Proposals for Zero Carbon New and Retrofitted Buildings in Canterbury

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CCAP
Canterbury
Climate
Action
Partnership

1.0 INTRODUCTION

1.1 – About 40% of all energy related emissions come from buildings and the construction process so in helping to achieve CCC's stated aim of becoming zero carbon by 2030, tackling buildings and the construction process will play a big part.

1.2 - Recent buildings to current regulations only account for a small percentage (1%) of the building stock; existing buildings account for the remainder; 21% of these were built before 1919, 16% between 1919 and 1944; 19% between 1945 and 1964; 20% between 1965 and 1979; 15% between 1980 and 2002 and only 8% after 2003. Many of these older houses are built of solid brick walls, un-insulated cavity brick walls or timber frames.

1.3 – Our greatest task will thus be to tackle the poor quality of the existing building stock within the District but going forward, it is vital that all new buildings are constructed to be as low carbon as possible in order not to add to the carbon load.

1.4 – All buildings in the district, be they new build or retrofitted, should therefore be required to show a level of energy efficiency and sustainability well beyond the minimum standards required by the current Building Regulations, with year on year improvements, until actual zero carbon in use (AZC) standards are achieved by 2025.

1.5 – This paper will make recommendations on how to frame policy in order to reduce carbon emissions, both within the CCC estate and in the wider District.

1.6 – Staff training will be required to achieve these new policies.

2.0 BACKGROUND

2.1 – The Planning and Energy Act 2008 (as amended) allows local planning authorities to set and apply policies in their local plans which require compliance with energy efficiency standards that exceed the requirements of the Building Regulations. This Act also committed the government to making all new homes carbon neutral by 2016.

2.2 – In 2015 however, the then government (under pressure from the big housing developers) axed the plan to make all new homes carbon neutral by 2016 and set out, in a Written Ministerial Statement its "expectation" that local planning authorities would set energy efficiency standards for new homes to Level 4 of the Code for Sustainable Homes (this being equivalent to about a 20% improvement on the Building

Regulations : Part L : 2013 standard). Furthermore, the current consultations on the Future Homes Standard (FHS) and Part L of the Building Regulations add to this state of flux. It is however fairly certain that a minimum improvement of 20% on the Building Regulations will soon be mandatory for all LPA's.

2.3 – There thus remains much confusion amongst local authorities as to how far they can exceed the requirements of the current Building Regulations but having declared a Climate Emergency in July of 2019, with the aim of becoming zero carbon by 2030, CCC should follow radical new policies being set by many local authorities around the UK; these radical new policies being the basis of our recommendations.

3.0 THE THREE R'S AND THE PRINCIPLES OF SUSTAINABLE DESIGN

3.1 – Before looking at specific carbon reduction policies in detail, CCC should promote the "three R's" of sustainable development, namely, Reduce, Reuse and Recycle.

3.1.1 – **Reduce**: Building nothing, challenge the need to build. Before any new building is constructed we should ask the question "why is it needed"? Can we manage without it? Where needed, buildings should be kept as small and efficient as possible.

3.1.2 – **Reuse**: Encourage refurbishment of buildings rather than replacement, especially property under the control of CCC. CCC should consider their current offices as an exemplar test case for reuse/retrofit. Also, encourage use of brown field sites.

3.1.3 – **Recycle:** New buildings should be constructed from recycled materials wherever possible and should be designed with the potential to be recycled and reused at the end of their lives. Also projects should have sufficient space for recycling facilities in the design.

3.2 – Whilst setting standards for the reduction in carbon emissions, it is also important to simultaneously promote the principles of sustainable building design, many of which are already included in the National Planning Policy Framework (NPPF) revised July 2018 and listed in Chapter 7 of the Canterbury District Local Plan adopted in July 2017 (Ref A3.1). These principles (Ref Appendix 2) can be incorporated into building developments at no, or very little, additional capital cost.

4.0 THE ZERO CARBON WAY AHEAD FOR NEW BUILDINGS

4.1 – The methods of measuring carbon and energy vary widely. The carbon assessment method included within the current Building Regulations creates a "performance gap" that results in buildings being far less efficient in reality than in their designs.

4.2 – There are however far more robust methods that should be considered, and one such method is the "Passivhaus Standard". (Ref A3.2). There are also others including the Association of Environmentally Conscious Builders (AECB) Building Standard (based on Passivhaus but adapted to the demands of the milder UK) but Passivhaus remains by far the most widely used international standard.

4.3 – The Passivhaus standard puts the need for high levels of fabric specification (insulation, air tightness and triple glazing etc) ahead of the provision of renewable energy solutions and offsetting and measures energy consumption rather than carbon emissions. It also includes assessment of currently 'non regulated' energy under the Building Regulations such as domestic appliances and cooking.

4.4 – Passivhaus has several standards, including:-

- PH Classic- the main standard of which over 60,000 buildings have been completed worldwide and will achieve a "near zero carbon" standard in use
- PH Plus, which matches energy consumption with energy generation on site and thus is an actual "zero carbon in use" (AZC) standard and
- PH Premium which exceeds energy consumption with generation and thus is "better than zero carbon in use"

4.5 – In setting policy, it is important to separately consider CCC development and private development, as in the former case CCC has control of its own estate and can thus more readily "call the shots" and become an exemplar authority.

4.5.1 – CCC Development

4.5.1.1 – In its Climate Emergency in July 2019, CCC declared that it will reach zero carbon by 2030. Thus, where CCC is developing its own estate, including East Kent Housing, or where it is selling land for development it can, and must, immediately set actual zero carbon (AZC) standards, in use, for all new buildings passing through the Planning and Building Regulation process.

4.5.1.2 – The most effective way to achieve zero carbon in use is to build using the Passivhaus Plus (or equivalent) standard which can and is being done right now. Reference should be made to the award winning Local Authority Passivhaus housing scheme in Norwich. (Ref A3.3).

4.5.1.3 – In addition, all efforts should be made to reduce "embodied energy" in construction.

4.5.2 – Private development

4.5.2.1 – Where CCC is setting policy for private developers and builders, the Council should stress the aim of achieving actual zero carbon (AZC) in use for all new buildings passing through the Planning and

Building Regulation process by the end of 2020 and that the Passivhaus Plus (or equivalent) standard is its preferred way of achieving this aim.

4.5.2.2 – Furthermore, CCC should also aim to persuade private developers and builders of the merits of zero carbon buildings as these buildings will be highly efficient, very cheap to run, easy to maintain and highly desirable. Homes with a low Energy Performance Certificate (EPC) rating of A or B are known to be more valuable by about 5%. For social housing developments it is important to note that housing built to Passivhaus standards will effectively eliminate fuel poverty.

4.5.2.3 – However, it is recognised that not all developers or builders will be geared up to deliver Passivhaus (or equivalent) standards in the short term so we recommend that CCC should set an interim target; a target that is significantly better than the current Building Regulations requirements, In doing so, CCC should refer to, and follow the lead of other like minded councils around the UK who are adopting radical policies to combat the climate emergency. Bristol is one such council and we urge CCC to adopt policy that equals or betters Bristol's lead (Ref A3.4).

4.5.2.4 – As such, it is recommended that all private development, which cannot meet the Passivhaus Plus standard, should be required to achieve, BY THE END OF 2020:

- a minimum of 20% reduction in regulated CO2 emissions compared to current Building Regulations through energy efficiency measures to the fabric of the building.
- a further minimum 40% reduction in regulated CO2 emissions compared to current Building Regulations through a combination of energy efficiency measures to the fabric of the building and on-site renewable energy generation (solar panels and heat pumps etc). Emphasis should be placed here on encouraging fabric improvement over renewable energy provision.
- after applying the above measures, all development should be required to reach a 100% reduction in regulated and unregulated emissions (ie achieve zero carbon emissions) through the use of carbon offsetting. Acceptable offsetting measures should be via an agreed payment to the Council (via a 106 agreement or other legal/planning mechanism currently in place) of £100 per tonne of CO_2 emitted by the development over a 30 year period.
- In addition to the above, commercial developments must achieve a BREEAM "excellent" standard and residential/mixed use developments must achieve a BREEAM for communities "excellent" standard. In this way, issues such as embodied energy and sustainable design principles can begin to be addressed.

4.5.2.5 – In addition, all efforts should be made to reduce "embodied energy" in the construction process. The Green Building Council have published a definition of zero carbon buildings in their 'Net Zero Carbon Buildings: A Framework Definition' which also takes into account operational energy and construction carbon used up to practical completion (Ref A3.5).

4.5.2.6 – It is also anticipated that there should be year on year improvement to the above policy such that by the end of 2030, all developments passing the Planning and Building Regulation process should be required to be truly zero carbon, including embodied energy, without the need for offsetting.

4.5.2.7 – Finally, all new developments should demonstrate, through an Energy Statement as part of the Sustainability Statement, how these requirements will be met.

5.0 THE ZERO CARBON WAY AHEAD FOR THE REFURBISHMENT, RETROFITTING AND EXTENSIONS TO BUILDINGS

5.1 – In 2017 there were 23.9 million homes in England, 63% owner occupied, 20% privately rented, and 17% owned by local authorities or housing associations, most of which are in need of major improvements to their energy efficiency. The task is vast and it will be necessary for local authorities to seek government funding to assist all those who do not have the resources to carry out the necessary work.

5.2 – In order to achieve zero carbon emissions in the District by 2030, most existing homes, offices, commercial premises, factories, and any building which needs heating, cooling or ventilating will need to be upgraded to a higher level of energy efficiency. Compounding the problem, there are many hard to treat buildings that need a higher level of expertise to refurbish, especially here in the Canterbury where we have a high proportion of historic buildings and buildings in conservation areas.

5.3 – However, to guide us, there is an expanding body of examples of high quality zero energy buildings and retrofits of buildings, including historic buildings.

- The UK Passivhaus Trust has an awards scheme which can be seen at: https://www.passivhaustrust.org.uk/passivhaus_awards/uk-passivhaus-awards
- The annual Architects Journal Retrofit Awards is a source of retrofit case studies by UK companies ranging from major cultural buildings to smaller domestic refurbishments. The most recent examples for the UK — the winners in 2019 — can be found at: https://retrofit.architectsjournal.co.uk/winners-2019
- The Royal Institute of British Architects (RIBA) Awards now insist on minimum sustainability requirements before projects are shortlisted https://www.architecture.com/awards-and-competitions-landing-page/awards

5.4 – Refurbishment requires the survey and evaluation of individual buildings to establish the easy gains, the opportunities and the barriers; this necessitates an incremental approach. Rapid roll-out of unsympathetic improvements could result in long term degradation of our building stock.

5.5 - Refurbishment will create increasing demand for insulation materials, therefore there is an increased need to use sustainable insulation materials to avoid adding to current plastic pollution. Medium and high rise buildings need to use fire resistant insulations and this means using either mineral wools or cork.

5.6 – Clients and designers need to recognise the skills missing from their own teams and appoint suitably qualified and experienced retrofit specialists to work alongside them on complex projects.

5.7 – As with new buildings, the Passivhaus Trust has a robust standard for retrofit that should be considered. The Passivhaus standard for the refurbishment and retrofitting of existing buildings is Passivhaus EnerPHit. It is similar to Passivhaus for new buildings but there are concessions to allow for complexity of construction such as slightly lower airtightness and thermal insulation requirements. It also allows a step by step approach, so that improvement measures can be spread over time and each stage approved in accordance with a long term plan. In many cases, this step by step approach will be necessitated by considerations of cost and disruption. (Ref A5.1)

5.8 – In addition to Passivhaus EnerPHit, PAS2035:2019 is a very useful refurbishment standard. Sponsored by the UK Government's Department for Business, Energy and Industrial Strategy (BEIS), PAS2035:2019 is a key document on how to conduct effective energy retrofits. It covers how to assess dwellings for retrofit, the identification of improvement options, design guidance, specifications for energy efficiency measures (EEM's) and the monitoring of completed projects. Organizations which trade using the Trustmark Government endorsed quality scheme are required to comply with PAS 2035:2019.

5.9 - As with new buildings, in setting the policy for refurbished buildings, it is important to separately consider CCC development and private development, as in the former case CCC has control of its own estate and can thus more readily "call the shots" and become an exemplar authority.

5.9.1 - CCC Development

5.9.1.1 - In its Climate Emergency in July 2019, CCC declared that it will reach zero carbon by 2030. Thus, where CCC is refurbishing or retrofitting its own estate, including East Kent Housing it can, and must, set actual zero carbon (AZC) standards, in use, for all buildings.

5.9.1.2 - The most effective way to achieve zero carbon in use is to refurbish using the Passivhaus EnerPHit (or equivalent) standard. It is also important to note that housing refurbished to Passivhaus EnerPHit standards will effectively eliminate fuel poverty.

5.9.1.3 - In addition, all efforts should be made to reduce "embodied energy" in construction.

5.9.2 - Private development

5.9.2.1 - Where CCC is setting policy for private developers, builders and individual building owners, who are making applications through the Building Regulations, and possibly the Planning process, the Council should stress the aim of achieving actual zero carbon in use and that the Passivhaus EnerPHit (or equivalent) standard is its preferred way of achieving this aim.

5.9.2.2 - Furthermore, CCC should also aim to persuade private developers, builders and individual building owners of the merits of zero carbon retrofits as these projects will be highly efficient, very cheap to run, easy to maintain and highly desirable.

5.9.2.3 - However, it is recognised that not all developers , builders or individual building owners will be geared up to deliver Passivhaus EnerPHit (or equivalent) standards in the short term so we recommend that CCC should set an interim target; a target that is significantly better than the current Building Regulations requirements.

5.9.2.4 - As such, it is recommended that all private development, which cannot meet the Passivhaus EnerPHit standard, should be required to achieve:-

- a minimum of 20% reduction in regulated CO2 emissions compared to current Building Regulations through energy efficiency measures to the fabric of the building
- a further minimum 40% reduction in regulated CO2 emissions compared to current Building Regulations through a combination of energy efficiency measures to the fabric of the building and on-site renewable energy generation (solar panels, heat pumps, hydrogen boilers etc). Emphasis should be placed here on encouraging fabric improvement over renewable energy provision.
- after applying the above measures, all development should be required to reach a 100% reduction in regulated and unregulated emissions (ie achieve zero carbon emissions) through the use of carbon offsetting. Acceptable offsetting measures should be via an agreed payment to the Council (via a 106 agreement or other legal/planning mechanism currently in place) of £100 per tonne of CO2 emitted by the development over a 30 year period.
- In addition to the above, projects should be required to comply with the BREEAM Refurbishment and Fit Out (RFO) standard. There are separate standards for domestic and non-domestic projects.

5.9.2.5 - All efforts should also be made to reduce “embodied energy” in the construction process.

5.9.2.6 - Finally, all refurbishment and retrofit schemes should demonstrate, through an Energy Statement as part of the Sustainability Statement, how these requirements will be met.

6.0 CONCLUSION

6.1 – Having declared a Climate Emergency in July of 2019, with the aim of becoming zero carbon by 2030, CCC should be brave and resolute in following or exceeding radical new building policies being set by many local authorities around the UK.

6.2 – All new and retrofitted buildings in the District should be required to show a level of energy efficiency and sustainability well beyond the minimum standards required by the current Building Regulations, with year on year improvements, until actual zero carbon (AZC), in use, standards are achieved by 2025.

6.3 – CCC should also promote the Principles of Sustainable Design, including the “three R’s”; Reduce, Reuse and Recycle.

6.4 – Where CCC is developing its own estate, including East Kent Housing, or where it is selling land for development it can, and must, immediately set actual zero carbon (AZC) standards, in use, for all buildings passing through the Planning and Building Regulation processes. The most effective way to achieve this is to build using the Passivhaus standard.

6.5 – Where CCC is setting policy for private developers and builders, the Council should stress the aim of achieving actual zero carbon (AZC) for all buildings passing through the Planning and Building Regulation process and that the Passivhaus (or equivalent) standard is its preferred way of achieving this aim. However, if actual zero carbon (AZC), in use, cannot be achieved using the Passivhaus standard, CCC must set minimum, interim targets that are significantly better than the current building Regulation standards.

6.6 – CCC should, together with like minded council’s around the UK enter into dialogue with HMG to ensure that national regulations and guidance are revised and significantly improved, in line with the recommendations outlined in this paper. CCC should also seek funding from HMG for the task of improving the energy efficiency of the existing building stock within the District.

APPENDIX 1: CCAP AND THE BUILDINGS SUB-GROUP

A1.1 – CCAP was formed in June of 2019 to bring together civic society, our universities and local business to support the Council in the implementation of their Climate Emergency, to reduce our carbon footprint/emissions throughout the District and to work towards a zero carbon Canterbury

A1.2 – CCAP has formed a number of sub-groups to develop detailed strategies as part of it’s 10 point action plan and this sub-group covers Action 6: Buildings and Infrastructure.

A1.3 – Sub-group members and authors of this paper:

Keith Bothwell – BSc, MSc, Dip Arch, RIBA, honorary senior lecturer and former Deputy Head of School at the Kent School of Architecture, University of Kent, specialising in sustainable design.
Tim Carlyle – B.A Philosophy, BArch, Dip Arch, Code for Sustainable Homes Assessor, part time teacher at UoK, an architect with 40 years experience.
Paul Mallion – BSc (Hons), MSc (Arch), FRICS, Certified European Passivhaus Designer and director of Conker Conservation Ltd, Chartered Building Surveyors.
John Yard – BSc (Hons) Arch, Dip Arch, March, retired architect who specialised in sustainable development and low energy design.

APPENDIX 2: BUILDING CLEVER

A2.1 – Whilst setting standards for the reduction in carbon emissions, it is important to promote the principles of sustainable building design, many of which are already listed in Chapter 7 of the current Local Plan and can be incorporated into building developments at no, or very little, additional capital cost. These principles include:

- Design on a “fabric first” basis; highly insulated and air-tight structures
- South facing orientations for passive solar gain where appropriate in conjunction with solar shading
- Design to higher densities and preferably on “brownfield” sites
- Design buildings and structures to support solar panels and other renewable energy systems and flat roofs to be able to support natural “green roofs”
- Construct using materials with low embodied energy and preferably those that have sequestered carbon such as timber, hemp and straw. (See ref A3.6)
- Construct using less high carbon materials such as concrete, steel, aluminium, plastics and petrochemical foams
- Construct efficiently as to avoid waste; such as constructing “modular” buildings or other off-site construction techniques
- Design for adaptability and longevity from durable good quality materials and on the principle of “Long Life, Loose Fit, Low Energy”
- Consider light pollution
- Reduce water consumption by adopting good design standards such as the AECB Water Standard
- Construct permeable paving or storm water storage for new hard surfaces
- Design with nature, as well as people, in mind; to enhance biodiversity
- Design to capture waste heat by incorporating a ventilation system with heat recovery
- Design for ease of waste management and require a management action plan
- Establish a checklist for developers to follow to assist in proving compliance with the above
- Establish a register of local specialist skills, sustainable suppliers, and other resources to encourage use of local materials and assets

APPENDIX 3: REFERENCES

A3.1 https://www.canterbury.gov.uk/downloads/file/868/canterbury_district_local_plan_adopted_july_2017
A3.2 https://www.passivhaustrust.org.uk/guidance
A3.3 https://www.architecture.com/awards-and-competitions-landing-page/awards/riba-stirling-prize
A3.4 https://www.bristol.gov.uk/planning-and-building-regulations/local-plan-review
A3.5 https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition
A3.6 https://www.greenspec.co.uk/green-products

APPENDIX 4 : FREQUENTLY ASKED QUESTIONS

A4.1 - The difference between the Passivhaus and BREEAM standards.

A4.1.1 - Passivhaus is an energy and comfort standard whereas BREEAM (Building Research Establishment Energy Assessment Method) endeavours to focus on all environmental impacts. This is why we are recommending Passivhaus for energy and comfort and BREEAM for all other sustainable design issues.

A4.1.2 - Passivhaus is an international standard that concentrates on the fabric of the building, ensuring that it is extremely well insulated, airtight and well ventilated. This high level of fabric specification, together with mechanical ventilation with heat recovery (MVHR) systems ensures high levels of comfort while using very little energy for heating. This standard also uses a rigorous and well proven quality assurance process.

A4.1.3 - BREEAM (Building Research Establishment Energy Assessment Method) is also an international scheme but unlike Passivhaus, it is a "catch all" assessment of the sustainable design performance of building, community and infrastructure projects based on value judgements. BREEAM covers a wide range of categories including energy, health and wellbeing, the embodied energy of materials, pollution, transport, waste and water. BREEAM does improve the energy performance of buildings as an excellent rating can be achieved without achieving the desired higher performance or monitoring levels of the Passivhaus standard. BREEAM lacks the rigorous post occupancy evaluation of Passivhaus so has not been proven to work well in practice in terms of energy consumption and indoor air quality.

A4.2 - What is the additional cost, over and above the current building regulations, of building to a Passivhaus standard.

A4.2.1 - There is no straightforward answer to this question as there are many factors influencing buildings costs including form, type, size, orientation, and builder experience but research by the Passivhaus Trust, the Green Building Store, the Zero Carbon project and many others puts the added cost for a 3 bed housing unit at between 5% and 10%. This addition cost will decrease once developers and builders learn from their experience and become more efficient and buyers will experience greatly reduced

energy bills (it is estimated that a 3 bed household will save approx 80% on an average annual energy bill of £1250), greater comfort and better interior air quality. It should also be noted that, although construction costs are slightly increased with Passivhaus standards, the sale prices are also increased.

APPENDIX 5 : PASSIVHAUS RETROFIT OF EXISTING BUILDINGS

A5.1 Stages of assessment:

- Air leakage test
- Infra red thermography
- Analyse construction, check cavities, floor and loft voids. Assess condition and structural integrity- ability to support additional insulation weight.
- Assess ventilation of the fabric (eg roof and floor voids).
- Assess ventilation for occupants
- Assess solar gains
- Measured survey
- Evaluate options
- Carry out works
- As built air leakage test
- Monitor quality throughout using infra red camera
- Commissioning of plant
- Monitor energy consumption
- Provide user guide
- Post occupancy evaluation

June 2020 update : Section 5 and Appendix 5 added and general text adjusted to include refurbished and retro-fitted buildings.