CC007-A

Report for Essex Climate Action Commission

NET ZERO CARBON VIABILITY AND TOOLKIT STUDY

Report of findings August 2022

Summary Report

Three Dragons
Qoda
Ward Williams Associates

NET ZERO CARBON VIABILITY AND TOOLKIT STUDY

Report of findings - August 2022

Summary Report for Essex Climate Action Commission

Three Dragons
Qoda
Ward Williams Associates

August 2022

Document control sheet	
Project name	Essex Climate Action Commission– net zero Carbon Viability and Toolkit Study
Project reference	
Report title	net zero Carbon Viability and Toolkit Study
Doc ref	Summary Report of findings
Date	August 2022
Prepared by	Lin Cousins, Mark Felgate, Dominic Houston, Laura Easton, Sarah Price, Tim Wilcockson, Mark Stevens
Reviewed by	Lin Cousins
Quality statement	In preparing this report, the authors have followed national and professional standards, acted with objectivity, impartially, without interference and with reference to appropriate available sources of information. No performance-related or contingent fees have been agreed and there is no known conflict of interest in advising the client group.
Use of this report	This report discusses the findings from the research undertaken to meet Essex Climate Action Commission's project objectives. It includes a high-level assessment of the viability of different development types. No responsibility whatsoever is accepted to any third party who may seek to rely on the content of the report unless previously agreed.

SUMMARY REPORT

Study objectives and research undertaken

1. In May 2019, Parliament declared a climate emergency in the UK. This followed the Climate Change Act 2008 which requires the UK to achieve net zero carbon emissions by 2050. In response, the Essex Climate Action Commission (ECAC) has been established, to provide expert advice and up-to-date recommendations to move Essex to net zero by 2050.
2. In its 2021 report, Net zero: Making Essex Carbon Neutral[1], the Commission put forward a number of recommendations for all new buildings, including that:
    - New schools commissioned to be net zero carbon by 2022 and carbon positive by 2030;
    - New homes and all new commercial buildings granted planning permissions to be net zero carbon by 2025 and carbon positive by 2030;
    - The Essex employment, training, skills, procurement and business operations should be reviewed to support delivery of the ambitions of the ECAC;
3. ECAC subsequently commissioned a net zero Carbon Viability and Toolkit Study as reported here. The core aim of the study is to assess the cost and viability of achieving net zero carbon development; with options for doing so identified and evaluated against a series of economic, social, and environmental criteria, including the capital costs for developers. Building on this, the research has considered how best to support local authority planners in seeking higher environmental standards that will help to meet net zero targets.
4. The research undertaken for the study included a literature review and interviews with local authority planning officers and representatives of the local development industry and a high-level review of the impact on scheme viability of different carbon reduction targets.

Definitions of net zero

5. While there is no single agreed UK definition of net zero, the established principles are that emissions of greenhouse gases for a period are balanced by the amount of that gas that is removed.
6. For new homes, it is important to consider i) embodied carbon - used in the building's product and construction stages ii) operational carbon – carbon emissions associated with the building's operational energy and include regulated and unregulated energy and iii) whole life carbon - the carbon emissions associated with the construction, use and disposal of a building. This study was asked to focus on (regulated) operational carbon but also makes comment on the other carbon types.

[1] See https://www.essexclimate.org.uk/sites/default/files/DS21_7178%20ECAC_Commission_Report-Final.pdf

Government targets for net zero

7. The Building Regulations (Part L and Part F) were updated in December 2021 (coming into force in June 2022) with new standards intended to deliver a 31% saving in carbon emissions in new residential development against the 2013 Building Regulations – applying to regulated operational carbon only. From 2025, the Building Regulations set out that 'fossil-fuel heating systems' in any domestic new build properties are not permitted.

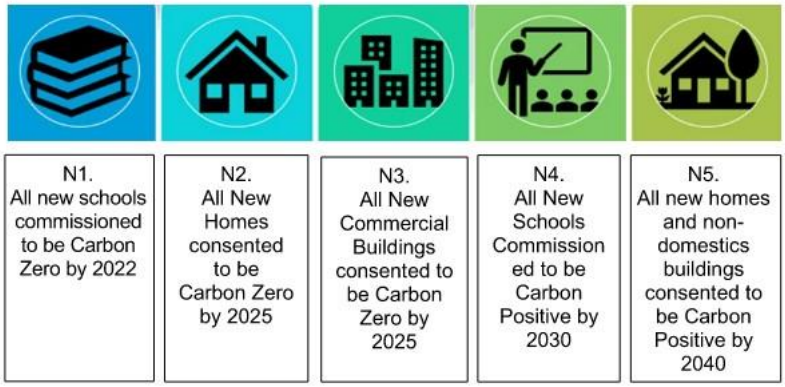
8. Government requirements are also changing. In its Future Homes Standard publication, the government sets out its intention that in 2025 there is a further reduction in CO_2 emissions (75% in total). Thereafter, government is relying on grid decarbonisation to achieve net zero operational carbon in all new homes by 2050. At the time of writing further, information is awaited about the measures that will be put in place to achieve the 2025 standard.

Local authority powers

9. The government has confirmed that local authorities retain the power, under the Planning and Energy Act 2008, to set local energy efficiency standards for new homes in their area. To confirm the position and provide confidence to local authorities to set strong net zero policies, one of the recommendations made in this report is for the local planning authorities to seek legal advice on this matter.

Essex policy approach and development industry charter

10. ECAC has set out its objectives for achieving net zero carbon in Essex as illustrated below:



11. The ECAC targets mirror those of the UK government but seek to achieve net zero at a much faster pace with all new buildings net zero carbon in 2025 - some 25 years earlier than the national target. In support of the ECAC targets, the Essex Developers Group (EDG) has signed up to a Developers Climate Action Charter. The Charter has been adopted by the EDG as well as Homes England, the South East Local Enterprise Partnership and the Essex Planning Officers Association (representing the 15 councils of Essex). The Charter restates the ECAC targets and, while it is acknowledged that the Charter cannot legally bind its signatories, it is an important statement of intent between the development industry and local planning authorities.

12. Planning policies effective in Essex (in the councils' local plans) have a variety of adoption dates – including four local plans adopted before 2012. As would be expected, newer plans are more likely

to have a stronger focus on policies that address climate change. In general they offer broad guidance and/or are supportive of measures to reduce carbon emissions. The importance of keeping policies up to date, in a fast-moving policy agenda, was apparent through the interviews undertaken for this research.

13. While neither Building Regulations nor other government guidance include targets for space heating demand and/or total energy use in buildings, emerging in local plans prepared elsewhere are policies that set such standards expressing these in terms of the total energy usage, referencing a metric such as kWh/m^2/year. These measures are being promoted to deliver a more accurate measure of operational net zero as they cover both regulated and unregulated energy use. At the same time, they more directly measure consumer costs, maintaining comfort levels for residents. These alternative approaches and are currently being tested at planning examination.

14. There is a considerable weight of guidance available both for the development industry and for planning authorities. These resources are generally freely available and it is likely that there will be further guides produced as more examples are built out and information becomes available. Given the wealth of general guidance already available, there is not a clear case for developing general guidance specifically for Essex.

Development industry perspectives

15. There are changing attitudes in the development industry to the energy performance of buildings with support for higher standards. Although there is said to be pressure from consumers for higher energy standards in new residential development this has not readily translated into higher market values with consumers expecting that new housing will be achieving higher standards as a matter of course. However, with the current significant increases in energy costs, consumer demand for lower energy housing seems to have the potential to lead to increased demand for increasingly energy efficient housing.

16. The development industry representatives interviewed also stressed the importance of having common standards across Essex (and beyond) and raised concerns about skills and capacity issues, in the short term at least.

Fabric first approach

17. A key principle of a low energy building is the efficiency of the thermal envelope i.e. the separation between the internal and external elements of a building. Improving the efficiency of the thermal envelope minimises heat losses through the fabric (step 1) before meeting the remaining energy demand through energy efficient systems (step 2) and renewables (step 3).

18. The epitome of a fabric first approach is Passivhaus - developed in Germany over 30 years ago, as a comfort and building performance standard using five design principles:

- High levels of thermal insulation;
- High performance windows;
- Mechanical ventilation that recovers heat;
- High levels of airtightness;

- Thermal bridge free design.

19. Passivhaus has three recognised levels of performance:

    - Passivhaus Classic –the essential high efficiency energy requirements that apply to the overall fabric, comfort and quality standards; its usage of regulated and unregulated energy must not exceed 15kwh/m2/year;
    - Passivhaus Plus – adds renewable energy such as photovoltaics to meet the normal regulated and unregulated energy demands required for the operational needs of the building;
    - Passivhaus Premium – where renewable generation exceeds the regulated and unregulated energy demands of the building.

Performance of options for carbon reduction

20. Five different approaches to reducing carbon emissions in new development were modelled including the move away from fossil fuels to assess their performance and the impact on occupiers – the modelling used a series of dwelling archetypes including apartments, terrace and detached housing. The options modelled were:

    - **Base Case: 2013** Part L Building Regulations;
    - **2021 Part L** Building Regulations - in place from June 2022;
    - **2025 Future Homes Standard** (using a best estimate of the likely standard);
    - "net zero Ready" standard based on the **Passivhaus Classic (this is the PH Classic but as it is generic rather than location specific we can only say it is based on the PH standard)**;
    - "net zero Carbon" Standard which closely aligns with the **Passivhaus Plus** standard. The net zero carbon standard was closely aligned with the requirements of the Passivhaus Classic standard but the local specific factors of climate, orientation etc have their part to play to make a building wholly conform with the PH standard. The Passivhaus standard takes into account both regulated and unregulated energy demands.

21. The modelling found that a fabric first approach, using a 'classic' Passivhaus will usually deliver housing at net zero. With the addition of photovoltaics, at an equivalent level to the Future Homes standard, new housing can become carbon positive. The Future Homes Standard has a formula for calculating how much PV is required to satisfy Building Regulations as enshrined in the current Building Regulations. The formula differs depending on whether a house or a flat. For example in the case of a house the PV renewable energy requirement measured in kWp (kilowatt peak) is 40% of the ground floor area, including unheated spaces, divided by 6.5.

22. Levels of comfort for occupiers increases and space heating demand reduces as the higher standards are introduced. However, it is only with a fabric first, Passivhaus, approach that there is a significant reduction in space heating demand (and consequently in household costs, with positive benefits for comfort and health.)

23. Other options for reducing carbon emissions such as heat networks and carbon off-setting can also have a role in reducing carbon emissions in new developments. Carbon offsetting should only be

considered as an option in exceptional circumstances when all other ways of delivering have been exhausted.

Impact on development viability

24. Using best available estimates of costs and values, three different standards of development were assessed to identify their impact on the viability of a series of 10 development typologies, ranging from 1 dwelling through to a strategic site of 5,000 new homes. The development typologies were tested in four notional value areas representing different housing market prices across Essex.

25. The three standards tested were:

- Building Regulations 2021;
- The government's 2025 Future Homes standard;
- ECAC's target for buildings to be net zero carbon by 2025.

26. With the majority of residential development. there is sufficient viability headroom to absorb the costs of net zero carbon. Moving from meeting the potential Future Homes Standard 2025, as set out in the government consultation documents, to net zero carbon, the additional costs average about £2,500 per unit for houses and £3,000 for flats.

27. Viability is weaker in the lower value area(s) and for a very limited number of development types. Where the costs of meeting net zero carbon mean that residential development becomes unviable, there may need to be an adjustment to land values and/or a balance of policy considerations, unless other measures can be taken to improve viability.

28. The costs of moving to net zero carbon for different types of non-residential uses (schools, offices and warehouse and industrial space were considered) vary significantly between schemes. The very high-level estimates identified for this report showed an additional 8%-12% costs for schools and 17%-20% for offices for achieving net zero carbon over current standards. However, these capital costs may be mitigated by significant operational cost savings. In any case, much non-residential development will be undertaken on a design and build basis, with the key determinants of whether schemes proceed related to the commercial (or educational) benefits to the occupiers.

Options evaluation

29. The final stage of the study addresses the core study requirement of evaluating the options identified to achieve net zero, against a series of economic, social, and environmental criteria.

30. The analysis showed that following Building Regulations alone (including Future Homes in due course) will make slow progress in reducing carbon. Although Future Homes will provide significant carbon reductions and some fuel poverty benefits, it does not address embodied carbon and unregulated operational energy and there are potentially sizeable impacts on the electricity grid capacity.

31. Unregulated energy use and the resultant carbon is not dealt with effectively by any of the Building Regulations and Future Homes housing development standards reviewed here. While the government standards are moving towards net zero in terms of regulated energy use only, it is

when the specifications and standards are tightened, as in the Passivhaus Classic with PV, that the government's CO_2 emissions targets are capable of confidently being achieved.

Conclusions and recommendations

32. It is recognised that tackling the climate emergency is a very fast paced agenda. The study, though, has reached the clear conclusion that a 'fabric first' approach should be the preferred method of achieving net zero and that we would strongly recommend that the Passivhaus Classic with photovoltaics (at 2021 Building Regulations levels which are based on a simple formula calculation related to floor areas and building type) is put forward as the standard to be adopted. This approach requires a series of performance indicators that will help achieve net zero and provide cost savings and comfort for occupiers. It will also require acceptance at any planning examination of the policy (typically in a local plan or equivalent).

33. Building on the above, the study has gone on to make a series of 15 recommendations

- **Recommendation 1**: Recognising that issues around energy use and carbon emissions is a fast changing area of policy development, it is critical that ECAC and the Essex planning authorities, keep under review approaches emerging elsewhere, particularly those backed at public examination.
- **Recommendation 2:** Within the context of the above recommendation, and as far as is practicable, the objectives for new development in Essex expressed through planning policy, should adopt the following performance indicators for both residential and non residential developments.

Building Type	Space Heating/Cooling Demand in kWh/m^2_{GIA}/year	Total Energy Consumption in kWh/m^2_{GIA}/year	Solar Electricity Generation in kWh/m^2_{GIA}/year
Residential	<15	<35	>35 on site for small scale; 70% of roof area for medium to large scale resi.
Schools	<15 - 20	<65	Exceeds metered energy use on site
Hotels	<30	<55	>120
Offices	<15	<55	>120
Light Industrial	<15 - 30	<55	>180

- **Recommendation 3:** A fabric first approach, that meets Passivhaus standards, should be the priority.
- **Recommendation 4**: Off-setting carbon reductions should be seen as the last resort and only allowed in exceptional circumstances. ECAC should review and provide further guidance on the types of circumstance in which off-setting might be considered acceptable.

- **Recommendation 5**: The use of PHPP software to account for unregulated energy and for transparency of targets is recommended. The key outputs to be demonstrated by the use of the PHPP software are:

Space Heating/Cooling Demand in $kWh/m^2_{GIA}/year$	Total Energy Consumption in $kWh/m^2_{GIA}/year$	Solar Electricity Generation in $kWh/m^2_{GIA}/year$

- **Recommendation 6**: The assessment of embodied carbon reductions and targets is evolving and its understanding is developing. Consequently, it is recommended that embodied carbon reduction targets are explored by ECAC and practical methodologies assessed - with industry involvement.
- **Recommendation 7:** A web based publication is produced by ECAC that provides information about specific aspects of planning for net zero – including available options and associated costs and occupier benefits. The publication will need strictly to be kept up to date.
- **Recommendation 8**: ECAC organises a 'planning policy summit' for the local planning authorities, with lead policy officers and their political portfolio holders invited. The summit would provide information about the policy options open to LPAs.
- **Recommendation 9**: ECAC (facilitated by ECC) organises and pump primes the funding of a pan-Essex group of expert advisers who can, on a call down basis, assist local authorities (officers and members) and developers in assessing planning applications.
- **Recommendation 10**: As already identified by ECAC, ECC and the district/unitary authorities should work together to put in place a monitoring process to ensure buildings meet the necessary standards and the potential 'performance gap' is tackled.
- **Recommendation 11**: Local plan policies will require back-up to describe, for the development industry and the wider public, how policies to reduce carbon emissions in new development are to be achieved and what is required. This can best be achieved through an Energy and Carbon Reduction SPD or alternatively, as an additional section to the existing Essex Design Guide already in place. ECAC should lead on the production of the SPD or equivalent.
- **Recommendation 12:** ECAC seeks a legal opinion on the role of local plans in setting standards beyond Building Regulations. This advice is then shared with the local planning authorities.
- **Recommendation 13**: As already recognised, the development industry workforce will require adapted and widened skills and enhanced delivery of factory produced products. ECAC should take these forward to ensure implementation of the ECAC Report Green Skills in Essex and to commission the necessary research to identify the best means of accelerated delivery of factory produced products.
- **Recommendation 14**: ECC and other public sector land owners across Essex should play a direct role in supporting development to the higher standards set out in this report. Interventions can include:
    - in their capacity as estate and asset owner by adopting the standards set out in this report;

- undertaking energy reviews when disposing assets and implementing retrofit measures.

  ECAC to seek to encourage all partner and public anchor organisations to do the same.
- **Recommendation 15:** A monitoring and reporting regime needs to be identified and put in place and it is recommended that ECAC commissions a feasibility study that examines how this can best be achieved and how it would be funded.