Annual Report 2023

Centre for Energy and the Environment

About SWEEG

The South West Energy and Environment Group (SWEEG) is a collaborative research partnership between public sector organisations in the South West which aims to share information and research on energy and environmental issues in the built environment.

The Centre for Energy and the Environment coordinates and carries out technical research for the group. Research completed by the Centre is disseminated among SWEEG partners. Work of wider interest is published in technical and academic journals. A list of this year's publications can be found at the end of this report. Further details about the Centre and SWEEG are available at www.exeter.ac.uk/cee.

Current SWEEG members

Devon and Cornwall Police
Devon County Council
East Devon District Council
Exeter City Council
Mid Devon District Council
Plymouth City Council
South Hams District and West Devon Borough Councils
Teignbridge District Council
University of Exeter

Organisations wishing to enquire about SWEEG or commission work from the Centre should contact:

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Decarbonisation of home heating is crucial to achieving net zero carbon emission targets. Highly efficient electric heat pumps along with renewable electricity provide a widely adoptable solution.

Introduction

About the Centre

The Centre for Energy and the Environment has been working with public sector organisations and businesses for over 45 years. Our research has a direct impact on environmental outcomes and policies.

The Centre for Energy and the Environment (the Centre) is a research group within the University of Exeter, and is uniquely placed to provide bespoke research which can help reduce carbon emissions and energy consumption.

Our expertise covers all aspects of the built environment including sustainable building design, efficiency in existing buildings, carbon reduction strategies, adaptation to climate change, renewable and community scale energy, thermal and daylight modelling, acoustic design, transport, waste and all related policy areas.

Research at the Centre ranges from 3 to 5 year Research Council programmes to short applied projects in both the public and private sectors. Staff from the Centre can deliver bespoke continuing professional development training programmes or provide academic supervision for Knowledge Transfer Partnerships with industry.

About the staff

Tony Norton Head of the Centre

A Chemical Engineer with a background in the international energy industry, Tony's experience of economic and commercial issues around energy provision is extensive and includes policy advice to government. Tony's work at the Centre focuses on energy aspects of local planning and the development of combined heat and power schemes and heat networks.

Dan Lash Senior Research Fellow

Dan studied architecture and specialises in low energy building design including natural ventilation, lighting, thermal performance and comfort.

Andrew Mitchell Research Fellow

Andrew qualified as an Environmental Engineer and now specialises in building performance monitoring, acoustics, air quality and transportation.

Andrew Rowson Research Fellow

Andrew is an Engineering Mathematician with a background in construction and engineering. His work is focused on energy technology and policy.

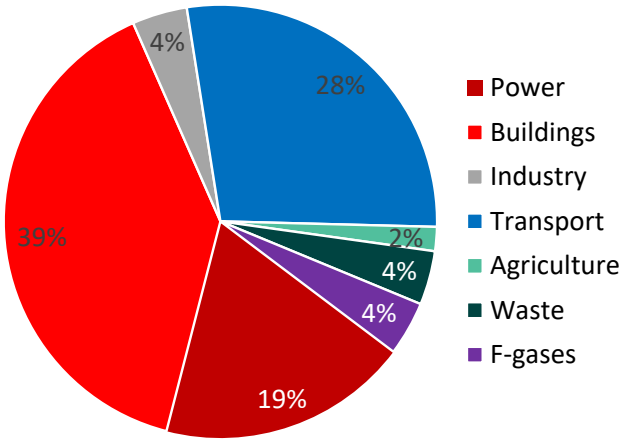
Carbon footprinting and descent

Local authority territorial carbon footprints

To support local authorities' Climate Emergency responses, the Centre provides territorial carbon footprints annually along with carbon descent progress reports.

The Centre has once again updated footprints for Devon and Cornwall district and unitary authorities. Enhancements to data reported by central government have simplified the task. Methane and nitrous oxide emissions are now reported for all sectors. Agricultural livestock and crop emissions included for the first time last year have now been made available as a time series back to 2005.

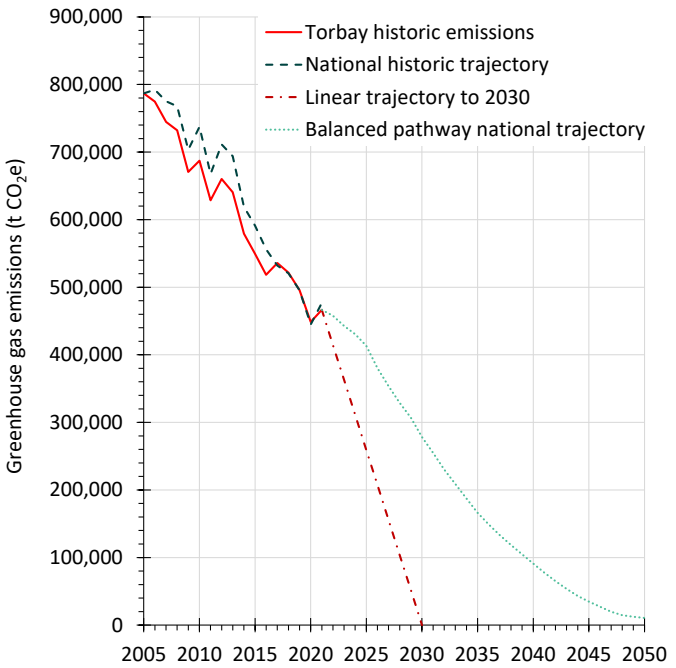
Emissions from the waste sector remain an area where further analysis is required since government figures are based on waste arisings, not the location of disposal facilities. National Atmospheric Emissions Inventory data are used, along with carbon emissions reported by South West Water.



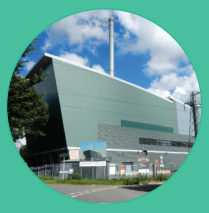
Sectoral split of greenhouse gas emissions in Torbay in 2021 (total emissions were 466.5 kt CO_2e including 0.2 kt CO_2e sequestered by land use and land use change).

The unitary authorities of Plymouth and Torbay have commissioned the Centre to provide detailed analyses of progress towards achieving net zero greenhouse gas emissions by 2030 or 2050. Annual emissions from the territorial footprints were compared to linear trajectories to net zero in 2030, and a number of indicators of progress devised for each emissions sector. For example, in the buildings sector indicators included uptake of thermal insulation measures and low carbon heating. For transport they included the uptake of electric vehicles, vehicle charging point provision and walking and cycling activity.

The progress necessary to achieve net zero emissions by 2030 is extremely demanding, and in many cases heavily dependent upon central government policy and funding support. The national commitment is to achieve net zero emissions by 2050, twenty years later. Accelerating this based only on actions within the power of local government is unlikely to be practical. In recognition of this, Torbay Council commissioned a further report comparing progress to that needed to meet a 2050 deadline. This work took the Climate Change Committee Balanced Net Zero Pathway and applied it to Torbay.



Historic emissions in Torbay compared to: the national historic trajectory, a projected linear trajectory to net zero emissions by 2030 and a projected trajectory to net zero emissions by 2050.



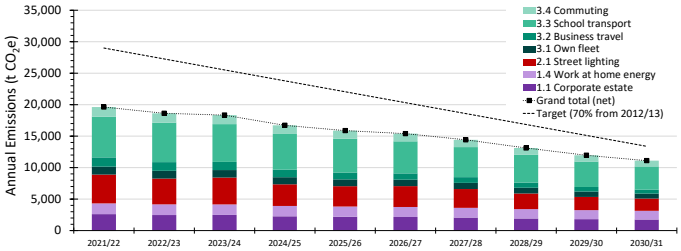
Organisational carbon footprinting for local authorities

Footprints of organisational greenhouse gas emissions have been updated. The annual cycle of reporting reveals whether carbon reductions are on target.

Footprints have been produced for Devon County Council and five district authorities within the county.

A new set of calculation tools has been developed by the Centre to align the reporting to ISO 14061-1 (organisational carbon footprinting) and the Greenhouse Gas Protocol. In addition to the standard reporting categories, the footprinting tool has the capability to classify emissions by alternative organisation-specific categories and sub-categories (for example: buildings, transport, procurement) to better align with operational departments. This is often more useful for identifying potential areas for improvement.

Another development has been the inclusion of greenhouse gas emission projections. This shows the impacts of planned carbon reduction activities (for example, programmes of building insulation or vehicle replacement) and wider national trends (for example, decarbonisation of grid electricity). This empowers organisations to take strategic decisions based on likely progress against net zero targets, and to identify areas for priority action.



Organisational footprint output with the target emissions reduction plotted as a linear decline.

Greenhouse gas emissions from seven forms of sedation

Many anaesthetic gases have a high global warming potential (GWP) and are a cause for concern. Emissions from seven alternative forms of sedation were compared.

UK health services are increasingly aware of the climate impacts of anaesthetic gases. The Royal Devon and Exeter NHS Foundation Trust asked the Centre to assess the greenhouse gas (GHG) impact of alternative sedation options for endoscopy procedures.

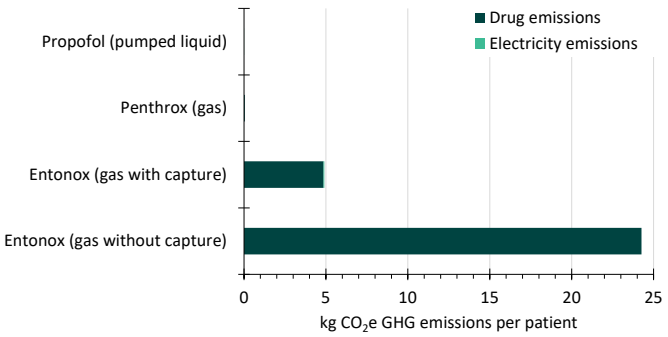
Seven sedation options were investigated. Three of these are liquids injected by hand that do not have operational GHG emissions. Four options have GHG emissions associated with either the sedation drug or electrically powered apparatus.

A liquid sedative (Propofol) administered by electrical pump was shown to have minimal GHG emissions.

A gaseous sedative (Penthrox) with a low GWP and no electricity consumption has low emissions.

Nitrous oxide (N_2O), referred to as Entonox when in a 50:50 mixture with Oxygen, has a GWP of 298 kg CO_2e per kg, which if administered unabated has significantly higher GHG emissions.

A mobile unit that captures 80% of the N_2O reduces emissions to one-fifth of the unabated case. While the unit uses electricity, this only accounts for 1% of total emissions. Even with capture emissions remain significantly higher than sedation options that do not use N_2O.



GHG emissions for four sedation options. The remaining three are hand-injected liquid anaesthetics and have no GHG emissions.

Carbon footprinting for the South West police region

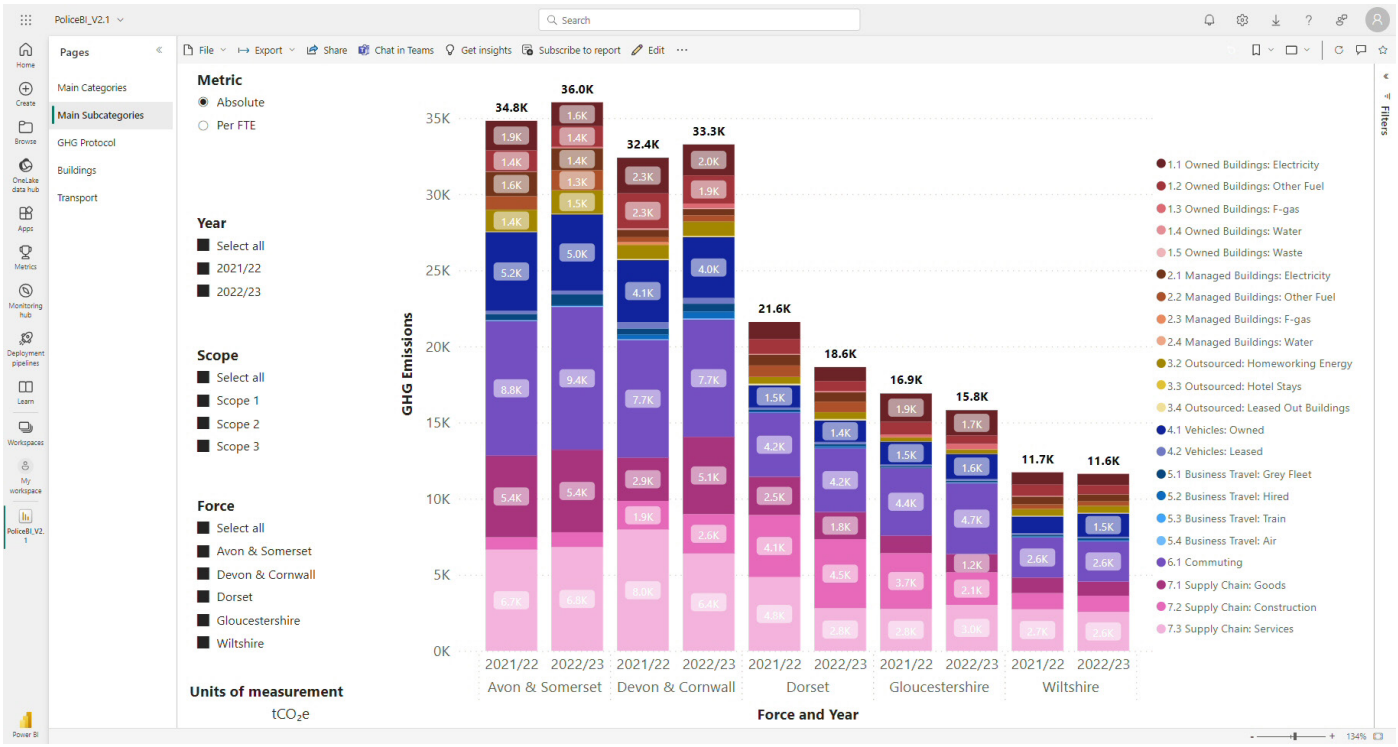
The Centre worked closely with five forces to develop a common framework for producing and presenting consistent carbon footprints.

The South West police region covers five forces: Gloucestershire, Wiltshire, Avon and Somerset, Devon and Cornwall, and Dorset. The Centre worked closely with the five forces to develop a common approach to quantifying the carbon footprints based on ISO 14064-1 and the Greenhouse Gas Protocol. A common method framework was produced that addressed all the relevant emissions categories and considered how information could be reliably and consistently gathered from the forces. An alternative categorisation scheme for reporting was also devised to supplement standard reporting categories.

The footprints were reported under eight main categories and 28 sub-categories. The main categories were owned buildings, managed assets, outsourced assets, vehicles, business travel, commuting, supply chain, and offsets. Emissions were reported both as absolute values and emissions per member of staff, to enable comparison between forces. In addition, further indicators were developed for buildings (emissions per metre squared of owned-occupied buildings), and transport (emissions per owned vehicle and per owned vehicle-mile).

In all cases supply chain and transport (commuting and own fleet) were the largest emitters. When considering the Greenhouse Gas Protocol categories, Scope 3 emissions accounted for the largest proportion of total emissions.

A visual dashboard was developed to present the results using Microsoft PowerBI. This enables emissions to be viewed using either classification scheme and for any indicator. Results can also be filtered by force and year. The dashboard enables stakeholders from within the forces to view and download data that is relevant to them, and should increase the likelihood of the data being used to develop actionable initiatives to help reduce emissions across the region.



Screenshot of the PowerBI reporting dashboard.

Carbon footprinting tools for road maintenance projects

Projects involving the Centre included the development of tools for designers and contractors, contributing to national standards, and work on specific road schemes.

Previous work with Devon County Council on its carbon footprint has indicated that road construction and maintenance projects result in significant emissions of greenhouse gases. The values in the footprint were estimates based on approaches such as multiplying the value of a contract by a generic sector-wide spending-based emission factor.

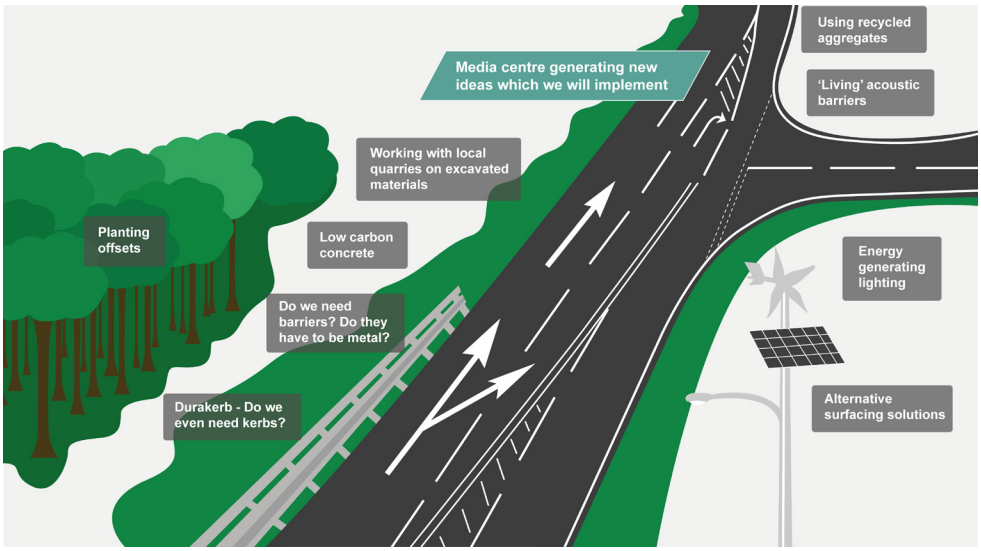
The Centre has been working with Devon County Council for some time on the development of tools to calculate the carbon emissions of road projects from project-specific detailed data. The latest work has been on a Designer Tool. The aim of this was twofold: firstly, to allow designers to account for carbon emissions in decision-making processes, and secondly to enable contractors to feed back live data from ongoing projects via the calculator. The tool covers a wide variety of infrastructure, such as road surfacing, kerbing, barriers, fencing, lining, signage and lighting, as well as maintenance tasks such as grass cutting, vegetation clearance and gully cleaning. The Centre worked with Devon County Council and external contractors as part of a team to create web-based data capture forms. The data collected is used to calculate and report carbon emissions for ongoing road maintenance jobs and provide feedback in a timely manner.

In addition, the Centre has been working with Devon County Council and the Future Highways Research Group to write standards for Scope 3 carbon accounting for the road maintenance sector. The group identified the approach adopted in Devon as being best practice within the sector. The standards are based on the methods utilised in the development of the carbon tool, adapted into a framework and methodological approach that can be applied to road maintenance projects across the country. Following extensive consultation and refinement, the first version of the guidance was released to the industry in October 2023.

The Centre has also been involved in the A382 road upgrade scheme between Drumbridges and Newton Abbot. Firstly, the Centre was part of a project team that successfully bid to the Department for Transport under the Live Labs competition, to deliver a 'carbon negative' road scheme. The work is in its infancy; a carbon model is being developed based on a combination of the Designer Tool and a proprietary tool developed by the project contractor Milestone.

The aim of the project is to compare the performance of a range of design alternatives and products that promise to reduce emissions, and in some cases act as carbon sinks. The ultimate goal is to explore how close to a carbon negative scheme it is possible to get.

In parallel with this, the Centre has been undertaking calculations of projected traffic on the A382 scheme under a range of growth scenarios.



Envisioning a carbon negative road construction scheme for the A382 road upgrade.

Built environment

Planning guidance for new development in Exeter

The Centre worked with Exeter City Council to help explain how the upcoming Exeter Plan can best aim to improve performance of new planned housing development.

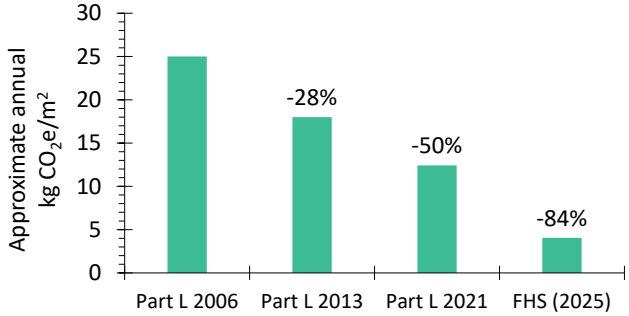
New development is governed by technical regulations and advisory guidance that have evolved over time and are often hard to interpret. The Centre worked with Exeter City Council to decipher the regulatory backdrop and advise on the upcoming Exeter Plan.

The plan will cover development in Exeter to 2040. Standards for climate change mitigation need to be decided upon. The Centre created a primer for councillors and the public to demystify the often-complex relationship between building regulations and planning guidance.

Operational carbon emissions from new development are covered by Part L of the Building Regulations. Since 2006 buildings have to be modelled using standard software (SAP for dwellings and SBEM for non-domestic). The model allows good performance in one part of a building's specification to be offset against less good performance elsewhere. Each update of Part L has seen standards tightened. The next update will see the introduction of the Future Homes Standard (FHS). This will require carbon emissions from new dwellings to be close to zero.

In addition to building regulations, the planning process can be used to set local standards. The Government's planning policies are published in the National Planning Policy Framework. First released in 2012 and updated several times since (most recently in 2021), it requires new development to be planned to help to reduce carbon emissions. Location, orientation and design may all play a part. There has been some confusion over the ability of local planning authorities to set operational carbon performance standards that are more ambitious than Part L of the Building Regulations. As Part L is tightened, the potential savings from improving on Part L are diminished. Initial analysis demonstrated that there are other aspects of developments that potentially have a far greater impact on carbon emissions.

Several policy options were investigated for inclusion in the Exeter Plan. These included setting a formal date for the adoption of Future Home Standard equivalent targets, prescriptive policies on photovoltaic panels, making homes photovoltaic-ready, requiring embodied carbon to be considered, and consideration of larger standalone renewable energy technologies. The Centre supported Exeter City Council at public engagement events.



Emissions under historic, current and proposed Part L versions.

Planning application reviews

The Centre supports its local authority members by reviewing the environmental aspects of planning applications.

SWEEG members regularly ask the Centre to review planning applications. These tend to be bigger and more complex applications where compliance with local planning policies is important and where the developer provides documents such as energy and carbon plans. These documents are sometimes incomplete, based on a flawed analysis or contain significant errors.

Recent reviews covered a range of local planning issues including building fabric standards, carbon emissions, and transport including sustainable travel and electric vehicle charging points. The review can occur at various stages of the planning process from initial application stage through to the discharge of planning conditions on approved developments.

Reducing carbon emissions from housing in Cornwall

National decarbonisation policy was examined in the Cornish context to provide an evidence base for the county's housing decarbonisation strategy.

Cornwall Council intends to prepare a housing decarbonisation strategy setting out the vision and roadmap to net zero for its housing sector. The Centre evaluated greenhouse gas (GHG) emissions from new and existing housing under alternative policy assumptions to provide an evidence base for the strategy.

In 2020, existing housing in Cornwall contributed 21% to the county's GHG emissions. Emissions from housing have fallen by 25% since 2008, but this is largely due to the decarbonisation of electricity generation. Emissions from domestic fossil fuel consumption have increased gradually since 2014. They formed 44% of emissions from housing in 2008 but now account for 64%; further decarbonisation of the national electricity grid will see this figure rise further. Progress in decarbonising Cornwall's housing sector relies on reducing fossil fuel use in homes.

While the Government's planned housing policies are projected to reduce GHG emissions more than the Climate Change Committee's Sixth Carbon Budget Balanced Net Zero Pathway requires, the risks attached to delivery of these policies are significant. When applied to Cornwall's housing, national policies with credible plans or some risk are projected to reduce fuel emissions in 2037 by 8%: significantly below the 54% in Sixth Carbon Budget. Progress in delivering policy is not supported by the reversals indicated in recent prime ministerial announcements.

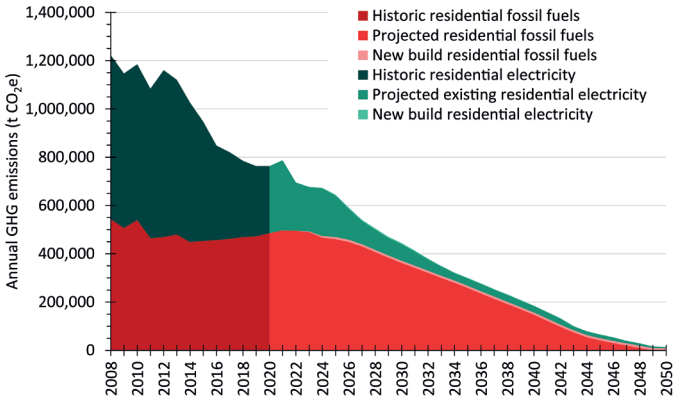
English local authorities are not able to implement material area-wide local policies to reduce carbon emissions from existing housing, but can implement new build housing policy, and Cornwall already has requirements in place.

Roof insulation has the potential to reduce energy consumption in 2050 by 2.6% from a 2020 baseline, wall insulation could save 5.6% and overall savings are 12.4%, 0.4% higher than those resulting from national policy.

49% of Cornwall's homes are heated by mains gas, far less than the 74% across England and Wales. 20% of homes use other fossil fuels with 32% using electric heating. Decarbonisation of heating using heat pumps could achieve a 52% reduction in fuel consumption. When combined with further decarbonisation of electricity generation it could eliminate GHG emissions from heating.

Both national and local policy requires new housing in Cornwall to have low GHG emissions. Consequently new housing should only account for 4% of the sector's emissions between 2023 and 2050. Again electricity decarbonisation should deliver zero carbon new housing by 2050. Reducing emissions from existing housing is key. However, central government funding for housing retrofit measures in Cornwall is only about 4.8% of the total cost, an order of magnitude short of the estimates needed to ensure a net zero outcome for the county by 2050.

While Cornwall has demonstrated that it can overcome local delivery challenges in previous retrofit programmes, the policy and funding shortfalls it faces are national rather than local. The supply chain and local labour market changes that will be required to deliver the scale of measures needed will also have to be addressed. Meeting the national trajectory for the decarbonisation of housing is likely to be challenging and ambitions to accelerate this further are unlikely to be practically achievable.



Historic and projected GHG emissions from housing in Cornwall to 2050.

Embodied carbon emissions for the Exeter Civic Centre

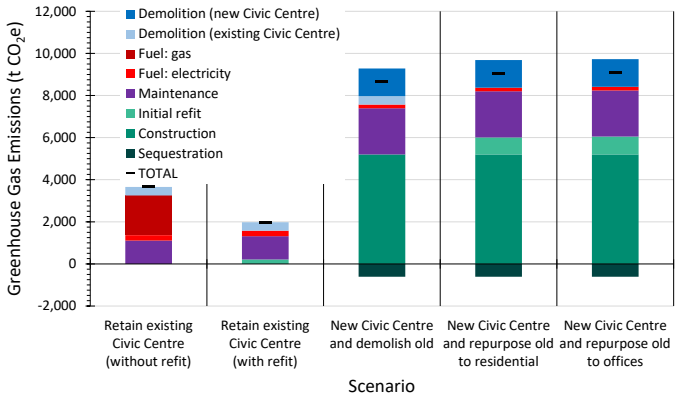
Assessment of the embodied carbon emissions from the production and usage of materials for the construction of buildings is an emerging area.

Whilst standards and legislation are well-developed to reduce energy use and therefore carbon emissions from buildings, embodied emissions from construction and eventual demolition and disposal phases of a building are not yet considered in the building regulations. They are, however, considered in accreditation schemes such as BREEAM and LEED. A number of computer models are available to assess embodied emissions for buildings.

Exeter City Council has been considering the future of its Civic Centre. Post-pandemic, more staff are working from home and the building is larger than required. Phase 1 of the building is now leased to commercial tenants. Previous work by the Centre has confirmed the poor thermal performance of the building, attributable to a lack of thermal insulation and poor zoning of the heating system. Future options for the building include:

- demolition, and construction of a new Civic Centre;
- refurbishment and re-use as commercial offices or residential accommodation, and construction of a new Civic Centre;
- continued use of the existing Civic Centre, with or without refurbishment.

The council was interested in the impact of this choice on embodied carbon emissions, and felt that conducting an assessment would demonstrate leadership.



Emissions arising directly (over a 60-year period) from the provision of a Civic Centre and re-purposing the existing building.

The free version of the ECCOLAB online calculation tool was found to offer sufficient functionality to conduct a high level comparison of the options. An extensive library of constructions is available in the tool and in-use emissions are calculated from an EnergyPlus simulation. Paid-for versions have enhanced functionality, including the ability to specify user-defined constructions and non-standard geometries, design optimisation tools, the ability to store multiple projects and a larger number of design variations, and a higher limit on the number of simulations that can be evaluated per month.

Whilst protocols exist for the assessment of embodied carbon, comparing new build and refurbishment options raises a number of issues to ensure consistency. As a result, one set of outputs were produced only considering emissions from buildings under the control of the council, whilst another set included ongoing emissions from buildings once sold or redeveloped. The first set of results provides different amounts of accommodation under the different scenarios, whereas the second set of results offers the same total floor area under all scenarios.

Embodied emissions from the construction phase are significant (and far greater than from a refit), so the option to retain the existing Civic Centre has by far the lowest total carbon emissions over a 60-year period. Refurbishing the building (including switching the heating fuel from gas to electricity) results in the lowest emissions owing to decarbonisation of grid electricity. The advantage of retaining the existing Civic Centre is less pronounced in the second set of results where the additional office or residential accommodation that would need to be built in place of that potentially created by re-purposing the Civic Centre building is considered.

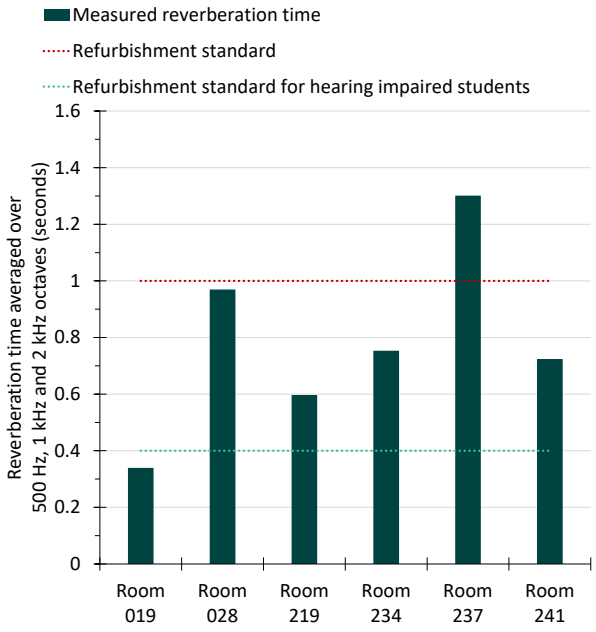
Construction, demolition and maintenance emissions are higher per unit floor area for offices than for residential accommodation, but fuel emissions are higher for residential buildings. Total emissions are slightly higher for offices than for residential accommodation.

Building reviews for the University of Exeter

The Centre continues to provide advice on the energy efficiency and acoustic performance of buildings.

Since its inception, the Centre has provided design and remedial advice on many aspects of building performance including energy efficiency, thermal performance, ventilation and acoustics. In recent years projects have largely focused on high level strategy to reduce emissions and mitigate their impacts at an organisational level. Nevertheless, detailed advice on specific projects continues to be given.

Publicly accessible buildings are required to have a Display Energy Certificate (DEC). The Centre has provided these for the University of Exeter for many years. Whilst an energy and carbon analysis must be updated annually, every seven years a building survey is required in order to update the advisory report. This report highlights any major deficiencies in the thermal performance of the building and the potential for introducing low and zero carbon technologies such as renewable electricity generation. This year many of the advisory report updates were due, and in total 66 buildings were evaluated.



Reverberation times (a measure of the speed at which sound decays) for each of the rooms evaluated. Maximum permissible reverberation times for refurbishment are shown.

Lecture theatre 219 already possesses good acoustic qualities.

Another annual task is the acoustic evaluation of teaching spaces at the university that are due to be refurbished. This is an ideal time to address many acoustic defects such as a lack of sound absorption or poor isolation from adjacent spaces.

This year six rooms in the Washington Singer building were surveyed and recommendations made on the remedial measures necessary to achieve the standards set out in government guidance for acoustics in educational buildings. Compliance with these standards is not mandatory in higher education establishments, but they represent best practice for the sector.

Five of the rooms have high ceilings. Unless highly sound-absorbent surfaces are provided this will increase reverberation in the space to an unacceptable level. One of the spaces already has adequate provision of absorption on both wall and ceiling surfaces, two lack acoustic wall treatment (necessary to suppress repeated echoes between parallel pairs of surfaces) and two have no acoustic wall or ceiling treatment.

A number of other acoustic deficiencies were identified: noisy equipment in adjacent spaces with inadequate sound isolation, rainwater or foul water pipes passing through the space with inadequate sound isolation, a lack of acoustic seals and closure devices on doors, and sub-optimal microphone placement.

Renewable energy and heat supply

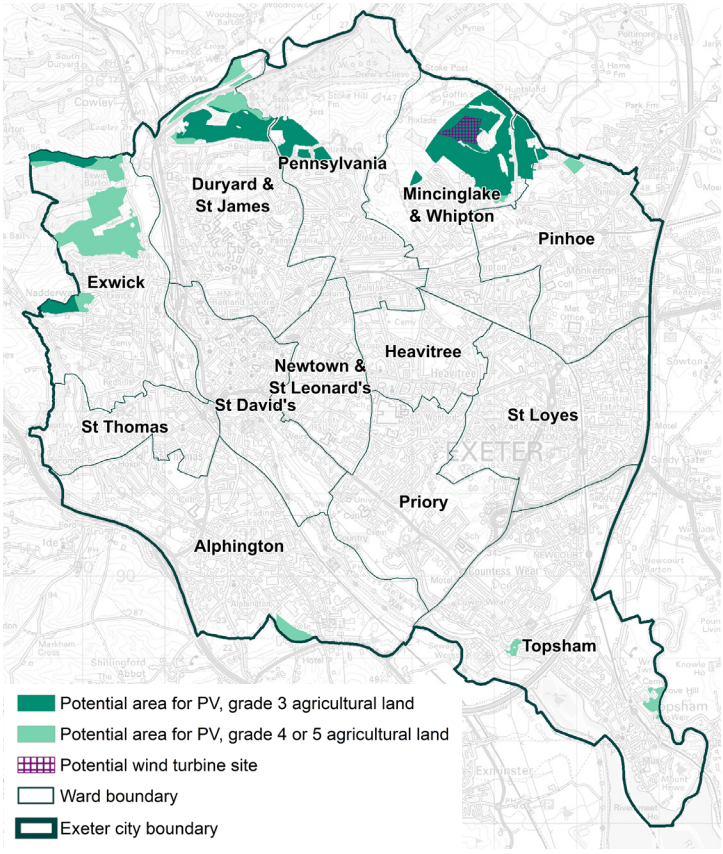
Renewable energy potential in Exeter

Past work to estimate the potential for large-scale electricity generation from wind and photovoltaic installations has been revisited and local site constraints applied.

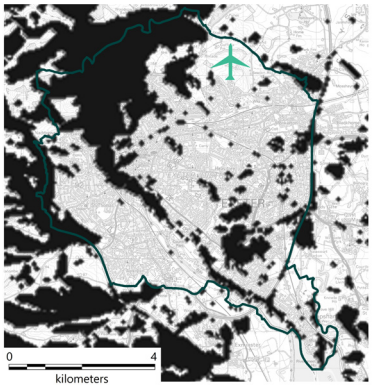
The Centre estimated the potential for large-scale wind and photovoltaic (PV) installations to provide evidence for the Greater Exeter Strategic Plan. Subsequently, more detailed studies have been produced for Teignbridge, and now for Exeter.

The original constraints applied remain valid (after updating to account for new or planned areas of urbanisation). The smaller study area made it possible to review the areas identified by the mapping, to an extent not previously practicable. School playing fields, valley parks, and other public open spaces have been omitted as unsuitable for renewable energy developments.

The vast majority of the potential is from PV arrays, with 24 areas identified. Together these could provide a generation capacity of 18 MW_p, yielding up to 16 GWh per annum. Most of the areas identified are around the periphery of the city, with the greatest potential on farmland and flood plain to the north.



Map of Exeter showing potential renewable energy locations.



Visibility of a 1 MW wind turbine in Exeter (the turbine is not visible from areas shaded black).

Only one wind turbine site has been identified. This is also to the north of Exeter and its potential contribution is small at 0.5 to 1.0 MW_p capacity. The site coincides with an area suitable for PV panels, and PV would have a greater output per unit land area. However, there may be scope to co-locate PV panels across most of the wind turbine site. The total combined output from wind and PV generation on all of the sites amounts to about 3.6% of electricity consumption in Exeter.

Suitability of the identified areas would require further investigation and planning permission may not necessarily be granted for renewable energy development. Likewise, areas additional to those identified may exist and may be granted planning permission.

Visibility maps were created for 500 MW or 1 GW wind turbines with blade tip heights of 50 and 90 metres respectively. Either turbine would be visible from much of Exeter. This could be viewed as positive (making an environmental statement) or negative (potentially attracting complaints).

Review of the Exeter Heat Plan

Heat networks have a potential role in providing low carbon heat. Exeter City Council is revising its existing heat network strategy and sought an updated evidence base.

Exeter's 2012 Core Strategy included policy supporting heat networks based on evidence available in 2010. The council asked the Centre for up to date evidence to support its heat network policy for inclusion in the Exeter Local Plan.

National policy regards heat networks as key to achieving net-zero targets. Heat network delivery is supported through the Green Heat Network Fund and Heat Networks Investment Project. The Energy Bill is introducing a heat network market framework and heat network zoning.

In Exeter, Core Strategy policies have been effective at delivering the Monkerton heat network and promoting the development of heat network plans in the city centre and to the south near the Marsh Barton Energy Recovery Facility.

An evidence base from this past experience shows that the policies developed in the 2012 Core Strategy have been effective, and that heat networks are practicable and viable locally.

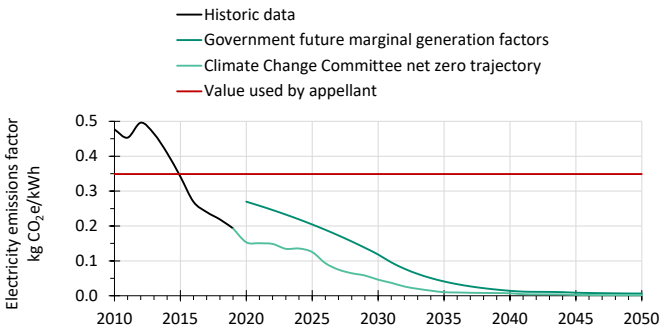
Creation of sufficient heat demand and a low carbon heat source requires supporting local planning policy to achieve a critical mass for viable development. The intent of the emerging Exeter Local Plan is to build on the demonstrable success of the 2012 Core Strategy policies with updated policy wording. The evidence supports this intent.

District heating has been delivered at Monkerton, Exeter.

Westbury energy-from-waste plant planning inquiry

The plant was refused due to climate impacts. The Centre provided evidence challenging the carbon assessment put forward by the applicant at appeal.

Where planning applications are refused by local authorities the applicant can appeal. Appeals are heard by planning inspectors at planning inquires. Barristers representing the appellant and the local authority present their cases for and against the application to the inspector.



Grid electricity emission factors versus the appellant's value.

Expert witnesses may submit documents ('proofs') ahead of the inquiry. These are usually rebutted in writing by the other party. At the inquiry witnesses present their evidence and are cross-examined by the opposing barrister. The inspector uses the evidence presented to decide whether the appeal should be upheld.

At the appeal, the Centre provided evidence challenging the applicant's assumptions about the carbon offset achieved through the export of electricity, the composition of waste to be burnt and the efficiency of the plant.

The inspector judged that the climate factors were not sufficient grounds for refusal and upheld the appeal. The proceedings at a planning inquiry are perhaps unnecessarily adversarial and not necessarily the best way to understand and resolve complex technical issues.

The Exeter Water Lane smart grid and storage project

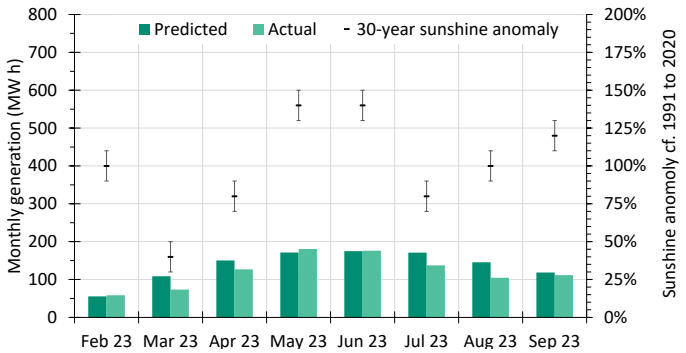
Exeter City Council has installed an innovative solar farm and battery storage facility. The Centre is providing an independent evaluation of its performance.

The scheme builds upon the council's existing photovoltaic generation at the city's multi-storey car parks and the livestock centre. The solar farm at Water Lane has a generating capacity of 1.2 MW_p and 2 MWh battery storage capacity. A photovoltaic array added to the Riverside Leisure Centre contributes a further 120 kW_p, and battery storage on this and two further sites add an additional 535 kWh storage capacity.

Installation took place during the Covid-19 pandemic. This, along with changes to the requirements for grid connection and unforeseen congestion of underground services and land contamination presented a considerable challenge to delivery of the scheme and it is credit to the council that these obstacles were overcome.

Photovoltaic panels are now a well-established technology, and the installation has proven itself capable of meeting design expectations for generation output. Large-scale battery storage installations are less well-established, but are a valuable part of the scheme, largely decoupling the time-dependence of electricity demand from generation.

A key aspect of the scheme is the provision of electric vehicle charging points at the council's Exton Road depot. This supports the transition of refuse collection vehicles from diesel to electric power. The first three electric refuse collection vehicles entered service in the city in 2022; these are among the first in the country.



Electricity generated by the Water lane solar farm compared to design predictions The anomaly between actual and long-term average monthly sunshine hours is also shown.

One of Exeter's innovative electric refuse collection vehicles.

Ongoing monitoring over the coming months will examine the role of the battery storage in matching the demands of vehicle charging and other electricity use at the depot with generation, and similarly at the livestock centre and John Lewis car park sites. The balance of electricity generation and demand will change with time of year as daylight hours change but vehicle and building energy requirements remain more static. Thus evaluation over at least a year is necessary to build up a full picture of the value of the battery storage aspect of the scheme.

The Water Lane solar farm.

Publications

List of publications

Details of documents produced by the Centre this year are shown below. SWEEG members can download documents from centres.exeter.ac.uk/cee/publications/

Internal documents

Number	Title	Author(s)
1020	Commuting statistics from the East Devon District Council travel carbon calculator	T.A.Mitchell
1021	South Hams District Council organisational carbon footprint Achieving net zero by 2030	D.Lash, T.A.Mitchell & A.D.S.Norton
1022	West Devon Borough Council organisational carbon footprint Achieving net zero by 2030	D.Lash, T.A.Mitchell & A.D.S.Norton
1023	Plymouth greenhouse gas reporting and monitoring 2023	A.D.S.Norton, T.A.Mitchell & A.T.Rowson
1025	Heat network evidence to support Exeter Plan policy CE2	A.D.S.Norton
1026	Review of renewable energy site mapping for Exeter	T.A.Mitchell
1028	Initial evaluation of carbon implications of future options for the Exeter City Council Civic Centre	T.A.Mitchell
1030	Exeter City Council's carbon footprint 2021/22	D.Lash
1031	Acoustic evaluation of six teaching spaces in the Washington Singer building, University of Exeter	T.A.Mitchell
1033	Mid Devon District Council's organisational carbon footprint 2022/23	D.Lash
1035	Estimating cost uplifts of Teignbridge District Council's CC2 policy	D.Lash
1036	Greenhouse gas inventories for SWEEG: updated methodology for 2021 reporting year	T.A.Mitchell
1037	Avon and Somerset Police's carbon footprint 2022/23	D.Lash
1038	Devon and Cornwall Police's carbon footprint 2022/23	D.Lash
1039	Dorset Police's carbon footprint 2022/23	D.Lash
1040	Gloucestershire Police's carbon footprint 2022/23	D.Lash
1041	Wiltshire Police's carbon footprint 2022/23	D.Lash

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Published November 2023