checklist. This would set minimum elemental U-Values, maximum percentage of glazing, maximum airtightness, minimum

# Delivering Zero Carbon Buildings in Wales

## A pragmatic route to lowering the carbon footprint of our buildings

heating & hot water efficiency, minimum percentage of low energy lighting (further standards may be needed).

These specific performance targets set out in the 'fast track' route would be pre-calculated (with a safety factor) to ensure that almost any permutation of design would achieve the energy reduction requirements. Whilst a small fraction of builds may therefore fail to achieve the precise energy reduction through fabric, most would marginally exceed the requirements and hence the average would deliver the required carbon reductions.

Any scheme failing to achieve or choosing not to follow the specific targets would be required to follow the second route. This is suggested as an energy/metre/year rate as per England's system. This requires SAP/SBEM compliant software calculations to demonstrate that the required overall fabric performance has been achieved in precisely the same method as used in England for all development.

### Wales is Blind to Energy Generation Location

This proposal suggests the long term goal for Wales' built environment is to achieve an overall carbon reduction from the built environment in line with the Welsh Assembly's announcements. The target should be achieved as a combination of the regulated minimum fabric performance and renewable energy generation.

This proposal suggests no requirement for achieving a fixed percentage of carbon reduction within the boundaries of the site, therefore not obliging any on-site energy generation (whilst not precluding it). The development would purchase, via a regulated open market, sufficient 'energy generation capacity' to make up the difference between the fabric performance and the 100% carbon reduction level.

The intention is to stimulate renewable energy generation on an efficient scale across Wales, in locations where it will be most effective, undertaken by energy suppliers who can operate and maintain the equipment reliably and cost effectively.

The removal of the on-site requirement is intended to reduce the use of small scale, building specific energy generation. This avoids developers and end-users having to pay for, install and maintain this equipment, instead requiring their focus to be on the building fabric.

The ability to provide all energy generation off site also ensures that this proposal can be applied to all development in Wales without exceptions due to site orientation or geography.

In its optimum form, the requirement to achieve 100% carbon emissions reduction from any development or redevelopment would not require more detailed restrictions to be created, presuming the appropriate framework and enforcement mechanisms set out later.

More investigation is needed in this area, and detailed work may suggest the need to introduce some level of complexity to simple overall requirement. These measures may include:

- A sliding scale of carbon costs tallied with proximity to site, favouring on site or near site energy sources.
- A 'zoned' scale of carbon costs working on concentric circles targeted on the specific site, with a predetermined cost and/or cost multiplier increasing for each zone moving away from site.
- A sequential test mechanism for energy supplies to ensure appropriate choices.

Further work to review the means of delivering the 100% carbon reduction is therefore needed to ensure a robust methodology is adopted.



### Delivering Off Site Energy in Wales

The successful delivery of 100% carbon reduction through the off site delivery of energy requires a regulated carbon sub-market with two key controls – a minimum price per tonne of carbon required (alternatively this could be expressed as kWh/annum) and an independent and/or government framework for monitoring.

Within this framework, developers would purchase a volume of the zero carbon generating capacity created by new renewable energy sites from energy supply companies. The amount required would be proportional to the difference between the development's fabric performance and the total carbon reduction required in line with Welsh Assembly policy (potentially 100%).

# Delivering Zero Carbon Buildings in Wales

## A pragmatic route to lowering the carbon footprint of our buildings

It is initially proposed that developers would be required to demonstrate 'Heads of Terms' for such a purchase at planning submission stage (this would be checked online by planning officers), with a legal contract in place by start of construction (checked by Building Control officers). The energy supplier would be required to deliver the new renewable energy site within 2 years of completion of the development (checked by an independent third party).

The developer's purchase is proposed as a single payment that acquires the zero carbon capacity from the renewable source for the lifetime of the source's operation (noting a minimum lifespan is likely to be required). This may be undertaken via some use of the existing Renewable Obligations Certificates (ROCs). The contract would not require a physical electrical connection direct from the renewable energy site to the development site. Once contracted, the energy supplier would be prohibited from counting the zero carbon energy regeneration as part of their carbon reduction requirements, or from selling or benefitting from the ROCs. The energy supplier would otherwise be able to sell the electricity generated on the open market (without accrediting it as a 'green' supply).

The minimum price per tonne should reflect the average cost of constructing new renewables in Wales, and is required to ensure strong investment in renewable energy generation. It is envisaged that all energy supply companies will be obliged to invest 100% of any payments received through this scheme in the creation of new renewable energy sites in Wales. This would be in addition to current UK government targets for carbon reductions. The minimum price would also reflect the energy company's inability to benefit from ROCs for the lifetime of the renewables.

The monitoring framework for the above would require further detailed consideration. Initially, this proposal envisages an independent third party moderating the interface between developers and energy suppliers and providing the following key services:

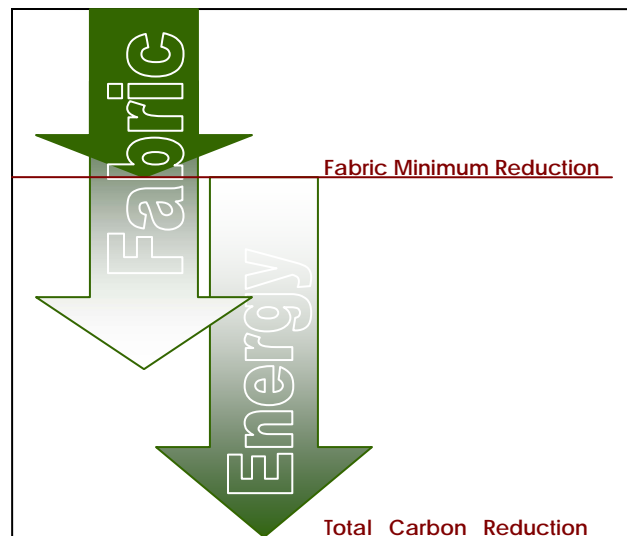
- A certification/approval process to become a registered energy supplier within the scheme
- Recording the assignment of renewable energy sites to developments, with a publicly accessible website displaying this information
- Undertaking auditing checks of development energy estimates and energy suppliers renewable generation
- Hosting a carbon marketplace, again probably via a website, allowing trading in the price of carbon offered by energy suppliers (above the minimum)
- Potential liaison with independent certification bodies (Code for Sustainable Homes etc) confirming carbon reduction achieved

It should be noted that off site energy generation is likely to be covered through the Allowable Solutions being discussed in England, which may provide an alternative to the above.

### Wales' Energy Hierarchy

The envisaged approach set out here would presume a revised carbon hierarchy to the triangle used by England.

A proposed format for this diagram is illustrated below. This shows a clear priority for fabric performance, with no differentiation between on and off site energy generation. The minimum energy performance is demonstrated, with the potential for further fabric performance savings suggested. The energy generation then continues to drive the carbon emissions down to achieve the total reduction required.



### Recommendations – the Next Steps

**The first recommendation** is for consultation and research with energy suppliers to establish the viability and legal status of a moderated carbon marketplace and the carbon assignment of new renewable energy sites.

**The second recommendation** is for consultation and research to determine the target fabric performance values for all new and refurbished building types. New build housing should be the first sector investigated.

Subsequent to the recommendations set out above, further actions can be identified to allow the full delivery of the processes and enable the delivery of zero carbon development in Wales.

As part of the above, this paper presumes access and a detailed review of the English Zero Carbon Hub's data will be undertaken.

# Delivering Zero Carbon Buildings in Wales

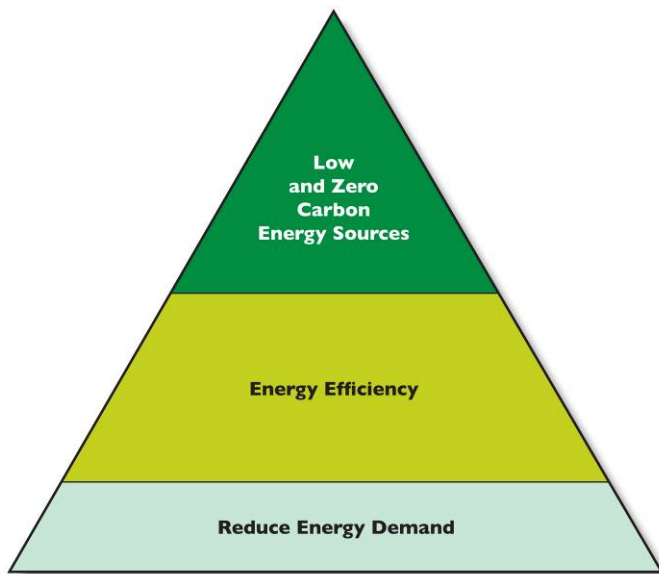
A pragmatic route to lowering the carbon footprint of our buildings

## Appendix

### Brief Summary of the English Approach

The context of this paper is primarily the English Building Regulations, Code for Sustainable Homes, the Zero Carbon Hub reports on fabric efficiency and the ongoing discussions on Allowable Solutions.

The English route to zero carbon has, in essence, been mapped out with the “energy hierarchy” triangle.



This triangle aims to set out that the first requirement on new homes in future will be to reduce the demand for energy through fabric efficiency. Beyond that, there will be a requirement to reduce energy demand through on site measures of ‘energy efficiency’. Lastly, there will be low and zero carbon energy sources achieved through ‘allowable solutions’.

Currently, the drafted documents propose that approximately 25% of energy reductions must be achieved through the fabric performance, with 70% of overall energy reductions required on site, known as “Carbon Compliance” level.

These targets broadly equate to fabric U-values for walls and floors of approximately 0.18 W/m<sup>2</sup>K with air leakage rates of 3m<sup>2</sup>/m<sup>3</sup>/h, although the actual targets are expressed not as performance requirements on building elements but rather as energy performance targets for the overall building.

The 70% Carbon Compliance level required on site is in excess of any energy reductions that can be achieved through fabric performance alone, hence the means of achieving this is unclear but seems certain to require on site low carbon technologies in the building.

### Concerns – The English Approach

The Carbon Compliance level effectively requires the buildings (in this case houses) to reduce their energy supplied from off site by 70% compared to current regulations. Given energy demands of PassivHaus designs typically only provide c.40% energy reductions, the additional energy reductions are expected to be achieved on site through the provision of micro-generation.

The demand for on site micro-generation is likely to be further promoted by two factors: the diminishing returns achievable from increasing the fabric performance, and the comparative ease of selling “obvious” renewable technologies to consumers above the more hidden benefits of a good building fabric.

Using this approach, there would need to be a rigorous minimum fabric standard in order to ensure that the housebuilders did not “switch” to using renewable energy sources on site “too early”; i.e. before they have built homes that have a low energy demand intrinsic in the fabric of their construction.

However, the English proposed fabric performance requires only 25% reduction compared to current regulations, which can be achieved with comparatively unchallenging performance values.

Based on the above rationale, it appears likely that the housing market will generally choose to satisfy the proposed English carbon reductions through a balance of fabric and on-site low carbon technologies skewed in favour of on-site technologies rather than the fabric performance. There is no reason to believe they will respond differently in Wales if the same system were to be adopted.

### On Site Technologies

Provision of low carbon technologies on site to reduce carbon emissions clearly achieves a reduction in carbon emissions. There are several considerations that must be borne in mind within this:

Reduction of demand is preferable to increase in supply, even when it is a renewable supply.

Micro-generation can not be presumed to be universally operating and well maintained.

Micro-generation is not always appropriate to a site for aesthetic, urban and/or geographic reasons.

Efficiencies in electrical generation increase broadly in line with the scale of production.

Energy generation is a specialist field historically separate to housebuilding and home ownership.

There is a risk that the over reliance on on-site micro-generation could result in unachieving on the carbon reduction goals, through a combination of sites being unable to meet the demands, homeowners not maintaining their equipment for the life of the dwelling and the inefficiencies in the underlying building fabrics.