Creating a climate-smart garden village for Oxfordshire Cotswolds

Review of evidence and preferred policy options responding to West Oxfordshire's declaration of climate and ecological emergency

Bioregional, November 2019

Contents

Executive summary of policy recommendations

Homes and buildings – climate mitigation

- Look to set requirements for fabric energy efficiency standards of ≤15kWh/m2/year for space heating (Passivhaus[1])
    - If not ≤ 15kWh then less than 35kWh (Energiesprong/RIBA[2])
    - To be revisited upon revisions to Part L / Future Homes Standard
- Exploring setting a Net Zero Carbon definition that includes embodied carbon of materials across the building's whole life cycle (see section below) and issue a materials hierarchy that encourages the lowest carbon intensity materials , with a requirement to measure and report on embodied carbon (Draft London Plan[3])
- Explore a requirement for developers to demonstrate following an 'Energy hierarchy' design approach to minimising energy use before using renewables and offsets to achieve required DER/TER reductions Draft London Plan[4])
- Explore a requirement for post occupancy reporting so that developers use a robust process to reduce the energy performance gap between 'as designed', 'as built' and 'in use' (Draft London Plan[5], The Green Construction Board[6]).
- Explore setting a requirement for no fossil fuel heating on site heating – as per the Climate Change Committee report (CCC[7])

Precedents:

- New London Plan (emerging), see also Reading and Manchester
- Going beyond Part L
- Energy hierarchy
- Energy performance gap

Defining 'net zero' buildings

- Look to require that all new buildings at OCGV should adhere to the UKGBC framework for Net Zero – starting with demand minimisation
- Explore signing up to the World GBC Net Zero Carbon Commitment[1]
- If offset payments are to be permitted as a way to achieve net zero:

---

[1] PassivHaus requirements (https://passiv.de/en/02_informations/02_passive-house-requirements/02_passive-house-requirements.htm)
[2] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge
[3] Policy SI2 Minimising greenhouse gas emissions, 9.2.9A, Draft London Plan
[4] Policy SI2 Minimising greenhouse gas emissions, Para 9.2.2, Draft London Plan
[5] Policy SI2 Minimising greenhouse gas emissions, Para 9.2.9, Draft London Plan
[6] GCB Recommendations for Newbuild in Response to 2030 Buildings Mission- http://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/05/GCB-BEM-Newbuild-RECOMMENDATIONS-230419.pdf
[7] UK Housing Fit for the future? (https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/)

    - require that these are recalculated at 'as-built' stage
    - require payments that cover the whole lifespan of the building (ideally 60 years)
    - ensure there is a structure that will spend these funds on actions that will demonstrably and transparently reduce additional carbon within a set period from building completion
        - Ideally within OCGV or West Oxfordshire
        - Or via recognised carbon offsetting frameworks as per UKGBC.
- Operate a central repository of all carbon and energy disclosures (e.g. a microsite) for buildings at OCGV, showing leadership and inspiring others.
- Reward scheme for developments that achieve "Active House" status[1] – buildings that make more energy than they use

Precedents:

- Reading Local Plan 2019
- Eliminating the performance gap

Renewables

- Explore how the relatively large area of open land could be used for onsite renewable energy generation, considering
    - low-temperature heating solutions including solar thermal, ground source heat pumps and inter-seasonal storage
    - probability of an increased amount of sunlight hours expected under climate change.
- Look to require that the whole development is designed so that energy demand can be met 100% by renewable or passive sources, with 20% from onsite sources. To include both regulated and unregulated energy.
- Pursue collaboration with project LEO (already proposed in OCGV AAP consultation version preferred policy approach 33)
- Look to require that any off-site renewable energy arrangements demonstrate 'additionality' – e.g. through power purchase agreements
- Explore setting a strategy to ensure that the energy grid will be ready to use electric vehicles for renewable energy storage part of a smart energy grid
- Look to require that the energy grid and any decentralised energy network is designed for ease of access for maintenance, monitoring, troubleshooting and upgrading

Precedents:

- New build minimum onsite renewables requirement

Transport

Mitigation:

- Explore the opportunity to reserve land for the creation of a rapid public transport link and uninterrupted cycle path as far as possible from the site to the railway station at Hanborough – making use of the portion of the site that runs alongside Lower Road
- Explore requiring of at least one EV charging point in any home that has a parking space or garage,
- Consider requiring the energy grid to be able to cope with 50% electric vehicles by 2030, and ready to use EVs for renewable energy storage part of a smart energy grid
- Consider using carbon offset payments (s106 and/or community infrastructure levy) to enact credible schemes to reduce transport carbon

Adaptation:

- Explore a requirement for high proportions of tree canopy cover for all major streets, reducing the likelihood that heatwaves will discourage active travel
- Explore a requirement for drainage to cope with a 1-in-100-year rainfall event without flooding (including climate change projections to 2080) along all major transport routes, especially walkways and cycleways

Precedents:

- Tackling transport in Garden and Eco Towns

Creating a climate-resilient townscape

- Explore a requirement for a combustion-free energy strategy
- Ensure developers following design guidelines to avoid buildings overheating such as CIBSE TM52 and TM59
- Consider a landscape planting strategy that maximises tree coverage, minimises bare soil, and demands low-allergenic species (e.g. based on OPALS rating) (and consider linking this to carbon credit schemes)
- Explore requirements that minimise the use of petrol and diesel cars, e.g. reducing parking spaces per household and maximising the viability of electric vehicles
- Explore a requirement to separate petrol and diesel cars from sensitive areas, e.g. schools, elderly housing and health facilities

Precedents

- **London**

Water stewardship

- Recommend a requirement for construction to be managed in a way that protects aquifer and surface water bodies found on and near site.
- Landscape and plot design that achieves better than greenfield runoff rates, and SUDS with capacity to deal with a 1-in-100-year rainfall event plus 20% allowance for climate change, without flood impacting homes, schools or businesses, which does not increase flood risk downstream, and which discharges water clean to the nearby watercourses
    - This should come with a robust long-term maintenance arrangement for the onsite infrastructure (green/blue and built)
- Explore a requirement that all buildings are designed with a footing higher than the 1-in-100 flood event plus 20% allowance for climate change and are fitted with flood resilience measures to 0.5m above floor
- Consider a requirement that buildings are set back by a minimum 10 metres from water courses. Make use of this buffer zone for gardens or public parks.
- Explore how any potential flood zones could be occupied by parks, playing fields and other public green spaces
- Explore setting a requirement for a high proportion of permeable surface on individual plots and across site, calculated including a 10% allowance for urban creep
- Recommend that landscape planting has a low watering demand
- Consider a requirement that buildings are completed with low-flow / low-flush fittings (and to demonstrate having considered greywater reuse) to achieve no more than 95 litres / person / day mains water (RIBA)[8].

Precedents

- Harrow and Weald Area Action Plan[1] – see policy AAP9, flood risk and sustainable drainage
- Barton Area Action Plan[1], Oxford City Council

[8] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge

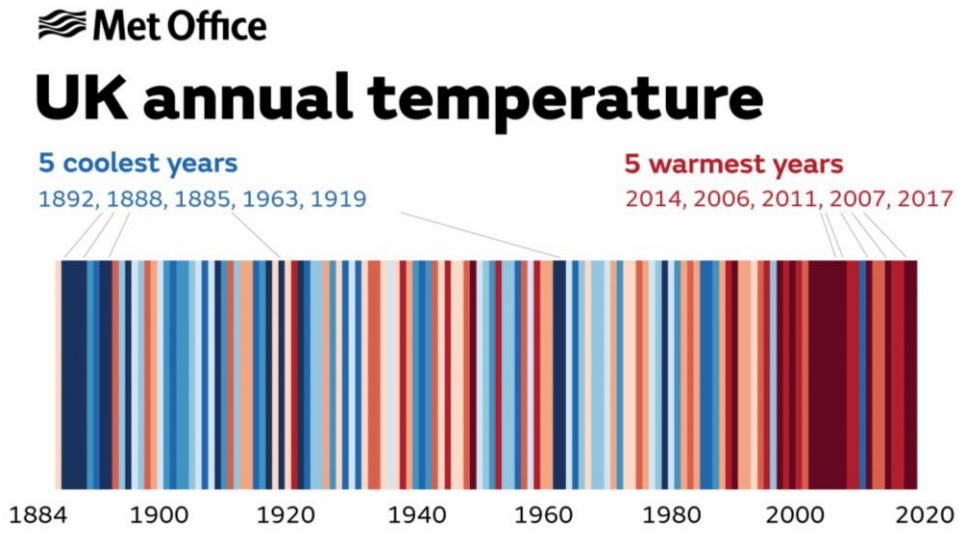
Introduction: what is the emergency?

Climate

In 2018, the latest climate science from IPCC showed the world that we had only 12 years to prevent irreversible catastrophic damage from a changing climate, and that any temperature increase above 1.5°C would involve far worse effects than previously thought, in terms of drought, flood, poverty for many people, and catastrophic biodiversity loss[i]. It also showed that the world is already seeing the effects of a 1°C rise in the form of extreme weather events, rising sea levels and diminishing ice at poles and glaciers, as well as increased methane emission from permafrost, which are an accelerator to climate change.

The 2018 IPCC report explained that this situation requires rapid and drastic – but achievable – transformation in the world's production and use of energy, buildings, food and goods. This must achieve a 45% reduction in net GHG emissions by 2030 (compared to 2010 levels), and net zero by 2050.

The UK is not immune to the climate emergency. Our ten hottest years on record have all occurred since 2002[ii], and six of the ten wettest years since 1998. Summers are likely to become 30% drier by 2050 and 40% drier by 2080[iii]. The central and south-east of the UK will experience the most extreme temperature peak rises in coming decades, while the catchments of major rivers – e.g. the Thames - will be most under threat from increased flood.



In 2019, the UK committed to an increased level of ambition in line with the IPCC recommendations, setting a legally binding target of net zero emissions by 2050. Given that much planning policy at national and local level since 2008 had been designed to enable planners to contribute towards the original Climate Change Act commitment of 80% reduction by 2050, this new net zero commitment ought to enable even more scope for climate-smart planning.

In June 2019, West Oxfordshire District Council (WODC) declared a climate emergency. 261 local authorities in the UK[iv] have now done the same, some two-thirds of councils in the nation. WODC's session minutes[v] show commitment to achieving "zero greenhouse gas (GHG) emissions across the district by 2050 or

earlier wherever possible" and that the council itself is "determined to be carbon neutral by 2030 and to encourage others in the District to follow its example"[9].

Similar declarations have been made by all five local councils in Oxfordshire as well as the county council, putting Oxfordshire in a strong political position to take decisive and collaborative action on the climate issue.

Ecological

Along with the climate emergency, WODC and many other local authorities have declared an ecological emergency. In 2019, the world heard drastic warnings from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (equivalent of the IPCC for ecology)[vi]. IPBES reported a global decline in biodiversity at an unprecedented scale in human history, with 1 million species at risk of extinction. This is because human activity has warmed the climate and significantly altered the majority of land and marine ecosystems.

As we depend on biodiversity and ecosystem services for everything from clean water to soil creation, waste breakdown, pest predation, crop pollination and climate regulation, this must urgently be addressed by restoring ecosystems.

What is a planning 'response' to this emergency?

A response to the climate and ecological emergency must include both mitigation and adaptation, in order to pull our weight on the root problem while being ready to deal with the impacts that are already unavoidable.

The National Planning Policy Framework (Annex 2)[vii] defines these two elements:

- **Adaptation:** Adjustments made to natural or human systems in response to the actual or anticipated impacts of climate change, to mitigate harm or exploit beneficial opportunities.
- **Mitigation:** Action to reduce the impact of human activity on the climate system, primarily through reducing GHG emissions.

Mitigating GHG emissions to a safe level will require drastic changes to the way we build, stay warm and cool, eat, travel and work. In 2008, the Committee on Climate Change calculated[viii] that in order for the world to have a 50% chance of limiting global temperature rises to 2°C, the global carbon budget would allow no more than 2 tonnes of GHG per capita by 2050 – an 80% reduction on how UK residents lived in 1990. Now we know we need to stay below 1.5°, and the UK Government has legally adopted a net-zero 2050 goal, there is a clear mandate to go beyond business-as-usual when it comes to carbon.

Adapting to the climate change that is already happening means readying our homes, workplaces, streets, transport and food systems for increased summer temperature extremes, more intense rainfall events, reduced overall rainfall, disruption to our supply chains, and the consequences of all of the above for wellbeing and economy.

[9] Please note in the meeting minutes it is not entirely clear whether both the 2030 and 2050 targets were included in the final motion passed, due to the addition and withdrawal of various amendments.

Adaptation and mitigation: needs and responses

Climate mitigation in Oxfordshire: what and how?

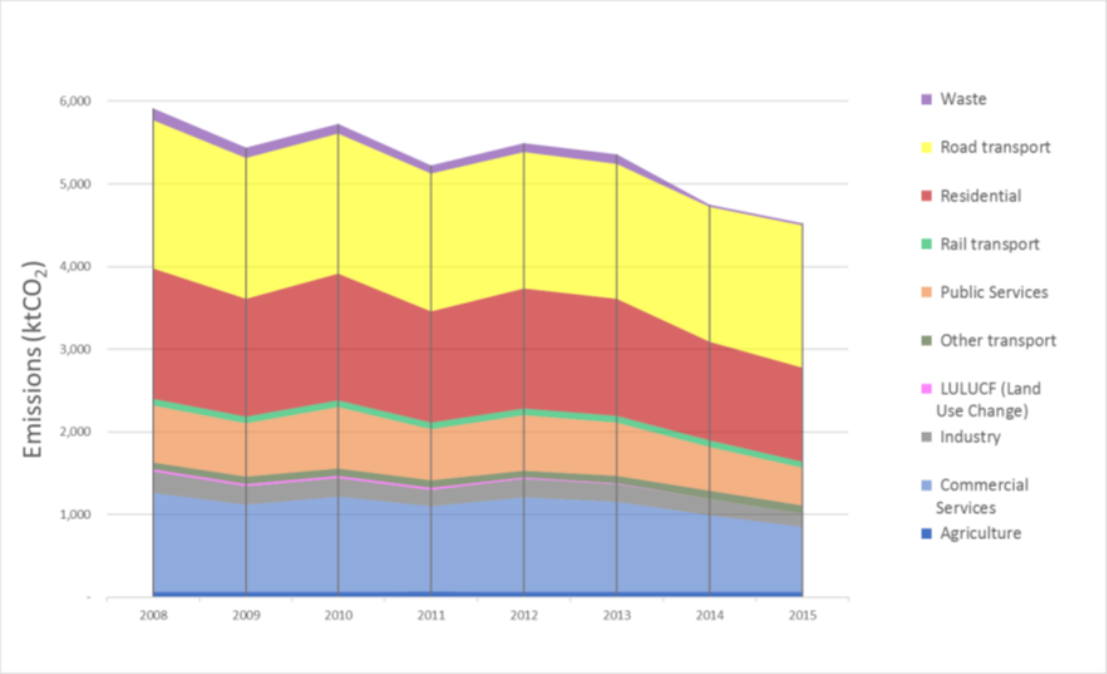
At national level, the most recent progress report[ix] by the UK's Committee on Climate Change shows that the country is not on target for the fourth or fifth carbon budget periods (2023-2027 and 2028-2032 respectively); neither is it prepared for the impacts of a 2°C temperature rise let alone a 4°C rise.

There is therefore a pressing need to mitigate the major sources of GHG emissions within the county, especially those that have been resistant to the overall downward trend in the last decade.

Oxfordshire County Council has prepared greenhouse gas emissions trajectories that show a need to go beyond existing national and local measures in order to reach the county's carbon targets for 2030 and beyond. These show that:

- **Road transport is the largest source** of GHG emissions coming from within Oxfordshire.
    - Unlike other categories, this has not reduced much since 2008.
- **GHGs from energy use in homes** is the second largest category (roughly 25%) but have been reducing since 2008.
- **Commercial services** are responsible for the third largest portion of GHGs, although this has seen a slight downward trajectory.
- **Public services** have similarly shown a very slight improvement.
- **Land use, agriculture, industry and non-road transport** are very small and remain largely unchanged since 2008.

Oxfordshire emissions by sector 2008 - 2015. Credit: Oxfordshire County Council.



Further analysis by the council found that with certain additional measures, the county could achieve close to a 70% reduction in GHG emissions by 2040.

The additional measures in the 70% by 2040 scenario include more stringent home energy efficiency standards, including a limit of 30kWh/m^2/year in new homes (translating to a ~45% reduction on current Part L TFEE[x]). They also involve an increase in renewable heat to meet 40% of Oxfordshire's total heat demand, and renewable electricity to meet 56% of total electricity demand.

In order to reach net zero by 2050, the remaining 30% of GHG emissions from the county would need to be addressed either through sequestration, or through further emissions reduction measures.

The road transport emissions profile – and the fact that it has not reduced greatly in the last decade – is fairly typical across the UK, especially in relatively rural areas. In fact, road transport emissions have stubbornly stable in the UK since 1990[xi]. This is one of the most urgent categories of emission to reduce, but it is not one of the low-hanging fruit as it relies on behaviour change.

Across the UK, given that >75% of the homes that we will live in by 2050 have already been built[10] – many of which to a standard that will be difficult or impossible to fully decarbonise – it is essential that all new buildings are built to net zero carbon standards, or are even carbon-negative. A significant proportion of historic buildings in the Oxfordshire may never be able to afford to run all-electric heating due to their low thermal efficiency and lack of space to retrofit with solar or ground source heating. Therefore new homes must pick up the slack by using entirely renewable heat and a very high proportion of renewable electricity. If this is not achieved, any new homes will continue to add to the problem, as they are expected to be in use for a lifespan well beyond 2050[xii].

Climate mitigation in OCGV AAP could therefore focus on:

- Reducing transport emissions as a matter of urgency
- Setting standards for homes and buildings that reduce energy demand
- Defining what it means to be a 'net zero' building in this location
- Strategy to maximise generation and use of renewable energy on site
- Using land to sequester carbon

Climate adaptation in Oxfordshire: what and how?

In its most recent national progress report[xiii] (2019), the Committee on Climate Change stresses that carbon reduction commitments at a global level will only deliver a 50% chance of staying below 3°C, never mind 1.5°C. This means there is a pressing need to prepare for the impacts of a 4°C scenario. Unfortunately, the report also shows that the country is not prepared even for a +2°C scenario.

At a local and regional level, there is a need to adapt to a changing climate which is projected to bring to this region (compared to late 20th century):

- Heatwaves at least once every three years by 2050[xiv]

[10] Taking the figure of 70% in 2008 (https://www.london.gov.uk/sites/default/files/ad_52_anne_power_-_does_demolition_or_refurbishment_.pdf) and calculating that roughly 1.8 million homes have since been built in the UK from 2008-2019 (https://www.gov.uk/government/statistical-data-sets/live-tables-on-house-building) representing about 6% of homes now existing in the UK (https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf)

- By 2050, a 3-4°C increase on summer mean maximum temperature[xv]
- By 2080, summer average temperature increase by between 2-8°C[xvi]
- Summer rainfall to drop 10% by 2050; 20% by 2080[xvii]
- Wettest day in winter +10% more rainfall by 2050; +20% by 2080[xviii]

These in turn bring health and livelihood risks including:

- Increased risk of flood in winter, bringing health risks as well as economic losses via property damage and disruption to travel, study and work. The Thames Valley is particularly vulnerable to this as a major river system.
- Increased risk of heatstroke in summer, and respiratory diseases[xix]
- Increased range of disease vector habitat (e.g. mosquitoes; ticks)[xx]

At the same time, a set of new opportunities may also arise including:

- A longer growing season for crops
- A longer season where people may choose to spend time outdoors
- Reduced cloud cover bringing more solar generation potential[xxi]
- Growth in the green economy[11], as mitigation actions are brought forward
- Scope to strengthen energy security, energy affordability and energy sovereignty via renewables

A climate-resilient OCGV must therefore steward our increasingly precious resources such as water and green infrastructure, protect people, wildlife and property from changing hazards, and make the most of new opportunities.

The site overlaps with designated Drinking Water Protected Areas (surface) and falls entirely within a Drinking Water Safeguard Zone[xxii]. These are areas where raw water is abstracted from rivers or reservoirs, and where land use is causing pollution of this water[xxiii]. Some eastern parts of the site overlap with secondary aquifers in bedrock or loose soil, and minor aquifers of high vulnerability to ground level water pollution[xxiv].

Given that climate change will make water resources more scarce in summer, at risk of more pollution from flooding in winter, and less predictable all year round, water stewardship must be a key part of climate resilience at OCGV. At the same time, being in a major river catchment with several nearby waterways may put the area at increased risk of flood.

Climate adaptation in OCGV AAP could therefore focus on:

- Water stewardship: flood mitigation, water use reduction, and avoiding pollution to surface water or ground water
- Requirements around building to avoid overheating
- Designing streets and public spaces to make use of green and blue infrastructure to provide shading and cooling in summer
- Taking advantage of increased potential for solar energy generation

[11] This includes not only low-carbon technology, but also related industries that support it such as AI and green finance.

Responding to ecological emergency

The distinction between adaptation and mitigation begins to dissolve when it comes to ecology, because arguably there is not much scope to adapt to a severe loss of biodiversity and ecosystem services. A response must therefore focus on mitigating the losses, both in the immediate location and in the wider sphere of influence of OCGV. Luckily, many actions that help support habitats and mitigate loss of biodiversity and ecosystem services – such as green landscaping (SUDS) and increasing tree cover – will also help to mitigate and adapt to climate change.

Oxfordshire Cotswold Garden Village

Oxfordshire Cotswolds Garden Village (OCGV) is designated in the Local Plan as a site on which to deliver ~2,000 new homes with associated infrastructure and facilities. This represents >4% increase on the District's current households[xxv].

Garden Communities and climate

The concept of a 'Garden Village' was originally intended to deliver its residents **something better than the norm** in terms of wellbeing, affordability and quality of life. The TCPA has distilled this intent into a set of nine principles for Garden Communities in the 21st century[xxvi]. Many of these principles mesh well with a response to climate emergency, as follows:

TCPA Garden City principle	Climate relevance
Development that enhances the natural environment, providing a comprehensive green infrastructure network and net biodiversity gains, and that uses zero-carbon and energy-positive technology to ensure climate resilience.	Self-explanatory; directly promotes mitigation and adaptation.
5. A wide range of local jobs in the Garden City within easy commuting distance of homes 8. Strong cultural, recreational and shopping facilities in walkable, vibrant, sociable neighbourhoods. 9. Integrated and accessible transport systems, with walking, cycling and public transport designed to be the most attractive forms of local transport.	Mitigation: reduces transport carbon emissions by reducing the need to drive and supporting the viability of cleaner transport. Adaptation: reduced exposure to disruption of transport infrastructure during extreme weather. Sociable neighbourhoods also grow social capital so that communities are more willing and able to support each other through shocks (resilience).
6. Beautifully and imaginatively designed homes with gardens, combining the best of town and	Mitigation: Designing homes for low energy demand provides a stimulus for more imaginative design and delivers a

country to create healthy communities, and including opportunities to grow food.	more comfortable home (natural light; thermal comfort). Growing food at home reduces food miles and grows food literacy, which may influence behaviour around food choices and waste Adaptation: healthy communities depend on adapting living environments to extreme weather. Growing food on site reduces vulnerability to disruption of international supply chains.
1. Land value capture for the benefit of the community 3. Community ownership of land and long-term stewardship of assets.	Adaptation and mitigation: these principles would support smart grids and onsite renewable energy generation that makes use of available space e.g. ground source heat or solar, to supply cheap zero-carbon energy to the community[12].

If all of these principles can be fulfilled at WODC, this is a major strategic opportunity to increase the proportion of West Oxfordshire residents who can achieve exemplary low-carbon, high-quality, climate-resilient lifestyles.

National and regional planning levers for climate

In its current form, the National Planning Policy Framework[xxvii] states that:

> *"Achieving sustainable development means that the planning system has three overarching objectives … [of which one is] an environmental objective … [which includes]* ***mitigating and adapting*** *to climate change, including moving to a* ***low carbon economy****"* (Paragraph 8)
>
> *"Plans should* ***take a proactive approach to mitigating and adapting*** *to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support* ***appropriate measures to ensure the future resilience*** *of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure."* (Paragraph 149)

And that:

> "*New development should be planned for in ways that:*

[12] This approach to renewable energy generation with a focus on community benefit is also supported by paragraphs 151 and 152 of the NPPF.

> *a) avoid increased vulnerability to [climate change risks] … care should be taken to ensure that risks can be managed through suitable adaptation measures, including ... green infrastructure;*
>
> *b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design*" (Paragraph 150).

Meanwhile the Town and Country Planning Authority's 2018 helpful report "Planning for Climate Change"[xxviii] acknowledges that although there is still some lingering confusion around how far local planning energy efficiency standards can go over and above building regulations, there is nothing in the NPPF to stop local plans adopting requirements for on-site renewable energy generation. Looking at other legislation, this TCPA document also notes that:

> *"Local planning authorities are bound by the legal duty set out in Section 19 of the 2004 Planning and Compulsory Purchase Act, as amended by the 2008 Planning Act, to ensure that, taken as whole, plan policy contributes to the mitigation of, and adaptation to, climate change ... Where local plan policy which complies with the duty is challenged by objectors or a planning inspector on the grounds, for example, of viability, they must make clear how the plan would comply with the duty if the policy were to be removed."*

And that:

> *"The Planning and Energy Act 2008 sets out powers for local authorities to require a proportion of the energy need related to new development to be sourced in the locality of the development, through renewable or low-carbon generation. This ... can be used to develop zero-carbon policy".*

Furthermore, on the NPPF:

> "*Taken as a whole, the NPPF requires local planning authorities to have a holistic understanding of climate adaptation, ranging from flood risk to increased temperatures and heat stress. Local plans should play a full part in building community resilience to a changing climate*. *The NPPF addresses several adaptation-related policy issues – in particular … to encourage sustainable transport modes and … reducing the need to travel*"

A further short briefing on specific regulations and policy covering the powers and duties of local planning authorities to respond to climate change has also been published by the TCPA, RTPI and environmental law specialist ClientEarth[xxix]. It includes this helpful quote from Planning Practice Guidance:

> "Section 19(1A) of the Planning and Compulsory Purchase Act 2004 requires local planning authorities to include in their Local Plans 'policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change'. This will be a consideration when a Local Plan is examined. The Climate Change Act 2008 establishes a legally binding target to reduce the UK's greenhouse gas emissions by at least 80% in 2050 from 1990 levels.'"

In theory, this should give local planning authorities a mandate to aim for even more ambitious carbon reductions now that the government's legally binding target for 2050 has been revised to net zero emissions.

In March 2019, the UK government announced[xxx] that it intended to develop a new Future Homes Standard "mandating the end of fossil-fuel heating systems in all new houses from 2025". This would follow the recommendations of the Committee on Climate Change's 2019 report "UK Housing Fit for the Future"[xxxi].

Although not part of the planning apparatus, the UK's "Road to Zero" strategy also sets out how the government intends to reduce transport emissions. This includes an intention for half of new cars sold to be ultra-low emission by 2030, and to end the sale of diesel and petrol cars and vans by 2050.

Specifically in Oxfordshire, in addition to each District's local plan, the County Council produced a draft developer guide to infrastructure delivery and contributions in January 2019[xxxii]. This clarifies that although the County Council is responsible for certain climate-relevant services such as flood risk management, highways and transport infrastructure, it is the District Councils and their respective Local Plans that can determine what requirements should be placed on a developer through planning conditions and s106 obligations or community infrastructure levy. It also clarifies that local plans may contain policies on infrastructure requirements and planning obligations.

This document contains a clear direction of travel when it comes to climate mitigation, stating that:

> "All development proposals should seek to minimise their carbon emissions to meet local carbon targets and national target set out in the Climate Change Act 2008. The local targets are:
>
> - Oxford - reduce carbon emissions by 40% by 2020
> - Oxfordshire - reduce carbon emissions by 30% by 2030
>
> Creating sustainable development is a requirement of national planning policy. Planning policies are set out in Local Plans by individual District Councils who can provide further guidance and advise on the specification of the development."

These reductions should now be revised upwards, as they were made in line with the previous UK government commitment to an 80% GHG reduction by 2050 which has since been increased to a Net Zero target for 2050 as of June 2019.

That same guidance document contains content relevant to climate adaptation, particularly flood. It notes that while the County Council is the Local Lead Flood Authority, the local planning authority (LPA, i.e. district) has a mandate to build in specific flood risk management requirements for new development.

The County Council has also produced a guidance document[xxxiii] on local standards and guidance for surface water drainage on major development. Specifically:

> "District Councils have … the duty to ensure that 'fit for purpose SuDS' schemes are delivered on new developments unless they are deemed

> inappropriate … The decision on whether a sustainable drainage system would be appropriate in relation to a particular development proposal is a matter of judgement for the [district] … [However,] the [district] must consult the Lead Local Flood Authority (the County Council for Oxfordshire) on all major planning applications" to review whether the proposed surface water drainage strategy is fit for approval.
>
> Meanwhile, "The LLFA encourages all new development … to use SuDS in order to reduce flood risk, improve water quality and present options for biodiversity and public amenity."

Specific local standards set out in that guidance document include requirements:

- to calculate the greenfield runoff rate including a 1-in-100-year event plus allowance for climate change
- to calculate impermeable area of residential developments with an extra 10% to allow for urban creep (e.g. paving over of front gardens).

Local planning: the opportunity to excel

National regulations addressing GHG emissions from buildings and transport have come and gone in recent years. During periods when there has been a vacuum of climate regulation in national planning, some local authorities have taken a leadership role in showing what is possible in driving forward climate-smart planning.

Thankfully, in 2018 the National Planning Policy Framework consultation response confirmed that local planning authorities can require energy efficiency that is better than national building regulations, so long as it is viable and deliverable.

As a new, standalone Garden Community, the Area Action Plan for OCGV represents an opportunity to ensure that the best parts of existing climate-related regulation and technology are applied and not permitted to backslide. At the same time this can create a place to live and work that promotes the health, wellbeing and prosperity of all its users in ways that are resilient to the risks of a changing climate.

In turn, this could boost the climate resilience of the wider district and county by reducing energy demand, decentralising energy generation, increasing the viability of clean transport, adding green space, and providing a tangible example of how climate-smart development can be done in West Oxfordshire.

How can OCGV Area Action Plan embed adaptation and mitigation for climate and ecology?

The consultation document on preferred policy options for OCGV's AAP (2019) included a set of objectives and preferred policy options relevant to climate. The ones included in the Climate & Resilience chapter are:

- **Preferred Policy Approach 31 - Flexibility, Durability and Adaptability** in relation to building use, design, siting and orientation and the overall layout of the development taking account of future potential changes in temperature, wind and rainfall.

- **Preferred Policy Approach 32 – Sustainable Construction**
    - setting out the sustainable construction requirements for residential and non-residential buildings at the garden village.
    - Subject to viability and practicality … to achieve zero-carbon standards for both residential and non-residential buildings, whilst allowing for carbon-offsetting where this is demonstrably shown to be impractical.

- **Preferred Policy Approach 33 – Decentralised, Renewable and Low Carbon Energy**
    - A requirement for development of the garden village to be underpinned by an ambitious and pro-active approach to decentralised, renewable and low carbon energy at a range of different scales from site-wide to property specific.
    - In accordance with the Local Plan, the developer will be required to prepare an energy feasibility assessment or strategy to assess the viability and practicability of a decentralised energy system
    - Requirement to consider as part of Project LEO, the potential for an integrated, low carbon energy system within the garden village and to maximise linkages with existing or proposed renewable and low carbon energy infrastructure in the locality.

- **Preferred Policy Approach 34 – Towards Zero Waste –** less relevant to climate adaptation or mitigation, other than biodegradable waste.

Climate-relevant policy approaches are also found in the chapters on transport and environment.

Homes and buildings

The main two ways that buildings can be decarbonised is firstly to use less energy (heat, light, appliances), and secondly to use only energy from zero-carbon sources – ideally generating more zero-carbon energy than they use. Building materials and construction methods are also increasingly important to reducing overall lifetime carbon, as their associated carbon emissions occur up front.

Materials

Because new builds are already required to be fairly energy-efficient, materials and construction can make up close to half of their whole-life carbon[13]. Many materials used in mainstream construction are carbon heavy. Cement alone is responsible[xxxiv] for 8% of global GHG emissions, while steel, glass and aluminium can also be carbon-heavy. Some other building materials – such as timber and hemp – can be carbon negative due to their biological origin. This must be balanced against the expected lifetime of the material and the building, and the required maintenance regime.

Energy efficiency, building regulations and carbon emissions

The UK electricity grid is moving away from fossil fuels, and the carbon intensity of UK-grid electricity is now almost on a par with natural gas. Reflecting this, there is an incoming update to the method ("SAP") by which buildings are assessed for compliance with Part L building regulations limits for carbon emissions. The incoming SAP10 has more than halved the carbon factor for electricity compared to the current SAP. The new SAP will become applicable when Part L is revised – due in 2019/20, which may also include a more ambitious target rate for carbon emissions of new buildings. This will encourage designers to specify heating systems based on electricity instead of gas.

This is positive for carbon reduction, but the electrical grid will come under an increased burden which it may struggle to carry – especially given an increased proportion of gas-free homes and electric vehicles that are likely to be mandated from 2025 (Future Homes Standard) and 2040 (by when the government intends to end the sale of new diesel and petrol cars[xxxv], which is widely expected to happen sooner, by market forces if not revised legislation). The new Part L may also come with higher energy efficiency requirements, but this is not yet certain.

The current Building Regulations Part L does require a certain fabric energy efficiency in kWh/m2/year, but this is less stringent than best-practice low-energy building frameworks such as Passivhaus and Energiesprong. Also, since Energiesprong is mostly for retrofit, new builds should be able to outstrip this.

Source figures from Transition Zero[xxxvi].	**Part L** (based on notional building)	**Passivhaus**	**Energiesprong**
Space heating (kWh/m2/ year)	54.26	15	<30

[13] N.B. current methods usually assume a new build lifetime of about 60 years, which may well be an under-estimate.

Position of Construction Leadership Council: 50% energy use reduction

The Green Construction Board of the CLC recently released a report[xxxvii] responding to the UK government's 2018 'Grand Challenge' Buildings Mission[xxxviii] of **halving the energy use of new buildings by 2030**. The report brought together evidence on the feasibility of achieving this, and comments on relevant methodologies, case studies and other related issues (e.g. health).

The report identifies case study buildings that do successfully use 50% less energy compared to similar buildings, suggesting that the Mission was achievable in the near term. It was found that there are recurring approaches, techniques and/or systems used by most or all of the successful case study buildings:

1. Contractual energy performance targets.
2. Prediction of future energy use at design stage and during construction.
3. Optimisation of form to reduce energy, allow comfortable conditions and save capital costs.
4. "Fabric first" approach with a very energy efficient envelope.
5. Openings for a passive ventilation strategy in summer and MVHR.
6. Low total energy consumption with consideration of all energy uses (not just the uses currently covered by Building Regulations).
7. Energy performance quality assurance during construction and comprehensive commissioning, with follow-up checks.
8. Aftercare to deliver low energy consumption in operation with mechanisms for performance monitoring and evaluation integrated at design stage and followed through during operation.

The report notes that although some case studies exist, there is a limited amount of reliable, publicly available data on actual energy use in buildings. It observes that to galvanise change in the wider industry, more disclosure of building energy data is vital and would be an area of potential for digital innovation.

CLC GCB provides a summary of specific recommendations[xxxix] from now through to 2030. These include limits on thermal energy demand (Passivhaus) and peak demand, measures to limit overheating, performance verification/metering, and incentivising early adopters with fast-tracked planning and reduced stamp duty.

Advice from the Royal Institute of British Architects – RIBA

RIBA is the independent UK body for architecture and the architectural profession. It intends to release an updated version (in 2019) of its Plan of Work, a set of seven stages which detail the tasks and outputs necessary at each point in the process of commissioning, creating and occupying a building.

The 2019 RIBA Plan of Work update will include a built-in sustainability lens[xl]. Design teams will be encouraged to focus on sustainability outcomes from the outset of the project, with a 'sustainable outcomes guide'. Associated targets should be set from stage 1 (preparation and brief), checked during stages 1 – 5 (design to construction), and verified during stages 6 and 7 (handover and use) including light-touch post-occupancy evaluation. The whole process will bring more of a focus on in-use outcomes, including a 'Plan for Use', and a 'Sustainability Strategy' which maps the sustainable outcomes and plan for use

principles through all stages of the Plan of Work 2019. **These documents are expected to incorporate metrics from RIBA's 2030 Climate Challenge**.

RIBA's 2030 Climate Challenge[14] is a voluntary commitment for architects to demonstrate that they are responding to the climate emergency It includes specific metrics that relate to both mitigation and adaptation, including:

- Energy efficiency targets[15] in kWh / m2 / year
  - <35 or equivalent of passivhaus for domestic; 55 for non-domestic
- Embodied greenhouse gases kgCO2/ m2 of floor area
  - <300 for domestic; <500 for non-domestic
  - to be calculated using RICS Whole Life Carbon Assessment
  - Includes not only materials and construction, but also maintenance, repair and eventual demolition and disposal[xli]
- Potable water use (mains water) in litres / person / day
  - <75 for domestic; <10 for non-domestic
- Maximum indoor temperature 28°c for all buildings (referencing CIBSE TM52 and TM59)
- Health-related targets for daylighting and air quality; all buildings

RIBA states that it set metrics for operational energy use, rather than operational emissions, "because reducing energy demand is necessary regardless of the use of renewable energy"[xlii]. It makes reference to the findings of the CLC GBC 'Buildings Energy Mission 2030' report which showed drastic energy use reduction is achievable using existing technologies and methodologies today (as above). However, the RIBA challenge also encourages participants to still target net zero whole life carbon as per the UKGBC.

In addition to these 2030 targets, RIBA's challenge also includes intermediate progressive targets for 2020 and 2025. RIBA states that it intends to differentiate these for different sectors, building types and locations in coming years. Architects who have signed up to this challenge will submit data on all their buildings via an online portal to be launched in 2020. Data from this portal will be anonymised and used by RIBA to identify trends in performance to help set new targets and develop new guidance for members, clients and constructors.

To create a truly future-proofed sustainable new community, it is therefore important to:

- specify that buildings should demand a very low kWh / m^2 /year
- rule out fossil fuel heating, including gas.

These highly efficient buildings will then automatically decarbonise over time if electrically heated, while putting reduced strain on the grid and reducing residents' exposure to potential energy price fluctuations.

[14] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge
[15] FAQs state that this can be verified by confirmed energy bills or metering, but it is unclear whether this refers to total energy demand or just 'regulated' energy as is targeted in building regs.

Delivering as promised

Actual building energy efficiency often falls far short of what was modelled in the design. This 'energy performance gap' tends to be caused by a series of coordination failures during construction that lead to the building not being delivered precisely as specified, especially the air-tightness. The gap becomes larger if only 'regulated' energy use is calculated in the design (i.e. permanent elements such as space heating and ventilation), rather than also including 'unregulated' energy use such as appliances. Also, occupants sometimes do not know how to get the most efficient performance when using the building.

Policy recommendations for OCGV homes and buildings – climate mitigation:

- Look to set requirements for fabric energy efficiency standards of ≤15kWh/m2/year for space heating (Passivhaus[16])
    - If not ≤ 15kWh then less than 35kWh (Energiesprong/RIBA[17])
    - To be revisited upon revisions to Part L / Future Homes Standard
- Exploring setting a Net Zero Carbon definition that includes embodied carbon of materials across the building's whole life cycle (see section below) and issue a materials hierarchy that encourages the lowest carbon intensity materials , with a requirement to measure and report on embodied carbon (Draft London Plan[18])
- Explore a requirement for developers to demonstrate following an 'Energy hierarchy' design approach to minimising energy use before using renewables and offsets to achieve required DER/TER reductions Draft London Plan[19])
- Explore a requirement for post occupancy reporting so that developers use a robust process to reduce the energy performance gap between 'as designed', 'as built' and 'in use' (Draft London Plan[20], The Green Construction Board[21]).
- Explore setting a requirement for no fossil fuel heating on site heating – as per the Climate Change Committee report (CCC[22])

Precedents:

- New London Plan (emerging), see also Reading and Manchester
- Going beyond Part L
- Energy hierarchy
- Energy performance gap

[16] Passivhaus requirements (https://passiv.de/en/02_informations/02_passive-house-requirements/02_passive-house-requirements.htm)
[17] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge
[18] Policy SI2 Minimising greenhouse gas emissions, 9.2.9A, Draft London Plan
[19] Policy SI2 Minimising greenhouse gas emissions, Para 9.2.2, Draft London Plan
[20] Policy SI2 Minimising greenhouse gas emissions, Para 9.2.9, Draft London Plan
[21] GCB Recommendations for Newbuild in Response to 2030 Buildings Mission- http://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/05/GCB-BEM-Newbuild-RECOMMENDATIONS-230419.pdf
[22] UK Housing Fit for the future? (https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/)

Defining 'net zero' and actions towards it

OCGV consultation (2019) Preferred Policy Approaches 32 will need a clear definition of 'net zero carbon buildings'.

Cash for carbon: Some local councils, including London and Reading, define zero carbon using a minimum Part L emissions reduction of 35% and the remainder of the carbon must be 'offset' through payments (often £60/tonne of emissions per year over a 30 year period). The offset can be made directly to the council through an S106 payment which goes into a fund that is meant to be spent on actions to reduce carbon within the locality such as by installing PV. Otherwise, in some locations the developer can instead invest the amount directly by taking actions to reduce carbon locally e.g. by insulating council houses[xliii].

Some local councils only require the offset to be calculated during the planning application stage. Others require recalculation of the offset either at detailed design stage, or on completion of the build, to encourage developers to minimise their energy performance gap.

However, in some places there are question marks[xliv] over how those funds are being spent to effectively reduce carbon, or at all. The cost per tonne of emissions may not reflect the cost of the actual actions the council would need to take in order to save the equivalent amount of carbon – and the 'additionality' of those actions is sometimes questionable. Furthermore, a 30-year period is clearly not the full lifespan of the building (most other considerations are on a 60-year basis at least). Finally, this system means the council has to take on the burden of organising the carbon reduction actions.

Industry definitions:

A helpful zero carbon definition has recently been released by UKGBC[xlv], a network of built environment specialists working to galvanise sustainable change within the industry. The UKGBC's definition sets out two 'scopes':

- Scope 1.1: Net zero carbon in construction
  - "When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy[23]."
- Scope 1.2: Net zero carbon in operational energy.
  - "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."

In the UKGBC's definition, it is made clear that:

- "**Reductions in energy demand** and consumption should be prioritised over all other measures."
- For renewables:
  - **On-site** renewables should be prioritised

[23] E.g. by 'meanwhile use' of the site for temporary solar PV during construction.

    - Any off-site renewables should **demonstrate additionality**
- Offsetting of the remaining carbon must use a recognised framework (e.g. CDM Gold Standard).
- **Public disclosure** of the whole-life carbon impacts and annual energy consumption is key, in order to achieve transparency, credibility, public trust and to ensure a positive ripple effect within the sector.

The document also contains a diagram showing the steps that should be taken at each stage in both scopes, and definitions of terms, e.g. credible ways to achieve additionality of offsite renewables and offsetting via recognised frameworks.

Policy recommendations for OCGV on defining 'net zero' buildings:

- Look to require that all new buildings at OCGV should adhere to the UKGBC framework for Net Zero – starting with demand minimisation
- Explore signing up to the World GBC Net Zero Carbon Commitment[1]
- If offset payments are to be permitted as a way to achieve net zero:
    - require that these are recalculated at 'as-built' stage
    - require payments that cover the whole lifespan of the building (ideally 60 years)
    - ensure there is a structure that will spend these funds on actions that will demonstrably and transparently reduce additional carbon within a set period from building completion
        - Ideally within OCGV or West Oxfordshire
        - Or via recognised carbon offsetting frameworks as per UKGBC.
- Operate a central repository of all carbon and energy disclosures (e.g. a microsite) for buildings at OCGV, showing leadership and inspiring others.
- Reward scheme for developments that achieve "Active House" status[1] – buildings that make more energy than they use

Precedents:

- Reading Local Plan 2019
- Eliminating the performance gap

Renewables

Depending on how renewable energy generation is built into the site, this can provide a significant contribution towards many aspects of mitigation and adaptation to climate change.

If the technology can be optimised to store and use the energy on site, it can:

- Reduce the carbon intensity of the energy consumed in buildings on site and by electric vehicles charged on site
- Improve energy security for residents and other site users – because they are less exposed to disruption elsewhere in the grid (e.g. flood-related power cuts)
- Reduce energy costs and energy poverty on site

If the technology is set up to export energy to the wider grid, it can:

- Become an income-generating community asset
- Reduce the carbon intensity of energy consumed in the local area
    - Contribute towards 'zero carbon' status for the site overall, offsetting unavoidable carbon emissions such as from materials and construction (if WODC decides that clean energy exports can count as an offset of the buildings' other carbon impacts)

Policy recommendations for OCGV on renewables (adaptation and mitigation):

- Explore how the relatively large area of open land could be used for onsite renewable energy generation, considering
    - low-temperature heating solutions including solar thermal, ground source heat pumps and inter-seasonal storage
    - probability of an increased amount of sunlight hours expected under climate change.
- Look to require that the whole development is designed so that energy demand can be met 100% by renewable or passive sources, with 20% from onsite sources. To include both regulated and unregulated energy.
- Pursue collaboration with project LEO (already proposed in OCGV AAP consultation version preferred policy approach 33)
- Look to require that any off-site renewable energy arrangements demonstrate 'additionality' – e.g. through power purchase agreements
- Explore setting a strategy to ensure that the energy grid will be ready to use electric vehicles for renewable energy storage part of a smart energy grid
- Look to require that the energy grid and any decentralised energy network is designed for ease of access for maintenance, monitoring, troubleshooting and upgrading

Precedents:

- New build minimum onsite renewables requirement

Transport

Road transport is the most concerning part of Oxfordshire's GHG emissions profile, given that it is not only the largest portion but also the category that has barely reduced over the last decade. This is fairly typical of UK regions with a rural character. Highly creative solutions will be needed at OCGV in order to address this problem.

The most effective means towards road transport emissions reduction are to give people realistic options to avoid road travel. Firstly, this involves providing for everyday needs on site. Secondly, directing investment away from actions that make it easier to drive and into actions supporting sustainable modes. Electric vehicles are also part of the picture in this location where most workers will need to commute outwards.

The UK Government's "Road to Zero" strategy (2018) confirms that it aims to end the sale of new petrol and diesel cars and vans by 2050, and to aim for ultra-low emission vehicles to make up 50% of new car sales by 2030. This includes an intention to ensure new homes and streets being constructed now are EV-ready and that charging points are 'smart-ready', including launching a £400 million Charging Infrastructure Investment Fund.

Policy recommendations for transport at OCGV:

Mitigation:

- Consider using carbon offset payments (s106 and/or community infrastructure levy) to enact credible schemes to reduce transport carbon
- Explore the opportunity to reserve land for the creation of a rapid public transport link and uninterrupted cycle path as far as possible from the site to the railway station at Hanborough – making use of the portion of the site that runs alongside Lower Road
- Explore requiring of at least one EV charging point in any home that has a parking space or garage,
- Consider requiring the energy grid to be able to cope with 50% electric vehicles by 2030, and ready to use EVs for renewable energy storage part of a smart energy grid

Adaptation:

- Explore a requirement for high proportions of tree canopy cover for all major streets, reducing the likelihood that heatwaves will discourage active travel
- Explore a requirement for drainage to cope with a 1-in-100-year rainfall event without flooding (including climate change projections to 2080) along all major transport routes, especially walkways and cycleways

Townscapes to manage extreme weather

Given that changes to climate will bring hotter summers, wetter winters and increased factors in respiratory disease, OCGV AAP could look at requirements to adapt to and address these.

Respiratory diseases[xlvi] are expected to increase under climate change due to more airborne particulates (dust and soil during dry or windy weather) and allergens (mould and pollen release). As new buildings are air-tight and efficient and as the likelihood of summer heatwaves increases, there is also a need to make sure their occupants are protected from overheating.

Actions to address these align well with actions to reduce carbon emissions and energy demand. This is also strongly related to water stewardship, below.

Overheating in homes and buildings is becoming a greater risk in the airtight, homes that are also necessary to curb carbon.

Policy recommendations for OCGV to create a climate-resilient townscape:

- Explore a requirement for a combustion-free energy strategy
- Ensure developers following design guidelines to avoid buildings overheating such as CIBSE TM52 and TM59
- Consider a landscape planting strategy that maximises tree coverage, minimises bare soil, and demands low-allergenic species (e.g. based on OPALS rating)
- Explore requirements that minimise the use of petrol and diesel cars, e.g. reducing parking spaces per household and maximising the viability of electric vehicles
- Explore a requirement to separate petrol and diesel cars from sensitive areas, e.g. schools, elderly housing and health facilities
- Consider a landscape approach that combines climate adaptation with carbon sequestration by creating new woodland areas and turning this into an income stream[xlvii]

Precedents

- **London**

Water stewardship

As discussed previously in this report under 'climate adaptation', OCGV Area Action Plan will need to address twin issues when it comes to water:

- Being ready for more intense rainfall incidences at certain times of year, and the increased flood risk this is likely to bring
- Being ready to use water more sparingly and more carefully, because of overall reduced rainfall during the year, plus more regular occurrence of droughts and heatwaves
    - This also means taking steps to protect the quality of Thames tributary rivers (e.g. Evenlode) and minor aquifers found on and near site.

Oxfordshire County Council is the lead local flood authority here (LLFA), and so the District Council has a duty to cooperate with the County towards flood risk reduction. However, the District Council is able to undertake works on minor water courses (such as those found at OCGV site) and take decisions on what is appropriate for developments in their own area[xlviii].

Policy suggestions for water stewardship and resilience at OCGV

- Recommend a requirement for construction to be managed in a way that protects aquifer and surface water bodies found on and near site.
- Landscape and plot design that achieves better than greenfield runoff rates, and SUDS with capacity to deal with a 1-in-100-year rainfall event plus 20% allowance for climate change, without flood impacting homes, schools or businesses, which does not increase flood risk downstream, and which discharges water clean to the nearby watercourses
    - This must come with a robust long-term maintenance arrangement for the onsite infrastructure (green/blue and built)
- Explore a requirement that all buildings are designed with a footing higher than the 1-in-100 flood event plus 20% allowance for climate change and are fitted with flood resilience measures to 0.5m above floor
- Consider a requirement that buildings are set back by a minimum 10 metres from water courses. Make use of this buffer zone for gardens or public parks.
- Explore how any potential flood zones are used for parks, playing fields and other public green spaces
- Explore setting a requirement for a high proportion of permeable surfaces on individual plots and across site, calculated including a 10% allowance for urban creep
- Recommend that landscape planting has a low watering demand
- Consider a requirement that buildings are completed with low-flow / low-flush fittings (and to demonstrate having considered greywater reuse) to achieve no more than 95 litres / person / day mains consumption(RIBA)[24].

Precedents

- Harrow and Weald Area Action Plan[1] – see policy AAP9, flood risk and sustainable drainage

[24] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge

- Barton Area Action Plan[1], Oxford City Council

Biodiversity

The site itself contains a small portion of land (Evenlode Farm) that is registered on the National Forest Inventory. The site also overlaps with breeding areas for several arable land and grassland birds including some red-listed ones[25]. The site borders on some BAP Priority Habitat Inventory areas including lowland meadows and semi-improved grassland to the North-West and deciduous woodland to the south. Further BAP PHI areas lie nearby, mostly woodland but also floodplain grazing marsh along the Thames. Care must be taken not to impact these, and to protect the features of the site that form wildlife corridors.

The site lies within the impact risk zones of several SSSIs. Two km away is Wytham Woods SSSI, an area containing patches of ancient woodland along with other high-value habitats and a rich variety of species. Most of this SSSI is woodland currently described as 'unfavourable; recovering' as of the latest data from 2012. This is due to an overly dense canopy, and possible nutrient oversaturation from adjacent pastureland. Small wildflower grassland areas are in 'favourable' condition, achieved via a grazing regime.

Also nearby are Cassington Meadows SSSI (~3km, condition 'favourable') and Wytham Ditches and Flushes SSSI (~3.5km, 'unfavourable, recovering'). As wetlands, these are particularly vulnerable to nutrient runoff and other pollution from agriculture, drains and roads. Threats like this could be exacerbated by climate change in terms of increased extreme weather leading to drought and flood, or more intensive agricultural use of nearby land.

To combat the ecological emergency at a local level, OCGV could:

- Protect existing havens for wildlife such as SSSIs, woodland, hedgerows and waterways and de-fragment these vital wildlife corridors;
- Create landscapes that will provide favourable habitats, especially species currently endangered or declining, and management/ownership structures that maintain these landscapes;
- Evaluate SUDS proposals from a biodiversity viewpoint
- Minimise light pollution (harmful for bats and insects)
- Minimise use of harmful pesticides, herbicides and fertilisers
- Consider a landscape approach that combines habitat creation with carbon sequestration and turning this into an income stream via carbon trading[xlix]

To combat the ecological emergency in its wider sphere of influence, OCGV could:

- Eliminate the use of materials known to have a particularly heavy impact on ecosystems elsewhere – such as peat and uncertified timber

[25] Defra Magic Map.

- Make it easy for locals to avoid products and services that are driving habitat destruction elsewhere by providing better options.

Precedents and case studies

Going beyond Part L carbon targets

The table below provides examples of other nearby Local Authorities that have energy efficiency policies above Building Regulations (BR). This is a selection we are aware of; there could well be many more.

Oxfordshire Local Authority	Energy Efficiency Policy
Cherwell District Council	(Adopted) In line with Government policy
Oxford City Council	(Consultation stage) looking for higher standards
South Oxfordshire	(Emerging) In line with Government policy
Vale of White Horse	(Adopted) In line with Government policy

In addition to the above, the London Plan has a policy of a 35% on-site energy reduction and a zero-carbon target for all major developments.

This approach is being followed by the majority of London boroughs both in terms of on-site efficiency requirements and zero carbon emissions through offset payments. Currently 22 out of 35 London Boroughs are already collecting carbon offset payments, and two more are to do so imminently. As of 2019, Reading has followed suit in its own Local Plan.

As outlined above, there is a growing precedent for Local Authorities setting standards within their local plans for energy efficiency and carbon standards above Building Regulations.

It is important to note again that any policies need to be evidenced and go through a viability assessment. Both Milton Keynes and Ipswich Borough provide examples of whole plan viability assessments.

Manchester: Science-Based Zero Carbon Framework 2038

Having adopted science-based targets[26] for the city, Manchester City Council released a draft framework in early 2019 for how to get to net zero by 2038. This, with a corresponding action plan, is to be finalised by March 2020. The draft framework outlines four 'Areas for Action' which are critical to meet the targets. These include:

- New builds to be zero-carbon in use; and low-embodied carbon materials
- Well-connected walking and cycling routes, public transport and electric vehicle charging to be key components of all new development
- "Renewable energy generated within the ... city-region, and … [from] the National Grid, are needed to power our buildings and transport system"

This Framework makes a distinction between 'zero carbon' (no emissions generated on site) and 'net zero' (offsets allowed). The term it uses throughout is 'zero carbon' which implies that offset payments and export of renewable energy will not count towards a building's zero-carbon status. This differs from the approach in London and Reading. Meanwhile, it is not yet clear the extent to which embodied carbon will have to be reduced in materials and construction.

Spatial planning is one of five 'cross cutting actions' to deliver the targets above. Here, planning policies will "ensure any buildings we build today that are not zero carbon will need to be retrofitted in the very near future". The document notes that science-based carbon targets should be embedded into governance and policy at all levels from Wards to the nation. The draft Greater Manchester Spatial Framework proposes that all new developments will be zero carbon from 2028[27].

Manchester City's science-based targets include:

- 15m tonne carbon budget 2018 – 2100 (27.7t /person excluding growth)
- Carbon reductions in line with UK/Paris carbon budget periods, including
    - 13% reduction per year; 50% reduction between 2018-2022
- Zero carbon by 2038.

The framework was prepared by the Manchester Climate Change Board and Manchester Climate Change Agency. MCCB member organisations emit ~20% of the city's GHGs and have committed to work towards these science-based targets. Of these, 60 "pioneers" have begun to act and share their progress. The document also contains a five-step process for organisations to contribute towards the targets, from measuring emissions to making a full action plan.

MCCB reports on the city's progress at its dedicated website (link). As this is done using BEIS local authority area-based data, organisations taking action towards achieving the targets are asked not to deduct any offsets or green energy tariffs when reporting their total annual GHG emissions, because BEIS data does not take these into account.

[26] On a two-degrees basis as per the Paris agreement, prior to the 1.5-degree aim from the IPCCC.
[27] This Spatial Framework is due to be adopted at the end of 2021 if found sound after further consultation, engagement and examination from 2020-2021.

Reading: Zero carbon homes and mandatory climate adaptation

Reading's local plan adopted in November 2019 sets out cutting edge policies aimed at both mitigating and adapting to climate change. Section 4.1 outlines nine policies that are cross-cutting through many issues and applicable across the whole of the city, several of which are relevant to climate in terms of both mitigation and adaptation. In addition, specific policies for new build homes build an even higher level of sustainable ambition. Perhaps the most relevant are:

Buildings, energy and carbon in Reading Local Plan:

- Policy H5 (housing):
  - **All major new-build residential development should be designed to achieve zero carbon homes.**
  - All other new build housing (non major) must achieve at least a 19% reduction on Part L 2013 target rate for carbon emissions.
- Policy CC2 (sustainable construction): For non-residential, and conversions to residential:
  - All major developments must meet BREEAM 'Excellent' standards
  - All minor must meet BREEAM 'Good' standards
- Policy CC4 (decentralised energy):
  - Any development of 20+ dwellings or non-residential over 1,000m^2 must demonstrate how the design has considered decentralised energy provision within the site unless it can be demonstrated that this is not suitable, feasible or viable.
  - Where there is existing centralised energy provision present within the vicinity, new developments of 10 dwellings or non-residential over 1,000m^2 must link into this network unless unfeasible.

To define 'zero carbon homes', Reading Council is now in the process of producing additional guidance (a revised Sustainable Design and Construction SPD). In the meantime, they have adopted the approach taken in London. This is that developers must show at least a 35% improvement on Part L 2013 target emissions, plus an offset payment of £60/tonne of remaining emissions over a 30-year period (total £1800/tonne). This offset payment is to be spent on actions elsewhere within Reading that will reduce carbon.

Climate adaptation through water stewardship in Reading Local Plan:

- Policy CC2:
  - For non-residential, and conversions to residential
    - Should incorporate water conservation measures so that predicted per capita consumption does not exceed the level set out in the applicable BREEAM standard[28], as above.
    - All developments should include recycling greywater and rainwater harvesting where systems are energy and cost effective.

[28] BREEAM water credits are awarded based on a percentage reduction of the anticipated water use of the building. This anticipated use is a litres/person/day rate based on the water-consuming elements of the building, and then mitigation measures are taken into account to estimate a percentage reduction.

Energy hierarchy: demonstrating the right steps

Some Local Authority planning departments require that new developments must be able to demonstrate that they have been designed using an XXX-step process to reduce their carbon emissions, starting with the most effective step and finishing with the least preferred step.

Examples of Local Authorities that have taken this approach include:

- **Uttlesford, Essex**[I] – Local Plan policy D9 requires that commercial and residential buildings demonstrate via an Energy Assessment that they have applied the energy hierarchy and will achieve at least a 19% DER carbon reduction on Part L 2013. 19% is chosen because it is believed to be viable. Uttlesford's Local Plan defines an energy hierarchy as follows:
    1. Design optimisation: orienting the building to optimise solar gain (with guidance on glazing proportions and south-side shading)
    2. Fabric improvement: ensuring the long-lived parts of the building are thermally efficient and air-tight without cold bridges; considering MVHR. This fabric improvement ensures that if renewable energy generation is introduced later, it will be able to cover a large proportion of the building's energy use.
    3. Renewable energy sources [on-site]: specifically directing that consideration should be given to solar PV, solar thermal, heat pumps from air or ground, and biomass boilers.

    Additionally, Uttlesford Local Plan Policy D8 requires that new development "embed sustainable design and construction techniques from the outset", including to "show how resource efficiencies and climate change adaptation measures will be incorporated through aspects such as the layout of the proposed development, orientation, massing, landscaping and building materials" as well as measures like green roofs, greywater reuse and renewable energy generation. BREEAM and Home Quality Mark are also encouraged.

- **Greater Manchester Spatial Framework (Draft)**: this document, due to be finalised in 2021, has just closed its first consultation period. One of policies under consultation[Ii,Iii] was GM-S 2, including a requirement that developers embed an energy hierarchy for new builds as follows:
    1. Minimise energy demand
    2. Maximise energy efficiency
    3. Utilise renewable energy
    4. Utilise low-carbon energy
    5. Utilise other energy sources
    6. Offset residual carbon emissions.

    Draft policy GM-S 2 also includes taking a whole life cycle carbon approach for new development, promoting energy retrofitting, carbon sequestration through land-use e.g. woodland, and "keeping fossil fuels in the ground".

Eliminating the performance gap

A number of Local Authorities have developed policies to ensure new developments perform as they are designed and built to a higher quality, e.g.:

- Milton Keynes: "The policy requires implementation of a recognised quality regime, which assures that 'as built' energy use, associated carbon emissions, indoor air quality, and overheating risk is as per design"
- Newcastle: "Development will be required to … Reduce its whole-life CO2 equivalent emissions impact" (achieved through demonstrating that the performance gap between design and as-built is minimised)
- Brent, City of London and Enfield[liii]: carbon offset payments (as part of the requirement to achieve net-zero carbon homes) must be recalculated at completion of the build, rather than solely during planning application or detailed design. This incentivises developers to deliver as designed.

An example of a 'performance gap' methodology is BEPIT (www.bepit.org). This was developed over the course of four years in Bicester. It is a practical, affordable and effective approach to ensuring that 'as built' matches 'as designed.' BEPIT offers a set of checks during a set of 60 'critical processes' to address the times during construction when errors are likely to creep in. As well as ensuring energy performance, BEPIT has been shown to help reduce snagging.

The Passivhaus certification process can also help to close the performance gap via a series of checks during stages 2-6 of the seven RIBA design stages.

Renewables as a minimum proportion of energy demand

Certain local councils require a proportion of buildings' anticipated energy demand to be met by renewable generation on site. One example is Spelthorne BC in Surrey, which requires a certain proportion of on-site renewable generation to meet the energy demands of buildings. Under policy CC1[liv] of Spelthorne's Development Plan Document:

- 10% of the energy needs a building must be met by **on-site** renewables.
- This applies to **total** energy demand, not just 'regulated' energy[29].
- This applies to any dwelling, and any other development of 100m^2+
- This is in addition to requiring the developer to first optimise design, layout and orientation to minimise energy demand (energy hierarchy).

There is a loophole whereby the 10% renewables requirement is waived if it can be shown that it would "seriously threaten the viability of the development". This makes sense in a setting where small developments may be created within an existing tight urban fabric where certain renewable technologies would take up

[29] Total energy use includes non-permanent elements such as appliances and external lighting as well as 'regulated' energy use, i.e. permanent elements of the building such as space heating, hot water, ventilation and internal lighting (as opposed to from Part L 2013 energy efficiency, which only looks at 'regulated' energy). Unregulated energy can be up to 65% of a building's total energy use. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/497761/Non-Domestic_Building_performance_full_report_2016.pdf

too much space, e.g. large-scale PV or solar thermal. However, OCGV as an entirely new settlement has the scope to build in space for these renewables from the beginning and thereby to exclude this waiver.

London: overheating and green infrastructure

While the London Plan is particularly well known for its ambitious net zero carbon buildings approach, there are also specific requirements around the use of building design processes and green infrastructure to address the effects of climate change.

In the current London Plan:

- Policy 5.9 requires that major development proposals reduce potential overheating and reliance on air conditioning systems using a 'cooling hierarchy' in building design, and should use trees, green areas and other shading. Policy 2.18 specifies that developers should incorporate green infrastructure, and policy 5.10 specifies that urban greening should contribute to climate change adaptation and mitigation.

In the Draft New London Plan:

- Policy SI14 states that developers should use CIBSE guidance TM59 and TM52 to address overheating risk in residential and non-residential buildings respectively.

Tackling transport in Garden and Eco Towns

At North-West Bicester Eco-Town, ambitions for substantial modal shift and 'trip containment' were laid out in the supplementary planning document.

The need for trip containment was evidenced by local household travel surveys, showing that although 69% of total trips were made by car, this was not the case for short trips – with 78% of journeys under 3km being made by other modes. The masterplan was therefore designed to achieve a mix of land uses that would allow necessary trips to be short.

The SPD requirements 6(a) and 6(d) include that:

- Planning applications should include Travel Plans which demonstrate how the design will enable at least 50% of trips from NW Bicester to be made by non-car means with the potential to increase to 60% by 2020.
- Internal bus stops should be within 400 metres of homes and located in the site's local centres, and should provide real-time journey information, shelter and cycle parking
- Planning applications should set out how they will deliver:
  - trip containment,
  - street design that discourages car movement but enables foot and bike permeability ('filtered permeability')
  - enhanced bus services into Bicester itself, additional bus priority measures, and live service times
  - High quality walking and cycling links to and from Bicester itself, and cycle storage.

Meanwhile requirement 6(b) demands that:

- Proposals should make provision for electric and low emission vehicles through infrastructure provision and support in Travel Plans.
- This is supported by Development principle 4 (homes) which includes a recommendation that homes should have electric vehicle charging.

There are examples of other proposed Garden Towns that are setting ambitious targets for modal shift. For example, Harlow and Gilston Garden Town Strategy [li] (consultation version, 2019) adopts a target not only for the new developments but which also reflects the Garden Communities' effect on the wider area:

- 60% of all journeys within the new Garden Town Communities, and 50% of all journeys across Harlow, will be undertaken by sustainable modes"
- "Applications for new development or change will be expected to consider its interaction with the wider transport context and may be required to participate in, and contribute to, wider collaborative proposals to facilitate overall sustainable travel delivery"

Not unlike OCGV, Harlow and Gilston Garden Town is to be situated adjacent to and between existing small settlements.

References

[i] IPCC 2018, *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments*: https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/ and United Nations 2019, *meetings coverage of 73rd Session High Level Meeting on Climate Change*: https://www.un.org/press/en/2019/ga12131.doc.htm

[ii] Met Office 2019, news bulletin summarising findings of annual report 'State of the UK Climate'. https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2019/state-of-the-uk-climate-2018

[iii] DEFRA, Environment Agency & Met Office, *UK Climate Projections 2009.* Medium emissions scenario, central estimate. https://webarchive.nationalarchives.gov.uk/20181204111406/http://ukclimateprojections-ukcp09.metoffice.gov.uk/23997?emission=medium

[iv] For a full list, numbers and percentages of local councils, see https://www.climateemergency.uk/blog/list-of-councils/

[v] West Oxfordshire District Council, *Meeting Minutes of the West Oxfordshire District Council held in the council chamber, council offices, Woodgreen, Witney on Wednesday 26 June 2019.* Shortened URL: https://preview.tinyurl.com/t94aglt

[vi] WWF EU 2019, news bulletin summarising IPBES Final Report on the State of Nature. http://www.wwf.eu/?uNewsID=346735

[vii] UK Government MHCLG, National Planning Policy Framework, Annex 2 https://www.gov.uk/guidance/national-planning-policy-framework/annex-2-glossary

[viii] Committee on Climate Change, 2014, *The IPCC report and the UK 2050 Target.* https://www.theccc.org.uk/2014/11/25/the-ipcc-report-and-the-uk-2050-target/

[ix] Committee on Climate Change 2019, *Reducing UK emissions – 2019 Progress Report to Parliament* https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/

[x] Transition Zero & Energiesprong, 2017, *Performance requirements: Part L UK vs Energiesprong vs Passivhaus*. http://transition-zero.eu/wp-content/uploads/2017/08/Performance-Requirements.pdf

[xi] BEIS, *2017 UK Greenhouse Gas Emissions: final figures - statistical summary.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776083/2017_Final_emissions_statistics_one_page_summary.pdf

[xii] Planning Portal Blog, 2018. *How long should a house last?* https://blog.planningportal.co.uk/2018/06/22/how-long-should-a-house-last/

[xiii] Committee on Climate Change, *Summary report: 2019 Progress Report to Parliament.* https://www.theccc.org.uk/wp-content/uploads/2019/07/2019-Progress-Report-Summary.pdf

[xiv] Oxfordshire County Council, 2014, *Oxfordshire in a Changing Climate.* Summary of UKCP09 findings relevant to Oxfordshire. https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/climatechange/OCC_UKCP09_summary_web_vsIDJan14.pdf. See also Met Office UKCP18 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf

[xv] DEFRA, Environment Agency & Met Office, *UK Climate Projections 2009.* Medium emissions scenario, mid-range estimate. https://webarchive.nationalarchives.gov.uk/20181204111206/http://ukclimateprojections-ukcp09.metoffice.gov.uk/23670?emission=medium

Although UKCP09 has been replaced by UKCP18, the UKCP18 headline findings summary states that the climate projections over land in the UK are consistent between UKCP09 and UKCP18.

[xvi] Oxfordshire County Council, 2014, *Oxfordshire in a Changing Climate.* Summary of UKCP09 findings relevant to Oxfordshire. https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/climatechange/OCC_UKCP09_summary_web_vsIDJan14.pdf. See also UKCP18 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf

[xvii] DEFRA, Environment Agency & Met Office, *UK Climate Projections 2009.* Medium emissions scenario, central estimate. https://webarchive.nationalarchives.gov.uk/20181204111406/http://ukclimateprojections-ukcp09.metoffice.gov.uk/23997?emission=medium

[xviii] Defra, Environment Agency & Met Office, *UK Climate Projections 2009 (UKCP09).* Medium emissions scenario, central estimate https://webarchive.nationalarchives.gov.uk/20181204111408/http://ukclimateprojections-ukcp09.metoffice.gov.uk/23998?emission=medium

See also UKCP18, the update to UKCP09. https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/land-projection-maps

[xix] European Respiratory Review, 2014. *Climate change and respiratory diseases*. https://err.ersjournals.com/content/23/132/161

[xx] UK Parliament Research Briefing, 2019. *Climate Change and Vector-Borne Disease in Humans in the UK*. https://researchbriefings.parliament.uk/ResearchBriefing/Summary/POST-PN-0597

[xxi] UK Climate Projections, annual average total cloud anomaly comparing late 20th century to 2050-2078, medium emissions scenario (RCP 6). Central estimate shows a reduction of up to 5% (maps grabbed from UKCP18 User Interface Tool). Planning submissions for major solar PV infrastructure have made reference to this kind of change - for example, see: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010085/EN010085-000704-10.6.3%20Climate%20Change%20Chapter%20Clarification%20Note.pdf

[xxii] DEFRA Magic Map. https://magic.defra.gov.uk/MagicMap.aspx Select layer "Land based designations" – "Non statutory" – "Drinking Water Protected Areas (Surface Water) (England)" and "Drinking Water Safeguard Zones (Surface Water) (England)".

[xxiii] For more detail on what these designations entail, see Environment Agency (2019) *Drinking Water Protected Areas (Surface Water)*: https://data.gov.uk/dataset/3d136e9a-78cf-4452-824d-39d715ba5b69/drinking-water-protected-areas-surface-water and https://data.gov.uk/dataset/6ac22521-2e77-4dc8-ba90-6bb55d2ea3b8/drinking-water-safeguard-zones-surface-water

[xxiv] See Defra magic map, layer 'Landscape' > 'Geology and soils' > 'Groundwater vulnerability map'. https://magic.defra.gov.uk/MagicMap.aspx

[xxv] Based on 2011 census figures and assuming the growth rate from 2001 – 2011 has continued to the present day. Published by WODC 2011.

https://www.westoxon.gov.uk/media/101468/west-oxfordshire-2011-census-leaflet.pdf

[xxvi] Town and Country Planning Association (no date), *Garden City Principles.* https://www.tcpa.org.uk/garden-city-principles

[xxvii] UK Government MHCLG, National Planning Policy Framework (Feb 2019 revision). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

[xxviii] Town and Country Planning Association & Royal Institute of Town Planners (December 2018 second edition), *Rising to the Climate Crisis: A Guide for Local Authorities on Planning for Climate Change.* https://www.tcpa.org.uk/Handlers/Download.ashx?IDMF=fd66dbe5-2b88-4acf-b927-256a82db9abe

[xxix] Town and Country Planning Association, ClientEarth & Royal Institute of Town Planners (2019), *Planning for Climate Change: Law and Policy Briefing.* https://www.tcpa.org.uk/Handlers/Download.ashx?IDMF=4927d472-a9f0-4281-a6af-463ddc642201

[xxx] UK Government, *Spring Statement 2019: Philip Hammond's Speech.* https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

[xxxi] Committee on Climate Change, 2019, *UK Housing: Fit for the Future?* https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf

[xxxii] The Oxfordshire County Council Developer Guide to Infrastructure Delivery and Contributions, consultation draft 2019. https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/planning/planningpolicy/DeveloperGuideConsultationDraft.pdf

[xxxiii] Oxfordshire County Council, 2018, *Local standards and guidance for surface water drainage on major developments in Oxfordshire, version 1*. https://www.oxfordshirefloodtoolkit.com/wp-content/uploads/2018/12/LOCAL-

STANDARDS-AND-GUIDANCE-FOR-SURFACE-WATER-DRAINAGE-ON-MAJOR-DEVELOPMENT-IN-OXFORDSHIRE.pdf

[xxxiv] Carbon Brief, 2018. *Why cement emissions matter for climate change.* https://www.carbonbrief.org/qa-why-cement-emissions-matter-for-climate-change

[xxxv] UK Government "Road to Zero" strategy, 2018. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf

[xxxvi] Transition Zero & Energiesprong, 2017, *Performance requirements: Part L UK vs Energiesprong vs Passivhaus*. See tables on page 2 http://transition-zero.eu/wp-content/uploads/2017/08/Performance-Requirements.pdf

[xxxvii] Construction Leadership Council, May 2019. *Buildings Mission 2030.* http://www.constructionleadershipcouncil.co.uk/news/green-construction-board-issues-new-report-on-buildings-energy-mission/

[xxxviii] UK Government BEIS (2019), *Policy Paper: The Grand Challenge Missions.* https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions#buildings

[xxxix] Construction Leadership Council 2019, *GCB Buildings Energy Taskgroup – summary of recommendations for newbuild in response to 2030 'Mission'.* http://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/05/GCB-BEM-Newbuild-RECOMMENDATIONS-230419.pdf

[xl] RIBA 2030 Climate Challenge https://www.ribaj.com/intelligence/updates-to-the-riba-plan-of-work-2019-dale-sinclair-gary-clark

[xli] RIBA 2030 Climate Challenge FAQs https://www.architecture.com/about/policy/climate-action/2030-climate-challenge/faqs

[xlii] RIBA 2030 Climate Challenge FAQs https://www.architecture.com/about/policy/climate-action/2030-climate-challenge/faqs

[xliii] For a short summary, see https://www.energistuk.co.uk/part-l-can-planning-authorities-still-request-carbon-offset-payments/

[xliv] National Energy Foundation, 2016. *Review of Carbon Offsetting Approaches in London: A NEF research report commissioned by the GLA.* https://www.london.gov.uk/sites/default/files/gla_cof_approaches_study_final_report_july_2016.pdf

[xlv] UK Green Building Council, 2019. *Net zero carbon buildings: a framework definition.* https://www.ukgbc.org/wp-content/uploads/2019/04/Net-Zero-Carbon-Buildings-A-framework-definition.pdf

[xlvi] European Respiratory Review, 2014. *Climate change and respiratory diseases*. https://err.ersjournals.com/content/23/132/161

[xlvii] The Forestry Commission's new Woodland Carbon Guarantee (launched November 2019), will allow woodland managers to sell carbon credits at a guaranteed price. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843628/4.1.4_FC_A5_Leaflet_Woodland_Carbon_Guarantee_WEB_FINAL.pdf

[xlviii] Local Government Association. *Managing flood risk: roles and responsibilities*. https://www.local.gov.uk/topics/severe-weather/flooding/local-flood-risk-management/managing-flood-risk-roles-and

[xlix] The Forestry Commission's new scheme, the Woodland Carbon Guarantee (launched November 2019), is designed for this. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843628/4.1.4_FC_A5_Leaflet_Woodland_Carbon_Guarantee_WEB_FINAL.pdf

[l] See Reg 19 Local Plan policies on design and construction https://www.uttlesford.gov.uk/media/8299/Reg-19-Design-and-Construction/pdf/Reg_19_Design_and_Construction.pdf?m=636663824600270000

[li] Greater Manchester Spatial Framework Topic Paper on Carbon & Energy. 2019. https://www.greatermanchester-ca.gov.uk/media/1738/carbon-and-energy-topic-paper-w-cover-web.pdf

[lii] https://www.rochdaleonline.co.uk/uploads/f1/news/document/201917_17110.pdf

[liii] National Energy Foundation, 2016. *Review of Carbon Offsetting Approaches in London: A NEF research report commissioned by the GLA* https://www.london.gov.uk/sites/default/files/gla_cof_approaches_study_final_report_july_2016.pdf

[liv] Spelthorne Borough Council 2016, *Developers Guidance Note for the 10% Renewable Energy Requirement Policy CC1 of the Council's Core Strategy and Policies Development Plan Document*. http://www.spelthorne.gov.uk/media/2290/Planning-Guidance-Note-Renewable-Energy/pdf/2016_Renewable_Energy_A_guide_to_help_developers_meet_planning_requirements_-_Final.pdf?m=636981757483870000