

This response is made on behalf of both the Royal Society of Architects in Wales and Design Circle, brief profiles of whom can be found at the end.

1. What role can housing can play in Wales' low carbon transition, including the potential positive impacts on greenhouse gas emissions?

The transition to a low carbon economy can be fundamentally supported by the right strategic choices being applied to housing in Wales. These choices must consider the following shifts;

- from gas and other fossil fuels for heating, with a significant proportion to electricity
- from fossil fuel for transport, most likely also to electricity for the majority
- towards greater renewable electrical generation for the foreseeable future (<50 years)
- towards alternative/additional power sources in the “unforeseeable” future (>50 years)
- towards a likely $+2.8\pm 1^{\circ}\text{C}$ warming and a wetter, warmer climate

The combination of these probable shifts is a more variable generation of electricity, combined with at least a six-fold increase in electrical demand overall (this is heating alone, not including transport), compounded by demand peaks and supply peaks fundamentally not aligned. This will be occurring in a climate more inclined to wetter, more severe weather conditions, but with no change on the levels of solar irradiance (warmer does not mean sunnier).

The right strategic choices must also consider known factors about housing in Wales that are unlikely to shift significantly, which include;

- Wales has the oldest housing stock in the Western world, and at rates of renewal and given the levels of economic activity underpinning, this appears likely to remain true
- UK private home owners have a poor general record for maintenance of their properties, and an SME industry that delivers much of this work in a lightly regulated or self-regulated fashion
- Despite increasing energy efficiency of individual devices, the profligation of the number of devices results in an occupancy energy demand that is unlikely to significantly reduce.

The logical strategic role for housing in Wales' Low Carbon future can therefore be summarised as RBG – Reduce, Balance, Generate.

- **Reduce.** With electrical demand soaring due to transport and heating loads switching to electric, housing must ensure it is placed to reduce the demand for energy from these causes first and foremost. This means homes built in the right place to minimise transport energy demands as well as with excellent fabric performance to reduce their heating demands.
- **Balance.** Housing's long life and predictable use align with their use to help shift the energy demands to better align with the energy generation. This can be achieved through technologies or fabric solutions (such as thermal mass) to shift heating demands to match supply, but additionally to include storage for balancing electrical demands (with batteries having less need to be lightweight or small compared to those in electric vehicles). The long life of our homes also provides a means to balance already present carbon emissions through locking atmospheric carbon into construction materials, as well as through associated landscaping & tree cover that can be included within residential development.

- **Generate.** Lastly, where appropriate ownership or maintenance models can be demonstrated, opportunist generation of energy across our housing stock is capable of making a worthwhile contribution to energy generation for Wales. However, this must be done in the context that the vast majority of these homes will outlive the energy generation system mounted on them (even assuming proper and effective maintenance is undertaken), and that these homes will need to continue to be a desirable and pleasant home after this.

In addition to the above, it is important for the strategic role of housing in Wales' Low Carbon future to be implemented beyond the scale of the individual home. Achieving any of the RGB steps is less technically and economically efficient if done on a case-by-case basis: this approach requires sizing elements to accommodate 'worst case' instances that are likely to occur very infrequently, but cannot be ignored. This increases material usage and prices whilst still not providing redundancy to individuals. Hence the individual home approach is both uneconomic and inefficient, whilst if suitable professional ownership or maintenance models are not required, also risks placing the operation and maintenance of an increasing part of our national energy generation in the hands of untrained, unfunded and uninterested homeowners.

Homes must therefore be thought of as communities of 'nodes', where 'worst case' events can be distributed across the locality. This approach must be applied to reduction (where some homes will not be able to reduce as far as others), balancing (where some may help balance others), and generation (where energy generation can help local homes not generating at that time). Whilst taken in the context of UK's legal, energy and property ownership frameworks, this is acknowledged as a challenging model, it does represent the most efficient means of delivering the low carbon outcome.

2. The development and availability of technology needed for highly energy efficient housing;

Homes and their occupants have always provided a very significant marketplace for new technologies, and this is unlikely to reduce in the foreseeable future. This ongoing demand for new technologies provides the economic underpinning that enables the development of innovative technologies, from the earliest purchasers of electricity from Edison's Electric Light Company, through homebuyers demanding gas central heating systems and uPVC, and on to the current demand for photovoltaic and solar thermal renewable energy systems.

Given the typical lifespan of a home in Wales, well in excess of 100 years, our homes are likely to have seen many of these technological advances: A typical valley's terrace may well be on its third form of heating system (coal fires & chimneys, replaced by [town] gas fires & back boilers, replaced by north sea gas condensing central heating), and its third generation of lighting (oil, replaced by electric filament bulbs, replaced by electric LED), all of which the home has adapted to accommodate within its existing walls and, quite possibly, it's original [slate] roof.

The development and availability of technology to achieve highly energy efficient homes is, therefore, a continual process that has happened within our (largely existing) homes for over a century. This technological advancement is underpinned by the consumer demand from the homes and their occupants, in turn providing the business case for innovating in order to sell to the domestic marketplace.

Whilst this may seem an inevitable, if slow process, it is the homes which actually shape the development and availability of the emerging technologies – if the homes cannot accommodate

the innovation, there is no marketplace, and therefore no business case against which to justify the investment in innovation: Gas back boilers replaced coal fires not because they were the most efficient option, but because they fitted in fireplaces.

The role of our housing in the development and availability of technology that is needed for highly efficient homes is therefore to supply the demand and have the flexibility to accommodate this demand. This means homes capable of adapting to future innovations, rather than rigidly restricting their adoption through inflexible construction, spatial planning and servicing. An example of this impact can be seen in homes built in the last few decades, where the tightly planned houses installed with condensing gas boilers and no hot water tank are effectively restraining the adoption of solar thermal heating systems because occupants usually won't or can't sacrifice the space required for the necessary thermal storage.

Whilst it is always possible to push for the 'next generation' of technological advances, it is demonstrably true that we have sufficient technology to deliver highly efficient and beyond-zero-carbon new homes today with the technologies we have now. Our homes must be focused on ensuring that they can accommodate tomorrow's generation of technologies, and in so doing provide the justification for those technologies to be created.

3. What changes are needed to ensure that existing housing stock is as energy efficient as it can be?

Wales' existing housing stock is well reported to represent a significant energy demand, which combines both the energy used for heating, ventilation and lighting (covered under Building Regulations) and the energy used by the occupants from their activities, and the existing housing stock is also highly likely to largely still in use by 2050, when 80% carbon reduction targets are legally required.

The scale of the challenge has resulted in a number of efforts to find the "magic bullet" that can resolve it, but in reality no such single solution is conceivable. Despite typological similarities, Wales' housing stock is effectively unique down to the individual home, with each home representing a different orientation, occupation pattern, heating and ventilation solution and building fabric thermal and moisture performance. Furthermore, each home will have a differing historic, aesthetic and placemaking value within its locality and wider context. This means that each home has a subtly unique limit that its energy efficiency can be driven to before unintended problems or detrimental impacts are likely to occur.

Changes required to ensure that existing housing stock is as energy efficient as it can be must therefore be systematic rather than dogmatic, focusing on the assessment of the individual property and the measures which can appropriately be applied, rather than setting top-down requirements that are likely to result in repeats of the issues seen with some external wall insulation.

In this context, systematic changes should focus on:

- **Individuality.** Individual assessments of what is possible for each home. At appropriate points in the lifespan of a home (perhaps at sale or letting), assessments of the optimal future improvements and their sequence should be undertaken to set out what, and how far, that unique home can go to make its contribution to energy efficiency. This concept has been discussed elsewhere, and is sometimes called "Building Passports".
- **Finances.** The economics of home improvement needs to be adjusted to provide access to funding for these improvements to be undertaken, whether in private or public sector. This is

more straightforward than it may sound – for private mortgages, the adoption of the LENDERS project in line with the position given by the UK Government in the recently published “Clean Growth Plan” goes a significant way to resolving this (full LENDERS report at www.epcmortgage.org.uk). For public housing, adopting similar LENDERS methodologies to change affordable rent levels to include fuel costs provides a step to tackle fuel poverty, but as importantly allows rental levels to increase where fuel bills decrease, incentivising Registered Social Landlords (RSLs) to commission or upgrade their housing stock funded through the increase in rental income.

- **Trust.** For homeowners, and to a lesser extent private landlords and RSLs, there are significant issues around whether they have confidence in the quality and outcomes of any work they may consider commissioning. This issue is dealt with in detail under the “Each Home Counts” report (available on www.gov.uk website), which recommended a quality mark or similar to tackle this. If correctly enforced and monitored, which almost certainly precludes self-certification of work such as predominates in the current construction industry, this approach may well provide the confidence to the home owner. Combined with the knowledge of what measures are suitable (first point), and the access to finance (second point), this trust is the penultimate element required to set a landscape for our existing housing stock to progress.
- **National Plan B.** Lastly, Wales must address the difficult topic about what is considered an acceptable performance for individual homes in the future, and what happens to those homes that fail this measure. The measure cannot be countrywide and must be addressed to the individual property level to give consideration of aesthetic and community benefits as well as the limits of energy efficiency that can be achieved – in effect, an output of the “Building Passport” above. However, in the context of the overriding national requirements for very significant carbon reductions, some homes will lack sufficient combined merit of heritage, culture or placemaking value, and will have insufficient potential for upgrade, that means the best route for the national best interest is their deconstruction and recycling rather than wasted attempts at upgrades. Wales as a nation must recognise this challenge, and establish a system that prevents the owners of those homes from being the ones which carry the economic burden unfairly. Instead Wales must develop a method to identify and purchase those homes for whole house redevelopment as part of achieving broader carbon reduction targets for the nation, bringing the potential economic benefits of scale and value of carbon savings to minimise the inevitable costs incurred.

4. Whether it is possible and feasible to deliver low carbon, Energy Positive, affordable housing at scale in Wales and, if so, how this can be achieved;

It is possible and feasible to deliver low carbon, Energy Positive, affordable housing at scale in Wales for locations where this is technically, environmentally and socially desirable to do so, however this is not the case for all locations across Wales – please reference answers Q1, 2, 8 & 9.

In locations where it is desirable to deliver energy positive homes capable of significant levels of generation, the remaining challenge to their successful delivery at scale is economic.

Development is, expressed most simply, an equation comprising the sales or capitalised rental value forecast, balanced against the planning contributions, development & construction costs, and a profit margin, with whatever remains being the land value. Of these elements, Wales has least control over the profit margin: Whilst a reality disliked by some, the profit provides the reason for the capital investment in construction, and deviating profit levels too far from those achievable

in international markets will simply result in investment funds moving to other opportunities with better yields: construction is not the only “fish” in the capital investment “ocean”. Next least easily influenced are the development and construction costs, which can be driven with economies of scale with regard to products and materials, but except in some niches of the industry, are also factors affecting quality of final construction, skills and employment levels, and pressurising these therefore can have undesirable consequences if taken too far.

The greatest opportunities for affecting the economics sit across land value, planning contributions and sales or capitalised rental value forecasts, which is also where Welsh Government can effectively apply policy. Land value and planning contributions are intrinsically linked, and both ultimately derive from planning use, obligations and density. Through enhancing the technical and spatial details in early stages of planning (see Q9 for more), land owners and potential developers can be given greater certainty over these core planning issues. In turn, land value expectations by land owners will be affected dependent on the more detailed and known planning contribution obligations that would be placed on development occurring there.

This approach provides an economic equalisation between developments: Sites with high potential for energy generation would have higher expectations set early enough in the planning frameworks for these expectations (and associated costs) to be reflected in the land value expected by land owners. Sites with lower generation potential (and therefore lower costs) would have levies clearly identified, again early enough to be reflected in land values. This enables sites where higher generation is desirable but uneconomic to deliver on their own sales or rental values to receive funds levied from other developments that were unable to meet their levels of generation.

It is entirely possible and feasible to deliver low carbon affordable housing at scale in Wales in an economically viable method, but it is not appropriate for all of this housing to be Energy Positive. Instead, a more sophisticated model should be used to ensure equity and optimal use of natural resources to deliver quality homes and places, and place generation where it is most effective.

5. What are the barriers to delivering transformative change in house building in Wales?

There are a number of barriers to delivering transformative change in house building in Wales, though a considerable number of these challenges can be reduced to the economics of development as covered in Q4. Beyond economic barriers are skills, policy and procedural barriers, which are addressed in Q7, 8 & 9 later.

One barrier to delivering transformative change in the delivery of housing in Wales not covered elsewhere is the strength of the major housebuilders in the current environment. The major housebuilders have the resources to drive efficiencies in their construction costs, and to identify and lobby for land well ahead of smaller developers and independents. This is combined with a capital-return driven disposal policy for public land that values receipts above outcome, meaning land sales tend to be of large plots as one site with no infrastructure or subdivision to achieve the best price and lowest risk, which effectively rules out the land being purchased by all but a few major developers. The result of these effects is that the major housebuilders are in an environment where they can identify and secure the land (either first or by being the only ones who can match the price), and as yet have no commercial reasons to do anything but meet minimum standards.

This does not mean that the major housebuilders are acting irrationally or that they should be avoided: Major housebuilders are the unintended consequence of the environment our society has created through consumer demands, public policy and protocols over decades. Changing this environment through increasing the value of energy efficient homes (see Q3 & 4) and changing the policies (Q8 & 9) will result in changes from the housebuilders, albeit reluctantly until these changes are sufficiently evidenced and entrenched. However, it is important to remember that the major housebuilders, if or when persuaded to change, are the ones with the greatest resources to make this change happen at scale and at pace: Whilst transformative change in Wales can happen without the major housebuilders, it can happen quicker if they act.

Mention should also be made here of the Welsh Government Innovative Housing Programme (IHP) launched by the late Carl Sargeant. This programme represents an excellent opportunity to challenge barriers to transformative change in Welsh housing across a broad spectrum aligned with the goals of the Wellbeing of Future Generations Act, as well as to be a beacon of excellence beyond our borders. Intended to support scalable solutions, the IHP should continue to be supported as an ongoing progression towards the change we need. However, the opportunities to learn from the supported schemes must not be lost, and information about the design, construction and operation of the IHP homes must be collected and shared as comprehensively and broadly as possible. This will enable others to learn lessons and take the housing transformation forward, whilst evidencing the successes (and noting to avoid failures) will be the means of bringing the major housebuilders to adopt change, or to supersede them if they do not.

6. What is the role of Ofgem and the national grid in enabling grid evolution to accommodate new types of housing, and what are the challenges presented by decentralised energy supply?

Energy regulations and management is currently under review by UK government in this context. In the context of this consultation response, therefore, this response has been kept to a minimum.

In the context of Low Carbon Housing, whilst elements of reduced regulation and grid evolution, allowing private individuals to sell or buy generation into the markets or sub-markets directly could lead to significant unintended consequences in future. If such a relaxation occurred, individuals are likely to be buying or selling a few kWh of electricity (probably automatically) as a side-effect of the operation of their homes. In these circumstances, poor maintenance and ineffective system control are likely to occur more often than desirable. Whilst it is critical that our national grid becomes a sharing mechanism for two-way sharing of energy, rather than a one direction distribution system, and that smaller and more diverse energy suppliers should be able to contribute to this, it is suggested that these changes stops at small scale organisations (which could be community owned), where professional operation and maintenance of future disparate energy generation and storage systems (even when installed within private homes), can be more confidently assured as part of the organisation's business operations and, if appropriate, regulated and monitored to be such.

7. Whether Wales has the requisite skills to facilitate and enable change in the housing sector;

Much is already written about the current skills shortage in construction, and the likely short term impacts of 'Brexit' worsening this in the UK. The longer term shortage of skills can be simplified to a several key influencing factors that underpin a large part of this issue, comprising:

- **No intake.** Construction is usually at least partly a site-based operation happening year-round, in most weather conditions. This presents an unattractive working environment that,

when matched with de-skilled approaches to construction, leads to conditions and levels of pay that are insufficient to tempt new or returning individuals to the industry in sufficient numbers.

- **No security.** In addition to the above, construction is highly cyclical, leading to downturns approximately every 7-9 years and consequential job losses. Combined with stop-start public funding schemes that compound this, construction therefore currently does not present the prospective of a stable life-long, rewarding career. In turn, this does not provide the incentive for individuals to develop the skills which the construction industry needs.
- **No standards.** Lastly, for those who do enter the industry, there are remarkably few independently verified checks or standards that are enforced in practice on a site-by-site level. As a result, for the individuals there are few real consequences to inadequate skills – the largely uncertified or self-certified SME refurbishment & maintenance market will still be a source of work, even if the modestly more controlled new build sector is not.

These factors combined to mean that construction offers comparatively poor pay with poor job security to work in a (seasonally) poor environment, whilst presenting no real consequences for those in the roles if they do not develop their skills and quality. The current result is, of course, individuals opt to work in other industries with better pay, better job security and better year-round environments, even if this means they must acquire relevant and appropriate skills to achieve this.

For the last few decades, 'offsite' construction has been heralded as the answer to the skills shortage. This undoubtedly does have a role to play in the future of the industry, though its current potential should not be overplayed: Wales' homes are largely existing, and even when new, they have unique placemaking, social and environmental conditions that render them effectively unique (see Q3). Offsite construction does offer the prospect of warm and dry workers and better quality control for factory-built components, but is likely to need the arrival of mass customisation through next-generation 3D surveying and "parametric bespokeing" before it can meaningfully tackle the full range of our housing stock in Wales.

To address the current issue of skills, therefore, there must be ongoing support for skills and training programmes reacting to the current and future demands (such as the Construction Industry Training Board's (CITB) "Construction Innovation Wales Centre" (CWIC) lead by University of Wales Trinity St David), and support of schemes which explore and demonstrate these skills in practice (such as through the Innovative Housing Programme). However, this must be supplemented by efforts to use public funding programmes to address the cyclical nature of construction in order to retain the skills during downturns, and be combined with stronger enforcement of the standard of skills at site level to ensure that poor quality is not accepted as the norm. Finally, we must recognise a genuinely skilled labour force will have an expectation of a reasonable level of pay, and we should be prepared for the consequential impacts on our construction costs (and therefore on land values as explained in Q4).

8. What changes are needed to Building Regulations in Wales to accelerate progress towards 'near zero' energy standards and beyond?

In their current form, Building Regulations provide a minimum performance standard for the fabric and 'wired-in' systems of new homes and, to a lesser extent, existing homes being modified. The achievement of this minimum performance standard is largely unverified in the completed construction under normal circumstances.

A 'near zero' energy standard is assumed to mean a home which requires nearly no energy over the course of a year to supply the regulated (covered by Building Regulations) and unregulated (not covered by Building Regulations) energy which is required to function and be inhabited.

Requiring this definition of 'near zero' energy on a home-by-home basis for new construction will drive the orientation and size of the homes, and will require energy systems that are sized to cope with fluctuations in occupant demands and external conditions. It will lead to new homes which are less economic to build, with less potential for variety, and arranged in spaces and places that are designed not for pleasant community environments but to optimise renewable generation. Trees, for example, will become undesirable in any new housing development as they will risk the overshadowing of required renewable generation: As a result, trees CO₂ absorption, ecological diversity, groundwater run-off control and simple aesthetic properties are likely to be ignored, since they are not directly required by regulation.

Put simply, this definition of 'near zero' on an individual new home basis will have significant and undesirable consequences on the quality, flexibility and desirability of our homes and the places they are in.

An alternative definition of 'near zero', however, may avoid many of these issues. Requiring our new homes to achieve the minimum possible energy demand before considering any energy generation drives energy efficiency. Such a definition, if combined with a realistic assessment of the existing building fabric's performance (especially considering moisture and ventilation), could also be adopted for our existing housing stock.

This required reduction in energy demand can then be aligned with policies adopted elsewhere (most likely through Planning under the current systems), to require energy generation for localities according to their capacity to generate and the appropriateness of such generation to the environment. Such an approach could be envisaged to use mechanisms such as Community Infrastructure Levies (in the current system) to shift funds from schemes that cannot reasonably meet their energy demands within the site boundary to those which have the capacity to generate excess energy, were funds available. This would enable site-specific discussions about the balance between quality of place, space and an appropriate level of generation to take place.

Such an approach is impossible through Building Regulations (in their current form) if the 'near zero' definition goes beyond a requirement for regulated energy demand reduction. Changes to Building Regulations in Wales should therefore not exceed this threshold, but changes to the delivery and expertise of the Planning system should be implemented in order to make full use of the capacity for a locality to act cohesively to meet its energy needs and become a 'near zero' community.

9. How communities can be planned and shaped to be more energy efficient and low carbon (including examples of good practice in Wales and further afield).

Communities can be more energy efficient and low carbon through better, earlier and more informed planning, collaboration and technical support to shape them. Whilst Wales has inherited a nominally "plan-led" planning system from England following devolution, and made limited significant changes to the process since, in practice the system is inadequate for the demands and opportunities of the 21st century. Furthermore, the planning system is significantly under resourced

and has limited access to technical expertise (internally or budget for externally), resulting in immediate pressures draining resources.

As a result, the planning system is frequently cited as a barrier to development by those within the industry, and is commonly seen by the wider public as being a “foregone conclusion” in favour of developers, whilst the planning system simultaneously regularly fails to realise opportunities and synergies at local scales beyond individual site applications.

To achieve communities that are successful and functioning, as well as being as energy efficient and low carbon as possible, the “plan-led” approach must be strengthened to meet the needs. The forthcoming National Development Framework (NDF) and to a greater extent Local Development Plan (LDP) stages should include assessments of acceptable energy demand and generation across the extent of their planned area, setting clear expectations ahead of development and giving certainty to those coming forward with proposals. Whilst beyond energy issues, this could be combined with more detailed expectations around scale and massing across the area, using 3D graphics and interactive functionality to support genuine public engagement and understanding of the complex balances being struck at LDP stage, where such engagement can make a meaningful difference to outcomes.

Though undoubtedly requiring greater resources at these earlier planning stages, such a genuine “plan-led” approaches ought to reduce uncertainty, risk and time for individual applications (where these do not choose to challenge the plan), due to fewer issues with local communities and applicants for individual applications. In effect, schemes proposed within the more detailed LDP requirements (including energy demand and generation), could be approved quickly, and in doing so deliver a planning system which genuinely enables appropriate development. This should provide significant incentive to suitable development in Wales through clarifying the process and reducing the risk associated with achieving planning approval.

About the Respondents:

The Royal Society of Architects in Wales

The Royal Society of Architects in Wales/Cymdeithas Frenhinol Penseiri yng Nghymru (RSAW) is the voice of the RIBA in Wales. As part of the Royal Institute of British Architects (RIBA), the RSAW champions better buildings, communities and the environment through architecture and our members, who comprise all Chartered Architects in Wales.

Design Circle

Design Circle is a voluntary group of creative and construction professionals engaged in the built environment, with active participants ranging from architects and artists to planners and project managers. Design Circle promotes excellence in the spaces and places formed in and around our built environment, and delivers exhibitions, competitions, charrettes, seminars and wider social activities to support this outcome. Design Circle was established in 2007, and is formally constituted as the southern branch of the Royal Society of Architects in Wales.

Response Lead Author

The lead author of this response is Andrew Sutton. He is a Chartered Architect whose work has included the design and delivery of the Barratt Green House, the multiple award winning first zero carbon ‘Code 6’ house by a housebuilder; the “off-grid” Maes-yr-Onn farmhouse outside Caerphilly (winning the RTPI Planning award); and the Cwmbach “Retrofit for the Future” refurbishment which

featured the first residential use of a transpired solar collector. Whilst this consultation response represents only those bodies named above, Andrew's activities and involvements in this field includes roles as:

- Associate Director, BRE Wales
- Welsh Gov. Planning Policy, Innovative Housing Programme & Smart Living Steering Groups
- Honorary Treasurer & past President, Royal Society of Architects in Wales (RSAW)
- Treasurer, Founder & past Chair, Design Circle RSAW South
- CEW Enabling Zero Waste Project Steering Group
- Past member, Building Regulations Advisory Committee (Wales)