Cotswold Renewable Energy Study

January 2025

Centre for Sustainable Energy

LUC

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1. Introduction

1.1. Background

Cotswold District Council (CDC) declared a climate emergency on 3 July 2019. The declaration committed the Council to a number of actions, including making the Council's own operations net zero carbon as soon as possible and reviewing the district's adopted Local Plan to make climate change a strategic priority. Accordingly, CDC appointed the Centre for Sustainable Energy (CSE) and Land Use Consultants (LUC) to undertake an assessment of existing and potential renewable energy (RE) resources in the district, which was first completed in 2021. The assessment underpins a more comprehensive study for renewable energy development to support the Council in achieving net zero across the district. The main aim of this study is therefore to provide CDC with evidence-based advice to inform decisions on climate change and achieving net zero, while supporting the current Local Plan review.

1.2. Objectives of the study

The key objectives of the study are to:

- Review local and national policy and goals, including local aspirations within the district, as reflected in CDC's recent climate emergency declaration and the ongoing Local Plan review.
- Undertake a district-wide energy needs assessment to provide a clear picture of current and projected future energy demands and emissions in Cotswold District.
- Provide an assessment of existing and potential RE resources (including a Landscape Sensitivity Assessment) across the district.
- Discuss the benefits and challenges of renewable energy development in relation to its environmental, social and economic impacts on the local area and its assets.
- Consider RE deployment scenarios and opportunities within Cotswold District.
- Provide strategic recommendations for RE development based on evidenced findings from a district wide RE resource assessment.
- Outline specific energy policy recommendations to underpin proposals for policies in the Local Plan review and for future revisions up to 2041.
- Provide well-evidenced proposed policy wording that reflects the district's net zero ambitions for consideration in the current Local Plan review.

1.3. The renewable energy study

CSE and LUC first completed a renewable energy assessment for CDC in November 2021. This document presents an updated study that reflects the progress of the Local Plan review since the 2021 work and includes proposed policy wording to be fed into that process. This renewable energy study includes:

- An introduction to the local and national planning and climate change policy context.
- An assessment of the baseline energy demand and emissions for the Cotswold District and Council estate, including an overview of existing grid constraints.
- Summary findings from the technical resource and opportunity assessment undertaken in 2021, which accompanies this document (Appendix A).
- Policy options and strategic recommendations for the development of renewables in the Cotswold District.
- Recommended wording for energy policies for consideration in the ongoing Local Plan review.

The renewable energy study is accompanied by the following appendices:

- Appendix A – Renewable energy resource and opportunity assessment
- Appendix B – Renewable energy assessment figures
- Appendix C – Landscape Sensitivity Assessment (with figures)
- Appendix D – Assessment assumptions
- Appendix E – Cotswold District Council Landscape Sensitivity Assessment for the Cotswold National Landscape

1.4. Assessment methodology overview

The renewable energy resource assessment undertaken in this study considers low or zero carbon energy generation technologies associated with each resource. The assessment of potential follows a standard area-based methodology that both CSE and LUC have used for previous studies. This involves a desk-based analysis of technical potential using industry-standard or in-house assumptions. The potential for each technology is expressed as generating capacity in megawatts (MW) and annual energy yield in megawatt hour (MWh) or gigawatt hour (GWh). Resulting carbon savings estimated from offsetting fossil fuels use current carbon emission factors.

The assessment estimates the theoretical resource that may remain after applying a set of broad constraints that are mostly technical in nature. Other constraints such as those imposed by political, financial or planning issues are discussed but not quantified, although scenarios are presented to help frame the debate around deployable potential across Cotswold District and how these might contribute to a net zero future.

The technologies considered are as follows:

- Solar photovoltaics (PV) – rooftop and ground mounted
- Solar water heating
- On-shore wind power
- Hydropower
- Bioenergy and waste
- Low or zero carbon district heating networks
- Ambient heat (with heat pumps)

The above list aims to cover the technologies that fall with the Council’s scope of influence and are more likely to be developed locally in the short to medium term. Technologies such as nuclear (small modular reactors) and use of hydrogen have not been included in the assessment as their development is more associated with initiatives and activities at national level.

2. Policy context

2.1. National climate change policy and legislation

The 2008 Climate Change Act[1] sets out emission reduction commitments that the UK must comply with. The Act committed the UK to reducing its greenhouse gas emissions by 80 per cent by 2050, compared to 1990 levels. However, this target was made more ambitious in response to the risks in failing to limit a global average temperature increase to 1.5°C set out by the International Panel on Climate Change (IPCC) in 2018[2]. In May 2019 the UK's Committee on Climate Change (CCC) recommended a new emissions target for the UK: net zero greenhouse gases by 2050[3]. In 2019 the UK parliament also declared a formal climate and environment emergency, and the Government subsequently committed to a legally binding target of net zero emissions by 2050.

As required under the Climate Change Act, in December 2020 the CCC published their Sixth Carbon Budget[4], which was adopted by the UK Government and seeks to provide ministers with advice on the volume of greenhouse gases the UK can emit during the period 2033-2037. The report outlines the UK's path to net zero and recommends the requirement of a reduction in UK greenhouse gas emissions of 78% by 2035 relative to 1990. This is a 63% reduction from 2019 and is accompanied by a similarly ambitious 2030 pledge to reduce emissions by at least 68% from 1990. The foreword to the report stresses the key role of policy in achieving net zero:

> "If policy is not scaled up across every sector; if business is not encouraged to invest; if the people of the UK are not engaged in this challenge – the UK will not deliver Net Zero by 2050".

The document goes on to say:

> "Policies must provide a clear direction to millions of people and businesses in the UK, shifting incentives to favour low-carbon options and tackling barriers to action".

In response to its obligations to prepare policies to meet climate targets, the UK Government has also produced various sector specific policies and strategies, including amongst others:

- The UK National Energy & Climate Plan (2019)

[1] https://www.legislation.gov.uk/ukpga/2008/27/contents
[2] www.ipcc.ch/sr15
[3] www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming
[4] https://www.eventbrite.co.uk/e/urban-greening-for-health-and-climate-action-tickets-160760736691

- The Clean Growth Strategy (2017)
- The Industrial Strategy White Paper (2017)
- Net Zero Strategy: Build Back Greener (2021)
- The Heat and Buildings Strategy (2021)
- The British Energy Security Strategy (2022)
- Powering Up Britain: Net Zero Growth Plan (2023)

2.2. National planning policy and legislation

In 2008 the Planning Act[5], as amended by further Acts, introduced a new planning regime for nationally significant infrastructure projects (NSIPs), including energy generation plants of capacity greater than 50 MW. However, in 2016 onshore wind installations of capacity above 50 MW were removed from the NSIP regime and are now dealt with by local planning authorities.

The Planning and Energy Act (2008)[6] enables local planning authorities to set requirements for energy use and energy efficiency in local plans, including a proportion of energy used in development to be generated from renewable and low carbon sources in the locality of the development.

The updated and revised National Planning Policy Framework (NPPF)[7] published in 2023 sets out the environmental, social and economic planning policies for England. At the core of the NPPF is a presumption in favour of sustainable development, with the following listed as one of the three overarching objectives of the planning system:

> "an environmental objective – to protect and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

The NPPF also states that strategic policies in Local Plans should provide guidance for "infrastructure for [...] the provision of minerals and energy (including heat)" and include "planning measures to address climate change mitigation and adaptation".

The document specifies that the "planning system should support the transition to a low carbon future in a changing climate" and "help to: shape places in ways that contribute to

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[5] https://www.legislation.gov.uk/ukpga/2008/29/contents
[6] https://www.legislation.gov.uk/ukpga/2008/21/contents
[7] https://www.gov.uk/guidance/national-planning-policy-framework

radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure".

The updated NPPF revises the policy context for onshore wind. Whilst the requirement to identify suitable areas for onshore wind is still substantially in place, exceptions have been put in place to enable communities to bring forward wind projects through Neighbourhood Development and Community Right to Build Orders, as well as to allow established wind developments to be re-powered without the need for a supportive local plan policy.

Additionally, the revised NPPF text allows local authorities to identify suitable areas for onshore wind within Supplementary Planning Documents (SPDs), introducing more flexibility for local decision makers. Developments for wind energy need to be able to demonstrate that, through consultation, the planning impacts identified by the affected local community have been "appropriately addressed" and the proposal "has community support"[8].

The National Planning Practice Guidance (NPPG)[9] provides further interpretation of national planning policy for the benefit of local planning authorities and planning practitioners and includes a section on climate change, which stresses the need to address climate change as one of the core planning principles that underpin both plan making and decision taking. The NPPG states that in order to:

> "be found sound, local plans will need to reflect this principle and enable the delivery of sustainable development in accordance with the policies in the National Planning Policy Framework. These include the requirements for local authorities to adopt proactive strategies to mitigate and adapt to climate change in line with the provisions and objectives of the Climate Change Act 2008, and cooperate to deliver strategic priorities which include climate change".

[8] The previous iteration of the NPPF required planning impacts to be "fully addressed" and that "the proposal has their (the communities') backing".
[9] https://www.gov.uk/government/collections/planning-practice-guidance

2.3. Local policy and guidance

2.3.1. Cotswold District Council

The Cotswold District Local Plan 2011-2031[10] was adopted in 2018 and sets out policies and proposals to meet the challenges facing the district over the period 2011-2031. The document notes that:

> "the main challenge facing Cotswold District is to plan for future development requirements in the most sustainable way possible".

The plan stresses the importance in planning for new development of taking into consideration the potential impact of climate change through adaptation, as well as climate change mitigation measures, including increased energy efficiency and renewable energy generation. The plan notes that while a significant number of solar farms and single wind turbines have been installed in the district to date, opportunities for renewable energy development need to be balanced against the conservation of the natural and built heritage of the district and of the Cotswold National Landscape.

One of the strategic objectives of the Local Plan is to reduce the environmental impact of development and vulnerability to the impacts of climate change. This includes maximisation of energy efficiency, promotion of renewable energy sources and sustainable construction methods, as well as reduction in pollution and waste.

With specific regard to renewable and low carbon energy development, Policy INF10 states that:

1. "Proposals for the generation of energy from renewable or low carbon sources will be permitted, provided it is demonstrated that:

   a. any adverse impacts individually and/or cumulatively, including: visual amenity; landscape character; heritage assets; biodiversity; water quality and flood risk; highways; residential amenity, including shadow flicker, air quality and noise, are or can be satisfactorily mitigated;

   b. it is of an appropriate type, scale, and design for the location and setting;

   c. it is compatible with surrounding land uses, such as military activities; and

   d. it avoids using the best and most versatile agricultural land unless justified by compelling evidence.

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[10] https://www.cotswold.gov.uk/media/k2kjvq3b/cotswold-district-local-plan-2011-2031-adopted-3-august-2018-web-version.pdf

2. The infrastructure and all associated apparatus and structures relating to the installation must be removed, and the site reinstated where appropriate, should it become redundant for energy generation purposes."

Following the declaration of a climate emergency in 2019, CDC agreed in June 2020 to undertake a partial update for the Local Plan, focusing only on issues that need modification within the plan period (to 2031), including ensuring that the plan is "green to the core". CDC also produced a Climate Emergency Strategy 2020-2030[11], which:

> "sets out high level principles, imperatives, targets and action areas for responding to the climate emergency (both as a Council and more widely for the district as a whole) for the ten year period 2020-2030".

As part of the Local Plan update process, CDC undertook an issues and options consultation in spring 2022. This sought input in respect of the Council's aspirations for ambitious climate policies within the local plan and the core aspiration to make the plan green to the core. The results of the consultation[12] set the context for this study:

- Well over half of respondents were willing to accommodate much or some change to the 'look and feel' of the district in response to the imperative of climate change.
- Over half of respondents either supported or strongly supported wind turbines in the National Landscape, and less than a third either objected or strongly objected. There was general acceptance that wind turbines are necessary and that the urgency of the climate crisis justifies their placement in the National Landscape. However, there was also concern about wind turbines being unsightly and suggestions that other renewables and climate solutions could be better.
- Over 60% of respondents were either most supportive or somewhat supportive of solar farms being more common within the district and less than 20% were non-supportive.
- Over 60% of respondents agreed that the Local Plan should go beyond the standards set by building regulations to require new development to be net zero carbon. The need, driven by the climate crisis, to move faster than building regulations was broadly accepted and almost two thirds of respondents supported zero carbon housing even if it also meant homes had a less traditional design.

[11] https://www.cotswold.gov.uk/media/8d8eab9716634de/cdc-climate-emergency-strategy-adopted-2020_09_23.pdf

[12] https://meetings.cotswold.gov.uk/documents/s5609/ANNEX%20A%20-%20Consultation%20Summary%20Report%20-%20Consolidated%20Report.pdf

Overall, the responses to the issues and options consultation revealed majority public support for ambitious climate policies and an acceptance of change to address climate change.

At the time of writing, the Regulation 18 consultation[13] is open, seeking public feedback on draft policy wording. This provides an opportunity for the Council's policies to be further refined prior to a final (Regulation 19) consultation on the final draft plan and its submission to the planning inspectorate for examination.

2.3.2. Gloucestershire County Council

The Gloucestershire County Council Sustainable Energy Strategy[14] was published in January 2019 and sets out the strategic energy ambitions for Gloucestershire, which include committing to reducing carbon emissions, increasing renewable electricity generation, improving building energy performance and tackling fuel poverty, decarbonising heat demand for heating buildings and for industrial processes by 2040, shifting to Electric Vehicles (EVs) and securing zero carbon new development.

Subsequently to the publication of the strategy, in May 2019 Gloucestershire County Council endorsed the climate emergency declared by the UK Government and hosted a climate change summit[15], calling on the local community to deliver the Gloucestershire Sustainable Energy Strategy. Following the declaration, the County Council published their Climate Change Strategy[16] in December 2019, which outlines the actions the County needs to reach the national target to be carbon neutral by 2050, with an interim target of a 57% reduction in carbon emissions by 2030.

2.3.3. Cotswolds National Landscape

The Cotswolds National Landscape Management Plan 2023-2025[17] was adopted in February 2023 and sets out the vision, outcomes, ambitions and policies to guide the management of the Cotswolds National Landscape (CNL), formerly known as Cotswold Area of Outstanding Natural Beauty (AONB), which accounts for 80% of the Cotswolds District land area.

Compared to the previous management plan, climate change policies have been brought to the fore of the 2023-2025 management plan. Policy CC1 (Climate Change – Mitigation) lists a range of measures to reduce greenhouse gas emissions, including improving energy efficiency and energy conservation, as well ensuring all developments should have

[13] www.cotswold.gov.uk/planning-and-building/planning-policy/local-plan-update-and-supporting-information/

[14] http://www.gfirstlep.com/downloads/2019/gloucestershire-energy-strategy-2019.pdf

[15] www.gloucestershire.gov.uk/gloucestershire-county-council-news/news-june-2019/county-council-leads-on-climate-action/

[16] https://www.gloucestershire.gov.uk/media/2094404/gloucestershire-climate-change-strategy.pdf

[17] https://www.cotswolds-nl.org.uk/planning/cotswolds-aonb-management-plan/

a net zero operational carbon balance, with 100% of energy provided by low carbon sources. It supports generation of energy from low carbon sources in a manner that is consistent with the purpose of National Landscape designation. Policy CC2 (Climate Change – Adaptation) states that "climate change adaptation should be a significant driver in all new development, infrastructure and transport provision".

The CNL also adopted a Renewable Energy Position Statement in June 2023[18]. This statement outlines six main types of renewable energy that, in principle, the CNL Board would "be supportive of […] these forms of renewable energy at a small-scale". The six types of energy identified are:

- Heat pumps
- Biomass
- Hydropower
- Solar energy
- Wind energy
- Battery storage

The statement does suggest that large-scale forms of renewable energy such as wind and ground mounted solar are unlikely to be compatible with conserving and enhancing the natural beauty of the CNL. They are not completely ruled out but consideration should be given to the sensitivity of the landscape to the type and scale of development being proposed, as this may vary from one area to other. Additionally, the statement suggests that "consideration should be given to whether exceptional circumstances apply […] particularly in the context of the climate emergency."

Further information on the implications of the Position Statement on the potential for RE development in the district are included in Appendices A and C.

A note that AONBs were re-branded as National Landscapes in November 2023. In legal terms they are still defined as AONBs under the 1949 National Parks and Access to the Countryside Act. The renewable technical potential assessment and associated maps accompanying this report still refer to AONBs.

[18] https://www.cotswolds-nl.org.uk/wp-content/uploads/2023/07/Renewable-Energy-June-2023.pdf

3. Baseline energy demand and emissions

3.1. District-wide baseline energy demand and emissions

This chapter provides an overview of the current demand for energy within the Cotswold District and sets out a carbon emissions baseline against which future changes and progress towards targets can be measured. It also provides an indication of the additional energy demand and CO_2 emissions that might arise as a result of planned development up until 2031 (i.e. the end of the local plan period).

According to the most recent statistics available from the Department for Energy Security and Net Zero (DESNZ) [19], total annual energy consumption within Cotswold across the industrial & commercial, domestic and transport sectors in 2021 was estimated to be 2,474.9 GWh.

With regards to the baseline CO_2 emissions during 2021, the smaller 'local authority scope of influence' emissions for Cotswold District total 524,914 tCO_2. These are those within the scope of influence of local authorities and exclude large industrial sites, railways, motorways and land-use. The 'full emissions' amount to 542,821 tCO_2 and represent approximately 18% of the total for Gloucestershire County and 2% of the South West region's emissions[20].

This dataset shows emissions allocated on an "end-user" basis, where emissions are distributed according to the point of energy consumption (or point of emission, if not energy related). Except for the energy industry, emissions from the production of goods are assigned to where the production takes place. Therefore, emissions from the production of goods which are exported will be included, and emissions from the production of goods which are imported are excluded.

Table 1 presents energy consumption statistics for 2021 which show building-related (i.e. non-transport) energy consumption across the district, mostly based on metered data, split between domestic and industrial & commercial users.

[19] Most recent up to 2021. https://www.gov.uk/government/statistics/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2021

[20] https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019

Table 1: Cotswold energy consumption statistics (non-transport) (2021 figures)

Sector	Electricity (GWh/year)	Gas (GWh/year)	Other fuels excl. bioenergy & waste (GWh/year)	Total (GWh/year)	CO_2 Emissions (kt/year)
Domestic	222.1	383.8	131.4	737.4	160.7
Industrial & commercial	195.4	141.9	164.0	501.3	95.5
Total	417.5	525.7	295.4	1,238.6	256.2

Heat demand from buildings throughout the district was modelled by THERMOS[21] and estimated as 640.14 GWh. The methods and results are presented in Appendix A as a district-wide heat map.

CSE has developed a parish-level carbon footprint tool in partnership with the Centre for Energy and Environment at the University of Exeter, with funding from the Department for Business, Energy and Industrial Strategy (BEIS), now DESNZ. This 'Impact tool' allows its users to view and download data relating to both a territorial and a consumption-based carbon footprint calculation approach and has been designed to provide a starting point for community-scale climate action.

A territorial carbon footprint includes all emissions that are generated within a defined geographical area, including those from industry, agriculture and transport activities (similar to the figures provided above). A consumption-based footprint includes upstream and downstream emissions from residents' consumption of manufactured goods, food and their own transport activity, regardless of where these emissions occur.

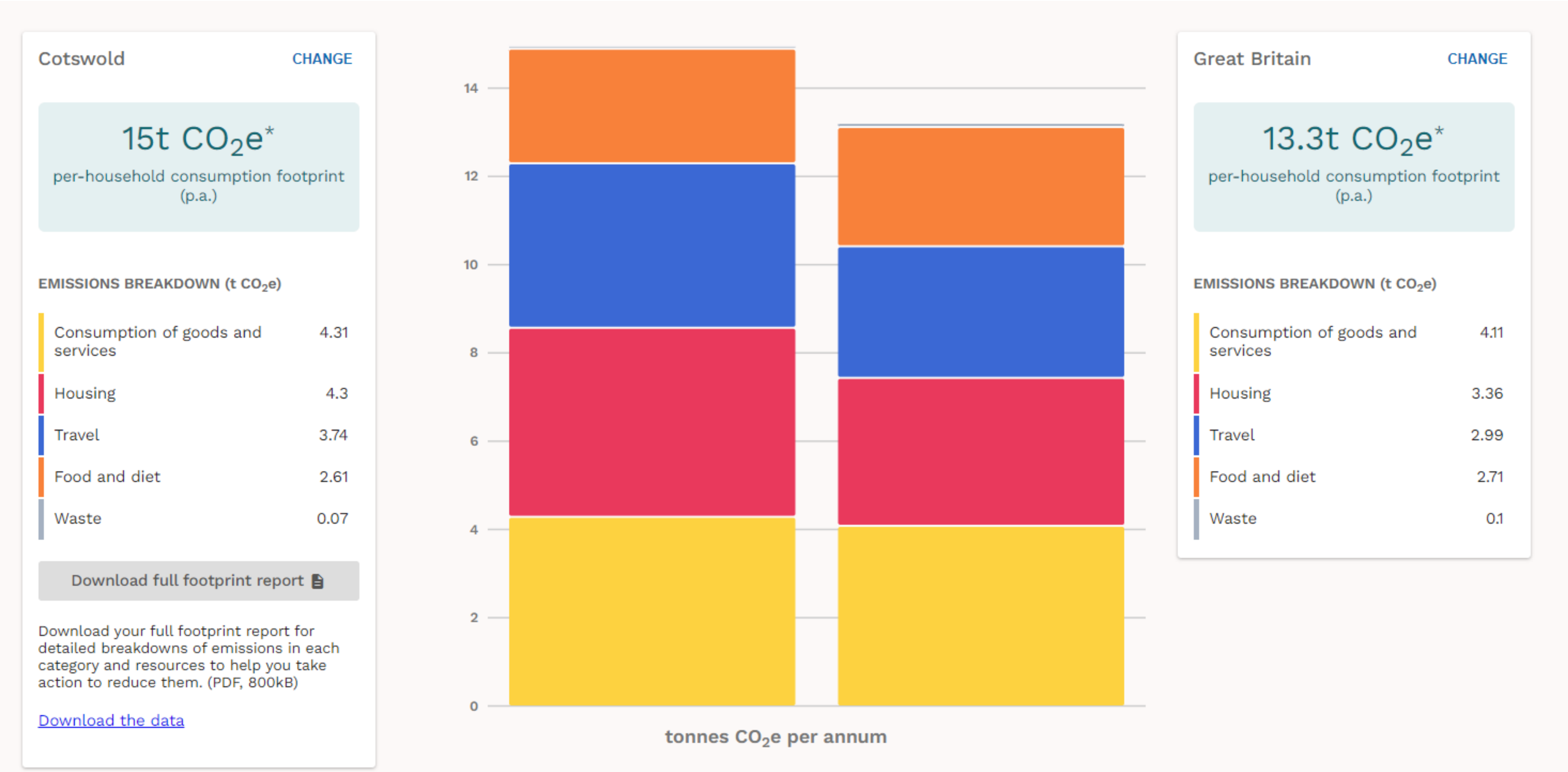
For the Cotswold local authority area, the annual consumption-based carbon footprint is estimated to be in the region of 686,417 tCO_2e, which equates to a per-household annual footprint of 15 tCO_2e.

The tool can be used to compare footprint size with that of any given parish within the district. Figure 1 provides an example comparison between a per-household footprint for Cotswold District and the per-household footprint across the whole of Great Britain, which is lower at 13.3 tCO_2e[22].

[21] https://www.thermos-project.eu/thermos-tool/what-is-thermos/

[22] https://impact-tool.org.uk/

Figure 1: Impact consumption footprint per household in in Cotswold District compared to Great Britain



3.2. Impact of new development

The Cotswold District Local Plan aims to deliver a minimum of 8,400 new homes over the plan period from 2011 – 2031. As of 1 April 2023, 6,277 of these dwellings had been completed. It is now estimated that a total of 9,671 new dwellings will be completed by 2031, which represents 115% of the Local Plan requirement.

Unless new ambitious planning policies are introduced to mandate developers to deliver net zero carbon buildings, it is inevitable that emissions across the area will rise as a result of this new development. As well as total emissions from regulated and unregulated operational use[23], whole-life cycle emissions including those resulting from their construction will also need to be addressed to achieve true zero carbon.

Table 2 estimates operational emissions from typical housing types built under the energy performance standards of SAP10.2[24] alongside current expectations as set out in the Government response to the Future Homes Standard consultation (January 2021). Table 3 then estimates the emissions resulting from new housing developments predicted for Cotswold up to 2031. Currently there is insufficient data to estimate the emissions of future non-domestic development.

Table 2: Estimated CO_2 emissions from new housing types assuming SAP10.2 standards (tonnes/year) (2017 figures)[25]

	Detached	Semi-detached	Terrace	Flat (average)
Prior to 2025	2.3	1.8	1.9	1.2
2025 onwards	2.2	1.7	1.8	1.1

Table 3: Estimated CO_2 emissions from new housing developments in Cotswold District to 2031

Local Plan housing commitments 2011-2031	Remaining required housing completions 2020-2031	Homes to be built per year to 2031 (assuming linear build-out)	Annual CO2 emissions from new development applying SAP10.2 standards (tonnes/year)	
			Prior to 2025	2025 onwards
10,139	4,935	449	847	828

[23] Regulated energy use refers to that controlled by Part L of the Building Regulations and includes energy used for space heating/cooling, water heating, fixed lighting, pumps and fans. Unregulated energy use refers to all other energy used within a building such as for cooking, appliances and small power. For non-domestic buildings, unregulated energy use also includes demands from lifts, manufacturing processes, server rooms etc.

[24] SAP10.2 (Standard Assessment Procedure 10.2) was published in December 2021.

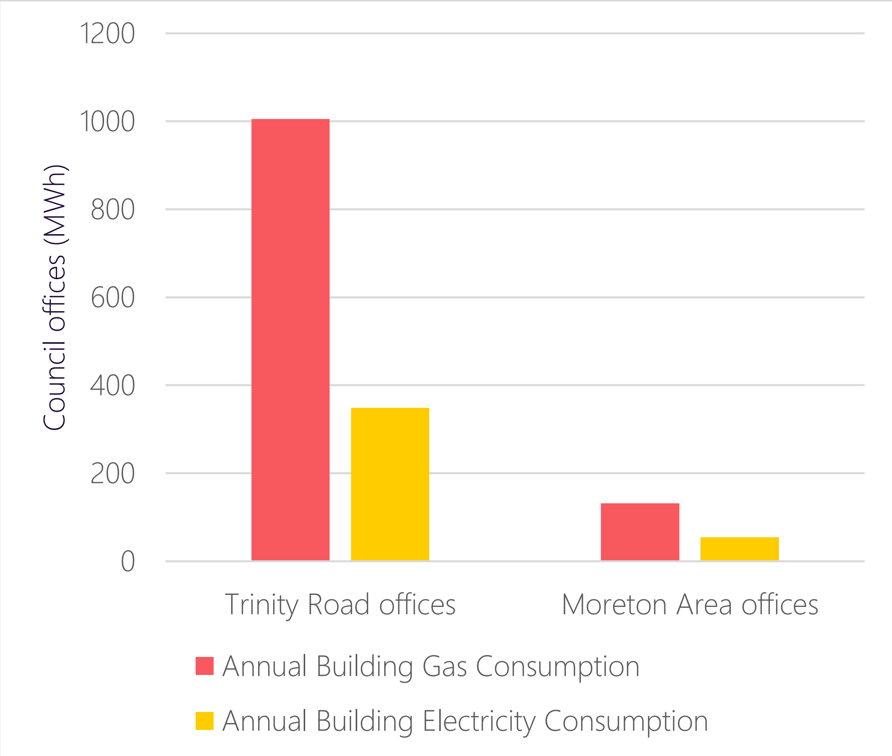
[25] Figures estimated based on unpublished analysis undertaken for Greater Manchester Combined Authorities by Currie and Brown.

3.3. Cotswold Council estate demand

Cotswold District Council has offices in Cirencester and Moreton. The annual gas and electricity consumption for Trinity Road and Moreton offices are shown in

Figure 2. The gas consumption at Trinity Road from April 2019 to March 2020 was 1,005,159 kWh. This equates to emissions of 184.11 tCO_2e. The electricity consumption over the same period was 348,386 kWh, which results in emissions of 73.97 tCO_2e (using UK Government GHG Conversion Factors for Company Reporting). The smaller Moreton Area offices emit 24.14 tCO_2e from gas consumption and 11.67 tCO_2e from electricity consumption.

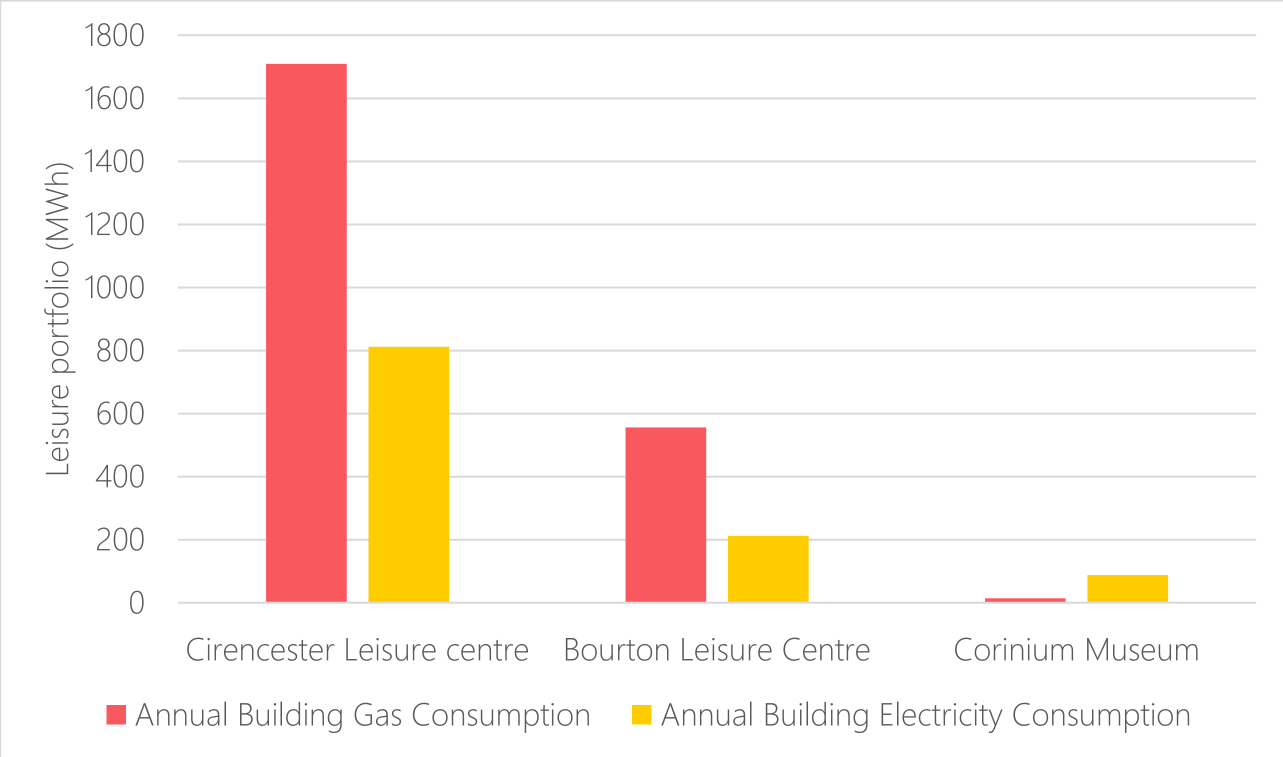
Figure 2: Summary of annual gas and electricity consumption from Cotswold District Council offices



The Council portfolio also includes Chesterton Cemetery and 44 Black Jack Street, which have a combined annual gas consumption of 12,421 kWh (2.3 tonnes CO_2e).

The leisure portfolio comprises Cirencester Leisure Centre, Bourton Leisure Centre and Corinium Museum, which are operated by leisure contractors. In total the gas consumption for April 2021 to March 2022 was 2,279,288 kWh. Electricity consumption across the leisure portfolio was 1,131 MWh, equating to 240.2 tonnes CO_2e. The annual consumption for each building is shown in Figure 3.

Figure 3: Summary of annual gas and electricity consumption across CDC's leisure portfolio



The Council portfolio also includes Abberly House offices, buildings for Parish Councils, public toilets, street lighting and EV charging points. These are fuelled by electricity only. Abberly House consumes over 30,000 kWh/year. Street lighting and EV charging points consume approximately 37,000 kWh/year total each. The Parish Council buildings average at around 2,500 kWh/year.

3.4. Energy system transmission – grid constraints

The UK distribution network was designed as a centralised system, with electricity flowing from a small number of very large power stations in the direction of the end user. Higher levels of distributed generation are causing new challenges for the electricity network, with ever-larger areas of the network reaching maximum capacity. In these areas, reinforcement is needed before new grid connections for the supply of power can be accepted.

In the short term, opportunities for new renewable energy deployment presented by the distribution network are therefore limited to areas where there is capacity still available or where there is an existing connection which is not being fully utilised. Such sites offer the opportunity to host additional generating capacity without the need for a new grid connection. Identifying these sites requires engagement with site operators as well as National Grid Electricity Distribution (NGED) and Scottish and Southern Energy Networks (SSEN), the Distribution System Operators (DSOs) within the Cotswolds area.

DSOs periodically upgrade the network to create extra capacity which can be applied for in advance, even when these upgrades take years to come online. It is therefore worth periodically checking with the DSO on capacity at a specific site of interest. Both DSOs, NGED and SSEN, maintain a network capacity map on their websites[26]. These are updated regularly (daily in the case of NGED) and therefore the following information is subject to change.

Figure 4 shows the primary substations within Cotswold District and their generation 'headroom'. If the substation is marked in green it indicates that this infrastructure is 'unconstrained', with around 25% of total site capacity still available. Amber substations are likely to have 10-25% of site capacity available and red substations are expected to have less than 10%. However, in some cases connections to red substations might still be possible with network reinforcement work. Conversely, connections to green substations may not always be possible in reality. Engagement with the DSOs is the best way to establish the possibility of connections at specific sites.

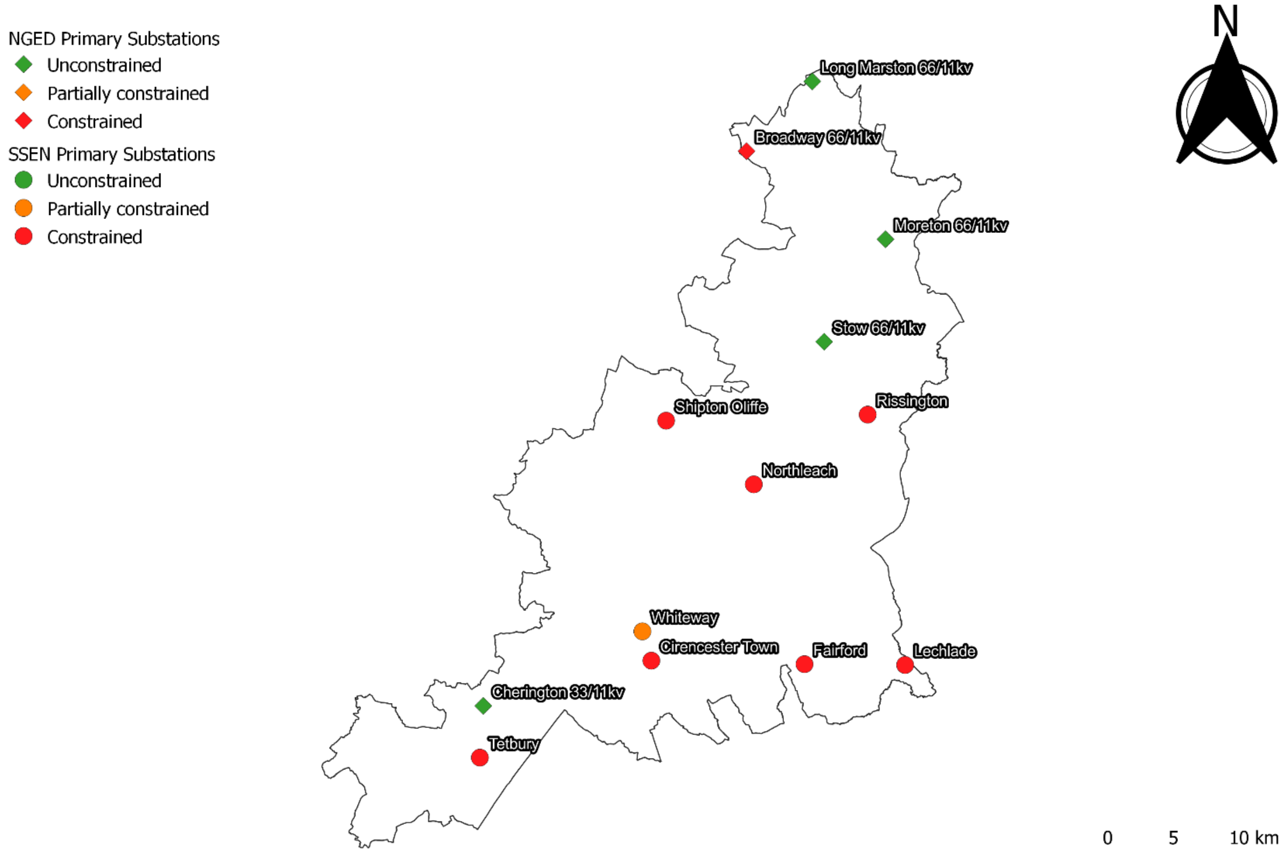
NGED operate five primary substations in the Cotswold District. Four of the substations are in the north of the district, covering Stow-on-the-Wold, Chipping Campden, Moreton-in-Marsh and Broadway. The one in the south of the district covers Kemble (Cherington). The generation headroom for one of these substations is constrained (Broadway), whilst the other four are unconstrained.

SSEN has 8 primary substations in the district. All but one substation (Whiteway) are constrained. Whiteway is partially constrained.

[26] NGED network capacity map available at: https://www.nationalgrid.co.uk/our-network/network-capacity-map-application

SSEN network availability map: https://www.ssen.co.uk/GenerationAvailabilityMap/?mapareaid=1

Figure 4: Network capacity generation headroom (as of October 2020)



3.5. Energy storage and demand side response

Energy storage technology, particularly batteries, has advanced considerably in recent years and is well placed to help alleviate the constraints that currently limit renewable energy generation connections to the grid.

By co-locating battery storage with renewable energy developments, developers can store excess power and sell it into the grid during high demand. This helps keep the grid 'in balance', by reducing voltage peaks, fluctuations, overheating and faults on the network and thus releasing capacity on the network for more renewable distributed generation. Currently there are not many co-location sites that are commercially viable and detailed modelling is required to assess the financial viability of investment in batteries. However, initial attractiveness can be tested via engagement with NGED and SSEN to determine whether potential generation sites sit in areas with significant network constraints.

At the domestic level, smart control systems are now available which integrate onsite generation, such as solar PV, with battery storage and optimise loads and power exports to the financial benefit of the occupant. Electric vehicles are also expected to integrate with such systems, potentially providing a significant amount of extra plug-in storage capacity.

Similar to storage, albeit 'one-way' only, provision of Demand Side Response (DSR) capacity can help relieve grid constraints by businesses reducing power usage during times of high demand and switching it back on when such peaks are over. Again, this helps keep the grid 'in balance' and release capacity on the network for more renewable distributed generation.

Businesses which represent most potential for provision of DSR, such as large commercial or industrial sites, can be identified in areas with known grid constraint and options considered. Typically, such sites should be able to provide a minimum 'downturn' of power of 50 kW to represent commercially viable opportunities.

It should be noted that increasing participation in demand side flexibility and installing energy storage across the district will not lead directly to significant additional reductions in carbon emissions. However, it would contribute to enabling the electricity system nationally and the distribution network locally to accommodate more renewable electricity generation at lower cost. In addition, if flexibility services were organised to serve local network operational requirements as much as national system balancing and stability needs, they could reduce the scale of investment needed for upgrading the electricity distribution network for the district.

For domestic customers, in the winter of 2022 the National Grid Electricity System Operator (ESO) launched the Demand Flexibility Service[27], the first national trial rewarding households for turning down their electricity demand to ease the pressure on the electricity system. In total, 1.6

[27] https://energysavingtrust.org.uk/demand-flexibility-service/#:~:text=The%20Demand%20Flexibility%20Service%20is%20run%20by%20the%20National%20Grid,Great%20Britain%20whenever%20it's%20needed.

million households and businesses took part and together they saved over 3,300 MWh of electricity, enough to power 10 million homes across Great Britain. It is likely that energy suppliers will release more tariffs which reward customers for adjusting their demand in response to market signals.

A report for the Committee on Climate Change[28] which draws on national level analysis has suggested that the maximum potential for shifting peak demand through flexibility is 41% for residential appliances and 10% for industrial and commercial electricity use.

[28] Vivid Economics and Imperial College (2018) www.theccc.org.uk/publication/accelerated-electrification-and-the-gb-electricity-system/ccc-accelerated-electrification-vivid-economics-imperial/

4. Renewable energy assessement summary

4.1. Summary findings of the technical resource assessment

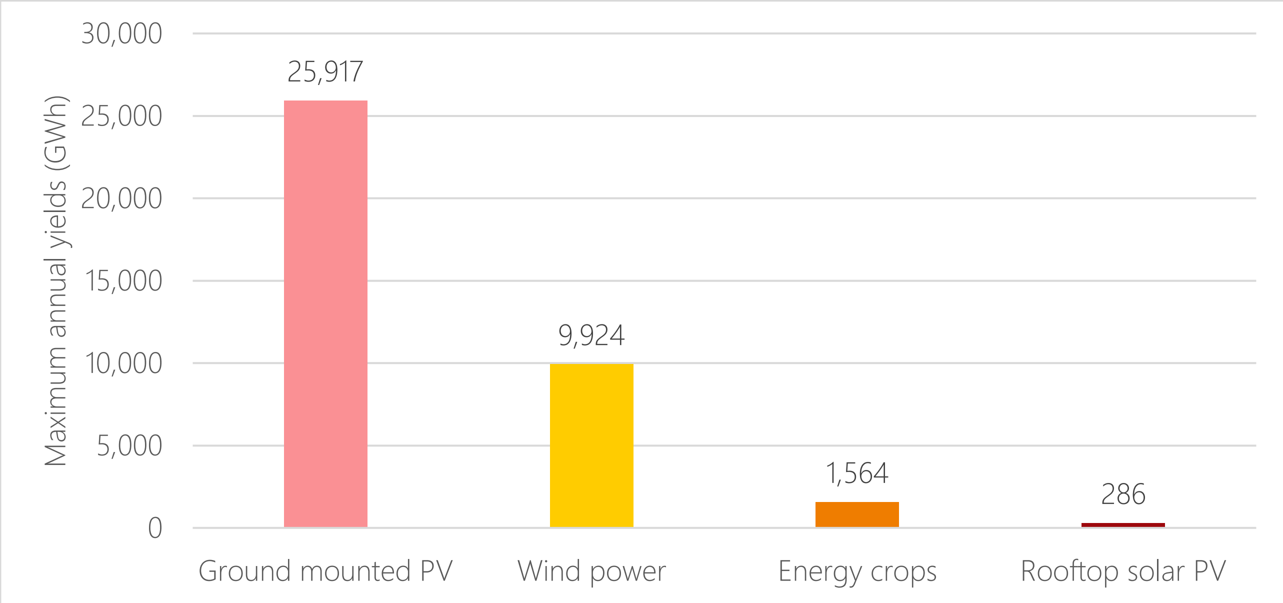
A range of low or zero carbon energy generation resources and technologies have been assessed as part of a desk-based exercise involving industry-standard assumptions, calculations and GIS mapping to establish the technical potential of each. By applying a set of tailored constraining factors to each resource, the renewable energy potential can be expressed as generating capacity (MW), typical annual energy yield (MWh or GWh) and resulting carbon savings from offsetting fossil fuels (tonnes or kilotonnes of CO_2/year). The technical resource assessment is presented in detail in Appendix A.

The assessment estimates the theoretical resource that may remain after applying a set of broad constraints that are mostly technical in nature. These are, for instance, minimum average wind speeds and minimum distance from dwellings (for wind power), available roof space and orientation (for rooftop solar PV) and agricultural land classification (for energy crops). Other constraints such as those imposed by political or financial issues have not been considered in this technical assessment and require further work. It is important to note that the viability of any individual proposal for renewable energy generation may be subject to additional site-specific factors.

A summary of the resource assessment is shown below in Figure 5, which shows the relative proportions of the full technical potential of each resource considered. Existing renewable energy generation capacity is intrinsically included within the estimates but is also assessed separately in Appendix A.

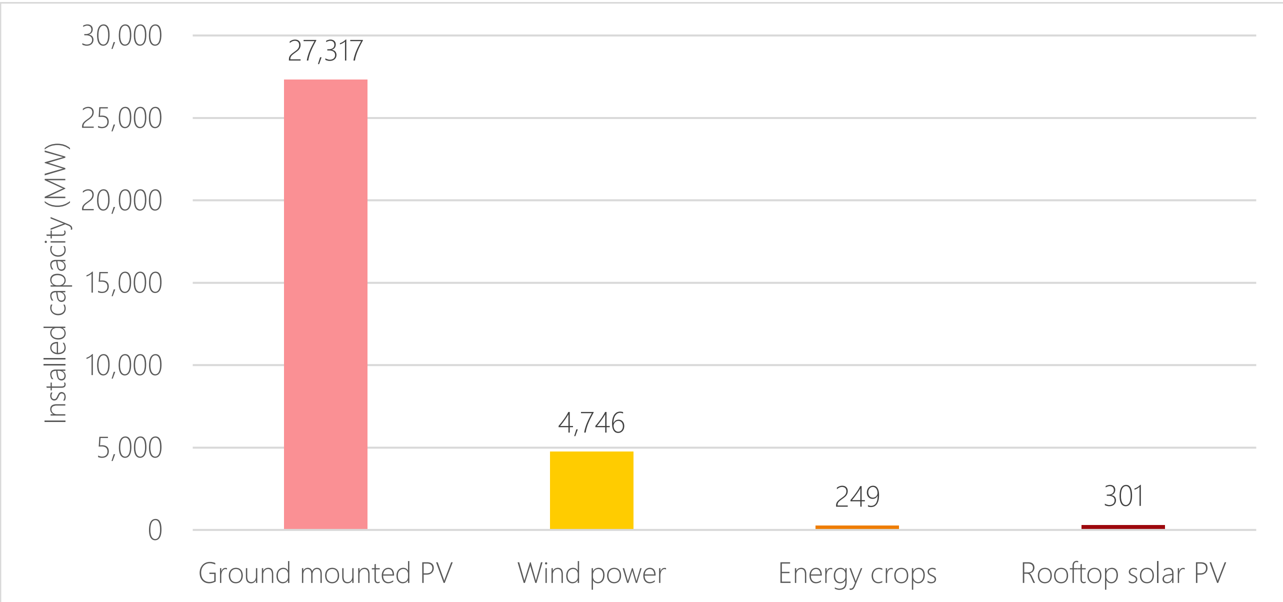
Figure 5 clearly shows that, from a technical perspective, the vast majority of the potential for renewable energy generation in the district comes from ground mounted solar PV and wind power, followed by energy crops, which reflects the rural geography of the district. The contribution from rooftop PV, woodfuel and fuel from agricultural residue is much smaller. As noted above, these results need to be taken into consideration alongside a range of non-technical factors (e.g. political ambitions, commercial viability, socio-demographic composition, etc.) that play a key role in determining the technology mix that would be feasibly deployable in the district. It should also be noted that there is overlap in the land requirement for these resources – solar, wind, and energy crops will all be viable on the same land, so there will be trade-offs in choosing between the different energy sources.

Figure 5: Summary annual yields of technical resource assessment



The installed capacity of each resource shows the size of installations, rather than the amount they would generate per year, this is most appropriate to the electricity generating resources. This summary is shown in Figure 6. As noted above, ground mounted PV, wind power and energy crops compete for land availability, and so there are trade-offs between each of these resources.

Figure 6: Summary of installed capacity of technical resource assessment



4.2. Deployment scenarios

4.2.1. Framing the scenarios

The UK's electricity system will need to undergo a significant transformation on the path to net zero due to the requirements to decentralise generation using renewable energy, decarbonise heat supplies through electrification (e.g. heat pumps) and deploy electric vehicles. Electricity demand will therefore dramatically increase across all sectors and will largely displace fossil fuel demand for heating and transport.

In meeting this demand, the Government's Net Zero Strategy (Section 2.1) relies heavily on the development of nuclear power, offshore wind and "more onshore, solar and other renewables" to fully decarbonise the electricity supply system by 2035. It is expected that some low or zero carbon (LZC) technologies such as hydrogen and specific types of bioenergy (see Appendix A) will also play a role in generating heat directly for certain applications.

The first step in evaluating Cotswold's resource is the estimation of the district-wide renewable energy technical resource, as set out in Appendix A. The results can then frame the debate on how much of this resource could actually be deployable when considering additional constraints related to issues around planning, economic viability, supply chains, cumulative impacts and infrastructure (energy storage and transmission).

However, it is rarely possible to be prescriptive about technology-specific targets as there are numerous scenarios and variables to consider regarding the technology mix that could be adopted. The deployability of wind turbines and ground mounted solar PV in particular is subject to often complex site-specific constraints that need to be considered on a case-by-case basis.

For these reasons, the deployment scenarios explored below are based on supplying varying proportions of Cotswold's current and forecast electricity demand, which is expected to be the dominant energy requirement on the path to a net zero 2050 for the district. The corresponding emission reductions have not been estimated as these will depend on the timescales needed to implement each scenario and the rate at which the UK electricity grid is decarbonised as a whole.

4.2.2. 2050 demand projection

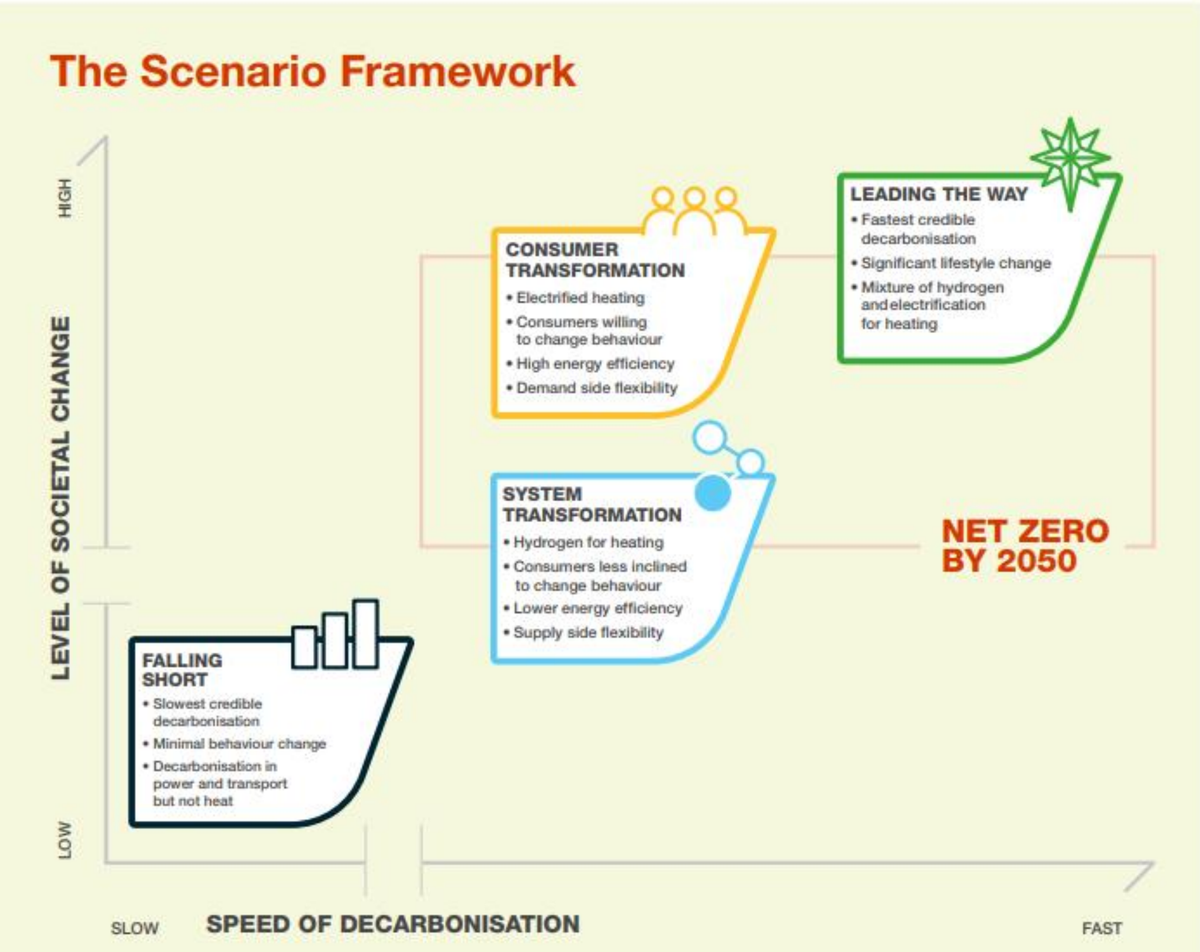
As seen above, the future switch to electrified heat and transport places the focus on ensuring sufficient renewable electricity generation to meet the increasing electricity demand. In estimating the future electricity demand of Cotswold District, two sources have been used: the National Grid's Future Energy Scenarios (FES) 2023[29]and the Climate Change Committee's (CCC) 6th Carbon Budget[30].

[29] www.nationalgrideso.com/future-energy/future-energy-scenarios
[30] https://www.theccc.org.uk/publication/sixth-carbon-budget/

These FES scenarios have been developed with the intention of informing network planning, investment decisions and government policy and consist of four pathway scenarios as shown in

Figure 7. The 6th Carbon Budget uses the balanced pathway to describe a likely scenario for societal changes to 2050.

Figure 7: National Grid Future Energy Scenarios 2023



The national forecasts in each source have been proportionally applied to the district's existing demand. For the purposes of predicting Cotswold's future electricity demand, the 'Consumer Transformation' (CT) FES scenario was used, which places emphasis on the way we use energy and achieves net zero by 2050[31]. This scenario estimates increases in electricity demand from 2022 levels of 77% and 42% in the industrial/commercial and residential sectors respectively. It also predicts an eight-fold increase in electric demand for surface transport. These proportions have been applied to Cotswold's 2021 electricity demand (as presented in Section 3) and

[31] It should however be noted that all three National Grid 2050 net zero scenarios show grid electricity turning carbon negative by the early 2030s due to the assumption that bioenergy with carbon capture and storage (BECCS) will be developed at Drax power plant. However, this technology is not yet mature and electricity generation from biomass at Drax was dropped from an index of green investment options due to doubts over its credibility as a low carbon generation method, therefore introducing some uncertainty around the timescales associated with this technology and consequently the decarbonisation scenarios.

assume that future changes at the local level will be typical of those at the national level. The resulting 2050 demands are shown in Table 4.

Table 4: Forecast 2021 to 2050 electricity demand increases for Cotswold District under the Consumer Transformation scenario

Sector	Cotswold demand (2021, GWh)	Projected Cotswold demand (2050 FES CT scenario, GWh)
Industry & commercial	195.4	345.3
Residential	222.1	316.3
Road & rail transport	8.3	79.9
Total	**425.8**	**741.6**

In addition to the 2050 demand for electricity, there is likely to be a relatively small demand increase for heat produced directly from certain LZC resources or technologies, such as hydrogen, specific types of bioenergy or solar water heating. However, this has not been quantified due to uncertainty in the respective roles of each resource in achieving net zero.

The CCC balanced pathway uses slightly different sector categorisations to the FES, however they are broadly transferrable. Industry and commercial in FES translates to manufacturing and commercial in the balanced pathway, whilst road and rail transport translates to surface transport. The balanced pathway predicts increases in electricity demand of 24% and 87% for manufacturing/commercial and residential sectors respectively. It predicts a 19-fold increase in the electricity demand for surface transport. The resulting 2050 demands are shown in Table 5.

Table 5: Forecast 2021 to 2050 electricity demand increases for Cotswold District under the balanced pathway

Sector	Cotswold demand (2021, GWh)	Projected Cotswold demand (2050 CCC balanced pathway scenario, GWh)
Manufacturing & commercial	195.4	242.1
Residential	222.1	415.6
Surface Transport	8.3	168.7
Total	**425.8**	**826.4**

4.2.3. Deployment scenarios

The example scenarios shown in Figure 8, Figure 9, Figure 10 and Figure 11 are intended to help explore renewable energy deployment options by considering four sets of technology combinations, which have been selected to supply varying proportions of the total electricity demand of Cotswold District both now and for future projections.

These are as follows:

- Scenario 1 – supplying 50% of existing (2021) electricity demand
- Scenario 2 – supplying 100% of existing (2021) electricity demand
- Scenario 3 – supplying 100% of FES Consumer Transformation forecast (2050) electricity demand
- Scenario 4 – supplying 80% of CCC balanced pathway forecast (2050) electricity demand

Four LZC power generation technologies were considered across the scenarios and compared with the district's total electricity demand during 2021, the forecast annual demand for 2050 and levels of LZC electricity generation during 2023[32].

Table 6, Table 7, Table 8 and Table 9 show the equivalent installed capacity for each technology in each scenario and the corresponding proportion of the district wide technical resource presented in Section 4.1. The tables also provide the equivalent scale of the technology when deployed at that level.

The technology mixes shown in these tables are for illustrative purposes only and based on expert judgement on what may be possible in the district. They are only intended to provide an idea of the scale of renewable energy deployment required under each scenario and how different technologies could help achieve that for Cotswold District.

Table 6: Scenario 1 – 50% of Cotswold's 2021 electricity demand met by LZC technologies

	Installed capacity (MW)	Annual yield (GWh)	Proportion of technical potential	Equivalent scale of technology
Rooftop solar PV	75.3	71.4	25%	25,090 domestic systems (3kW each)
Ground mounted solar PV	149.1	141.5	1%	3 km^2 of solar array
Wind power	0	0	0%	–
Energy crops[33]	0	0	0%	–

[32] LZC generation is based on those sites recorded in sub-regional FiT data (not updated since 2020 as no new FiT sites could be added after this date) and the Renewable Energy Planning Database (last updated July 2023).

[33] Use of energy crops may also produce useful heat, for example via combined heat and power plant, if it can be efficiently distributed to local demands.

Table 7: Scenario 2 – 100% of Cotswold's 2021 electricity demand met by LZC technologies

	Installed capacity (MW)	Annual yield (GWh)	Proportion of technical potential	Equivalent scale of technology
Rooftop solar PV	150.5	142.8	50%	50,180 domestic systems (3kW each)
Ground mounted solar PV	191.2	181.4	1%	3.8 km^2 of solar array
Wind power	18.6	39.0	0.4%	7 very large-scale turbines (2.5 MW each)
Energy crops	10	62.6	4%	23.8 km^2 of miscanthus plantation supplying one central generation plant.

Table 8: Scenario 3 – 100% of Cotswold's 2050 electricity demand met by LZC technologies

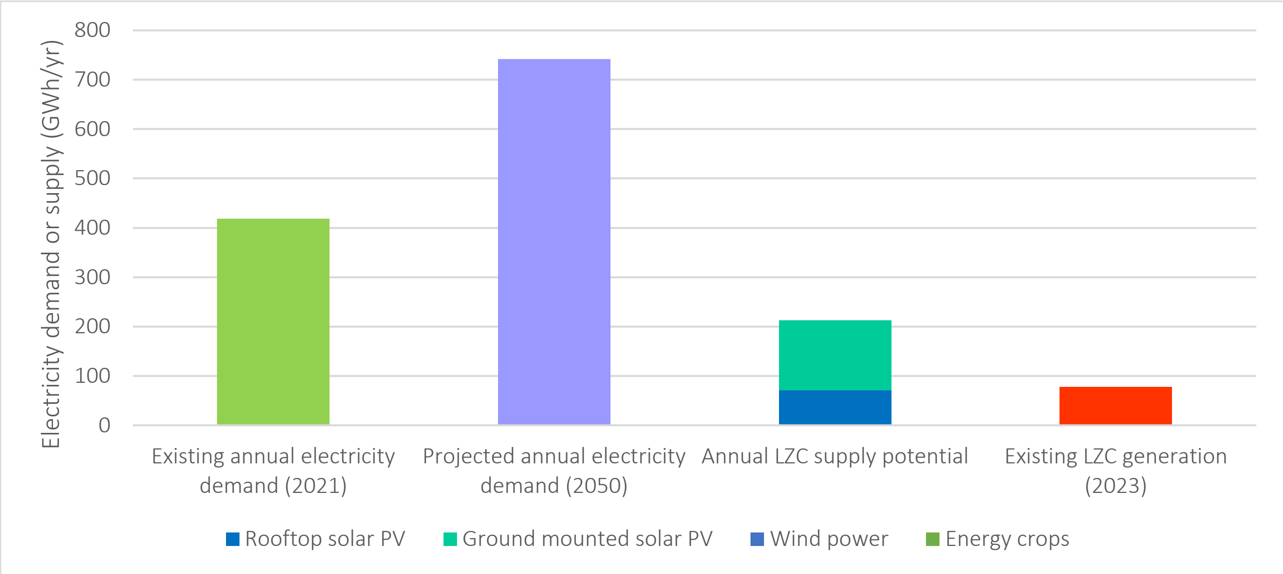
	Installed capacity (MW)	Annual yield (GWh)	Proportion of technical potential	Equivalent scale of technology
Rooftop solar PV	225.8	214.2	75%	75,270 domestic systems (3kW each)
Ground mounted solar PV	341.5	324.0	1%	6.8 km^2 of solar array
Wind power	67.3	140.8	1%	27 large scale turbines (2.5 MW each)
Energy crops	10	62.6	4%	23.8 km^2 of miscanthus plantation supplying one central generation plant.

Table 9: Scenario 4 – 80% of Cotswold's 2050 electricity demand met by LZC technologies

	Installed capacity (MW)	Annual yield (GWh)	Proportion of technical potential	Equivalent scale of technology
Rooftop solar PV	225.8	214.2	75%	75,270 domestic systems (3kW each)
Ground mounted solar PV	300.5	285.1	1%	6.0 km^2 of solar array
Wind power	47.5	99.2	1%	19 large scale turbines (2.5 MW each)
Energy crops	10	62.6	4%	23.8 km^2 of miscanthus plantation supplying one central generation plant.

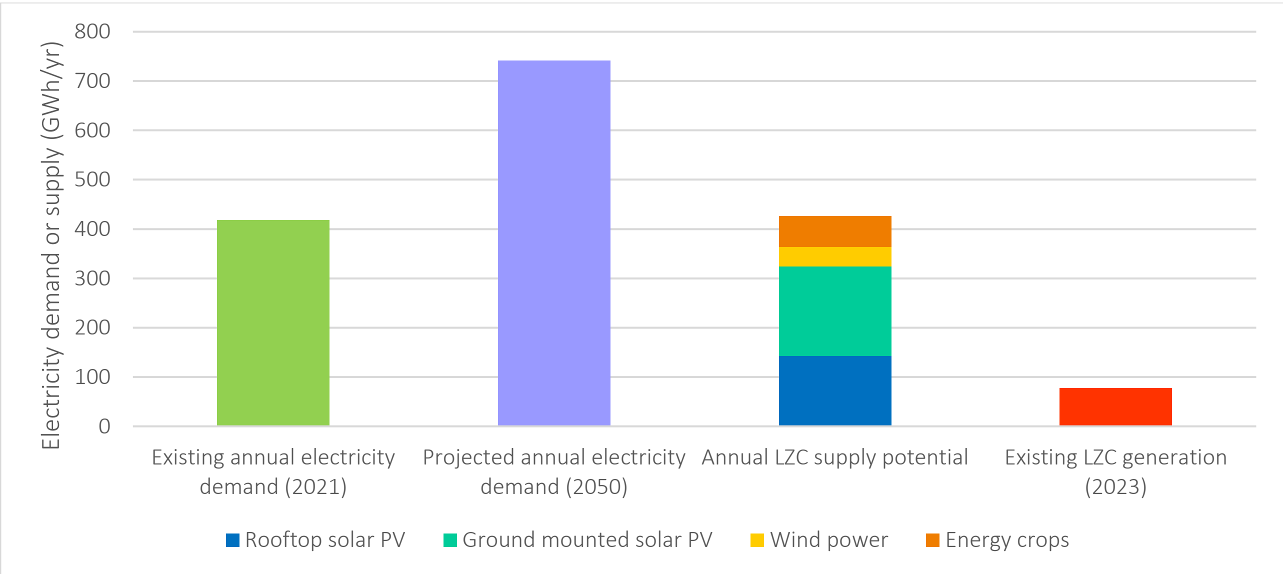
To illustrate how future demand could be met in scenario 1, the data presented in Figure 8 draws on the deployment of two technologies: 75 MW of rooftop solar PV and 150 MW of ground mounted solar PV. These together could provide approximately 50% of the total district's electricity demand from 2021 (214 GWh). This amount of solar PV would be around twelve times the existing installed rooftop capacity and double the ground mounted capacity installed as of 2021.

Figure 8: Example scenario 1 deployment



Scenario 2, shown in Figure 9, then adds wind power and energy crops to result in 375 MW of generation capacity, deployed to provide approximately 100% of the district's electricity demand from 2021 (436 GWh).

Figure 9: Example scenario 2 deployment



Scenario 3, illustrated in Figure 10, assumes the same technology mix as scenario 2, but increases the deployment capacities for solar PV and wind power to provide 672 MW, which would result in LCTs supplying the entire district's forecast electricity demand for 2050 (799 GWh).

Figure 10: Example scenario 3 deployment

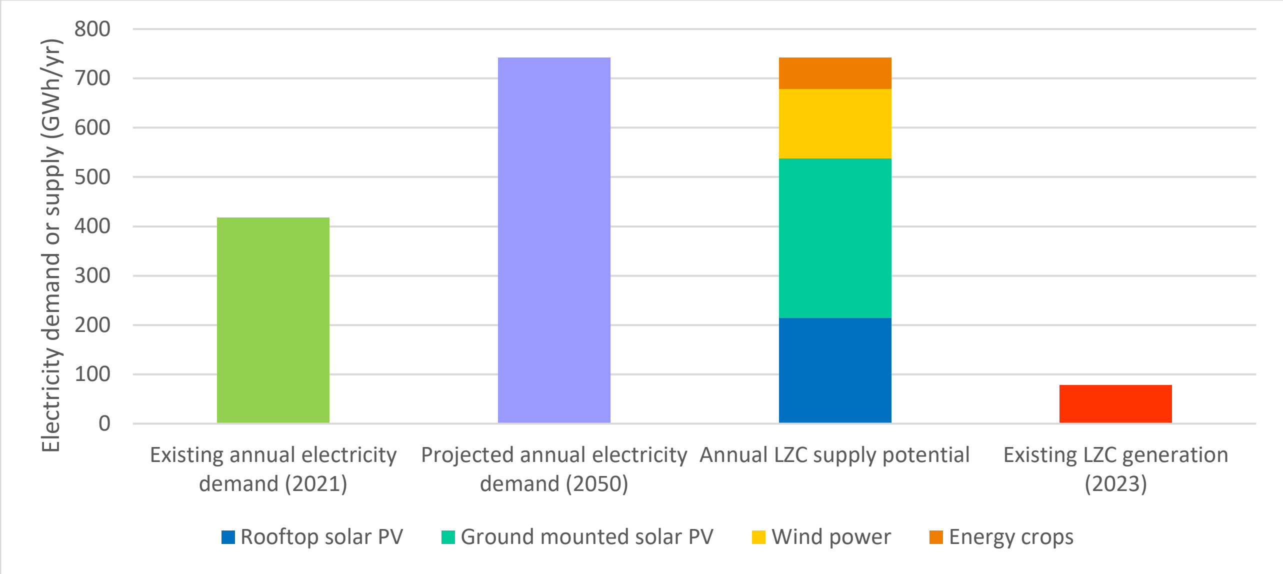
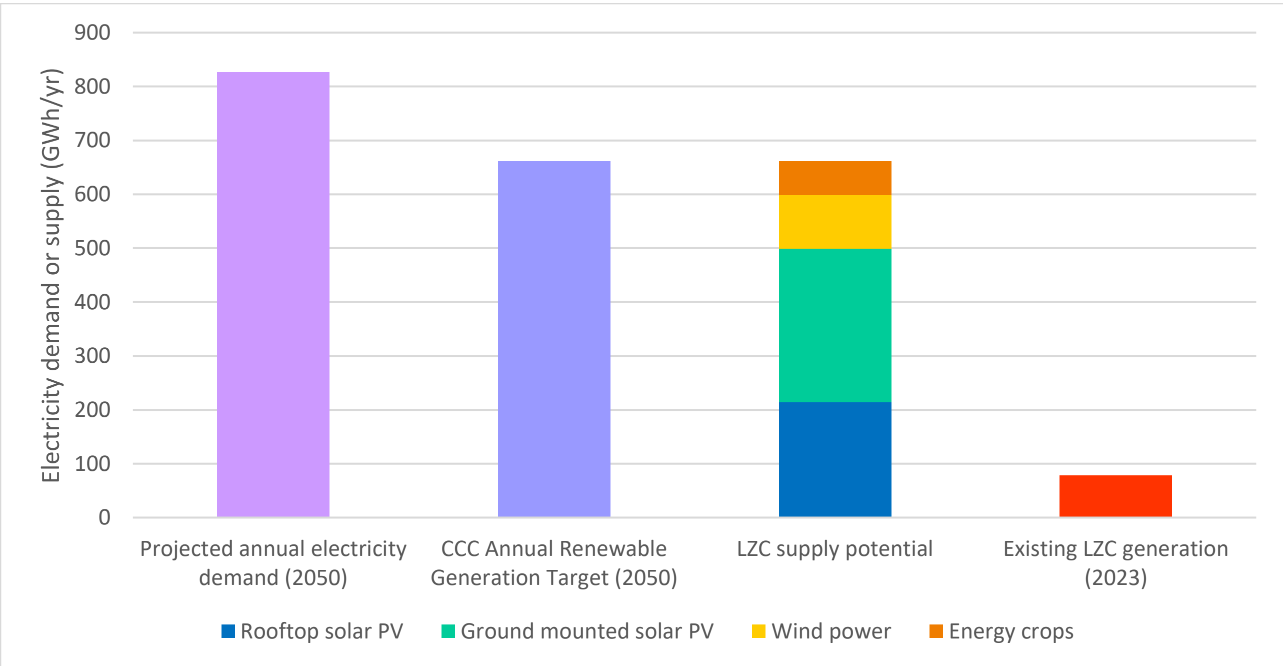


Figure 11 shows scenario 4, which diverges from FES assumptions and conforms to the target set in the balanced pathway of the 6th Carbon Budget report. This states that 80% of electricity demand should be met by variable renewables by 2050. This scenario uses a mix of the four energy sources to meet 2050 projected annual demand: 225.8 MW of rooftop solar, 300.5 MW of ground mounted solar, 47.5 MW of wind and 10 MW of energy crops.

Figure 11: Example scenario 4 deployment



4.3. Benefits, challenges and sensitivities of renewable energy development in Cotswold District

4.3.1. Environmental, social and economic impacts on Cotswold District

The benefits of renewable energy when used within a well-designed and efficient energy generation process are well proven as an alternative to fossil fuels. Chief among these is the ability to generate clean energy without contributing to greenhouse gas induced climate change, most notably through the absence of net positive carbon dioxide emissions.

Other more localised social and economic benefits arise through the decentralised nature of renewables and include:

- Increased security of energy supply, with lower, more stable energy costs likely in the longer term to help decrease fuel poverty.
- Local economic development through the introduction of new technologies and the need for a supporting local installer base and robust supply chains.
- Opportunities to raise income for local communities through the development of community energy projects, for example through Neighbourhood Plans.
- Flexibility on renewable energy technology types to suit different applications at different scales, including standalone or building integrated systems, as either retrofit or new build.
- Technologies such as wind and solar PV are well proven and quick to deploy, leaving zero or minimal impacts on the landscape once decommissioned. During operation, standalone installations can also allow additional agricultural uses of the land, such as crop cultivation or livestock grazing. Suitable habitat management plans alongside these can benefit nature conservation at the site.
- Improved local air quality through reduced fossil fuel use, including a decrease in nitrogen oxides (NOx) from phasing out natural gas combustion and fewer harmful transport emissions resulting from a switch from petrol and diesel to cleaner electricity[34].

To achieve these benefits, several challenges around the deployment at scale of renewable energy generation across the district will need to be overcome. The predicted increase in electricity demand up to 2050 will require a significant investment in power supply infrastructure to accommodate an increased number of decentralised generation plants. This will typically involve strengthening the grid and upgrading or adding substations, particularly where generation plants are located in more remote rural areas. Additionally, there is likely to be a

[34] However, note that some feedstocks used in bioenergy combustion processes can give rise to particulate emissions if these are not captured at the source.

need for new energy storage facilities with smart controls to provide flexibility and to help mitigate the issue of intermittency within renewable energy generation[35].

Further investment may be needed to tackle the costs of heat networks, should any prove viable in the district, and help higher capital cost heat pumps compete in the market with gas boilers. The gradual phase-out of gas boilers, along with national funding initiatives[36], may help to address this in the short term, but local schemes may still be needed to accelerate uptake and tailor roll-out to local needs.

Uncertainties around the environmental benefits and costs of using certain types of bioenergy will also need to be better understood by the Council before they can be confidently adopted as part of the future net zero energy generation mix (see Section 5).

4.3.2. Safeguarding sensitivities around the Cotswold National Landscape and other assets

It is inevitable that much of the wind power and ground mounted solar PV resource summarised in Section 4.1 falls with the Cotswold National Landscape, which covers around 80% of the district. A balance therefore needs to be struck between the need to generate 'home-grown' renewable energy across the district and the need to preserve the unique characteristics of the landscape.

To assist the consideration of landscape impacts, a landscape sensitivity assessment (LSA) to wind and large sale solar PV development was undertaken. The LSA method was developed in accordance with Natural England guidance and good practice. It assesses the potential impact of different scales of wind and ground mounted solar development on the landscape. It includes a set of criteria which cover the specific landscape and visual characteristics most likely to be affected by wind and solar energy development. These criteria include landform and topography, land cover pattern, historic landscape character, perceptual qualities and skylines/intervisibility.

LUC prepared the LSA for all areas outside of the Cotswold National Landscape and Cotswold District Council prepared the assessment of all areas within the National Landscape (using the same LUC methodology). The methodology and findings of the LUC LSA assessment are set out in Appendix C and the CDC LSA for the National Landscape is included in Appendix E.

The findings of the assessment of landscape sensitivity (for wind and ground mounted solar) were overlaid in GIS with the results of the assessment of technical potential (see Appendix A). These findings are set out in Figures 2.12 – 2.19 of Appendix C. The maps identify the landscape

[35] Local impacts of renewable power generation intermittency will also be decreased due to the diverse range of generating plant and storage at national level throughout the UK.
[36] These include the [Boiler Upgrade Scheme (BUS)] which will offer capital grants to property owners who wish to replace fossil fuel heating systems with heat pumps, and in limited circumstances, biomass boilers. Also, the [Green Heat Network Fund (GHNF)] aims to provide capital grants to low or zero carbon heat network projects.

sensitivity of areas identified with technical potential for wind and solar within the district. The key findings are listed below.

Ground mounted solar:

- There are significant areas with technical potential with low-moderate sensitivity to small scale solar (1-5ha) outside of the National Landscape. Within the National Landscape the sensitivity to small scale solar is moderate or moderate-high.
- There are some areas of low-moderate sensitivity to medium scale solar (5-20ha) outside of the National Landscape – particularly in the River Basin Lowland (TV1) and areas of moderate sensitivity – in the Cornbrash Lowlands (TV2), Dip Slope Lowlands (TC3) and Unwooded Vale (VE1C) character types. Within the National Landscape the sensitivity to medium scale solar is moderate-high.
- The sensitivity to large (20-50ha) and very large (50-120ha) solar is high across the district (both within and outside of the National Landscape) with the exception of the River Basin Lowland (TV2) and Unwooded Vale (VE12) character types, which are of moderate-high sensitivity to large scale solar.

Wind:

- There are significant areas with technical potential for small scale wind (up to 60m to blade tip) with low-moderate landscape sensitivity outside of the National Landscape. Within the National Landscape the majority is of high sensitivity, although there are some character types on the southern edge which are of moderate sensitivity to small scale wind.
- There are some areas of moderate sensitivity to medium scale wind (up to 100m to blade tip) outside of the National Landscape – particularly in the Dip Slope Lowland (TC3) and Unwooded Vale (VE1C) character types. Within the National Landscape the sensitivity to medium scale wind is high.
- The sensitivity to large (up to 150m to blade tip) and very large (up to 200m to blade tip) wind is high across the district (both within and outside of the National Landscape), with the exception of the Cornbrash Lowland (TV2) and Dip Slope Lowland (TC3) character types, which are of moderate-high sensitivity to large scale wind.

An appropriately worded planning policy on renewable energy proposals (see section 5.3) together with the energy opportunity maps included in Appendix C (Figures 2.12-2.19) will help to identify what areas are likely to be of greatest suitability for wind and solar within the district. These maps could be included within the Local Plan in compliance with Footnote 58 of the NPPF, which states that local authorities should identify areas of potential suitability for wind.

Requirements for comprehensive site-specific assessments at the planning application stage will also ensure that impacts of proposals on the environment, landscape, local communities and local amenity will be accurately assessed and where possible reduced to acceptable levels before approval. It is also vital to consult with the affected local community at an early stage and ensure their views are understood.

Building integrated generation technologies, such as solar PV, heat pumps or biomass boilers, may also impact characteristics of the built heritage in the district, although many historic buildings already have a significant degree of protection by means of listed building status or from being located in conservation areas. However, there are also many historic buildings that do not enjoy such protection and may be at a higher risk of cumulative impacts of measures which can impact the 'streetscapes' of where they are located. Again, in most cases a balance can be achieved in identifying and/or modifying LCT measures to make them sympathetic to a building's heritage significance. There is now a wide range of guidance on these issues published by Historic England.[37]

Lastly, it is important that the Council undertakes regular monitoring of renewable energy deployment across the district. Regular reviews of the rate of progress against expectations can identify when deployment might be stalling, why this may be occurring and what can be done about it. They may also identify when inappropriate or adverse impacts of renewable energy installations may arise, such as those from cumulative impact, and whether remedial action can be taken.

[37] For example, see: Generating Energy in Older Houses

5. Strategic recommendations and policy options

5.1. Strategic recommendations for renewable energy development

In setting out levels of ambition for local renewable energy generation, a challenge for local authorities and their communities is deciding on the extent to which they can and should contribute to national targets, bearing in mind national initiatives as well as their own constraints and opportunities with regard to developing local renewable energy resources. In other words, there is a question to consider around what would be a district's 'fair share' of technology deployment in tackling the UK's renewable energy deficit once national jurisdiction projects such as offshore wind and nuclear power are accounted for.

However, the lack of detail on how the UK will achieve 2050 net zero in practice, together with the complexity of issues to consider at the local level, make the setting of district-wide evidence-based renewable energy deployment targets a difficult process. As a way forward, the scenarios explored in Section 4.2.3, alongside other findings presented in this report, should help frame the debate on the levels of ambition that the district should adopt on its own path to net zero.

Deciding on an appropriate technology mix and the rate of deployment will depend on the views of a range of stakeholders and communities and their appetite for change. At a high level, this could consider whether the district should aim to be: a net-exporter of renewable energy; self-sufficient in most categories of energy provision; or accepting that the predominantly sensitive landscape means the district should limit its energy ambitions.

It is recommended that Cotswold District Council should facilitate and convene this debate. Such engagement could be twofold. Firstly, carrying out community engagement to inform the preparation of the Council's Local Plan (and updates) is required under its statutory duties as a local planning authority. Secondly, the 'general power of competence', introduced through the Localism Act 2011[38] enables local authorities "to do anything that individuals generally may do".

The Council is therefore not restricted in convening wider debate about how renewable energy deployment might be increased locally, for instance through the development of community energy projects, and should maximise its influence to promote renewable energy deployment in the areas described below.

[38] https://www.legislation.gov.uk/ukpga/2011/20/section/1/enacted

5.1.1. Supportive policy on renewable energy

In practice, technology-specific deployment targets will tend to be aspirational rather than robust evidence-based predictions due to the site-specific uncertainties in establishing the feasibility of deployment. The specific technology mix to be adopted on the path to net zero is therefore uncertain but the goal is clear, meaning that local authorities are obligated to encourage, or in some cases require, renewable energy development. They can do so by adopting appropriate and supportive criteria-based policies that aim to maximise deployment whilst minimizing adverse harmful impacts.

As noted above, planning for net zero in Cotswold District should be shaped by stakeholder consultation but should be pitched at levels of ambition that are in line with, or where appropriate, go beyond national policy. The resulting policies and strategies should also be aligned and compatible with those that deal with other aspects of climate change mitigation, such as energy efficiency, electrification of transport, renewable energy infrastructure development or waste management. Key policy options to consider are presented in Section 5.2 and recommended wording for renewable energy policy is in Section 5.3.

5.1.2. Low or zero carbon heat networks

District heating networks which make use of efficiently supplied ambient heat (from air, ground or water), waste heat or other LZC heat sources are expected to play a key role on the UK's path to net zero. Although these will predominantly feature in larger cities and dense urban areas, there may also be opportunities within smaller towns typical of those in Cotswold District. Therefore, further investigation should be actively encouraged, particularly within major new developments or where suitable heat supplies are identified. This should build upon the analysis of Heat Focus Areas and the illustrative THERMOS modelling presented in Appendix A. Heat networks can also be encouraged through appropriate local policy requirements, including a heat hierarchy which underpins energy performance standards for new development (see Section 5.2.2) and through further strategic work preparation to fulfil the coordinator role as a local authority in the emerging heat network zones[39].

5.1.3. Individual building heat supplies

For new development, where connection to a heat network is shown to be unviable, the decarbonisation of heat supplies to individual buildings can again be enforced via appropriate energy performance standards in local policy. Such policies should be mindful of existing or proposed national policy regarding the energy performance of buildings, such as the Future Homes Standard and the Written Ministerial Statement (WMS) in respect of local energy efficiency standards[40]. However, they can also offer opportunities to go beyond national requirements and/or accelerate their implementation. Energy performance standards should encourage the phase-out of gas boilers, but along with heat pumps they should also permit

[39] https://www.gov.uk/government/collections/heat-network-zoning
[40] https://questions-statements.parliament.uk/written-statements/detail/2023-12-13/hcws123

other LZC heating options where appropriate, such as use of specific types of bioenergy or solar water heating.

For existing development, the roll-out of heat pumps is expected to be the predominant technology to displace gas boilers in a location like the Cotswold District. The Council can facilitate their deployment in a number of ways, including:

- Promoting and/or funding retrofit and energy efficiency programmes to reduce heat demand across the existing building stock to levels considered more feasible for heat pump installations. This may also include retrofitting low temperature heat distribution systems to ensure compatibility with heat pump systems.
- Encouraging retrofit rooftop solar PV systems which will help to lower running costs of heat pumps whilst contributing to the district's zero carbon power generation capacity.
- Promoting and encouraging the phase-out of gas boilers during retrofit measures on existing buildings where feasible.

5.1.4. Appropriate use of bioenergy

To varying extents, bioenergy is factored into all major national scenarios being proposed to achieve net zero by 2050, including those of the Committee on Climate Change and National Grid presented in section 4.2. There is also a reliance on bioenergy carbon capture and storage (BECCS) being deployed on large scale generation plants to remove residual emissions from the supply chain and potentially make the process carbon-negative overall.

However, this technology carries a risk in relation to how soon it can be successfully developed and rolled out, because it is not yet technologically or economically proven at scale. Additionally, bioenergy resources are diverse, therefore increased scrutiny should be placed on those types of feedstock where there is more uncertainty on the actual carbon emissions savings they achieve in practice, in addition to whole-life sustainability impacts or air quality issues that may result from their use.

In particular, the combustion of woodfuel should only be encouraged where it can be demonstrated that the resulting life-cycle emissions and environmental impacts are acceptable when compared to alternative end-uses for the wood. This invariably means that supplies should be sourced very locally to their end use and that there is sufficient confidence that re-growth of equivalent amounts of biomass will be achieved in an acceptable timeframe. Purpose-grown energy crops are more likely to achieve shorter predictable re-growth timescales, although impacts of resulting changes in land use are an additional consideration. In general, biogas production from sewage, agricultural waste and food waste should be encouraged, with potential end-uses including electricity and heat production (e.g. as part of a heat network), or injection into the gas grid.

With these issues in mind, the Council should consider exploring criteria-based local policies to encourage renewables which include bioenergy where its use can be demonstrated as beneficial and fit for purpose. For example, these could include requirements for project proposals to include robust whole-life net emissions calculations including supply chains. However, validating these may prove complex and will require keeping up to date with the latest thinking and research on the issues. Although the district-wide technical resource of the main types of bioenergy has been estimated, it is currently difficult to estimate the extent to which these may be deployed in the future.

5.1.5. Facilitating community energy and neighbourhood planning activities

Existing Council links to local community energy groups should be utilised to offer assistance to those wishing to identify, assess and develop local sites for renewable energy projects. The Council could provide funding and/or a supporting facilitation role in a number of areas. This could include: helping to identify sites through the wind and solar mapping work described in this report; advising on feasibility issues or partnering on share offers and publicity activities; and/or exploring the potential to utilise Council land for community energy projects. Similar services could be provided to communities when developing Neighbourhood Plans and the Council could also actively support community consultation activities where appropriate.

5.1.6. Renewables within the corporate estate

The Council should lead by example by exploring all opportunities to develop renewable energy supplies across its own estate. It should exploit any advantages conferred by local authority property and land ownership, access to finance and knowledge of site energy consumption data. This should include local authority assets in conjunction with those of Gloucestershire County Council which may be located within Cotswold District. Specific opportunities include:

- Further analysis of the rooftop solar PV assessment dataset to filter out the modelled best performing public and local authority-owned buildings.
- Identification and evaluation of any least-constrained sites from the wind and ground mounted solar PV assessment that may fall within the estate.
- Further assessment of ‘anchor load’ heat demands or potential energy centre locations within the estate which may benefit the development of a district heating network.
- Inclusion of a renewable heating options appraisal as part of building refurbishment projects to include use of air, ground or water source heat pumps.

5.1.7. Internal resourcing

Strong policies to encourage renewables and enforce challenging energy standards for new developments will oblige local authorities to build sufficient resource capacity and expertise to manage and implement the requirements. Development management, in particular, will need to understand the implications of processing planning applications and be familiar with the most common solutions. As a result, they could confidently enter into negotiations with developers and adopt systems for checking compliance. Tasks that are most likely required when implementing policies and facilitating the development of renewables include:

- The provision of detailed information on the assessment process to officers in both Planning and Development Management, as well as other officers involved in sustainability issues.
- The provision of detailed information on renewable energy and low carbon technologies to officers in both Planning and Development Management.
- The provision of guidance to planners on how to ensure that the benefits of climate change mitigation are taken into account and given due weighting in the planning process when considering proposals for renewable energy projects.
- The provision of clear and detailed advice to developers during up-front negotiations, such as the scope and format of an energy strategy, potential funding options and advice on market leadership and development selling points.
- Specification of monitoring requirements for installations.
- Monitoring and wider communication of overall progress regarding development of renewables throughout the district, including public engagement and facilitation of community energy development activities.

5.1.8. Wider community engagement and facilitation of partnerships

In addition to working with community energy groups, the Council should maximise its influence and reach in engaging with wider stakeholders across the district to promote and enable the deployment of renewables. Key recommendations are as follows:

- The Cotswolds National Landscape covers 80% of Cotswold District and therefore hosts the majority of the mapped technical resource for wind power and ground mounted solar PV. The Council should therefore liaise closely with the Cotswolds Conservation Board in planning for net zero and maximising the deployment of renewables whilst minimising as far as possible any adverse impacts.
- The much higher levels of electricity demand and new renewable power generation foreseen across the district in the run up to net zero will require major strengthening of the local power grid. Productive engagement with the local DSOs (National Grid Electricity Distribution and Scottish and Southern Energy Networks) on proactive plans for strengthening grid capacity and new energy storage projects is therefore essential.
- Opportunities to facilitate community and business partnerships across a range of stakeholders should also be exploited, including local supply chains and installers of renewable energy equipment. Bulk purchase and ‘reverse-auction’ schemes can result in

significant cost savings and improve the viability of deployment. They also can, for example, potentially form part of a packaged service offer to consumers.[41]

- Council involvement in site development is also possible and there are several options on how such projects can be delivered. Key dependencies include the financial business case and who ends up owning the equipment along with the Council's attitude to risk and the resources it can make available to undertake processes such as due diligence, procurement, project management and operation of the site. Local authority ownership of solar farms has increased significantly in recent years[42], although such investments now need to be considered in a subsidy-free environment. The leasing of Council owned land could be a simpler option and may provide an opportunity to actively engage with community energy groups, although in most cases this would also require working alongside developers.[43]

- The Council can also take forward its community leadership role in terms of communicating the arguments, raising awareness of climate change and advising on community and individual action. This may involve making use of effective communication channels, including social media, to clearly highlight funding opportunities and the local environmental, social and financial benefits of renewable energy projects. In addition, collaboration with other local authorities in Gloucestershire and intermediary agencies is recommended to help build capacity and technical expertise in the sector.

5.1.9. Local Area Energy Plans

Local area energy plans (LAEPs) can support local authorities achieve their net zero goals by adopting a whole system approach to the decarbonisation of the local energy system. An LAEP for Cotswold District could complement the renewable energy study by providing a route map with clear timescales and recommendations for achieving net zero.

This could expand on the technical analysis undertaken for the renewable energy study to fully assess how to decarbonise heat, transport and energy systems in the local area. The LAEP should also include a considered analysis of key non-technical factors (such as local programmes, capabilities, initiative-taking, policies, funding available, commercial attractiveness, socio-demographic factors, fuel poverty, etc.) to determine the changes needed to successful achieve net zero in a timely and cost-effective manner.

[41] For example, see https://solartogether.co.uk/bristol/home and www.energyservicebristol.co.uk/business/solar/

[42] For example, Public Power Solutions, a company developing community focused solar farms spun out of a project by Swindon Borough Council: www.publicpowersolutions.co.uk

[43] For example, see www.bristol247.com/news-and-features/news/englands-tallest-wind-turbine-step-closer-to-being-built-in-bristol/

5.2. Policy options

Alongside the strategic recommendations discussed above, there are a number of specific policy options the Council can consider in order to encourage the appropriate development of renewables across the district. These are summarised below.

5.2.1. Deployment targets for renewables

As discussed in Section 5, the levels of ambition for local renewable energy generation needs to be shaped by the views of stakeholders throughout the Cotswold communities and should consider what may be the district's 'fair share' of technology deployment, accounting for local circumstances and national initiatives (i.e. those beyond the scope of the Council's influence) in tackling the UK's renewable energy deficit in the run up to net zero.

Agreeing a trajectory of deployment targets will therefore be challenging, not least because of the lack of detail on national initiatives and the complexity of issues to consider at the local level. Targets may act as a further incentive and material consideration within the local planning process but will tend to be aspirational due to a high degree of uncertainty in terms of both the rate at which they can be realised and the technology mix that will be adopted.

However, at a high level, the scenarios explored in Section 4.2.3 can set the scene and inform the debate. These consider whether the district should aim to be: a net-exporter of renewable energy; self-sufficient in most categories of energy provision; or accepting that the predominantly sensitive landscape means the district should limit its energy ambitions.

Strengths	Weaknesses
• Provides an overarching target which will be a material consideration in the planning process. • Provides a clear indication of the level of ambition proposed in contributing to national net zero targets.	• Targets likely to be aspirational and carry a risk of not being achieved in practice. • Difficult to develop an evidence base that is prescriptive about technology mix. • Requires a consensus through stakeholder consultation, which may be complex and resource intensive.

5.2.2. Criteria-based policies for development of renewables

Criteria-based policies should be designed to allow a local authority to maximise the development of renewables whilst minimising adverse impacts, particularly with regard to local sensitivities and characteristics. Well-written policies should clearly set out the circumstances in which renewable energy proposals will and will not be permitted but should be framed positively in terms of a principled underlying support for renewable energy generation.

Policies should not conflict with those set out at national level in the NPPF and should be mindful of the guidance included in NPPG on the criteria to consider for specific technologies. If thought appropriate, more detailed supporting guidance could be developed within a Supplementary Planning Document. The key generic points to consider include the following:

- Local topography and cumulative impacts – particularly with wind and ground mounted solar PV and their impact on different landscapes, as the number of developments increase.
- Heritage assets – impacts on the significance of a heritage asset or on the surrounding views that may be important to their setting.
- Proposals in and around designated landscapes – impacts on the special qualities of the designation. This is directly relevant to the Cotswold National Landscape, which has its own position statement on the development of renewable energy within the protected area.
- Protecting local amenity – impacts on inherent characteristics that benefit a location or contribute to its enjoyment and value. This could include residential visual amenity, noise, air quality, etc.
- Buffer zones or separation distances – renewable energy proposals should not be ruled out as a result of inflexible rules on buffer zones or separation distances. Other than when dealing with set back distances for safety, distance of itself does not necessarily determine whether the impact of a proposal is unacceptable. Distance must be considered in the context of other local factors such as topography, the local environment and near-by land uses.

Strengths	Weaknesses
• Creates greater policy certainty for developers. • Allows the Council to clearly set out the circumstances in which renewable energy proposals will and will not be permitted.	• May be perceived to be overly restrictive by certain stakeholders.

5.2.3. Enhanced energy standards in new development

Consideration should be given to the setting of energy performance standards for new development that are in excess of those required by Part L of the Building Regulations. An ambitious but achievable approach for residential development might follow that recently proposed by Cornwall Council, which requires developers to meet net zero operational emissions on site (operational emissions include those end uses that are currently classed as regulated and unregulated). Cornwall's Climate Emergency Development Plan Document (DPD) builds upon proposals published by LETI[44], which recommend setting an Energy Use Intensity (EUI) target (in $kWh/m^2/year$) and a space heat demand target, banning the use of fossil fuels on site. They also recommend requiring the installation of sufficient onsite renewable generation to match the building's demand. In cases where the requirement for renewables is deemed not to be viable, LETI suggest the use of Renewable Energy Credits to fund off-site installations. However, Cornwall Council has proposed a more traditional offsetting approach with developers making payments to a Council-run fund, albeit with this fund targeted at the installation of rooftop solar on Council housing[45].

If such policies are pursued, careful thought should be given to the Written Ministerial Statement issued on 13 December 2023[46], which deters plan-makers from setting local energy efficiency standards for buildings that go beyond current or planned Building Regulations. The WMS states:

> "Any planning policies that propose local energy efficiency standards for buildings that go beyond current or planned buildings regulation should be rejected at examination if they do not have a well-reasoned and robustly costed rationale that ensures:
>
> - That development remains viable, and the impact on housing supply and affordability is considered in accordance with the National Planning Policy Framework.
> - The additional requirement is expressed as a percentage uplift of a dwelling's Target Emissions Rate (TER) calculated using a specified version of the Standard Assessment Procedure (SAP)."

The second bullet, whilst lacking justifying arguments, directly challenges the use of policies framed around an energy intensity metric. However, open legal advice[47] commissioned by Essex County Council, reflecting on the WMS and the successful Judicial Review of the Salt Cross examination, recommends that the WMS is treated with circumspection. It also notes that the WMS must be interpreted in a way that allows for the effective operation of local planning authorities' power to set their own energy efficiency standards in their plans, including the use of metrics other than those specified in the WMS.

A policy approach based on energy targets, rather than carbon targets, avoids uncertainty around the use of an appropriate carbon factor for grid electricity and means that post-occupation monitoring to help evaluate the effectiveness of the policies and encourage ongoing compliance is more straightforward. Monitoring and reporting requirements on energy use

44 The London Energy Transformation Initiative: https://www.leti.london/
45 www.cornwall.gov.uk/media/mg5frwsk/cedpd-policy-sec1-2b-renewable-energy-off-setting.pdf
46 https://questions-statements.parliament.uk/written-statements/detail/2023-12-13/hcws123
47 www.essexdesignguide.co.uk/climate-change/essex-net-zero-evidence/essex-open-legal-advice-energy-policy-and-building-regulations/

during the first years of operation is recommended. Policies framed around an Energy Use Intensity metric are also likely to make offsetting regimes more robust and easier to administer.

Compliance with EUI targets can be demonstrated through the provision of Standard Assessment Procedure (SAP) output documentation, alongside a calculation to convert these outputs into a consistent format and to account for recent improvements in the efficiency of home appliances that are not yet reflected in the SAP assumptions[48]. A simple calculation methodology is suggested in Cornwall Council's Technical Evidence Base for Policy SEC 1. This approach implicitly aligns with the energy hierarchy.

The Council may also wish to set requirements for new development that refer to the achievement of third-party certification standards such as BREEAM or NABERS UK. Whilst these schemes ensure high all-round environmental standards are met, they are not in themselves designed for the purpose of delivering zero or nearly zero carbon buildings, even where scoring is high. In order to set out how the energy targets implied in these standards would be met, energy statements from developers would be required based on a detailed template.

Targets for embodied emissions for new development may be difficult to enforce at this time, however a requirement for Circular Economy Statements and whole life carbon assessments for major developments that are based on a recognised methodology could help to support the development of industry skills in this area and to gather information that can be used to inform future targets.

Finally, policy relating to the provision of electric vehicle charging infrastructure could be considered, for example requiring applications for residential developments with off-street parking to accommodate an active EV charging point per dwelling. It could also be stated that all applications for non-residential development must include at least 25% of their car parking provision to be served by active electric vehicle charging infrastructure and a further 25% of passive infrastructure to allow for future capacity, with a minimum of one parking space serviced by electric vehicle charging infrastructure for all schemes.

Policy for enhancing the energy performance of new development should be adequately supported by development management resource.

[48] https://www.gov.uk/guidance/standard-assessment-procedure#:~:text=The%20Standard%20Assessment%20Procedure%20(%20SAP%20)%20for%20the%20energy%20rating%20of,L%20of%20the%20Building%20Regulations

Strengths	Weaknesses
• Low/zero carbon energy efficient homes have already been built at scale and the standard can be met using traditional construction methods and materials without adding substantial development costs. • The evidence needed to confirm compliance can be prepared by the developers in a consistent easy to measure way. • Enhanced building energy performance standards represent a cost-effective way of contributing to climate change commitments. • Policies can be shaped to future-proof buildings to avoid the need for retrofitting in the future.	• To minimise the risk of challenges, developers need to be convinced of the benefits of going beyond the Building Regulations requirements and that there is no 'undue burden' or insurmountable impact on viability. • Enhanced building energy standards may still incur additional development costs. • There is some uncertainty over the standards that will result from the interim update to Part L of the Building Regulations due in 2022 and their compatibility with locally set standards.

5.2.4. Identification of areas suitable for renewable energy

The NPPF and NPPG encourage local planning authorities to *"consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure."* Identifying and mapping areas that may be suitable for specific types of renewable energy assumes a different approach to criteria-based policies but should not replace them. Suitable areas should be considered alongside relevant criteria-based policies when assessing proposals.

Currently, there is a requirement in the NPPF that planning applications for wind turbines should not be approved unless the proposed development site lies in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan. Additionally, it should be demonstrated that the planning impacts identified by affected local communities have been appropriately addressed and the proposal has community support. Care should be taken to avoid the case where onerous requirements for local community backing may begin to act as an undue barrier to development. Areas (or buildings) identified as having the most potential for heat networks or rooftop solar can also be mapped to help focus their development in the most appropriate locations – see also Section 5.2.5.

The NPPG states that "there are no hard and fast rules about how suitable areas for renewable energy should be identified, but in considering locations, local planning authorities will need to ensure they take into account the requirements of the technology and, critically, the potential impacts on the local environment, including from cumulative impacts. The views of local communities likely to be affected should be listened to."

The technical resource assessments for wind power and ground mounted solar PV summarised in Section 4.1 have resulted in mapped areas across the district which are not affected by the constraints considered. Although in NPPF policy terms these could be considered 'suitable areas' for the respective technologies, it is important to remember that all proposals will still be subject to site-specific assessment which will consider any additional localised constraints, in addition to the relevant criteria-based policy on renewable energy proposals.

In addition to the technical constraint maps, the Landscape Sensitivity Assessment described in Section 5.3.2 and in set out in Appendix C has produced an additional mapped layer of potential constraint regarding the landscape sensitivity of wind turbines and ground mounted solar PV. The technical constraint maps were overlaid with the LSA map to help identify the areas which are least constrained both in terms of technical constraints and landscape sensitivity. This can also help to identify what scale of turbine may be appropriate in which areas. These maps could potentially be referenced in a relevant renewable energy policy as outlined above.

Strengths	Weaknesses
• Enables planners to have informed discussions with developers and communities about potential opportunities for wind, i.e. proactive rather than reactive planning. • Meets NPPF, NPPG and WMS in that local planning authorities should consider identifying suitable areas for renewable and low carbon energy sources and supporting infrastructure. • Meets specific NPPF footnote 58 requirement that planning applications for wind energy development should not be considered acceptable unless it is in areas identified as suitable for wind energy development in the Local Plan or SPD. • Can act as a useful tool for neighbourhood planning.	• There may be concern that it will lead to multiple wind energy applications within the areas identified as being suitable for wind. However, all applications would still need to be assessed on their own merits, in isolation and in combination with existing developments, and it would not be a replacement for detailed site studies. They would also have to have community support (in line with footnote 58 of the NPPF). • It does not provide a definitive statement on the suitability of a certain location for wind turbine development – each application must be assessed on its own merits. It is not a replacement for detailed site studies.

5.2.5. Development of 'energy opportunity maps'

In addition to the wind and ground mounted solar PV maps described above, other resources or technologies can potentially be mapped to geographically indicate areas of opportunity. The Heat Focus Areas identified in Appendix A are intended to show locations where district heating networks may have most potential. Similarly, the rooftop solar PV assessment (Appendix A) has estimated the potential for solar PV across all rooftops in the district, with the resulting dataset providing the opportunity to map the most promising buildings within specific building categories.

Such 'energy opportunity maps' could be used to support criteria-based policies, potentially within a Supplementary Planning Document, or as part of the evidence base which informs updates to the Local Plan. They can also help to inform community energy initiatives or projects being proposed by neighbourhood planning groups as well as commercial developers.

Strengths	Weaknesses
• Enables planners to have informed discussions with developers and communities about potential opportunities for renewable and low carbon energy technologies – i.e. proactive rather than reactive planning. • Meets NPPF, NPPG and WMS in that local planning authorities should consider identifying suitable areas for renewable and low carbon energy sources and supporting infrastructure. • Can act as a useful tool for neighbourhood planning.	• Not possible to identify locations for all types of renewable energy technologies. • It does not provide a definitive statement on the suitability of a certain location for a particular development – each application must be assessed on its own merits. It is not a replacement for detailed site studies. • May identify potential areas for renewable energy development which are unpopular.

5.2.6. Allocation of sites for standalone renewable and low carbon energy developments

The allocation of sites for standalone renewable and low carbon energy developments can potentially provide more strategic direction to the siting of renewables and help prioritise sites which may otherwise be developed for other purposes. It can also broaden the appeal of such sites, which may be constrained in ways that make them less attractive to commercial developers but still of interest to other stakeholders such as landowners or cooperatives.

Alternatively, or in addition, the Council could undertake a 'call for sites' exercise for renewable and low carbon development and consider the merits of promoted sites in isolation or in combination with other planned types of development. It should however be noted that such exercises tend to generate a relatively poor level of response.

It is important to highlight that allocated sites will still be subject to detailed site-specific assessment as part of any planning proposals and should not preclude projects in other areas.

Strengths	Weaknesses
• Provides strategic direction to the siting of renewables. • Ensures sites with the greatest potential are identified. • May promote sites to a wider audience such as cooperatives.	• Resource intensive to gather necessary evidence to justify allocation. • Would be desirable to secure agreement of landowner which may be resource intensive. • May identify potential sites for renewable energy development which are unpopular.

5.2.7. Encouraging community renewables

The NPPF states that local authorities should support community-led initiatives for renewable and low carbon energy, including developments being taken forward through neighbourhood planning. As recommended in Section 5.1, the Council should therefore offer assistance to community-led renewable energy projects. These are increasingly being seen as an attractive option for local communities wishing to contribute to local and national climate change targets, and as a way to generate local revenue to directly benefit the community.

Community groups can face considerable challenges in the pre-planning stage and there are several opportunities for local authorities to provide valuable support and guidance throughout this stage. They can provide early advice on planning requirements and lend resources to consultation activities within the community.

The Council could broaden its support for community renewable schemes by adopting policy which states that it would actively encourage such schemes which are led by or meet the needs of local communities. Neighbourhood planning provides a particular opportunity to define detailed local site allocation policies for renewable and low carbon technologies.

Strengths	Weaknesses
• Provides support to local communities to develop renewables and low carbon energy. • Increases potential to generate local revenue to directly benefit the local community. • Can secure a broad base of local support for renewable energy schemes.	• Care may need to be taken not to prescribe the process of community ownership (e.g. shared ownership) as it is not the role of the planning system to do this.

5.3. Recommended policy wording for the Local Plan update

CSE and LUC have worked with CDC to draft suggested wording for a new renewable energy policy to be included in the Cotswold Local Plan update. The proposed policy reflects the findings and recommendations of the renewable energy study work presented in this report and accompanying appendices. The recommended policy set out below is intended to replace the adopted Local Plan Policy INF10: Renewable and low carbon energy development.

Policy CC2a: Renewable and low carbon energy generation, storage and transmission

1. In the context of the Council's climate emergency declaration, proposals for renewable and low carbon energy generation, energy storage and distribution networks will be permitted where they contribute to generating Cotswold District's electricity demand from renewable sources or alleviate grid constraints and/or allow further renewable developments to be deployed. Proposals will meet all the following requirements:

    a) they balance the wider environmental, social and economic benefits of renewable electricity, heat and/or fuel production and distribution; and

    b) they will not result in significant adverse impacts on the local environment that cannot be satisfactorily mitigated, including cumulative landscape and visual impacts, the special qualities of all nationally important landscapes, and the significance of heritage assets including their settings, and the character of wider historic townscapes and landscapes; and

    c) they will not result in significant adverse impacts on the users and residents of the local area, including, where relevant, air quality, water quality, traffic, vibration, noise, dust and odour; and

    d) they will not result in significant loss of the best and most versatile agricultural land (Grades 1, 2, and 3a) unless exceptionally justified or significant sustainability benefits are demonstrated to outweigh any loss; and

    e) the development provides for a minimum of 10% Biodiversity Net Gain, and, where the current use of the land is agricultural, the use allows for the continuation of the site for some form of agricultural activity proportionate to the scale of the proposal, where feasible; and

    f) commercial-led energy schemes with a capacity over 5MW shall provide an option to communities to own at least 5% of the scheme subject to viability; and

    g) there are appropriate plans and a mechanism in place for the removal of the technology on cessation of generation, and restoration of the site to its original use or an acceptable alternative use; and

    h) they are compatible with surrounding land uses, such as military activities.

2. Proposals for renewable energy that affect the Cotswolds National Landscape must demonstrate the benefits of development outweigh harm to the designated area or its setting.

3. Proposals for battery and other zero carbon energy storage systems and balancing plant will be supported where the visual impact of associated development and plant is minimised or mitigated, and safety risks are adequately managed or mitigated. Balancing plant that increases the District's carbon emissions, for example those that burn fossil fuels directly, such as gas or fuels derived from oil, will be refused unless it can be demonstrated by the applicant that the objectives of the proposal could not feasibly be met by zero carbon alternatives such as battery storage.

Policy CC2b: Wind energy development

1. Wind energy development proposals will be permitted where they:

   a) avoid or adequately mitigate shadow, flicker, noise and adverse impact on air traffic operations, radar and air navigational installations; and

   b) do not have an unacceptable overbearing effect on nearby habitations; and

   c) do not lie within an area of high landscape sensitivity within the Cotswolds National Landscape.

   Wind energy proposals are more likely to be supported if they are located in a 'broadly suitable area' identified on the Policies Map and as defined in the Renewable Energy Study, are for the repowering of an existing wind turbine / farm, or if they comprise community energy schemes as defined in policy CC2d.

2. Proposals should clearly demonstrate that the scale of the development is appropriate to the site, the benefits of the development outweigh any harm to the local community, and the development complies with criteria CC2a (a) – (g) and CC2b (a) – (d) above.

Policy CC2c: Roof mounted and ground mounted solar panels

1. Where planning permission is required for building-mounted solar thermal and photovoltaics panels and the development of solar arrays on gantries over car parks, appropriate proposals will be supported and encouraged, including within conservation areas. Where listed building consent is required, proposals will be assessed against policy CC1. Standalone ground mounted installations and extensions or repowering of solar installations will be supported in accordance with policy CC2a.
2. In addition, ground mounted solar energy development proposals will be supported where they:
   a) are located in a 'broadly suitable area' identified on the Policies Map and as defined in the Renewable Energy Study; and
   b) avoid the unavoidable loss of hedgerow and woodland connectivity unless appropriately mitigated; and
   c) avoid the loss and deterioration of UK priority habitats (as shown on the Policies Map); and
   d) meet current best practice guidelines and standards on protection and enhancement of biodiversity.
3. Encouragement will be given to ground mounted solar developments that incorporate public access, where possible.
4. Ground mounted solar energy proposals are more likely to be supported in locations with technical potential for solar and in areas of lower landscape sensitivity (for the size of development under consideration). However, applications can be submitted in all areas and will not necessarily be refused in areas of higher landscape sensitivity, provided that the adverse impacts on the landscape can be satisfactorily addressed.

Policy CC2d: Community renewable energy schemes

Significant weight will be given to community led energy schemes where evidence of community support can be demonstrated, with administrative and financial structures in place to deliver / manage / own the project and any income from it. Encouragement will be given to schemes to provide for a community benefit in terms of profit sharing or proportion of community ownership and delivery of local social and community benefits.

6. Achieving Net Zero

Cotswold Council's ambition to become a net zero district, in line with the national full net carbon neutrality by 2050 target, has been the drive behind their climate emergency declaration and associated current Local Plan review. Whilst this national and local ambition may be challenging in light of the unprecedented rate and scale of change required across all sectors to reach the target, with momentum and motivation there are options and routes for Cotswold to pursue to successfully become a net zero district. A radical and transformative approach will be required, which combines the application of technologies and techniques with ongoing public and business engagement.

This study was commissioned with the intention of providing a sound technical evidence base to underpin decisions for strategic renewable energy development and proposals for planning and energy policies. The assessment focuses on the recommended interventions for net zero carbon development, sustainable building design and renewable energy. The ongoing Local Plan review provides a valuable opportunity for securing ambitious yet achievable policy options and targets for a net zero district, whilst maximising positive local action and public engagement on climate change. To this end, proposed policy wording for inclusion in the Local Plan update process has been included in this renewable energy study, alongside a review of various other policy options that the Council may wish to explore.

Whilst local authorities are reliant on decarbonisation of the national grid to become net zero and fulfil their own policy commitments, which in turn is dependent on timely national policies and legislation being implemented, this should not hinder their motivation to tackle emissions in key sectors that they can influence. In sectors like power and heat generation, existing and new buildings, surface transport and waste, local authorities have a deep understanding of the local area needs, opportunities and constraints. Working in engagement with their residents, social landlords, major employers, community leaders, planning authorities and service providers will help achieve local ambitious climate goals.

The recommendations presented in this study should be taken forward alongside an integrated programme of stakeholder and public engagement. All policy recommendations should also consider viability issues, for which further work will be required. Changes will also be required to how policies are implemented in ensuring that the urgency and value of addressing climate change and reaching net zero is at the core of all development management decisions.