Annex A

York Climate Change Strategy: A City Fit for the Future: Technical Annex

About this Document

This Technical Annex supplements York Climate Change Strategy: A City Fit for the Future and aims to provide further detail on the content, analysis, policy context and objectives within the strategy. This technical annex should be used to provide a more in-depth understanding of the strategy and the assumptions behind pathways modelling.

Strategic Framework

The council and city partners are co-designing a 10 year plan that will be informed by three strategies covering climate change, economic growth and health and wellbeing. The council is following a sustainable approach to developing the city's ambitions for the decade ahead.

The goal of sustainability is to, "create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations." or put simply - 'Enough, for all, forever'.

This means that sustainable approaches need to consider the interdependencies between actions that might affect the environment, society, and the economy. To this end, the council is developing three strategies to inform city-wide direction over the next decade.

The Strategy and Policy framework sets out how strategies and policies fit together to achieve overarching ambitions (Figure XY).

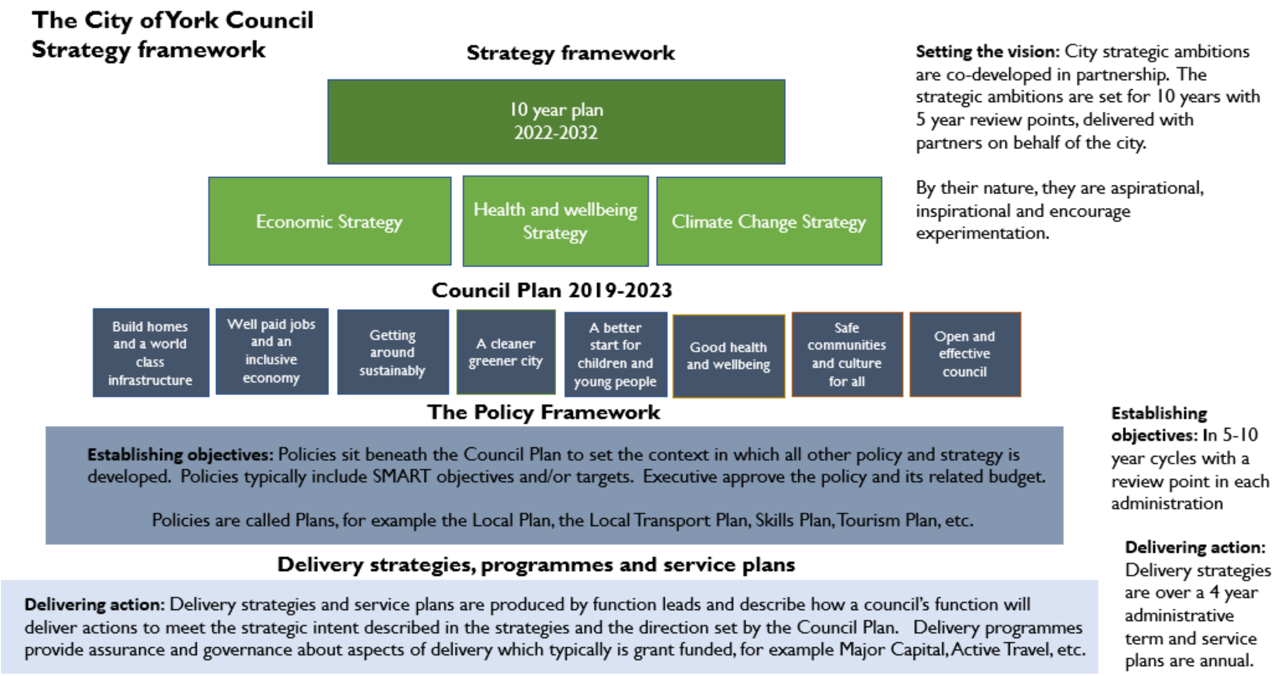


Figure xy: Strategic Framework showing the relationship between council Strategy, Policy and Action Plans.

Working Together

The Climate Change Strategy is for the whole of York. Achieving the ambition will be the responsibility of everyone living, working and visiting our city. We will need to work with existing and develop new networks and partnerships that can bring together organisations from the city's public, private, community, faith, education and academic sectors to achieve the ambitious objectives and targets.

Figure xy: The stakeholders and partnerships involved in supporting and delivering the Climate Change Strategy

In Focus: York Climate Commission

The York Climate Commission was formed in December 2020 with the approval of City of York Council. Recognising that no single organisation has the power, authority, resources or ability to achieve the city-level change needed to deliver York's ambition, the Commission was created.

The role of the York Climate Commission

- Promote leadership in the city on climate change, encouraging stakeholders to take effective action now, while maintaining a long-term perspective.

- Provide authoritative independent advice on the most effective steps required to meet the city's carbon reduction target to inform policies and actions of local stakeholders and decision makers.
- Monitor and report on progress towards meeting the city's carbon targets and recommend actions to keep on track.
- Make the economic case for project development, implementation and investment in low carbon and climate resilient projects in the city; and promote best practice in public engagement on climate change and its impacts in order to support robust decision-making.
- Bring together major organisations and key groups in York to collaborate on projects that result in measurable contributions towards meeting the city's climate reduction target.
- Act as a forum where organisations can exchange ideas, research findings, information and best practice on carbon reduction and climate resilience.

Engagement & Consultation

Our Big Conversation Phase 1

Stakeholder roundtables

Our Big Conversation Phase 2

Policy Context

The York Climate Change Strategy exists within a complex policy context at the local, regional and national scale. The integration of Strategic objectives across policy areas is key requirement for delivering on our climate change ambition, with existing and emerging policy acting as levers and critical enablers for action.

National	Regional	Local
The Clean Growth Strategy set targets to upgrade as many houses to EPC band C by 2035 (2030 for all fuel-poor households). The Government's preferred target is that non-domestic property owners in the private sector achieve EPC band B ratings by 2030. Alongside the strategy, BEIS published joint industrial decarbonisation and energy efficiency action plans with seven of the most energy intensive industrial sectors, including the food and drink sector.	The Yorkshire and Humber Climate Commission is an independent advisory body set up to bring actors from the public, private and third sectors together to support and guide ambitious climate actions across the region.	The COVID-19 Economic Recovery Transport and Place Strategy was produced to secure the active travel benefits that have been realised during the pandemic. The strategy proposes to invest and create new networks of park and cycle hubs, priority cycle routes, cycle hire and parking to prioritise active travel as the preferred from of commuting.
The Future Homes Standard provides an update to Part L of the building	The Yorkshire and Humber Plan – The Regional Spatial Strategy to 2026 aims	The City of York Local Transport Plan 2011-2031 (LPT3) aims to reduce

regulations and will include the future ban on gas boilers by 2025 (which may be brought forward to 2023 under the recent 10-Point Plan).	to guide development in the next 15 to 20 years. Relevant policies picked out below.	emissions across York by providing quality walking, cycling and public transport networks. The Local Transport Plan 4 is under development and will reflect the objectives within the Climate Change Strategy
Energy White Paper outlines the latest plans on decarbonising the UK's energy system consistent with the 2050 net zero target.	Policy YH2: Climate change and resource use encourages better energy, resource and water efficient buildings and minimise resource demands from developments, as well as exploiting the continued supply of brown field opportunities.	In 2020, York launched a Clean Air Zone across the city which regulated buses. Funding from DEFRA and the Department for Transport was used to upgrade or replace existing buses using fossil fuels
The UK Green Building Council was set up in 2013 to investigate and recommend new ways forward to reach zero-carbon buildings.	Policy Y1: York sub area policy encourages strategic patterns of development on the Sub Regional City of York, whilst safeguarding its historic and environmental capacity.	York's Public EV Charging Strategy sets out their approach to accelerating the transition to EV through a public charging network.
Ten Point Plan for a Green Industrial Revolution includes ending the sale of new petrol and diesel cars and vans by 2030.	Policy T1: Personal travel reduction and modal shift highlights the need to reduce travel demand and congestion and encourage a shift to sustainable travel methods	CYC Asset Management Strategy 2017-2022 sets out how the council will manage its built assets. This will be supplemented with the emerging Housing Retrofit Action Plan
Moving Forward Together strategy commits bus operators to only purchase ultra-low or zero carbon buses from 2025.	Policy T3: Public transport sets out the need for improving public transport infrastructure and services to address problems of congestion and accessibility	Private sector housing strategy 2016-2021 covers the private housing stock in the city
Well Managed Highway Infrastructure – A Code of Practice - advocates sustainability through sustainable consumption and production; climate change and energy; natural resource protection and environmental enhancement; and sustainable communities.	Policy ENV12: Regional Waste Management Objectives advises that all plans, strategies, investment decisions and programmes should aim to reduce, reuse, recycle and recover as much waste as possible.	Cultural strategy 2019-2025 is designed to make a measurable, positive difference to the people of York
The Road to Zero Strategy 2018 sets out new measures to establish the UK as a world leader in development, manufacture and use of zero emission road vehicles.	Policy ENV12: Encourages local authorities to support waste facilities and management initiatives by moving it ravel the management of waste streams up the hierarchy, achieving waste management performance targets, and managing waste at the nearest appropriate location	The Low Emissions Strategy is targeted at reducing airborne emissions and has a direct positive impact on reducing carbon and other ghg emissions
Waste and Recycling: Making Recycling Collections Consistent in England (2019) The government are working with local authorities and waste management businesses to implement a more consistent recycling system in England. The measures are expected to come into effect in 2023.	Policy YH1 of the Yorkshire Humber Plan – Regional Spatial Strategy to 2026 states that growth and change in the region will be managed to achieve sustainable development	"Let's talk rubbish" outlines York's Joint Municipal Waste Management strategy with North Yorkshire County Council. The report highlights an increased need for reducing, reusing and recycling.
Our Waste, Our Resources: A Strategy for England (2018) sets out how the country will preserve resources by minimising waste, promoting resource efficiency and moving to a circular economy.	Policy ENV5 of the Yorkshire and Humber Plan states the regions plan to maximise improvements to energy efficiency and increase renewable energy capacity.	The City of York's Council Plan 2019-2023 outlines that the Council will review waste collection to identify options to provide green bins to more houses, curbside food waste collection and the range of plastics currently recycled.
Waste Prevention Programme for England aims to supporting a resource efficient economy, reducing the quantity and impact of waste produced	The Yorkshire and Humber Waste Position Statement was produced to ensure appropriate coordination in planning for waste	York are currently developing a Green Infrastructure Strategy which will establish a long-term vision for the planning and management of Green

whilst promoting sustainable economic growth		Infrastructure across York, identifying where the protection and enhancement of green spaces and natural elements can be achieved.
In the UK's Industrial Strategy, one of the grand challenges set is clean growth, which refers to driving economic growth whilst reducing carbon emissions, and maximising the advantages for UK industry.	The Yorkshire and Humber Waste Technical Advisory Body ensures effective collaboration between Waste Planning Authorities in Y&H.	The City of York Local Biodiversity Action Plan 2017 provides information about the wildlife in York, the sites that are of value, its importance both for York and nationally, the current threats and what is being done to conserve it.
The Ten Point Plan for a Green Industrial Revolution includes plans to invest in carbon capture for industries that are particularly difficult to decarbonise.	The Yorkshire and Humber Regional Biodiversity Strategy highlights how the region can contribute to local, regional and international biodiversity obligations and identifies the key mechanisms and actions required of difference partners and sectors	Section 14 of the City of York Local Plan promotes sustainable connectivity through ensuring new development has access to high quality public transport, cycling and walking networks.
The 25 Year Environment Plan includes commitments to create new forests/woodlands, incentivise tree planting, explore innovative finance; and increase protection of existing trees.	The Humber Clean Growth Local White Paper sets out for the Humber region to be a net zero carbon economy by 2040.	York set an ambition to increase tree canopy cover in line with national average in the Tree Canopy Expansion Target
Land use: Policies for a Net Zero UK (2020) includes converting 22% of agricultural land (mostly from livestock) to forestry.	One of North Yorkshire and York Local Nature Partnership Strategy objectives is to conserve and enhance natural habitats and species. The LNP also sets out to strengthen natural corridors for species movement and aims to have a 75% coverage of green infrastructure corridors in LNP priority areas.	Joint Health and Wellbeing Strategy 2017-2022: considerable co-benefits to health and wellbeing from reducing carbon emissions and minimising the impact of climate change
Woodland Trust Emergency Tree Plan recommends Local Authorities write an Emergency Tree Plan and set targets for tree planting.	The Humber Local Energy Strategy sets out two key objectives: To ensure decarbonization in Humber in the electricity, heat and transport sectors and; To foster clean growth by supporting low carbon technologies and taking advantage of opportunities of a low carbon economy.	
The UK's National Planning Policy Framework (2019) states as a core planning principle that planning should support the transition to a low carbon future	The York, North Yorkshire & East Riding's Local Energy Strategy provides a clear pathway towards a low economy by implementing high-impact low carbon energy technologies such as energy efficient vehicles, renewable heat pumps, anaerobic digestion and biomass for heat.	
UK National Energy and Climate Plan sets out integrated climate and energy objectives, targets, policies and measures for the period 2021-2030.		

In Focus: Tourism

Tourism in York

In 2018, York received 8.4 million visitors, a figure which has increased 11.8% since 2014.

With York's permanent population estimated to be 209,900, several key challenges arise when aiming to sustainably cater for both residents and tourists, such as:

- Tourism congestion, relating to the density and seasonality of visitors to the city
- Supporting businesses in the tourism sector to reduce emissions
- Ensuring the city remains livable for residents

We are in the process of updating our Tourism Strategy, which will include our approach to promoting sustainable tourism and how the sector can support our climate change ambition. Following the COVID-19 pandemic, the entertainment, tourism and hospitality sectors have been significantly impacted. Opportunities to influence behaviour change as the industries recover and as tourists return should will considered as part of the strategy.

"*Sustainable tourism has the potential to advance urban infrastructure and universal accessibility, promote regeneration of areas in decay and preserve cultural and natural heritage... Greater investment in green infrastructure should result in smarter and greener cities, from which not only residents, but also tourists, can benefit*." *(United Nations World Tourism Organisation, 2015)*

Emissions Profile

The current emissions profile for the area administered by City of York Council is shown in figure XY, based on the SCATTER tool calculations. This covers scope 1 and 2 emissions for the city-wide area of York. This covers 3 greenhouse gases: carbon dioxide, nitrous oxide and methane and relates to the 2018 reporting year. While the embodied carbon associated with creating products used in York is an important consideration, this emissions profile only covers emissions generated within the city, as this follows the same boundaries set out by UK Government.

Not all subsectors can be neatly summarised as a "slice" of this chart. Emissions from land use act as a carbon sink for the region, sequestering carbon from the atmosphere. An illustration of this has been included in the chart.

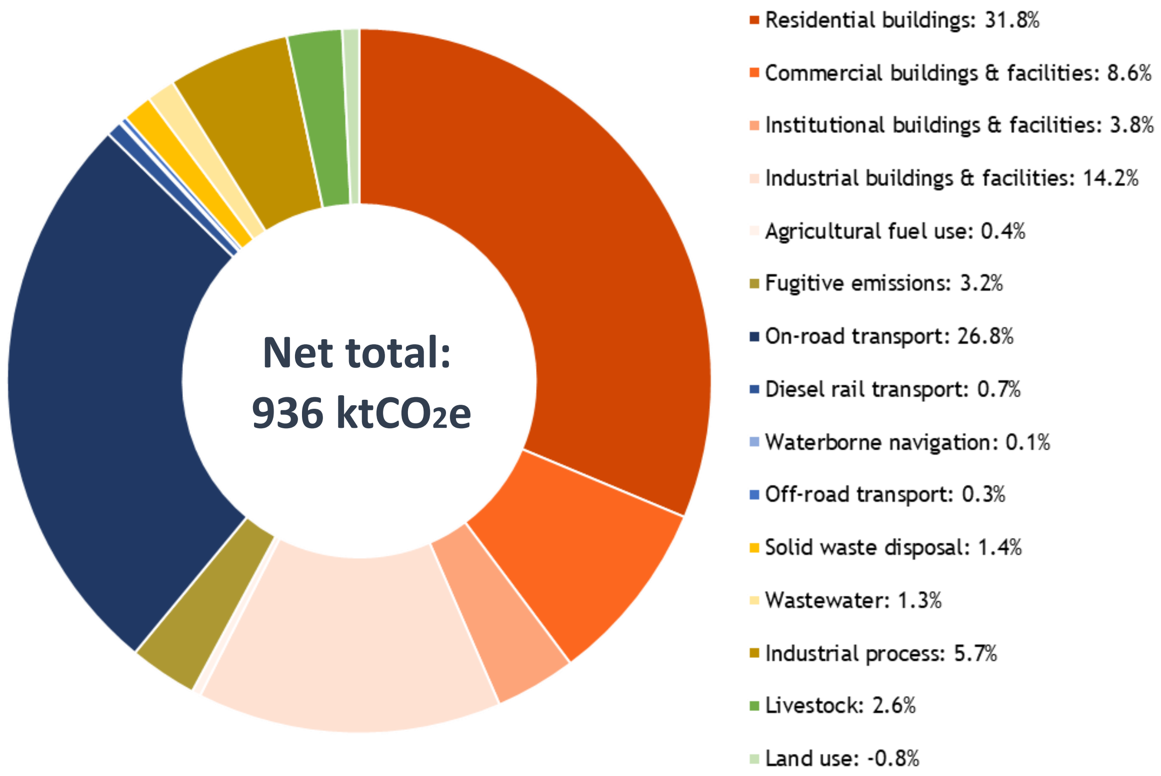


Figure XY: SCATTER emissions inventory for York, 2018

City-wide emissions data (sometimes referred to as "community" or "geographic") encompasses all emissions within a specific geopolitical boundary over which local governments can exercise a degree of influence through the policies and regulations they implement.

The Global Covenant of Mayors (GCoM) requires committed cities to report their inventories in the format of the Common Reporting Framework, to encourage standard reporting of emissions data. The GCoM Common Reporting Framework is built upon the Emissions Inventory Guidance, used by the European Covenant of Mayors and the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), used by the Compact of Mayors. Both refer to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.

The main greenhouse gases defined by the United Nations Framework Convention on Climate Change (UNFCCC) are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF6), as well as nitrogen trifluoride (NF3). GCoM cities are required to report at least CO2, CH4 and N2O gases.

An emissions inventory uses activity data which is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time e.g volume of gas used, tonnes of solid waste sent to landfill. Emission factors are then applied to this activity data. An emissions factor is a measure of the mass of GHG emissions relative to a unit of activity. Government conversion factors for greenhouse gas reporting are used. Global Warming Potentials (GWP) use a factor describing the degree of harm to the atmosphere of one unit of a given greenhouse gas relative to one unit of CO_2.

York Emissions Subsectors

The following tables demonstrate the profile of each emissions sector and explain the sources of Scope 1 and 2 emissions included in each[1]:

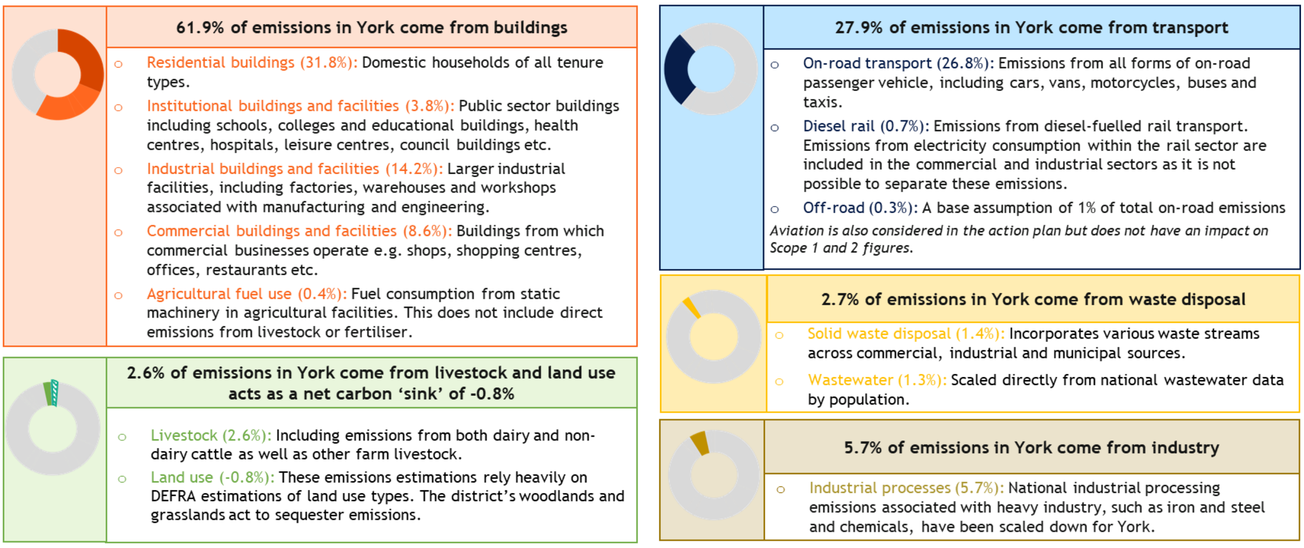


Figure XY: Emissions by sector in York

Link data tables to appendix

In Focus: City of York Council Corporate Emissions

In 2021, City of York Council reported on emissions associated from its corporate activity for the first time. In total, its buildings, corporate waste, business travel and fleet were responsible for 3,635tCO_2e for the financial year 2020/21.

The council is committed to achieving net zero for its own operations by 2030 and has produced the following recommendations to achieve this:

- Produce a decarbonisation plan for our largest emitting sites to identify improvements in heat generation, building fabric and energy efficiency and renewable generation
- Adopt a policy to consider low carbon heating solutions for all system replacements
- Develop and promote a behaviour change campaign to reduce emissions associated with staff activity
- Explore opportunities to replace mains water with grey water
- Implement vehicle route planning and driver training across our corporate fleet
- Promote remote event attendance where possible
- Adopt a policy that prioritises train travel over flights, wherever possible
- Increase the proportion of hybrid and electric vehicles in the car club fleet and encourage staff to use electric and hybrid vehicles
- Review the corporate waste contract and undertake a waste audit

[1] Emissions sectors may not add up to exactly 100% due to rounding.

- Incorporate sustainable procurement and circular economy principles into our purchasing decisions
- Develop a methodology to calculate Scope 3 emissions associated with council activity

Emissions Reduction Pathway for York

The current emissions profile offers the baseline from which to measure progress towards net zero by 2030.

Also important is the fact that once emitted, greenhouse gases such as CO_2 and N_2O can remain in the atmosphere for extended periods of time – up to hundreds of years. This means it is crucial to consider York's *cumulative* year-on-year emissions.

The Paris Agreement aims of remaining *"…well below 2°C"* of warming dictate an upper limit of greenhouse gas emissions that are allowed.

We can join these ideas together in the form of a *carbon budget, which* guides a trajectory for emissions reduction.

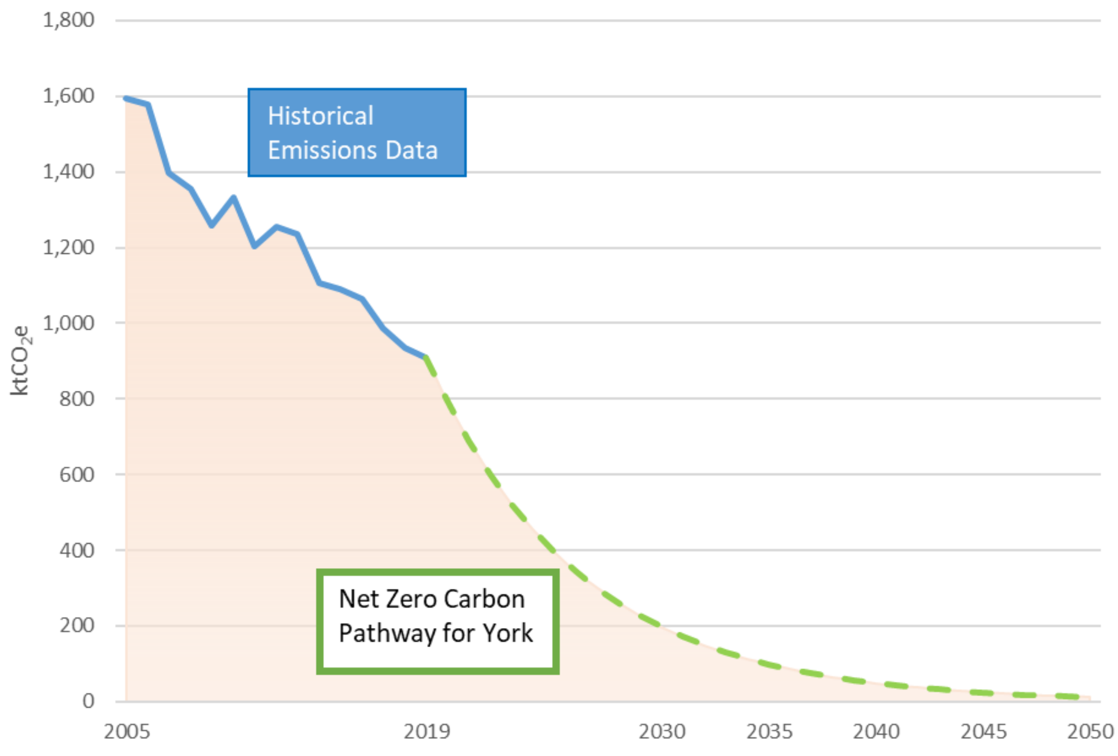


Figure XY: Science based emissions reduction pathway for York that is consist with the IPCC 1.5oc scenario

The Tyndall Centre for Climate Change Research, based at the University of Manchester, have produced advisory climate change targets for York to make its fair contribution to meeting the objectives of the United Nations Paris Agreement on Climate Change. The latest scientific consensus on climate change in the Intergovernmental Panel on Climate Change Special Report on 1.5°C is used as the starting point for setting sub-national carbon budgets that quantify the maximum carbon dioxide emissions in York to meet this commitment.

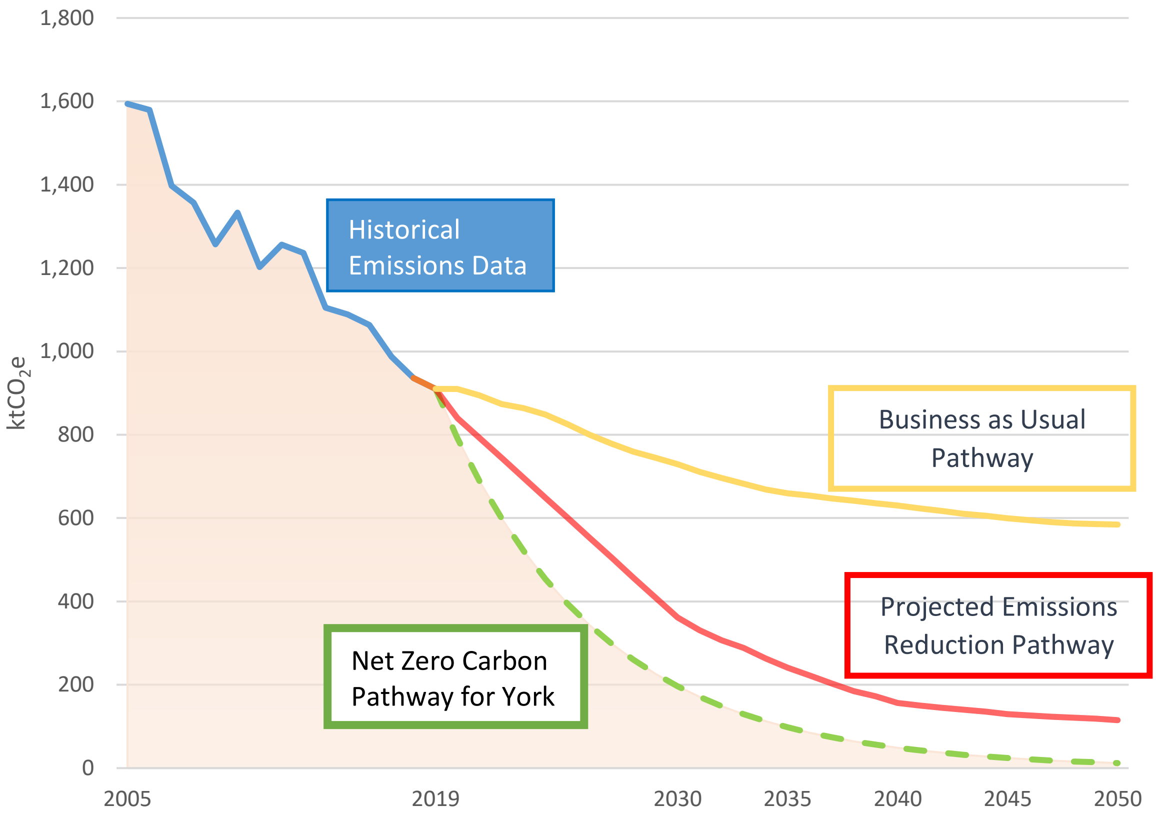


Figure XY: Projected Emissions Reduction Pathway and Business as Usual Pathway for York

In Focus: SCATTER Tool

SCATTER is a local authority focussed emissions measurement and modelling tool, built to help create low-carbon local authorities. SCATTER provides local authorities and city regions with the opportunity to standardise their greenhouse gas reporting and align to international frameworks, including the setting of targets in line with the Paris Climate Agreement. Its use is free of charge to all local authorities in the UK.

The SCATTER tool:

- Generates a greenhouse gas emissions inventory following the Global Protocol for City-wide Greenhouse Gas emissions for your local authority area
- Helps the understanding and development of a credible decarbonisation pathway in line with emissions reduction targets
- Provides outputs that can be used for engagement to create a collaborative carbon reduction approach for local authorities

Objectives Analysis

Understanding carbon impact potential

Figure XY provides a visual overview of the estimated carbon savings that would result if the objectives detailed in the Projected Emissions Pathway were achieved. Savings provided are cumulative, for the period 2020-2030.

- The diagram illustrates the high variance between the impact potential of the objective areas
- Mirroring the trend observed in the emissions inventory, the largest savings potential is found within the buildings and transportation sectors
- Specifically, actions associated with on-road transportation and building energy efficiency offer the biggest potential carbon savings

In seeking to achieve your net zero target, it is recommend prioritising action with the largest carbon saving potential.

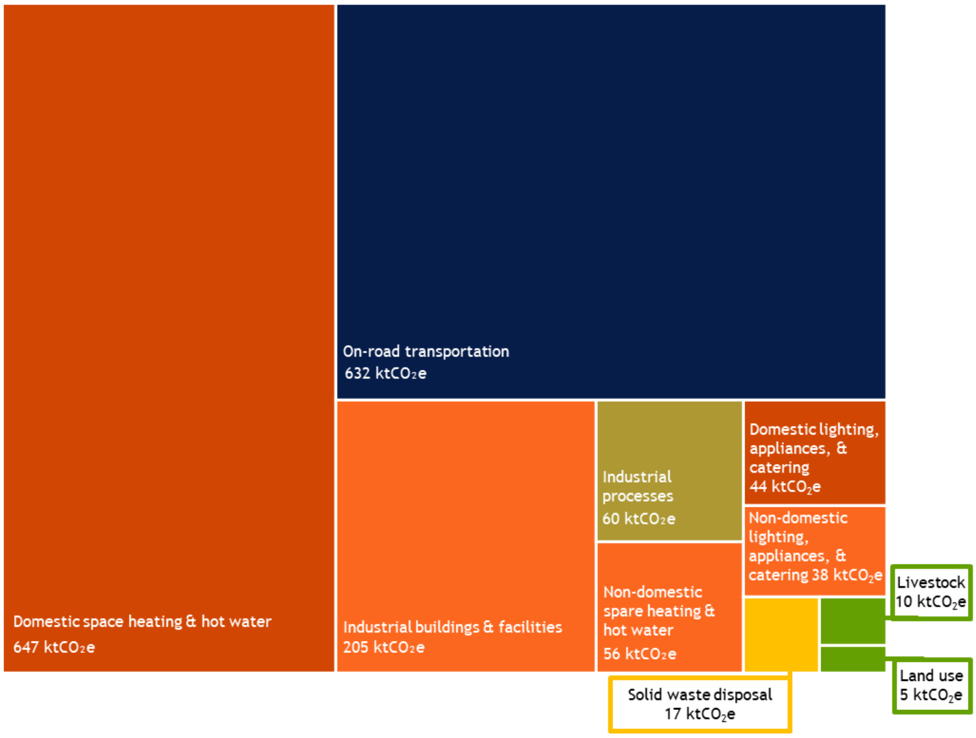


Figure xy: Cumulative carbon savings for York, 2020-2030, in line with the Projected Emissions Reduction Pathway

Cost Implications

There are different types of cost to consider when evaluating carbon reduction actions, which can be helpful to define:

- <u>Capital expenditure</u> (capex) represents funds used to acquire, replace or upgrade a fixed asset e.g., the showroom price of an electric vehicle
- <u>Operational expenditure</u> (opex) represents funds spent or earned in the use and maintenance of that asset throughout its life e.g., the price of charging point electricity used to power the electric vehicle

- Marginal cost represents *additional* expenditure incurred as a result of choosing a low-carbon option over a higher-carbon alternative e.g., the difference between the showroom price of an electric vehicle versus a diesel equivalent
- Annualised costs represent a combined yearly capex and opex cost associated with a given initiative. The upfront capex is averaged over the lifetime of the project/asset (equivalent to a depreciation charge) and combined with any in-year operational cost/savings to provide a single number to compare assets like for like.

Each of these financial metrics represents an important consideration for the business case for different actions and are not always directly comparable. Estimates provided here reflect this, with an attempt made to clearly define the type and specific nature of each cost.

It should be noted that costs given are high-level estimates only and that forward-looking cost models are inherently limited in accuracy. Estimates are not intended to act as definitive costings and are instead better used as a means of appreciating the scale and nature of the financial implications of different activities.

Methodology

Estimates are based on a comparison between the cost of a baseline case (the “BAU”) and Projected Emissions Reduction Pathway equivalent within SCATTER for each sector. Estimates have been made in isolation for different objectives based on specific research and data contexts. Where possible, an attempt has been made to enable like-for-like comparison between estimates made for different activities within the same sector. Cost assumptions are themselves based on government datasets and underlying research papers, most notably the CCC’s Sixth Carbon Budget.

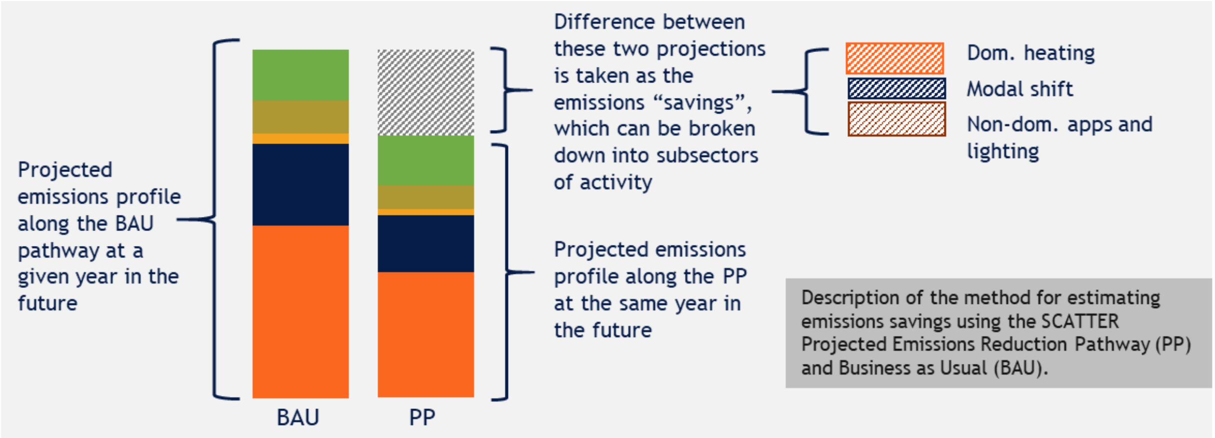
Carbon savings

Understanding the activities which offer the highest potential carbon savings is another way York can prioritise action towards net zero. Understanding which activities contribute most to reducing both District’s emissions also links into the hierarchy of actions for project development and sets out the “heavy hitting” objectives defined by SCATTER.

Estimating emissions savings

Using the Projected Emissions Reduction Pathway and “Business as Usual” scenarios we can estimate emissions savings, broken down into different categories. This is done by comparing the projected emissions along each pathway from different subsectors (e.g. domestic lighting or commercial heating) for each year, and defining the difference between them.

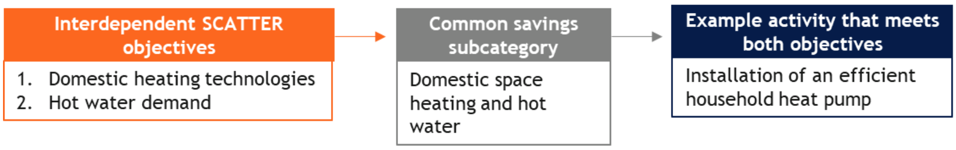
A visual representation of this method is given below.



Which areas of activity have been estimated?

The categories of emissions savings are broken down slightly differently to the SCATTER objectives, meaning that the savings are grouped slightly differently. This is because of the interdependency of the SCATTER objectives, where more than one objective contributes to the same savings subcategory.

Since one action can contribute to more than one SCATTER objective target, the savings from multiple separate objectives may be combined into one subcategory. This is illustrated below:



Estimated Cumulative Savings

Sector	SCATTER Objective	Subsector	Cumulative Savings from 2020	
			2030	2050
Domestic	Improved building efficiency	Domestic space heating and hot water	647 $ktCO_2e$	2,405 $ktCO_2e$
Domestic	Improved lighting and appliance efficiency	Domestic lighting, appliances, and cooking	44 $ktCO_2e$	117 $ktCO_2e$
Non- Domestic	Improved building efficiency	Industrial buildings and facilities	205 $ktCO_2e$	694 $ktCO_2e$
Non- Domestic	Improved heating efficiency	Commercial space heating, cooling, and hot water	56 $ktCO_2e$	262 $ktCO_2e$
Non- Domestic	Shifting off gas heaters			
Non- Domestic	Improved lighting and appliance efficiency	Commercial lighting, appliances, equipment, and catering	38 $ktCO_2e$	101 $ktCO_2e$

Sector	SCATTER Objective	Subsector	Cumulative Savings from 2020 ($ktCO_2e$)	
			2030	2050
Waste	Reducing the quantity of waste	Solid waste disposal	17 $ktCO_2e$	54 $ktCO_2e$
Waste	Increased recycling rates			
Transport	Switching to electric vehicles	On-road	632 $ktCO_2e$	1,582 $ktCO_2e$
Transport	Travelling shorter distances			
Transport	Driving less			
Transport	Improving freight emissions			
Industry	Shifting from fossil fuels	Industrial processes	21 $ktCO_2e$	87 $ktCO_2e$
Energy Supply	Local technologies	Stationary Energy sectors	1,050 $ktCO_2e$	3,744 $ktCO_2e$
Energy Supply	Large scale technologies			
The Natural Environment	Increase tree coverage and planting	Land use	5 $ktCO_2e$	21 $ktCO_2e$
The Natral Environment	Land use management			
The Natural Environment	Livestock management	Livestock	10 $ktCO_2e$	57 $ktCO_2e$

Buildings

Stakeholder Perspective

As part of the Climate Change Strategy & Action Plan development, three workshops were held, and a public attitude survey published to gain stakeholder views on how York could respond to the climate emergency. A summary of the key stakeholder views relating to buildings are detailed below.

Challenge areas	
Technical	○ Technologies that have reached maturity are now trusted and widely accepted (e.g. PVs), newer technologies still treated with scepticism and suffer from high cost. Heat pumps need financial subsidy to stimulate market until economies of scale drive down price. ○ Complicated systems that underperform can generate negative reactions. Only appropriate solutions should be specified with local demonstrators/pilots to showcase new technology.
Policy	○ Approach to decarbonisation of conservation/heritage assets is insufficient and inconsistent. National policy (NPPF) needs to reflect climate emergency priorities, local policy (The Local Plan) needs to provide standards and guidance for heritage retrofit and planning practice needs a consistent, joined up approach. ○ Need to balance decarbonisation with reducing fuel poverty and recognise the role of demand reduction.
Financial	○ Government subsidies for low carbon heating solutions have not been effective. Gas is too cheap and so a greater financial incentive is needed switch to electricity. ○ Financial offers can be complicated and initial capital outlay may be prohibitive for some organisations/households. Role for specialist independent advice.
Community	○ Broad awareness of need for change has increased significantly, but there is an evident behavioral gap when it comes to uptake. ○ Inconvenience, lack of simple independent information, complicated list of suppliers and pricing all add hassle factors to retrofit. There is a need for an independent and trusted brokerage service and local pilot/demonstrators.
Delivery	○ Limited availability of specialist consultants (particularly for heritage buildings). Highly skilled project co-ordinators/managers also needed in construction sector. Potential for area-based skill sharing schemes for Clerk of Works/Building Inspectors. ○ Need to provide suitable training, skills and market development but high level of inertia in trainers/education. National curriculum change will be slow so need to promote local apprenticeships and integrate into purchasing policy of local organisations.

Cost Estimates

SCATTER activity	Assessed cost (£m)
Switch to electric cookers	**6.1** (marginal opex as a result of switching to all-electric cooking systems)
New build standards are Passivhaus	**23** (marginal capex of building to Passivhaus standard during construction) **119** (marginal capex of retrofitting new-build Part L in the future)
Reduced household energy demand	**700 (**capex required for retrofit on existing homes)
Switching away from gas heating	**144** (marginal capex for domestic electric heating systems) **-155** (marginal opex as a result of switching to electrified heating)

<u>Notes & Caveats</u>

Switch to electric cookers

- *No additional capex assumed with the cost of installation for new electric cooking systems.*

- *Main cost here represents the potential added cost of fuel each year if the borough switches over time to electric systems, based on a marginal cost over a gas equivalent.*
- *Projected Emissions Reduction Pathway assumes a linear transition to electric cookers ending in 2035 – modelled as a retirement rate of 1/15th of gas systems replaced each year.*
- *The cost for a household that switches from a full gas to a full electric system may incur higher energy bills as a result of the higher cost of electricity. Long-run energy prices taken from the CCC Sixth Carbon Budget.*
- *This analysis does not consider government subsidies for energy prices which may have a significant role to play in lowering the cost to consumers.*

New build standards are to Passivhaus

- *These figures are taken from a Currie & Brown and AECOM report which defines the marginal cost between building Part-L or Passivhaus standard both during construction and retrofit phases at a later date. This also accounts for heating systems (assumes air-source heat pump in a semi-detached house).*
- *The cost of retrofitting runs very high because retrofitting newly-built Part L to higher standards in future can cost between 3-5 times more than building to Passivhaus during construction.*
- *Number of new builds taken from SCATTER newbuild projections between 2020-40.*

Reduced energy demand in homes

- *This represents the capex required to complete inner/external wall retrofit on the numbers of households described by the HA pathway.*
- *Point capital costs for insulation and all other costs come from this BEIS study into the cost of domestic retrofitting. This also accounts for economies of scale, other fixed project costs and local geographical weighting, as well as a hurdle rate.*
- *Assumes a linear transition of completed retrofit from 2020 household numbers.*

Switching away from gas heating

- *CCC Sixth Carbon Budget has data on capex and opex of a variety of domestic heating systems. An average of these systems was used to determine the cost estimate opposite.*
- *Number of households taken from SCATTER (2020) and split between gas/non-gas according to aggregated government estimates at LSOA level. A flat 5% assumption was made on households already served by an electric system. All other off-gas properties assumed to be oil boilers.*
- *All systems assumed replaced at some point (retirement rate 1/15), so replacement costs are calculated for all systems including fossil.*
- *Opex assumption assumes energy bills are reduced over time as a result of efficiency improvements of electric over gas.*

Building archetype	Improved building efficiency		Switching away from gas heating	
	Capex (£m)	Annual opex (£m)	Capex (£m)	Annual opex (£m)
Arts, community and leisure	5.1	-0.007	1.1	0.1
Education	4.8	-0.009	1.8	0.15
Emergency services	1.4	-0.003	0.6	0.05
Factories	18.1	-0.018	2.7	0.25
Health	3.9	-0.010	1.7	0.15
Hospitality	4.1	-0.007	0.8	0.05
Offices	14.2	-0.018	1.6	0.15
Shops	13.3	-0.018	1.1	0.1
Warehouses	5.8	-0.008	1.1	0.1
Total	70.560.6	-0.098	12.2	1.1

Notes & Caveats

Improved building efficiency

- *Non-domestic buildings in any area make up a very broad stock of diverse properties.*
- *The Non-Domestic National Energy Efficiency Database (ND-NEED) was used to find the number of rateable properties in York.*
- *Costings from Building Energy Efficiency Survey (BEES), which outlines the cost of a package of retrofit measures across different non-domestic archetypes. These were mapped onto the ND-NEED rateable properties register at the local level according to a nationally representative mix of archetypes.*
- *Costs represent one round of retrofit. Annualised costs relate to the annual marginal expenditure across all sectors over the lifetime of a 15-year cycle of retrofit.*

Switching away from gas heating

- *Average load demand for heating across different archetypes calculated based on a combination of BEES consumption data and CCC statistics on heating systems.*
- *CCC publish £/kW values for capex and opex which have been applied to a scaled figure of average load demand for space heating and hot water.*
- *Figures represent the capex of a new heating system, whilst opex covers routine maintenance but not fuel costs. Fuel costs are only projected to constitute significant additional bills in the retail and office sectors, offering cost savings to many archetypes due to more efficient systems.*
- *Heating systems assumed to be replaced at a rate of $1/15^{th}$ each year.*
- *Costs expressed represent the annualised, marginal cost between a business-as-usual gas case and a Projected Emissions Reduction Pathway transition to electrified systems. They represent the annual additional cost of electric systems versus replacement like for like with gas.*

Transport

As part of the Climate Change Strategy & Action Plan development, three workshops were held, and a public attitude survey published to gain stakeholder views on how York could respond to the climate emergency. A summary of the key stakeholder views relating to transport are detailed below.

Challenge areas	
Technical	○ There are many concerns regarding the lack of infrastructure surrounding the support of the transitions to EVs from a technical perspective; such as the lack of charging infrastructure and a gap in the data to help estimate the required change need to meet the growing demand. ○ Central hub is needed to connect more than one mode of transport e.g., one app connecting all journeys with different modes and influence decision making with costs per mode and carbon cost.
Policy	○ Long term security of policy is impossible due to change in political parties' agendas. ○ Clarification on policy on EV charging demand. ○ Historic nature of the city - how to accommodate infrastructure that is compliant with guidance. ○ Members of the Council may not live in the inner-city areas - who they represent may limit York's activities.
Financial	○ Funding schemes are short term - no finance in the medium/long term e.g., in 7-8 years. ○ Limited finance to pay for new bus networks/improvements. ○ Need funding to encourage residents to switch and enact that behaviour change and ensure offers are affordable. ○ How to make roads safer to increase cyclist confidence, speed reduction, large vehicle restriction - limited space. ○ 73% of survey respondents listed that an efficient and affordable public transport system should be a key objective of York's Climate Change Strategy.
Community	○ Lack of education on cost of an EV - Council should encourage people to think about switching to EV through more educational opportunities. ○ Encourage co-creation - discuss solutions with members of the community. ○ Engagement with community when encouraging shorter distances. ○ Ethical considerations are important - fair and just transition to consider all communities. ○ Direct engagement with communities to challenge conceptions and drive change.
Delivery	○ Facilitating behavior change by introducing earlier bus schedule. ○ Number of residents put pressure on transport and infrastructure - puts more pressure on the NHS. ○ Council to develop cycling routes through the city centre which connect to outer areas. ○ People don't want to leave the safety of their vehicles, especially with the pandemic and weather is changeable.

Type of cost	*Overall investment (£m)*	
	Capex	*Opex*
Infrastructure: cars/ vans/ motorcycles	*74.5*	*-*

Infrastructure: HGVs/ buses	*38.3*	*-*
Infrastructure: rail	*3.7*	*-*
Total infrastructure	*116.5*	*-*
New vehicles: cars/ vans/ motorcycles	*433.5*	*-1,441.1*
New vehicles: HGVs/ buses	*108.4*	*-23.8*
New vehicles: rail	*30.9*	*-129.5*
Total new vehicles	*572.8*	*-1594.4*
Efficiency measures	*-*	*-284.7*

Notes & caveats

- *CCC Sixth Carbon Budget costings for capital expenditure and operational savings in the surface transport sector have been recast under SCATTER objectives to 2050 to give an estimate for the implications of the Projected Emissions Reduction Pathway.*
- *Costs represent a scaled down portion of national expenditure in each area as set out in the Sixth Carbon Budget, based on vehicle registrations in York.*
- *Demand reduction and modal shift objectives have been mapped from the Projected Emissions Reduction Pathway onto the expenditure, assuming all costs rise proportionally.*
- *The vast majority of expenditure and savings related to transport is made in the purchase and operation of new electric vehicles.*
- *Additional costs have also been given as part of this analysis, shown below in Table X. These are sourced from DfT and CCC Sixth Carbon Budget.*
- *Scaled costings have also been included for the "efficiency measures" objective from CCC modelling. It should be noted that whilst the costings are representative of similar changes within SCATTER, the details of this measure do differ and this figure should be taken with an added caveat.*

Waste

As part of the Climate Change Strategy & Action Plan development, three workshops were held, and a public attitude survey published to gain stakeholder views on how York could respond to the climate emergency. A summary of the key stakeholder views relating to waste are detailed below.

Challenge areas	
Technical	○ Need to consider whether there is potential for a waste recovery plant and if it is a long-term solution, as waste is diverted from landfill and is instead generating energy. Potential to utilise existing technology but with additional infrastructure or technology should be explored - e.g. the conversion of the anaerobic digestion site. ○ Ongoing technical projects to find single use plastic alternatives through University of York. ○ Mycelium packaging assessing technical viability.
Policy	○ Having consistency between households and businesses, as businesses are mandated to do recycling and sort more waste as a result. ○ There's a need to be consistent in policy in infrastructure for waste, packaging and producer responsibility alongside any ongoing cost and management of waste. ○ Potential policy change could include food waste.
Financial	○ Uptake of Re-biz programme is not as high in certain areas due to a lack of audits and grants. ○ 55% of respondents to the Our Big Conversation Residents survey listed cost as a key reason preventing them from reducing their carbon footprint in areas including waste.
Community	○ Need to increase community awareness and business incentives to discourage single use plastic. ○ Need for community champions who provide encouragement and education for the smallest businesses.
Delivery	○ The biggest issue with microplastics is their depository in natural areas, their life cycle needs to be managed. ○ Time and effort into recycling different plastics and determine what can and can't be recycled. ○ Greater emphasis on larger businesses, need to consider whether different language and a different approach is needed.

SCATTER activity	Assessed cost (£m)

Reduce overall volume of waste & increased recycling	**-56.9** (opex savings in gate fees)

Notes & caveats

Waste disposal

- *This is based on simple modelling of future gate fees for recycling, landfill and incineration based on statistics in the 2019/20 WRAP gate fees report.*
- *SCATTER estimates for the volume and stream of waste are applied to current figures cast forwards to 2040.*
- *Gate fees represent the charge levied per tonne to dispose of waste by a given means e.g. landfill site or material recovery facility.*
- *Estimates do not cover the cost of collection and transport of waste. We have assumed there is no marginal cost between the two scenarios – lifetime cost of electric refuse collection vehicles (RCVs) is comparable to that of diesel RCV (see table opposite from DfT data).*
- *Not all payments for waste are handled purely through gate fees but this represents a useful proxy for comparative costs of increased recycling and reducing waste volumes versus the counterfactual.*

Commercial & Industrial

As part of the Climate Change Strategy & Action Plan development, three workshops were held, and a public attitude survey published to gain stakeholder views on how York could respond to the climate emergency. A summary of the key stakeholder views relating to industry are detailed below.

Challenge areas	
Technical	○ Although technology already exists to capture carbon emissions, such as carbon capture storage (CCS), it is not readily available. ○ Consistent demand for energy in industry provides an opportunity for a Power Purchase Agreement. ○ Consistent demand for energy in industry may limit the ability to rely on renewable energy without sufficient energy storage.
Policy	○ There is an existing Clean Growth Strategy for the UK, which should be referenced and considered. ○ Most policy focused on industry is at larger geographical scales than a local authority, so the influence of CYC may be limited.
Financial	○ COVID Recovery Loan Scheme from government is set to help industries hit particularly hard by the pandemic and provides an opportunity for building back better and driving low-carbon growth and low-carbon infrastructure. ○ Development of low-carbon infrastructure can have high associated costs. ○ Businesses may not have significant available funds due to COVID-19, and therefore would need financial support to implement changes. ○ Funding needs to be made available to businesses of all sizes. ○ CCS has high associate costs.
Community	○ Jobs may be created in CCS trials and low-carbon infrastructure. ○ May face resistance from industry without support. ○ There may be a skills shortage in the local workforce to install low -carbon infrastructure.
Delivery	○ External reporting mechanisms provide guidance and structure to reporting. ○ External reporting mechanisms have high credibility and reflect well on the business. ○ Knowledge of low-carbon infrastructure and energy efficiency measures to be included in new builds may be limited. ○ Heritage and historical importance of York's landscape may limit infrastructure improvements.

SCATTER activity	Assessed cost (£m)
Industrial processes	**5.6** (capex)

Notes & Caveats

- *Cost represents the marginal capex of a low-carbon pathway for industry, scaled to Slough based on their share of national industrial fuel consumption.*
- *Government pathways can be found in the industrial pathways to decarbonisation summary report.*

Natural Environment

Challenge areas	
Technical	○ Tree planting can be used to mitigate the risk of flooding which doesn't have to be within York's boundary and can be tied into local York initiatives. ○ Trees offer a nature-based solution to the warming of urban areas by providing shade.
Policy	○ Under the UK's exit from the European Union, policy can move away from the Common Agricultural Policy and a provide a change in funding requirements for landowners. The requirements could focus on the public good and there could be more funding options for decarbonisation/afforestation. ○ The temporal period is a barrier to tree planting and tree cover reducing carbon emissions. Policy should consider that more mature trees have more significant impact but may not tie into the 2030 timeline.
Financial	○ There are existing funding streams available for urban planting. ○ There is an associated cost to the maintenance of trees and green space which needs to be demonstrated. ○ The return on investment in the form of carbon sequestration will be more in the long-term.
Community	○ Need to address the public view of the value of trees and how they benefit the city. ○ Community engagement is very important and should be viewed as a positive upfront investment. ○ Involving the community with green infrastructure initiatives engages people with nature. ○ There may be disagreement and resistance to local changes, also known as "Not In My Back Yard"-ism (NIMBYSM), over the location of new trees.
Delivery	○ There are opportunities for rewilding and tree planting in the outer areas of York. ○ Tree planting in urban areas can also look at levels of deprivation when deciding on locations to improve local areas. ○ Land use availability - land under local authority ownership covers a small percentage of the district, which means that the impact tree planting can be dependent on the engagement and willingness of local landowners.

SCATTER activity	Assessed cost (£m)
Increased forest and tree coverage	**3.9-0.77** (capex range depending on availability of government grant support)

Notes & Caveats

- *Tree coverage and land area change under SCATTER objectives were modelled to 2030 in terms of increase in hectares of woodland.*
- *Woodland Creation & Management Grant gives costs for capex and opex per hectare of new woodland, which have been applied to the new hectares.*
- *Further funding opportunities for woodland creation, maintenance, management and tree health can be found here.*
- *Figures represent a marginal case for Projected Emissions Reduction Pathway over BAU; the range represents the impact government grant funding may have.*

Energy

As part of the Climate Change Strategy & Action Plan development, three workshops were held, and a public attitude survey published to gain stakeholder views on how York could respond to the climate emergency. A summary of the key stakeholder views relating to energy supply are detailed below.

Challenge areas	
Technical	○ Assessments from the Council should look at all renewable energy options e.g., a heat pump strategy, wind strategy. ○ The use of technology should be maximised, e.g., apps that show the amount of money and carbon saved from renewable energy. ○ Technology should also be used to amplify good practice e.g., apps to share case studies and tips.
Policy	○ There is a gap in policy for new-build properties between the Local Plan and the requirements of Passivhaus. There is a need to balance Passivhaus and offering retrofitting such as loft insulation across the city, existing stock should also be focused on. ○ Historic and heritage-based policy may conflict with renewable energy installation.
Financial	○ Energy Service Companies (ESCOs) can benefit SMEs through free or cheap audits, the development of a plan and help accessing finance to invest in upgrades. The payment then comes out of saving made from energy bills. This method is working well in Oxford but does require some initial capital investment. The ability of ESCOs to benefit small businesses may be limited. ○ Funding opportunities are predominantly for larger businesses and need to be made available to small businesses. ○ Need to provide a financial incentive for people/businesses.
Community	○ Need to ensure all groups are accounted for and get a say in any transition/conversation. ○ Negative view of putting in a planning application for wind turbines to the council due to negative past experiences. ○ Opportunity for tying the COVID-19 recovery to initiatives. ○ Role of the creative sector to reshape the heritage view of the city to now include renewable options e.g., wind turbines.
Delivery	○ Solar tiles may be more beneficial than solar panels. ○ Implement smart grid technologies e.g., demand-side response to manage renewable energy supply/demand. ○ Allocate small portion of new renewables to be community-owned. ○ Carbon literacy may help with the missing conversation to promote renewable energy.

Renewable energy source	*Overall investment (£m)*			
	Capex *to 2030*	***Opex*** *to 2030*	***Capex*** *to 2050*	***Opex*** *to 2050*
Offshore wind	*32.6*	*47.5*	*127.2*	*227.9*
Onshore wind	*47.2*	*29*	*21.9*	*15.2*
Large-scale PV (>10kW)	*3.5*	*2.4*	*8.3*	*6*
Small-scale PV (<10kW)	*136.3*	*27.9*	*398*	*76*
Hydroelectric	*8*	*4.8*	*8.4*	*5.1*
Total	*227*	*111*	*563.7*	*330.2*

Notes & Caveats

- *The Projected Emissions Reduction Pathway for installed capacity across different renewable energy types has been cost modelled according to a BEIS report on the development of new installations.*
- *Costs of installation and maintenance are in constant flux; two benchmark constructing years (2030 & 2050) have been chosen from BEIS data and compared against capacities within the Projected Emissions Reduction Pathway*
- *It is important to acknowledge that not all costs are incurred by a single stakeholder, since larger installations are government funded and smaller scale PV installations are paid for by households and businesses.*
- *Figures below indicate the scale of investment in renewable energy each year in order to meet the capacity targets set out by the Projected Emissions Reduction Pathway.*

Date Tables

Local Authority territorial CO_2 emissions estimates 2005-2019 (kt CO_2) - Full dataset

Region/Country	Second Tier Authority	Local Authority	Code	Year	Industry Electricity	Industry Gas	Industry 'Other Fuels'	Large Industrial Installations	Agriculture	**Industry Total**	Commercial Electricity	Commercial Gas	Commercial 'Other Fuels'	**Commercial Total**	Public Sector Electricity	Public Sector Gas	Public Sector 'Other Fuels'	**Public Sector Total**
Yorkshire and the Humber	York	York	E06000014	2005	51.7	50.9	27.9	2.5	6.7	**139.8**	174.6	112.3	0.7	**287.5**	50.7	56.8	1.6	**109.1**
Yorkshire and the Humber	York	York	E06000014	2006	52.4	49.8	27.4	2.6	6.5	**138.7**	176.9	110.0	0.5	**287.3**	51.3	55.7	1.1	**108.1**
Yorkshire and the Humber	York	York	E06000014	2007	49.1	33.2	27.2	2.6	5.9	**117.8**	165.7	73.2	0.5	**239.3**	48.1	37.0	0.9	**86.1**
Yorkshire and the Humber	York	York	E06000014	2008	48.7	32.3	22.5	0.1	6.0	**109.5**	164.4	71.2	0.5	**236.1**	47.7	36.1	0.8	**84.6**
Yorkshire and the Humber	York	York	E06000014	2009	44.8	27.3	19.1	0.3	5.8	**97.2**	151.3	60.2	0.4	**211.9**	43.9	30.5	0.6	**74.9**
Yorkshire and the Humber	York	York	E06000014	2010	48.5	31.0	20.9	0.0	5.7	**106.1**	163.6	68.5	0.4	**232.5**	47.5	34.7	0.4	**82.6**
Yorkshire and the Humber	York	York	E06000014	2011	43.3	26.8	18.0	0.2	5.9	**94.1**	150.3	55.6	0.4	**206.2**	42.8	28.9	0.8	**72.4**
Yorkshire and the Humber	York	York	E06000014	2012	43.6	17.0	19.9	0.3	5.8	**86.6**	148.2	65.5	0.3	**214.1**	44.6	42.5	0.5	**87.6**
Yorkshire and the Humber	York	York	E06000014	2013	40.6	30.8	17.7	0.1	5.3	**94.4**	139.8	74.3	0.3	**214.4**	40.9	35.4	0.3	**76.6**
Yorkshire and the Humber	York	York	E06000014	2014	36.6	28.2	19.1	0.0	5.7	**89.6**	124.9	60.8	0.4	**186.1**	36.8	29.3	0.4	**66.4**
Yorkshire and the Humber	York	York	E06000014	2015	29.1	50.0	20.2	0.1	5.7	**105.0**	97.0	46.7	0.6	**144.3**	28.9	30.4	0.2	**59.5**
Yorkshire and the Humber	York	York	E06000014	2016	22.3	51.9	20.0	0.2	5.8	**100.2**	77.9	46.9	0.5	**125.3**	22.7	29.7	0.2	**52.6**
Yorkshire and the Humber	York	York	E06000014	2017	22.2	34.5	20.4	0.1	5.8	**83.0**	66.7	51.7	0.2	**118.5**	19.3	24.7	0.3	**44.2**
Yorkshire and the Humber	York	York	E06000014	2018	20.8	32.4	20.6	0.1	5.7	**79.6**	63.5	50.7	0.6	**114.8**	18.0	29.3	0.3	**47.6**
Yorkshire and the Humber	York	York	E06000014	2019	17.2	33.1	19.8	0.1	6.3	**76.5**	56.3	47.7	0.5	**104.5**	16.8	24.3	0.2	**41.3**

Year	Domestic Electricity	Domestic Gas	Domestic 'Other Fuels'	**Domestic Total**	Road Transport (A roads)	Road Transport (Motorways)	Road Transport (Minor roads)	Diesel Railways	Transport Other	**Transport Total**	Net Emissions: Forest land	Net Emissions: Cropland	Net Emissions: Grassland	Net Emissions: Wetlands	Net Emissions: Settlements	Net Emissions: Harvested Wood Products	**LULUCF Net Emissions**	**Grand Total**	Population ('000s, mid-year estimate)	**Per Capita Emissions (t)**	Area (km^2)	**Emissions per km^2 (kt)**
2005	185.8	259.7	15.6	**461.1**	198.0	0.0	104.5	7.8	3.5	**313.9**	-7.4	9.3	-10.7	0.0	5.6	0.0	**-3.3**	**1,308.1**	188.2	**6.9**	272.0	**4.8**
2006	191.6	251.5	15.0	**458.1**	198.1	0.0	104.9	7.8	3.6	**314.5**	-7.6	9.2	-11.0	0.0	5.5	0.0	**-4.0**	**1,302.8**	189.0	**6.9**	272.0	**4.8**
2007	188.8	236.0	13.8	**438.5**	195.9	0.0	108.6	8.0	3.6	**316.1**	-7.6	8.8	-11.2	0.0	5.3	0.0	**-4.7**	**1,193.2**	189.8	**6.3**	272.0	**4.4**
2008	180.3	244.3	14.6	**439.1**	182.8	0.0	107.2	8.1	3.7	**301.8**	-7.7	8.8	-11.4	0.0	5.2	0.0	**-5.1**	**1,166.1**	190.8	**6.1**	272.0	**4.3**
2009	165.2	223.0	13.8	**402.0**	177.1	0.0	103.6	8.2	3.7	**292.6**	-7.7	8.9	-11.5	0.0	5.0	0.0	**-5.2**	**1,073.5**	192.4	**5.6**	272.0	**3.9**
2010	170.8	249.2	15.1	**435.0**	174.4	0.0	103.9	8.2	3.8	**290.3**	-7.7	8.7	-11.6	0.0	5.0	0.0	**-5.7**	**1,140.7**	195.1	**5.8**	272.0	**4.2**
2011	162.8	206.6	12.9	**382.3**	170.5	0.0	103.4	8.1	3.8	**285.7**	-7.8	8.6	-11.8	0.0	4.9	0.0	**-6.1**	**1,034.7**	197.8	**5.2**	272.0	**3.8**
2012	172.9	226.8	12.7	**412.4**	172.1	0.0	102.7	8.1	3.7	**286.5**	-7.6	8.5	-12.0	0.0	4.9	0.0	**-6.3**	**1,080.9**	199.6	**5.4**	272.0	**4.0**
2013	156.3	229.5	13.7	**399.4**	168.8	0.0	105.3	8.0	3.8	**285.9**	-7.6	8.3	-12.3	0.0	4.7	0.0	**-6.9**	**1,063.8**	202.1	**5.3**	272.0	**3.9**
2014	132.5	193.6	12.7	**338.7**	169.0	0.0	111.2	8.2	3.9	**292.4**	-7.7	8.0	-12.3	0.0	4.7	0.0	**-7.2**	**966.0**	203.7	**4.7**	272.0	**3.6**
2015	112.5	204.0	12.7	**329.2**	174.7	0.0	112.9	8.2	4.0	**299.9**	-7.8	8.0	-12.6	0.0	4.7	0.0	**-7.7**	**930.2**	205.8	**4.5**	272.0	**3.4**
2016	91.9	209.9	12.6	**314.4**	175.5	0.0	120.1	8.2	4.0	**307.9**	-7.8	7.9	-12.6	0.0	4.8	0.0	**-7.7**	**892.8**	206.9	**4.3**	272.0	**3.3**
2017	78.8	203.2	12.5	**294.5**	178.4	0.0	121.8	8.1	4.2	**312.6**	-7.8	7.9	-13.0	0.0	4.6	0.0	**-8.2**	**844.7**	208.2	**4.1**	272.0	**3.1**
2018	71.5	209.4	12.7	**293.6**	170.0	0.0	130.5	7.7	4.2	**312.4**	-7.8	7.7	-13.1	0.0	4.6	0.0	**-8.6**	**839.4**	209.9	**4.0**	272.0	**3.1**
2019	63.5	208.5	12.2	**284.1**	165.8	0.0	132.6	7.1	4.3	**309.8**	-7.8	7.8	-13.2	0.0	4.5	0.0	**-8.6**	**807.6**	210.6	**3.8**	272.0	**3.0**

Local Authority territorial CO_2 emissions estimates estimates within the scope of influence of Local Authorities 2005-2019 (kt CO_2) - Subset dataset *(Excludes large industrial sites, railways, motorways and land-use)*

Region/Country	Second Tier Authority	Local Authority	Code	Year	Industry Electricity	Industry Gas	Industry 'Other Fuels'	Large Industrial Installations	Agriculture	**Industry Total**	Commercial Electricity	Commercial Gas	Commercial 'Other Fuels'	**Commercial Total**
Yorkshire and the Humber	York	York	E06000014	2005	51.7	50.9	27.9	0.0	4.2	**134.7**	174.6	112.3	0.7	**287.5**
Yorkshire and the Humber	York	York	E06000014	2006	52.4	49.8	27.4	0.0	4.0	**133.6**	176.9	110.0	0.5	**287.3**
Yorkshire and the Humber	York	York	E06000014	2007	49.1	33.2	27.2	0.0	3.8	**113.2**	165.7	73.2	0.5	**239.3**
Yorkshire and the Humber	York	York	E06000014	2008	48.7	32.3	22.5	0.0	3.7	**107.1**	164.4	71.2	0.5	**236.1**
Yorkshire and the Humber	York	York	E06000014	2009	44.8	27.3	19.1	0.0	3.7	**94.8**	151.3	60.2	0.4	**211.9**
Yorkshire and the Humber	York	York	E06000014	2010	48.5	31.0	20.9	0.0	3.7	**104.1**	163.6	68.5	0.4	**232.5**
Yorkshire and the Humber	York	York	E06000014	2011	43.3	26.8	18.0	0.0	3.8	**91.8**	150.3	55.6	0.4	**206.2**
Yorkshire and the Humber	York	York	E06000014	2012	43.6	17.0	19.9	0.0	3.9	**84.4**	148.2	65.5	0.3	**214.1**
Yorkshire and the Humber	York	York	E06000014	2013	40.6	30.8	17.7	0.0	3.8	**92.9**	139.8	74.3	0.3	**214.4**
Yorkshire and the Humber	York	York	E06000014	2014	36.6	28.2	19.1	0.0	3.8	**87.8**	124.9	60.8	0.4	**186.1**
Yorkshire and the Humber	York	York	E06000014	2015	29.1	50.0	20.2	0.0	4.0	**103.3**	97.0	46.7	0.6	**144.3**
Yorkshire and the Humber	York	York	E06000014	2016	22.3	51.9	20.0	0.0	4.2	**98.5**	77.9	46.9	0.5	**125.3**
Yorkshire and the Humber	York	York	E06000014	2017	22.2	34.5	20.4	0.0	4.2	**81.3**	66.7	51.7	0.2	**118.5**
Yorkshire and the Humber	York	York	E06000014	2018	20.8	32.4	20.6	0.0	4.2	**78.0**	63.5	50.7	0.6	**114.8**
Yorkshire and the Humber	York	York	E06000014	2019	17.2	33.1	19.8	0.0	4.2	**74.3**	56.3	47.7	0.5	**104.5**

Year	Public Sector Electricity	Public Sector Gas	Public Sector 'Other Fuels'	**Public Sector Total**	Domestic Electricity	Domestic Gas	Domestic 'Other Fuels'	**Domestic Total**	Road Transport (A roads)	Road Transport (Minor roads)	Transport Other	**Transport Total**	**Grand Total**	Population ('000s, mid-year estimate)	Per Capita Emissions (t)	Area (km^2)	Emissions per km^2 (kt)
2005	50.7	56.8	1.6	109.1	185.8	259.7	15.6	**461.1**	198.0	104.5	3.5	**306.1**	**1,298.5**	188.2	6.9	272.0	4.8
2006	51.3	55.7	1.1	108.1	191.6	251.5	15.0	**458.1**	198.1	104.9	3.6	**306.7**	**1,293.8**	189.0	6.8	272.0	4.8
2007	48.1	37.0	0.9	86.1	188.8	236.0	13.8	**438.5**	195.9	108.6	3.6	**308.1**	**1,185.2**	189.8	6.2	272.0	4.4
2008	47.7	36.1	0.8	84.6	180.3	244.3	14.6	**439.1**	182.8	107.2	3.7	**293.7**	**1,160.7**	190.8	6.1	272.0	4.3
2009	43.9	30.5	0.6	74.9	165.2	223.0	13.8	**402.0**	177.1	103.6	3.7	**284.4**	**1,068.1**	192.4	5.6	272.0	3.9
2010	47.5	34.7	0.4	82.6	170.8	249.2	15.1	**435.0**	174.4	103.9	3.8	**282.0**	**1,136.2**	195.1	5.8	272.0	4.2
2011	42.8	28.9	0.8	72.4	162.8	206.6	12.9	**382.3**	170.5	103.4	3.8	**277.6**	**1,030.4**	197.8	5.2	272.0	3.8
2012	44.6	42.5	0.5	87.6	172.9	226.8	12.7	**412.4**	172.1	102.7	3.7	**278.4**	**1,076.9**	199.6	5.4	272.0	4.0
2013	40.9	35.4	0.3	76.6	156.3	229.5	13.7	**399.4**	168.8	105.3	3.8	**277.9**	**1,061.2**	202.1	5.3	272.0	3.9
2014	36.8	29.3	0.4	66.4	132.5	193.6	12.7	**338.7**	169.0	111.2	3.9	**284.2**	**963.2**	203.7	4.7	272.0	3.5
2015	28.9	30.4	0.2	59.5	112.5	204.0	12.7	**329.2**	174.7	112.9	4.0	**291.7**	**928.1**	205.8	4.5	272.0	3.4
2016	22.7	29.7	0.2	52.6	91.9	209.9	12.6	**314.4**	175.5	120.1	4.0	**299.7**	**890.6**	206.9	4.3	272.0	3.3
2017	19.3	24.7	0.3	44.2	78.8	203.2	12.5	**294.5**	178.4	121.8	4.2	**304.5**	**843.1**	208.2	4.1	272.0	3.1
2018	18.0	29.3	0.3	47.6	71.5	209.4	12.7	**293.6**	170.0	130.5	4.2	**304.7**	**838.7**	209.9	4.0	272.0	3.1
2019	16.8	24.3	0.2	41.3	63.5	208.5	12.2	**284.1**	165.8	132.6	4.3	**302.7**	**806.9**	210.6	3.8	272.0	3.0

Pollution Inventory — **CO_2 emissions (kt)**

Local Authority Distract Name	Operator	Site	Postcode	Reference	Substance Name	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
York	British Sugar Plc	York	YO26 6XF	AA2518	Carbon dioxide	59.31														
York	British Sugar Plc	York	YO26 6XF	BW9239IF	Carbon dioxide - 'thermal'		57.29	80.64												
York	Nestle UK Ltd	York	YO91 1XY	BO9298IQ	Carbon dioxide					30.19	32.70	30.95	26.67	26.78	30.58	29.55	25.67	24.80	31.68	32.35
York	Nestle UK Ltd	York	YO91 1XY	BO9298IQ	Carbon dioxide - 'thermal'				43.84											
York	Yorkshire Water Services Ltd	York Naburn STW	YO23 2XD	27/24/0124	Carbon dioxide					10.18										
York	Yorwaste Ltd	York	YO23 3RR	BK0507IB	Carbon dioxide	13.70						0.03								

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

The tables below set out the IPCC sectors from the UK GHGI which are included in each of the LA CO2 sector categories, including the specific fuels or other sub-categories where necessary.

Sectors used in LA CO_2 - IPCC or other scope

LA CO_2 Sector	Scope
Industry Electricity	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'Unallocated' purchases from high voltage lines
	Further split using IDBR data for SIC07 subsections 01-32, 35-39 & 42
Industry Gas	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'C. Large Industrial Installations'
	Further split using IDBR data for SIC07 subsections 01-32, 35-39 & 42
Large Industrial Installations	Large industrial installations excl. gas combustion - from e.g. EUETS, IPPC & EEMS
	Large gas users excluded from BEIS subnational dataset
Industry 'Other Fuels'	1A2 Blast furnace gas
	1A2 Burning oil
	1A2 Coal
	1A2 Coke
	1A2 Coke oven gas
	1A2 DERV
	1A2 Fuel oil
	1A2 Gas oil
	1A2 LPG
	1A2 Lubricants
	1A2 OPG
	1A2 Petrol
	1A2 Petroleum coke
	1A2 Scrap tyres
	1A2 Waste
	1A2 Waste oils
	1A2 Waste solvent
	1A4a Burning oil (Railways - stationary combustion)
	1A4a Coal (Railways - stationary combustion)
	1A4a Fuel oil (Railways - stationary combustion)
	1A4a Gas oil (Railways - stationary combustion)
	2B6
	2B7
	2B8
	2C3
	2D4
	5C1
Agriculture	1A4c Burning oil
	1A4c Coal
	1A4c Fuel oil
	1A4c Gas oil
	1A4c Petrol
	3H
Commercial Electricity	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'Unallocated' purchases from high voltage lines
	Further split using IDBR data for SIC07 subsections 33, 41, 43-82, 88-96
Commercial Gas	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'C. Large Industrial Installations'
	Further split using IDBR data for SIC07 subsections 33, 41, 43-82, 88-96
Commercial 'Other Fuels'	1A4a Burning oil (Miscellaneous industrial/commercial combustion)
	1A4a Coal (Miscellaneous industrial/commercial combustion)
	1A4a Fuel oil (Miscellaneous industrial/commercial combustion)
	1A4a Gas oil (Miscellaneous industrial/commercial combustion)
Public Sector Electricity	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'Unallocated' purchases from high voltage lines
	Further split using IDBR data for SIC07 subsections 84-87
Public Sector Gas	Non-domestic, as per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
	Some large users included in 'C. Large Industrial Installations'
	Further split using IDBR data for SIC07 subsections 84-87
Public Sector 'Other Fuels'	1A4a Burning oil (Public sector combustion)
	1A4a Coal (Public sector combustion)
	1A4a Fuel oil (Public sector combustion)
	1A4a Gas oil (Public sector combustion)
Domestic Electricity	As per BEIS subnational electricity statistics
	sub-national-methodology-guidance.pdf
Domestic Gas	As per BEIS subnational gas statistics
	sub-national-methodology-guidance.pdf
Domestic 'Other Fuels'	1A4b Anthracite
	1A4b Burning oil
	1A4b Coal
	1A4b Coke
	1A4b DERV
	1A4b Gas oil
	1A4b LPG
	1A4b Peat
	1A4b Petrol
	1A4b Petroleum coke
	1A4b SSF
	2D2
Road Transport (A roads)	1A3b (A roads) Petrol/DERV
Road Transport (Motorways)	1A3b (Motorways) Petrol/DERV
Road Transport (Minor roads)	1A3b (Minor roads) Petrol/DERV
Diesel Railways	1A3c Gas oil
Transport Other	1A3b LPG
	1A3b Lubricants
	1A3c Coal
	1A3d
	1A3e
Net Emissions: Forest land	4A
Net Emissions: Cropland	4B
Net Emissions: Grassland	4C
Net Emissions: Wetlands	4D
Net Emissions: Settlements	4E
Net Emissions: Harvested Wood Products	4G

IPCC sectors covered by LA CO_2

IPCC code	IPCC name
1A2a	Iron and steel
1A2b	Non-Ferrous Metals
1A2c	Chemicals
1A2d	Pulp Paper Print
1A2e	food processing beverages and tobacco
1A2f	Non-metallic minerals
1A2gvii	Off-road vehicles and other machinery
1A2gviii	Other manufacturing industries and construction
1A3bi	Cars
1A3bii	Light duty trucks
1A3biii	Heavy duty trucks and buses
1A3biv	Motorcycles
1A3bv	Other road transport
1A3c	Railways
1A3d	Domestic navigation
1A3eii	Other Transportation
1A4ai	Commercial/Institutional
1A4bi	Residential stationary
1A4bii	Residential: Off-road
1A4ci	Agriculture/Forestry/Fishing: Stationary
1A4cii	Agriculture/Forestry/Fishing: Off-road
2A1	Cement Production
2A2	Lime Production
2A3	Glass production
2A4a	Other process uses of carbonates: ceramics
2A4b	Other uses of Soda Ash
2B1	Ammonia Production
2B1	Chemical Industry: Ammonia production
2B6	Titanium dioxide production
2B7	Soda Ash Production
2B8c	Ethylene Dichloride and Vinyl Chloride Monomer
2B8d	Ethylene Oxide
2B8f	Carbon black production
2B8g	Petrochemical and carbon black production: Other
2C1a	Steel
2C1d	Sinter
2C3	Aluminium Production
2D1	Lubricant Use
2D2	Non-energy products from fuels and solvent use: Paraffin wax use
2D3	Non-energy products from fuels and solvent use: Other
2D4	Other NEU
2G4	Other product manufacture and use-baking soda
3G1	Liming - limestone
3G2	Liming - dolomite
3H	Urea Application
4A1	Forest Land remaining Forest Land
4A2	Land converted to Forest Land
4B1	Cropland Remaining Cropland
4B1	Cropland Remaining Cropland
4B2	Land converted to Cropland
4C1	Grassland Remaining Grassland
4C2	Land converted to Grassland
4D1	Wetlands remaining wetlands
4D2	Land converted to wetlands
4E1	Settlements remaining settlements
4E2	Land converted to Settlements
4G	Harvested Wood Products
5C1.2b	Non-biogenic: Clinical waste
5C1.2b	Non-biogenic: Other Chemical waste

Renewable electricity: number of installations at Local Authority Level

	0	Local Authority Name	Region	Country	Estimated number of households	Photovoltaics	Onshore Wind	Hydro	Anaerobic Digestion	Offshore Wind	Wave/Tidal	Sewage Gas	Landfill Gas	Municipal Solid Waste	Animal Biomass	Plant Biomass	Cofiring	Total
2020	E06000014	York	Yorkshire and The Humber	England	84,212	3,301	6	-	-	-	-	2	2	-	-	-	-	3,311
2019	E06000014	York	Yorkshire and The Humber	England	84,212	3,288	6	-	-	-	-	2	2	-	-	-	-	3,298
2018	E06000014	York	Yorkshire and The Humber	England	84,212	3,183	6	-	-	-	-	2	2	-	-	-	-	3,193
2017	E06000014	York	Yorkshire and The Humber	England	84,212	3,135	6	-	-	-	-	2	2	-	-	-	-	3,145
2016	E06000014	York	Yorkshire and The Humber	England	84,212	3,085	6	-	-	-	-	2	2	-	-	-	-	3,095
2015	E06000014	York	Yorkshire and The Humber	England	84,212	2,944	6	-	-	-	-	2	2	-	-	-	-	2,954
2014	E06000014	York	Yorkshire and The Humber	England	84,212	2,386	7	-	-	-	-	2	2	-	-	-	-	2,397

Renewable electricity: Installed Capacity (MW) at Local Authority Level

	Local Authority Code	Local Authority Name	Region	Country	Estimated number of households	Photovoltaics	Onshore Wind	Hydro	Anaerobic Digestion	Offshore Wind	Wave/Tidal	Sewage Gas	Landfill Gas	Municipal Solid Waste	Animal Biomass	Plant Biomass	Cofiring	Total
2020	E06000014	York	Yorkshire and The Humber	England	84,212	12.424	0.043	-	-	-	-	0.717	7.119	-	-	-	-	20.302
2019	E06000014	York	Yorkshire and The Humber	England	84,212	12.1	0.0	-	-	-	-	0.7	7.1	-	-	-	-	20.0
2018	E06000014	York	Yorkshire and The Humber	England	84,212	11.6	0.0	-	-	-	-	0.7	7.1	-	-	-	-	19.5
2017	E06000014	York	Yorkshire and The Humber	England	84,212	11.4	0.0	-	-	-	-	0.7	7.1	-	-	-	-	19.3
2016	E06000014	York	Yorkshire and The Humber	England	84,212	11.1	0.0	-	-	-	-	0.7	7.1	-	-	-	-	19.0
2015	E06000014	York	Yorkshire and The Humber	England	84,212	10.7	0.0	-	-	-	-	1.1	7.1	-	-	-	-	19.0
2014	E06000014	York	Yorkshire and The Humber	England	84,212	8.5	0.1	-	-	-	-	1.1	7.1	-	-	-	-	16.8

Renewable electricity generation: (MWh) at Local Authority Level

	Local Authority Code	Local Authority Name	Region	Country	Estimated number of households	Photovoltaics	Onshore Wind	Hydro	Anaerobic Digestion	Offshore Wind	Wave/Tidal	Sewage Gas	Landfill Gas	Municipal Solid Waste	Animal Biomass	Plant Biomass	Cofiring	Total
2020	E06000014	York	Yorkshire and The Humber	England	84,212	12,213.716	115.613	-	-	-	-	4,258.048	23,021.000	-	-	-	-	39,608.377
2019	E06000014	York	Yorkshire and The Humber	England	84,212	11,181	93	-	-	-	-	5,198	28,665	-	-	-	-	45,138
2018	E06000014	York	Yorkshire and The Humber	England	84,212	11,309	90	-	-	-	-	4,269	28,003	-	-	-	-	43,670
2017	E06000014	York	Yorkshire and The Humber	England	84,212	98,585	357	-	-	-	-	4,503	31,061	-	-	-	-	134,507
2016	E06000014	York	Yorkshire and The Humber	England	84,212	96,738	358	-	-	-	-	4,685	33,587	-	-	-	-	135,368
2015	E06000014	York	Yorkshire and The Humber	England	84,212	8,755	107	-	-	-	-	4,275	34,715	-	-	-	-	47,852
2014	E06000014	York	Yorkshire and The Humber	England	84,212	7,316	269	-	-	-	-	3,762	35,233	-	-	-	-	46,581

https://www.gov.uk/government/statistics/regional-renewable-statistics

A. City information

	Data source
Official name of local government	York
Country	
Region	
Inventory year	
Resident population	
Description of boundary and map	
GDP	
Heating/cooling degree days	

Notation keys:
Not Occuring
Integrated Elsewhere
Not Estimated
Confidential
Combination of notation keys
N/A
Required
Optional

B. Inventory setup

GWP (IPCC AR version used)	IPCC 4th AR (2007)
Types of emissions factors	IPCC

Year
2019

Global Warming Potentials

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C. Emission sources and emissions

Sector	Sub-sector	ETS or non-ETS	Description of activity /facility	Direct (fuel combustion) or Indirect (grid energy) or Other	Total tCO2e	Activity data: Amount (2019)	Unit	SCATTER data reference
Stationary energy	Residential buildings		Domestic space heating and hot water	Direct	1,677.14	4,865,090	kWh	DATA_ECUK
				Direct	6,458.60	27,632,735	kWh	DATA_ECUK
				Direct	199,213.41	1,083,564,917	kWh	DATA_ECUK
				Indirect	16,707.45	65,365,599	kWh	DATA_ECUK
				Direct	439.78	48,380,922	kWh	DATA_ECUK
				Other	242.09	4,865,090	kWh	DATA_ECUK
				Other	1,745.84	27,632,735	kWh	DATA_ECUK
				Other	25,908.04	1,083,564,917	kWh	DATA_ECUK
				Other	2,528.34	65,365,599	kWh	DATA_ECUK
				Other	776.03	48,380,922	kWh	DATA_ECUK
			Domestic lighting, appliances, and cooking	Direct	NO	-	kWh	DATA_ECUK
				Direct	NO	-	kWh	DATA_ECUK
				Direct	4,862.23	26,446,710	kWh	DATA_ECUK
				Indirect	60,821.55	237,956,005	kWh	DATA_ECUK
				Direct	NO	-	kWh	DATA_ECUK
				Other	NO	-	kWh	DATA_ECUK
				Other	NO	-	kWh	DATA_ECUK
				Other	632.34	26,446,710	kWh	DATA_ECUK
				Other	9,204.14	237,956,005	kWh	DATA_ECUK
				Other	NO	-	kWh	DATA_ECUK
	Commercial buildings & facilities		Commercial space heating, cooling, and hot water	Direct	223.95	958,178	kWh	DATA_ECUK
				Direct	23,211.95	126,254,817	kWh	DATA_ECUK
				Indirect	11,384.49	44,540,254	kWh	DATA_ECUK
				Direct	23.30	67,581	kWh	DATA_ECUK
				Other	60.54	958,178	kWh	DATA_ECUK
				Other	3,018.75	126,254,817	kWh	DATA_ECUK
				Other	1,722.82	44,540,254	kWh	DATA_ECUK
				Other	3.36	67,581	kWh	DATA_ECUK
			Commercial lighting, appliances, equipment, and catering	Direct	116.66	499,112	kWh	DATA_ECUK
				Direct	4,658.90	25,340,751	kWh	DATA_ECUK
				Indirect	33,906.75	132,655,516	kWh	DATA_ECUK
				Direct	NO		kWh	DATA_ECUK
				Other	31.53	499,112	kWh	DATA_ECUK
				Other	605.90	25,340,751	kWh	DATA_ECUK
				Other	5,131.12	132,655,516	kWh	DATA_ECUK
				Other	NO		kWh	DATA_ECUK
	Institutional buildings & facilities		Institutional space, heating and hot water	Direct	44.45	190,194	kWh	DATA_ECUK
				Direct	20,024.04	108,915,072	kWh	DATA_ECUK
				Indirect	2,438.43	9,540,019	kWh	DATA_ECUK
				Direct	NO		kWh	DATA_ECUK
				Other	12.02	190,194	kWh	DATA_ECUK
				Other	2,604.16	108,915,072	kWh	DATA_ECUK
				Other	369.01	9,540,019	kWh	DATA_ECUK
				Other	NO		kWh	DATA_ECUK
			Institutional lighting, appliances and cooking	Direct	5.38	22,997	kWh	DATA_ECUK
				Direct	2,919.97	15,882,335	kWh	DATA_ECUK
				Indirect	7,395.51	28,933,911	kWh	DATA_ECUK
				Direct	NO		kWh	DATA_ECUK
				Other	1.45	22,997	kWh	DATA_ECUK
				Other	379.75	15,882,335	kWh	DATA_ECUK
				Other	1,119.16	28,933,911	kWh	DATA_ECUK
				Other	NO		kWh	DATA_ECUK
	Industrial buildings & facilities		Industrial buildings & facilities	Direct	14,122.91	60,424,040	kWh	DATA_ECUK
				Direct	52,014.89	282,920,275	kWh	DATA_ECUK
				Indirect	55,173.08	215,857,129	kWh	DATA_ECUK
				Direct	972.14	2,820,006	kWh	DATA_ECUK
				Other	3,817.59	60,424,040	kWh	DATA_ECUK
				Other	6,764.62	282,920,275	kWh	DATA_ECUK
				Other	8,349.35	215,857,129	kWh	DATA_ECUK
				Other	140.32	2,820,006	kWh	DATA_ECUK
	Agriculture		Off-road transportation	Direct	3,719.28	15,204,315	kWh	DATA_RF
				Indirect	NO		kWh	DATA_RF
				Other	885.20	15,204,315	kWh	DATA_RF
				Other	NO		kWh	DATA_RF
			Agricultural final energy consumption	Direct	0.16	867	kWh	DATA_AG
				Direct	0.00	1,240	kWh	DATA_AG
				Direct	2.09	8,551	kWh	DATA_AG
				Indirect	0.86	3,381	kWh	DATA_AG
				Other	0.02	867	kWh	DATA_AG
				Other	0.03	1,240	kWh	DATA_AG
				Other	0.50	8,551	kWh	DATA_AG
				Other	0.13	3,381	kWh	DATA_AG
	Fugitive emissions		Fugitive emissions	Direct	29,796.45	29,796,454	kgCO2e	DATA_Fugitive
Transportation	On-road		Road transport / Petroleum	Direct	264,968.59	1,083,184,479	kWh	Data_fuel
			Road transport / Bioenergy & Waste	Direct	IE	49,781,914	kWh	Data_fuel
			Road transport / Electricity	Indirect	IE		kWh	N/A
			Road transport / Scope 3	Other	NO	-	kWh	DATA_ONROADSC3
				Other	IE		kWh	Data_fuel
				Other	IE		kWh	N/A
	Rail		Rail transport / Coal	Direct	NO	-	kWh	Data_fuel
			Rail transport / Petroleum	Direct	6,206.94	25,373,815	kWh	Data_fuel
			Rail transport / Electricity	Indirect	IE		kWh	N/A
			Rail transport / Scope 3	Other	NO	-	kWh	Data_fuel
				Other	1,477.26	25,373,815	kWh	Data_fuel
				Other	IE		kWh	N/A
	Waterborne navigation		Waterborne transport / internal waterways	Direct	1,751.97	7,161,990	kWh	DATA_Transport_Water
			Waterborne transport / coastal	Direct	NO	-	kWh	DATA_Transport_Water
			Waterborne transport / electricity	Indirect	IE		kWh	DATA_Transport_Water
			Waterborne transport / Scope 3	Other	NE		kWh	DATA_Transport_Water
				Other	IE		kWh	DATA_Transport_Water
	Aviation		Aviation / in-boundary	Direct	NO	-	tonnes	DATA_Aviation
			Aviation / electricity	Indirect	IE			N/A
			Aviation / out of boundary	Other	116,461.82	36,607	tonnes	DATA_Aviation
	Off-road		Off-road transport / Petroleum products	Direct	2,649.69	10,831,845	kWh	DATA_OFFROAD
			Off-road transport / Electricity	Other	NE		kWh	N/A
Waste	Solid waste disposal		Solid Waste Disposal / Open-loop	Direct	-	41,093	Tonnes	DATA_Waste
			Solid Waste Disposal / Closed-loop	Direct	NO	-	Tonnes	DATA_Waste
			Solid Waste Disposal / Landfill	Direct	10,488.04	17,882	Tonnes	DATA_Waste
			Solid Waste Disposal / Scope 3	Other	IE		Tonnes	N/A
	Biological treatment		Biological Treatment / Composting	Direct	NO	-	Tonnes	DATA_Waste
			Biological treatment / Scope 3	Other	IE		Tonnes	N/A
	Incineration and open burning		Incineration and open burning / Combustion	Direct	801.19	37,520	Tonnes	DATA_Waste
			Incineration and open burning / Scope 3	Other	IE		Tonnes	N/A
	Wastewater treatment and discharge		Wastewater treatment and discharge	Direct	3,828.26	5,407,151	m3	DATA_Wastewater
			Wastewater / Scope 3	Other	-	5,407,151	m3	DATA_Wastewater
IPPU	Industrial process		Industrial process	Direct	5,298.54	6,237,250	kWh	DATA_IP
				Direct	421.90	11,015,643	kWh	DATA_IP
				Direct	839.84	15,697,852	kWh	DATA_IP
				Direct	3,604.43	38,142,151	kWh	DATA_IP
				Direct	43,516.74	163,966,601	kWh	DATA_IP
	Industrial product use		Industrial product use	Direct	0.00	235,059,497	kWh	DATA_IP
				Other	NE			N/A
AFOLU	Livestock		Livestock	Direct	6,907.92	1,600	head	DATA_Livestock
				Direct	12,423.31	7,244	head	DATA_Livestock
				Direct	NO	11,110	head	DATA_Livestock
				Direct	NO	15,002	head	DATA_Livestock
				Direct	NE	-	head	DATA_Livestock
				Direct	165.40	93,674	head	DATA_Livestock
	Land use		Land use non-CO2	Direct	- 0.01	- 9	kgCO2e	DATA_LULUCF_NonCO2
			Forestland	Direct	- 7,751.17	- 7,751,166	KgCO2	DATA_LULUCF

Year	Reference	EF name	Data year	Unit	kg CO2	kg CH4	kg N2O	kg CO2e	Year	Source	Tab	Source link	Location	Method	EF tag
				GWP	1	25	298								
2019	Industrial Processes_Chemicals	Chemicals	2016	kWh	-	-	-	0.0945	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Chemicals2019
2019	Industrial Processes_Iron and steel	Iron and steel	2016	kWh	-	-	-	0.8495	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Iron and steel2019
2019	Industrial Processes_Mineral products	Mineral products	2016	kWh	-	-	-	0.0535	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Mineral products2019
2019	Industrial Processes_Non-ferrous metals	Non-ferrous metals	2016	kWh	-	-	-	0.0383	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Non-ferrous metals2019
2019	Industrial Processes_Other industry	Other industry	2016	kWh	-	-	-	0.2654	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Other industry2019
2019	Product use_Product use	Product use	2016	kWh	-	-	-	2.01826E-09	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.gov.uk/reports/reports?section_			Product use_Product use2019
2019	Aviation spirit	Aviation spirit	2019	tonnes	3127.67	61.46	29.8	3218.92	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.uk/government/pul		Fuel for pist	Aviation spirit2019
2019	Aviation turbine fuel	Aviation turbine fuel	2019	tonnes	3149.67	1.91	29.8	3181.37	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.uk/government/pul		Fuel for turl	Aviation turbine fuel2019
2019	Biogas	Biogas	2019	kWh	0	0	0	0.00021	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Bioenergy	https://www.gov.u	UK		Biogas2019
2019	Biogas_Sc3	Biogas WTT	2019	kWh	0	0	0	0.02405	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - bioenergy	https://www.gov.u	UK		Biogas_Sc32019
2019	Biomass Grass/Straw	Biomass_Grass/straw	2019	kWh	0	0	0	0.00909	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Bioenergy	https://www.gov.u	UK		Biomass Grass/Straw2019
2019	Biomass Grass/Straw_Sc3	Biomass Grass/Straw_Sc3	2019	kWh	0	0	0	0.01604	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - bioenergy	https://www.gov.uk/government/publications/gr			Biomass Grass/Straw_Sc32019
2019	Biomass Wood logs	Biomass_Wood logs	2019	kWh	0	0	0	0.01563	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Biomass Wood logs2019
2019	Biomass Wood logs_Sc3	Biomass Wood logs_Sc3	2019	kWh	0	0	0	0.01277	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.uk/government/publications/gr			Biomass Wood logs_Sc32019
2019	Coal (domestic)	Coal (domestic)	2019	kWh (Gross CV)	0.3147	0.02565	0.00438	0.34473	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Coal (domestic)2019
2019	Coal (domestic)_Sc3	Coal (domestic)_Sc3	2019	kWh (Gross CV)	0	0	0	0.04976	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Coal (domestic)_Sc32019
2019	Coal (electricity generation)	Coal (electricity generation)	2019	kWh (Gross CV)	0.30373	0.00009	0.00179	0.30561	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Coal (electricity generation)2019
2019	Coal (electricity generation)_Sc3	Coal (electricity generation)_Sc3	2019	kWh (Gross CV)	0	0	0	0.04976	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.uk/government/publications/gr			Coal (electricity generation)_Sc32019
2019	Coal (industrial)	Coal (industrial)	2019	kWh (Gross CV)	0.32835	0.00093	0.00256	0.33183	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Coal (industrial)2019
2019	Coal (industrial)_Sc3	Coal (industrial) WTT	2019	kWh (Gross CV)	0	0	0	0.04976	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Coal (industrial)_Sc32019
2019	Diesel (average biofuel blend)	Diesel	2019	kWh (Gross CV)	0.24137	0.00003	0.00322	0.24462	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Diesel (average biofuel blend)2019
2019	Diesel (average biofuel blend)_Sc3	Diesel	2019	kWh (Gross CV)	0	0	0	0.05822	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Diesel (average biofuel blend)_Sc32019
2019	Electricity generated	Electricity	2019	KWh	0.25358	0.00065	0.00137	0.2556	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	UK Electricity	https://www.gov.u	UK		Electricity generated2019
2019	not used	WTT- UK electricity (generation)	2019	KWh	0	0	0	0.03565	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT- UK & oversea	https://www.gov.uk/government/publications/gr			not used2019
2019	not used	WTT- UK electricity (T&D)	2019	KWh	0	0	0	0.00303	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	UK Electricity	https://www.gov.uk/government/publications/gr			not used2019
2019	Electricity generated_Sc3	WTT and T&D	2019	kWh (Gross CV)	0.02153	0.00005	0.00012	0.03868	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT- UK & oversea	https://www.gov.u	UK		Electricity generated_Sc32019
2019	Fuel Oil	Fuels	2019	kWh (Gross CV)	0.26683	0.00035	0.00065	0.26782	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.uk/government/publications/gr			Fuel Oil2019
2019	Fuel Oil_Sc3	WTT - fuels	2019	kWh (Gross CV)	0	0	0	0.05076	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.uk/government/publications/gr			Fuel Oil_Sc32019
2019	Gas Oil	Liquid fuels_Gas oil	2019	kWh (Gross CV)	0.25359	0.00027	0.0029	0.25676	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Gas Oil2019
2019	Gas Oil_Sc3	Gas Oil_Sc3	2019	kWh (Gross CV)	0	0	0	0.05888	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.uk/government/publications/gr			Gas Oil_Sc32019
2019	Landfill gas	Landfill gas	2019	kWh	0	0	0	0.0002	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Bioenergy	https://www.gov.u	UK		Landfill gas2019
2019	Landfill gas_Sc3	Landfill gas WTT	2019	kWh	0	0	0	0	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - bioenergy	https://www.gov.u	UK		Landfill gas_Sc32019
2019	LPG	LPG	2019	kWh (Gross CV)	0.21419	0.00014	0.00014	0.21447	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		LPG2019
2019	LPG_Sc3	LPG WTT	2019	kWh (Gross CV)	0	0	0	0.02697	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		LPG_Sc32019
2019	Marine fuel oil	Marine fuel	2019	kWh (Gross CV)	0.25918	0.00011	0.00369	0.26298	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Marine fuel oil2019
2019	Marine fuel oil Scope 3	Marine fuel	2019	kWh (Gross CV)	0	0	0	0.05076	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Marine fuel oil Scope 32019
2019	Municipal Waste_Closed-loop	Refuse_Municipal Waste_Closed-loop	2019	tonnes	0	0	0	0	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Waste disposal	https://www.gov.u	UK	As defined i	Municipal Waste_Closed-loop2019
2019	Municipal Waste_Combustion	Refuse_Municipal Waste_Combustion	2019	tonnes	0	0	0	21.3538	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Waste disposal	https://www.gov.u	UK	As defined i	Municipal Waste_Combustion2019
2019	Municipal Waste_Landfill	Refuse_Municipal Waste_Landfill	2019	tonnes	0	0	0	586.5138	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Waste disposal	https://www.gov.u	UK	This factor i	Municipal Waste_Landfill2019
2019	Municipal Waste_Open-loop	Refuse_Municipal Waste_Open-loop	2019	tonnes	0	0	0	0	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Waste disposal	https://www.gov.u	UK	As defined i	Municipal Waste_Open-loop2019
2019	Municipal waste_wastewater-treatment	Refuse_Municipal Waste_Open-loop	2019	m3	0	0	0	0.708	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Water treatment	https://www.gov.u	UK		Municipal waste_wastewater-treatment2019
2019	Natural gas	Natural gas	2019	kWh (Gross CV)	0.18351	0.00024	0.0001	0.18385	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Natural gas2019
2019	Natural gas_Sc3	Natural gas WTT	2019	kWh (Gross CV)	0	0	0	0.02391	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Natural gas_Sc32019
2019	Organic_Composting	Refuse_Organic: mixed food and garder	2019	tonnes	0	0	0	10.2039	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Waste disposal	https://www.gov.u	UK	As defined i	Organic_Composting2019
2019	Petrol	Petrol (average biofuel blend)	2019	kWh (Gross CV)	0.23235	0.00072	0.00066	0.23373	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	Fuels	https://www.gov.u	UK		Petrol2019
2019	Petrol_Sc3	Petrol (average biofuel blend) WTT	2019	kWh (Gross CV)	0	0	0	0.06318	2019	BEIS, 2020. Greenhouse gas reporting: conversion factors 2019. Convers	WTT - fuels	https://www.gov.u	UK		Petrol_Sc32019
2019	Municipal Waste_Electricity	electricity, from municipal waste inciner	2019	kWh	0	0	0	0	2019	ecoinvent 3.6 (2019); electricity, from municipal waste incineration to generic market for el		https://www.gov.uk/government/publications/gr			Municipal Waste_Electricity2019
2019	Municipal wastewater_NMVOC	electricity, from municipal waste inciner	2016	m3	0	0	0	0.000015	2016	European Environment Agency; EMEP (2016) EMEP/EEA air pollutant emission inventory guidebook 2016			Europe		Municipal wastewater_NMVOC2019
2019	n/a	Used where data is provided in CO2e	0	n/a	1	0	0	1	0	n/a	n/a	n/a	n/a	n/a	n/a2019
2019	Dairy Cattle	Dairy Cattle	2017	head	0	166.5572698	0.5162619	4317.777781	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Dairy Cattle2019
2019	Deer	Deer	2017	head	0	20.22	0.101863	535.8551781	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Deer2019
2019	Goats	Goats	2017	head	0	5.13	0.0532133	144.1075656	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Goats2019
2019	Horses	Horses	2017	head	0	19.56	0.5422575	650.5927352	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Horses2019
2019	Non-dairy cattle	Non-dairy cattle	2017	head	0	61.71394352	0.5775239	1714.950713	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Non-dairy cattle2019
2019	Poultry	Poultry	2017	head	0	0.012014023	0.0049174	1.765735214	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Poultry2019
2019	Sheep	Sheep	2017	head	0	4.973816124	0.0026216	125.1266456	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Sheep2019
2019	Swine	Swine	2017	head	0	5.574262898	0.1694965	189.8665171	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Swine2019
2019	EF_Hydro	electricity production, hydro, run-of-rive	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Hydro2019
2019	EF_Hydro/Pumped Storage	electricity production, hydro, pumped s	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Hydro/Pumped Storage2019
2019	EF_Nuclear	electricity production, nuclear, pressure	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Nuclear2019
2019	EF_Solar PV	electricity production, photovoltaic, 570	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Solar PV2019
2019	EF_Wind	electricity production, wind, 1-3MW tur	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Wind2019
2019	EF_Wind (Offshore)	electricity production, wind, 1-3MW tur	2013	kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Wind (Offshore)2019
2018	Industrial Processes_Chemicals	Chemicals		kWh	0	0	0	0.094475132	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Chemicals2018
2018	Industrial Processes_Iron and steel	Iron and steel		kWh	0	0	0	0.849476877	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Iron and steel2018
2018	Industrial Processes_Mineral products	Mineral products		kWh	0	0	0	0.053517151	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Mineral products2018
2018	Industrial Processes_Non-ferrous metals	Non-ferrous metals		kWh	0	0	0	0.03833479	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Non-ferrous metals2018
2018	Industrial Processes_Other industry	Other industry		kWh	0	0	0	0.26536312	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.go	UK		Industrial Processes_Other industry2018
2018	Product use_Product use	Product use		kWh	0	0	0	2.01826E-09	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Gove	DA Pivot Tables wit	http://naei.beis.gov.uk/reports/reports?section_			Product use_Product use2018
2018	Aviation spirit	Aviation spirit		tonnes	3127.67	56.45	29.8	3213.91	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels			Fuel for pist	Aviation spirit2018
2018	Aviation turbine fuel	Aviation turbine fuel		tonnes	3149.67	1.69	29.8	3181.15	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels			Fuel for turl	Aviation turbine fuel2018
2018	Biogas	Biogas		kWh				0.00022	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Bioenergy		UK		Biogas2018
2018	Biogas_Sc3	Biogas WTT		kWh				0.02405	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - bioenergy		UK		Biogas_Sc32018
2018	Biomass Grass/Straw	Biomass_Grass/straw		kWh				0.01314	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Bioenergy		UK		Biomass Grass/Straw2018
2018	Biomass Grass/Straw_Sc3	Biomass Grass/Straw_Sc3		kWh				0.01604	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Conversion factors 2018 - Full set (for advanced users)					Biomass Grass/Straw_Sc32018
2018	Biomass Wood logs	Biomass_Wood logs		kWh				0.01506	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Bioenergy		UK		Biomass Wood logs2018
2018	Biomass Wood logs_Sc3	Biomass Wood logs_Sc3		kWh				0.01277	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Conversion factors 2018 - Full set (for advanced users)					Biomass Wood logs_Sc32018
2018	Coal (domestic)	Coal (domestic)		kWh (Gross CV)	0.3147	0.02565	0.00438	0.34473	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Coal (domestic)2018
2018	Coal (domestic)_Sc3	Coal (domestic)_Sc3		kWh (Gross CV)				0.05066	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Coal (domestic)_Sc32018
2018	Coal (electricity generation)	Coal (electricity generation)		kWh (Gross CV)	0.30924	0.00009	0.00179	0.31112	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Coal (electricity generation)2018
2018	Coal (electricity generation)_Sc3	Coal (electricity generation)_Sc3		kWh (Gross CV)				0.05066	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels				Coal (electricity generation)_Sc32018
2018	Coal (industrial)	Coal (industrial)		kWh (Gross CV)	0.32153	0.00089	0.00239	0.32482	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Coal (industrial)2018
2018	Coal (industrial)_Sc3	Coal (industrial) WTT		kWh (Gross CV)				0.05066	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Coal (industrial)_Sc32018
2018	Diesel (average biofuel blend)	Diesel		kWh (Gross CV)	0.24414	0.00004	0.0035	0.24768	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Diesel (average biofuel blend)2018
2018	Diesel (average biofuel blend)_Sc3	Diesel		kWh (Gross CV)				0.05833	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Diesel (average biofuel blend)_Sc32018
2018	Electricity generated	Electricity		KWh	0.28088	0.00066	0.00153	0.28307	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	UK Electricity		UK		Electricity generated2018
2018	Electricity generated	WTT- UK electricity (generation)		KWh	0	0	0	0.04198	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT- UK & overseas elec				Electricity generated2018
2018	Electricity generated	WTT- UK electricity (T&D)		KWh	0	0	0	0.00358	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT- UK & overseas elec				Electricity generated2018
2018	Electricity generated_Sc3	WTT and T&D		kWh (Gross CV)	0	0	0	0.04556	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT- UK & overseas elec		UK		Electricity generated_Sc32018
2018	Fuel Oil	Fuels		kWh (Gross CV)	0.26733	0.00034	0.00064	0.26831	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels				Fuel Oil2018
2018	Fuel Oil_Sc3	WTT - fuels		kWh (Gross CV)	0	0	0	0.05076	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels				Fuel Oil_Sc32018
2018	Gas Oil	Liquid fuels_Gas oil		kWh (Gross CV)	0.25359	0.00028	0.02265	0.27652	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Gas Oil2018
2018	Gas Oil_Sc3	Gas Oil_Sc3		kWh (Gross CV)	0	0	0	0.05888	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels				Gas Oil_Sc32018
2018	Landfill gas	Landfill gas		kWh				0.0002	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Bioenergy		UK		Landfill gas2018
2018	Landfill gas_Sc3	Landfill gas WTT		kWh				0	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - bioenergy		UK		Landfill gas_Sc32018
2018	LPG	LPG		kWh (Gross CV)	0.21419	0.00015	0.00014	0.21448	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		LPG2018
2018	LPG_Sc3	LPG WTT		kWh (Gross CV)				0.02697	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		LPG_Sc32018
2018	Marine fuel oil	Marine fuel		kWh (Gross CV)	0.25877	0.00011	0.00367	0.26255	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Marine fuel oil2018
2018	Marine fuel oil Scope 3	Marine fuel		kWh (Gross CV)				0.05076	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Marine fuel oil Scope 32018
2018	Municipal Waste_Closed-loop	Refuse_Municipal Waste_Closed-loop		tonnes				21.3842	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Waste disposal		UK	As defined i	Municipal Waste_Closed-loop2018
2018	Municipal Waste_Combustion	Refuse_Municipal Waste_Combustion		tonnes				21.3842	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Waste disposal		UK	As defined i	Municipal Waste_Combustion2018
2018	Municipal Waste_Landfill	Refuse_Municipal Waste_Landfill		tonnes				565.1471	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Waste disposal		UK	This factor i	Municipal Waste_Landfill2018
2018	Municipal Waste_Open-loop	Refuse_Municipal Waste_Open-loop		tonnes				21.3842	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Waste disposal		UK	As defined i	Municipal Waste_Open-loop2018
2018	Municipal waste_wastewater-treatment	Refuse_Municipal Waste_Open-loop		m3				0.708	2017	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Water treatment		UK		Municipal waste_wastewater-treatment2018
2018	Natural gas	Natural gas		kWh (Gross CV)	0.18362	0.00024	0.0001	0.18396	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Natural gas2018
2018	Natural gas_Sc3	Natural gas WTT		kWh (Gross CV)				0.02557	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Natural gas_Sc32018
2018	Organic_Composting	Refuse_Organic: mixed food and garden waste_Composting		tonnes				0	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Waste disposal		UK	As defined i	Organic_Composting2018
2018	Petrol	Petrol (average biofuel blend)		kWh (Gross CV)	0.23234	0.00072	0.0007	0.23377	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	Fuels		UK		Petrol2018
2018	Petrol_Sc3	Petrol (average biofuel blend) WTT		kWh (Gross CV)				0.06317	2018	BEIS, 2019. Greenhouse gas reporting: conversion factors 2018. Convers	WTT - fuels		UK		Petrol_Sc32018
2018	Municipal Waste_Electricity	electricity, from municipal waste incineration to generic marke		kWh				0	2017	ecoinvent 3.4 (2017); electricity, from municipal waste incineration to generic market for el		https://www.ecoinvent.org/			Municipal Waste_Electricity2018
2018	Municipal wastewater_NMVOC	electricity, from municipal waste incineration to generic marke		m3				0.000015	2016	European Environment Agency; EMEP (2016) EMEP/EEA air pollutant emission inventory gu		http://www.eea.(	Europe		Municipal wastewater_NMVOC2018
2018	n/a	Used where data is provided in CO2e			1			1		n/a	n/a	n/a	n/a	n/a	n/a2018
2018	Dairy Cattle	Dairy Cattle		head		159.9454446	0.5054756	4149.267853	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Dairy Cattle2018
2018	Deer	Deer		head		20.22	0.1103286	538.3779279	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Deer2018
2018	Goats	Goats		head		5.13	0.0555516	144.804374	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Goats2018
2018	Horses	Horses		head		19.56	0.616082	672.5924373	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Horses2018
2018	Non-dairy cattle	Non-dairy cattle		head		63.0428222	0.5826673	1749.705425	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Non-dairy cattle2018
2018	Poultry	Poultry		head		0.021247011	0.004933	2.001219647	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Poultry2018
2018	Sheep	Sheep		head		4.667992956	0.0024563	117.4318127	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	These are tl	Sheep2018
2018	Swine	Swine		head		6.698366746	0.1748644	219.5687633	2017	UK average livestock emissions factors	Table3.As1; Table3	http://naei.beis.go	UK	*These are tl*	Swine2018
2018	EF_Hydro	electricity production, hydro, run-of-river		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Hydro2018
2018	EF_Hydro/Pumped Storage	electricity production, hydro, pumped storage		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Hydro/Pumped Storage2018
2018	EF_Nuclear	electricity production, nuclear, pressure water reactor		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Nuclear2018
2018	EF_Solar PV	electricity production, photovoltaic, 570kWp open ground inst		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Solar PV2018
2018	EF_Wind	electricity production, wind, 1-3MW turbine, onshore		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Wind2018
2018	EF_Wind (Offshore)	electricity production, wind, 1-3MW turbine, offshore		kWh				0	2013	Zero emissions - all emissions are scope 3 and not included			GB		EF_Wind (Offshore)2018
2017	Industrial Processes_Chemicals	Chemicals		kWh	-	-	-	0.0945	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Industrial Processes_Chemicals2017
2017	Industrial Processes_Iron and steel	Iron and steel		kWh	-	-	-	0.8495	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Industrial Processes_Iron and steel2017
2017	Industrial Processes_Mineral products	Mineral products		kWh	-	-	-	0.0535	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Industrial Processes_Mineral products2017
2017	Industrial Processes_Non-ferrous metals	Non-ferrous metals		kWh	-	-	-	0.0383	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Industrial Processes_Non-ferrous metals2017
2017	Industrial Processes_Other industry	Other industry		kWh	-	-	-	0.2654	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Industrial Processes_Other industry2017
2017	Product use_Product use	Product use		kWh	-	-	-	0	2016	BEIS (Amanda Penistone, Roger Littlewood, Sam Bradley); Scottish Government (Claire McFadden, Andrew Mortimer); Welsh Government (S					Product use_Product use2017
2017	Aviation spirit	Aviation spirit		tonnes	3127.67	17.54	29.8	3175	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Aviation spirit2017
2017	Aviation turbine fuel	Aviation turbine fuel		tonnes	3149.67	1.75	29.8	3181.22	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Aviation turbine fuel2017
2017	Biogas	Biogas		kWh	0	0	0	0.00023	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biogas2017
2017	Biogas_Sc3	Biogas WTT		kWh	0	0	0	0.0241	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biogas_Sc32017
2017	Biomass Grass/Straw	Biomass_Grass/straw		kWh	0	0	0	0.0209	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biomass Grass/Straw2017
2017	Biomass Grass/Straw_Sc3	Biomass Grass/Straw_Sc3		kWh	0	0	0	0.016	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biomass Grass/Straw_Sc32017
2017	Biomass Wood logs	Biomass_Wood logs		kWh	0	0	0	0.0127	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biomass Wood logs2017
2017	Biomass Wood logs_Sc3	Biomass Wood logs_Sc3		kWh	0	0	0	0.0128	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Biomass Wood logs_Sc32017
2017	Coal (domestic)	Coal (domestic)		kWh (Gross CV)	0.3147	0.02294	0.00444	0.3447	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (domestic)2017
2017	Coal (domestic)_Sc3	Coal (domestic)_Sc3		kWh (Gross CV)	0	0	0	0.0503	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (domestic)_Sc32017
2017	Coal (electricity generation)	Coal (electricity generation)		kWh (Gross CV)	0.30683	0.00009	0.00173	0.3111	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (electricity generation)2017
2017	Coal (electricity generation)_Sc3	Coal (electricity generation)_Sc3		kWh (Gross CV)	0	0	0	0.0503	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (electricity generation)_Sc32017
2017	Coal (industrial)	Coal (industrial)		kWh (Gross CV)	0.32132	0.00089	0.00221	0.3248	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (industrial)2017
2017	Coal (industrial)_Sc3	Coal (industrial) WTT		kWh (Gross CV)	0	0	0	0.0503	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Coal (industrial)_Sc32017
2017	Diesel (average biofuel blend)	Diesel		kWh (Gross CV)	0.24318	0.00005	0.002	0.2452	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Diesel (average biofuel blend)2017
2017	Diesel (average biofuel blend)_Sc3	Diesel		kWh (Gross CV)	0	0	0	0.0585	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Diesel (average biofuel blend)_Sc32017
2017	Electricity generated	Electricity		KWh	0.34885	0.00062	0.00209	0.3516	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Electricity generated2017
2017	Electricity generated	WTT- UK electricity (generation)		KWh	-	-	-	0.0561	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Electricity generated2017
2017	Electricity generated	WTT- UK electricity (T&D)		KWh	-	-	-	0.0052	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Electricity generated2017
2017	Electricity generated_Sc3	WTT and T&D		kWh (Gross CV)	0	0	0	0.0613	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Electricity generated_Sc32017
2017	Fuel Oil	Fuels		kWh (Gross CV)	0.26733	0.00034	0.00064	0.2683	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Fuel Oil2017
2017	Fuel Oil_Sc3	WTT - fuels		kWh (Gross CV)	-	-	-	0.0508	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Fuel Oil_Sc32017
2017	Gas Oil	Liquid fuels_Gas oil		kWh (Gross CV)	0.253588513	0.000282608	0.0220053	0.2759	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Gas Oil2017
2017	Gas Oil_Sc3	Gas Oil_Sc3		kWh (Gross CV)	-	-	-	0.0589	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Gas Oil_Sc32017
2017	Landfill gas	Landfill gas		kWh	0	0	0	0.0002	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Landfill gas2017
2017	Landfill gas_Sc3	Landfill gas WTT		kWh	0	0	0	0	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Landfill gas_Sc32017
2017	LPG	LPG		kWh (Gross CV)	0.21419	0.00015	0.00016	0.2145	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					LPG2017
2017	LPG_Sc3	LPG WTT		kWh (Gross CV)	0	0	0	0.027	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					LPG_Sc32017
2017	Marine fuel oil	Marine fuel		kWh (Gross CV)	0.26757	0.0001	0.00198	0.2697	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Marine fuel oil2017
2017	Marine fuel oil Scope 3	Marine fuel		kWh (Gross CV)	0	0	0	0.0508	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Marine fuel oil Scope 32017
2017	Municipal Waste_Closed-loop	Refuse_Municipal Waste_Closed-loop		tonnes	0	0	0	0	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Municipal Waste_Closed-loop2017
2017	Municipal Waste_Combustion	Refuse_Municipal Waste_Combustion		tonnes	0	0	0	0	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Municipal Waste_Combustion2017
2017	Municipal Waste_Landfill	Refuse_Municipal Waste_Landfill		tonnes	0	0	0	567.1463	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Municipal Waste_Landfill2017
2017	Municipal Waste_Open-loop	Refuse_Municipal Waste_Open-loop		tonnes	0	0	0	0	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Municipal Waste_Open-loop2017
2017	Municipal waste_wastewater-treatment	Refuse_Municipal Waste_Open-loop		m3	0	0	0	0.708	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Municipal waste_wastewater-treatment2017
2017	Natural gas	Natural gas		kWh (Gross CV)	0.18381	0.00026	0.0001	0.1842	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Natural gas2017
2017	Natural gas_Sc3	Natural gas WTT		kWh (Gross CV)	0	0	0	0.0279	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Natural gas_Sc32017
2017	Organic_Composting	Refuse_Organic: mixed food and garden waste_Composting		tonnes	0	0	0	0	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Organic_Composting2017
2017	Petrol	Petrol (average biofuel blend)		kWh (Gross CV)	0.23229	0.00074	0.00039	0.2334	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Petrol2017
2017	Petrol_Sc3	Petrol (average biofuel blend) WTT		kWh (Gross CV)	0	0	0	0.0633	2017	BEIS, 2018. Greenhouse gas reporting: conversion factors 2017. Conversion factors 2017 - Full set (for advanced users)					Petrol_Sc32017
2017	Municipal Waste_Electricity	electricity, from municipal waste incineration to generic marke		kWh	0	0	0	0	2017	ecoinvent 3.4 (2017); electricity, from municipal waste incineration to generic market for electricity; kWh; GB; EI3.4 cutoff; Ref. Prod: electrici					Municipal Waste_Electricity2017
2017	Municipal wastewater_NMVOC	electricity, from municipal waste incineration to generic marke		m3	0	0	0	0.000015	2016	European Environment Agency; EMEP (2016) EMEP/EEA air pollutant emission inventory guidebook 2016					Municipal wastewater_NMVOC2017
2017	n/a	Used where data is provided in CO2e			1	0	0	1	0	n/a					n/a2017
2017	Dairy Cattle	Dairy Cattle		head	0	159.9	0.505	4149	2017	UK average livestock emissions factors					Dairy Cattle2017
2017	Deer	Deer		head	0	20.2	0.11	538	2017	UK average livestock emissions factors					Deer2017
2017	Goats	Goats		head	0	5.1	0.056	145	2017	UK average livestock emissions factors					Goats2017
2017	Horses	Horses		head	0	19.6	0.616	673	2017	UK average livestock emissions factors					Horses2017
2017	Non-dairy cattle	Non-dairy cattle		head	0	63	0.583	1750	2017	UK average livestock emissions factors					Non-dairy cattle2017
2017	Poultry	Poultry		head	0	0	0.005	2	2017	UK average livestock emissions factors					Poultry2017
2017	Sheep	Sheep		head	0	4.7	0.002	117	2017	UK average livestock emissions factors					Sheep2017
2017	Swine	Swine		head	0	6.7	0.175	220	2017	UK average livestock emissions factors					Swine2017
2017	EF_Hydro	electricity production, hydro, run-of-river		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Hydro2017
2017	EF_Hydro/Pumped Storage	electricity production, hydro, pumped storage		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Hydro/Pumped Storage2017
2017	EF_Nuclear	electricity production, nuclear, pressure water reactor		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Nuclear2017
2017	EF_Solar PV	electricity production, photovoltaic, 570kWp open ground inst		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Solar PV2017
2017	EF_Wind	electricity production, wind, 1-3MW turbine, onshore		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Wind2017
2017	EF_Wind (Offshore)	electricity production, wind, 1-3MW turbine, offshore		kWh	0	0	0	0	2013	Zero emissions - all emissions are scope 3 and not included					EF_Wind (Offshore)2017
	END	END	END	END	END	END	END	END	END	END	END	END	END	END	END

FileName	Data reference	Reference	Reference 2	URL	Tab	Data year	Method
DATA_AG	**DATA_AG**	Agricultural small area statistics: 2002 to 2017	Welsh Governmer	https://gov.	SmallAreas	2017	Original small area statistics have been pasted. Residual codes have been mapped to individual local authority codes with reference to the Wales_LA tab, as all local authorities were matched correctly no further action was required.
DATA_AG		ECUK Data tables U5	Energy Consumpti	https://www	U5	2018	ECUK data table - units added, year added, external references removed, type added
DATA_AG		Farm Census - LGD2014, 2013-2016	OpenData NI	https://data	n/a	2016	Existing LA codes have been mapped against the 2018 LA list to ensure they are correct. As all data matched correctly, no further actions were required.
DATA_AG		Number of holdings with crops and grass and area of crops and grass by regional grouping and region, June 2001 and 2016	Scottish Governm	https://www	2016	2016	Original agriculutral holding file has been pasted, and the number of local authorities in each sub-region has been listed (only sub-regional data available). Sub-regions have been mapped to individual local autorities, and sub-regional averages have been apportioned to each local authority depending on the amount of local authorities in each sub-region..
DATA_AG		Structure of the agricultural industry in England and the UK at June, English geographical breakdowns, local authority.	Department for E	https://www	2013-2016 L	2017	Original agriucultural structure file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. Aggregated data has been removed.
DATA_Aviation	**DATA_Aviation**	2014-based local authority population projections for Wales, 2014 to 2039	Welsh Governmn	https://stat	n/a	2014	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. Welsh data has been extrapolated to 2041, as 2014-based population projections are currently only available for Wales.
DATA_Aviation		2016-based Population Projections for Areas within Northern Ireland, 11 LGDs - population totals (2016-2041)	Northern Ireland S	https://www	LGD14	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Aviation		Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2018	Luke Jones, Glen T	http://naei.	UK By Sourc	2018	Categories 1A3a and Aviation Bunkers for England, Wales, Scotland and Northern Ireland.
DATA_Aviation		Population Projections for Scottish Areas (2016-based)	National Records	https://www	Table 2	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Aviation		Population projections for local authorities: Table 2, 2016 based	Office for Nationa	https://www	Persons	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. The units have been changed from thousand-persons to persons.
DATA_CHP	**DATA_CHP**	DUKES 7.2 Fuel used to generate electricity and heat in CHP installations	Department for B	https://www	7.2	2018	n/a
DATA_CHP		DUKES 7.10 Large scale CHP schemes in the United Kingdom, operational at the end of December 2018 (DUKES 7.10)	Department for B	https://www	7.10	2018	Large scale CHP schemes in the United Kingdom as at December 2017. Each power plant has been manually assigned to a Local Authority, and the fuel consumption for heat and electricity is given an average value according to its installed capacity, based on DUKES 7.2, Fuel used to generate electricity and heat in CHP installations
DATA_CHP		Inland consumption of primary fuels and equivelents for energy use, 1970 to 2018 (DUKES 1.1.1)	Department for B	https://www	1.1.1	2018	n/a
DATA_DUKES 5.11	**DATA_DUKES 5.11**	Power stations in the United Kingdom, May 2019 (DUKES 5.11)	Department for B	https://www	5.11	2018	External links, footnotes, table headings and blank rows removed and unit column added. The local authority codes from the ONS list have been matched to station names. The plant installed capacity (MW) has been converted to kWh and mutiplied by respective load factors for different fuel types from DUKES 6.5 or DUKES 5.10.
DATA_ECUK	**DATA_ECUK**	RETAIL MARKET MONITORING Annual Transparency Report For calendar year 2018	Northern Ireland I	https://www	n/a	2018	Northern Ireland gas and electricity consumption data has been apportioned to local authorities based on total industrial and domestic fuel consumption in other fuel types as published by BEIS
DATA_ECUK		ECUK Data tables U3	Energy Consumpti	https://www	U3	2018	External links removed, columns added for units, type, and year. Type tag as "domestic".
DATA_ECUK		ECUK Data tables U4	Energy Consumpti	https://www	U4	2018	External links removed, columns added for units, type, and year. Type tag as "industrial".
DATA_ECUK		ECUK Data tables U5	Energy Consumpti	https://www	U5	2018	ECUK data table - units added, year added, external references removed, type added
DATA_ECUK		Total final energy consumption at regional and local authority level	Department for B	https://www	2018r GWh	2018	Mapped against full Local Authority list to apply final LA code; combined areas (e.g. England, Outer London) removed from dataset.
DATA_Emissions	**DATA_Emissions**	2005 to 2018 UK local and regional CO2 emissions – data tables	Department for B	https://www	Full dataset	2018	LA mapping checked and codes updated
DATA_Fuel	**DATA_Fuel**	RETAIL MARKET MONITORING Annual Transparency Report For calendar year 2018	Northern Ireland I	https://www	n/a	2018	Northern Ireland gas and electricity consumption data has been apportioned to local authorities based on total industrial and domestic fuel consumption in other fuel types as published by BEIS
DATA_Fuel		Total final energy consumption at regional and local authority level	Department for B	https://www	2018r GWh	2018	Mapped against full Local Authority list to apply final LA code; combined areas (e.g. England, Outer London) removed from dataset.
DATA_Fugitive	**DATA_Fugitive**	2014-based local authority population projections for Wales, 2014 to 2039	Welsh Governmn	https://stat	n/a	2014	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. Welsh data has been extrapolated to 2041, as 2014-based population projections are currently only available for Wales.
DATA_Fugitive		2016-based Population Projections for Areas within Northern Ireland, 11 LGDs - population totals (2016-2041)	Northern Ireland S	https://www	LGD14	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Fugitive		Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017	Luke Jones, Glen T	http://naei.	UK By Sourc	2017	Category 1B
DATA_Fugitive		Population Projections for Scottish Areas (2016-based)	National Records	https://www	Table 2	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Fugitive		Population projections for local authorities: Table 2, 2016 based	Office for Nationa	https://www	Persons	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. The units have been changed from thousand-persons to persons.
DATA_IP	**DATA_IP**	1.1 Aggregate energy balance 2018	DUKES_1.1-1.3	https://www	2018	2018	>Dukes 1.2 2009 Units have been added in column A. Industrial fuel consumption has been tagged in column B against industry type: Iron and steel, Non-ferrous metals, Mineral products, Chemicals
DATA_IP		Devolved Administration GHG Inventory 1990-2019	BEIS (Amanda Pen	http://naei.beis.gov.uk/		2018	DA Pivot Tables with GHG emissions by source (1990-2016), filtered for "Industrial Process"
DATA_IP		Electricity: commodity balances (DUKES 5.1)	DUKES_5.1	https://www	Internet onl	2018	>Dukes 5.1 Units have been added in column A. Industrial electricity has been tagged in column B against industry type: Iron and steel, Non-ferrous metals, Mineral products, Chemicals
DATA_IP		RETAIL MARKET MONITORING Annual Transparency Report For calendar year 2018	Northern Ireland I	https://www	n/a	2018	Northern Ireland gas and electricity consumption data has been apportioned to local authorities based on total industrial and domestic fuel consumption in other fuel types as published by BEIS
DATA_IP		Total final energy consumption at regional and local authority level	Department for B	https://www	2018r GWh	2018	Mapped against full Local Authority list to apply final LA code; combined areas (e.g. England, Outer London) removed from dataset.
DATA_Livestock	**DATA_Livestock**	Agricultural small area statistics: 2002 to 2018	Welsh Governmer	https://gov.	SmallAreas	2018	
DATA_Livestock		Cattle populations in Northern Ireland from 1981 to 2018	Department of Ag	https://www	CATTLE	2017	
DATA_Livestock		ENGLAND COW NUMBERS BY COUNTY	Agriculture & Hor	https://dair	compare_2(	2016	
DATA_Livestock		ERSA C10 (ii) Number of livestock by regional grouping and region June 2001 and 2016	Scottish Governm	https://www	2017	2016	Sub-regions have been mapped to individual local autorities, and sub-regional averages have been apportioned to each local authority depending on the amount of local authorities in each sub-region. Dairy/non-dairy cattle proportions have been allocated based on Number of cattle, 2007 to 2017 from the Scottish Agricultural Census.
DATA_Livestock		Farm Census - LGD2014, 2013-2016	OpenData.NI Farm	https://data	n/a	2016	Proportion of dairy and non-dairy cattle has been allocated based on a dataset, Cattle populations in Northern Ireland from 1981 to 2018, published by the Northern Ireland Department of Agriculture, Environment and Rural Affairs
DATA_Livestock		Structure of the agricultural industry in England and the UK at June, English geographical breakdowns, local authority.	Department for E	https://www	2013-2016 L	2016	Data has been allocated from sub-regions to Local Authorities based on number of authorities in that sub-region. Dairy/non-dairy cattle numbers per local authority have been applied according to a dataset "England Cow Numbers by County" published by the Agriculture & Horticulture Development Board.
DATA_Livestock		Table 3. Number of cattle, 2007 to 2018: Data obtained from Cattle Tracing Scheme	Scottish Agricultu	https://www	Table 3 catt	2018	
DATA_OFFROAD	**DATA_OFFROAD**	Total final energy consumption at regional and local authority level	Department for B	https://www	2018r GWh	2018	1% of total on-road fuel consumption apportioned to off-road
	DATA_Renewables	Renewable electricity by local authority	Department for B	https://www	LA - Genera	2018	Renewable electricity generation (MWh) for England, Scotland, Wales and Northern Ireland allocated at local authority level.
DATA_RF	**DATA_RF**	Sub-national residual fuel consumption data, Residual fuel consumption at regional and local authority level.	Department for B	https://www	2016	2018	Original residual fuels file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. Aggregated totals are excluded.
DATA_Waste	**DATA_Waste**	Business waste data 2018	Scottish Environm	https://www	Total_local	2018	External links removed, column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for any local authority exclusions.
DATA_Waste		Household waste summary data, 2018	Scottish Environm	https://www	Table 1	2018	External links removed, column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for any local authority exclusions.
DATA_Waste		LAC Municipal Waste Data Tables Appendix: 2018-19	Department of Ag	https://www	Table 3	2018	External links removed, column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for any local authority exclusions.
DATA_Waste		Local authority collected waste generation from April 2000 to March 2019 (England and regions) and local authority data April 2018 to March 2019	Department for E	https://www	Table 2	2018	External links removed, column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for any local authority exclusions, whereby, averages have been taken for local authorities in County Councils and Metropolitan Borough Councils.
DATA_Waste		Rolling 12 month period of combined municipal reuse/recycling/composting rates by local authority	Rolling 12 month	https://stat	Waste Land	2018	The individual data exports (i.e. waste tonnages by variable) from the Stats Wales online data tool were compiled into a master local authority waste dataset. External links removed column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for an lcoal authority exclusions.
DATA_Waste		Waste From All Sources Application - Waste management (tonnes), Mangement subcategory	Scotland's Enviror	https://www.environme		2018	External links removed, column added for units and local authority codes from ONS list matched to local areas. The dataset has been checked for any local authority exclusions.
DATA_Wastewater	**DATA_Wastewater**	2014-based local authority population projections for Wales, 2014 to 2039	Welsh Governmn	https://stat	n/a	2014	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. Welsh data has been extrapolated to 2041, as 2014-based population projections are currently only available for Wales.
DATA_Wastewater		2016-based Population Projections for Areas within Northern Ireland, 11 LGDs - population totals (2016-2041)	Northern Ireland S	https://www	LGD14	2016	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Wastewater		Devolved Administration GHG Inventory 1990-2019	BEIS (Amanda Pen	http://naei.beis.gov.uk/		2018	
DATA_Wastewater		Population Projections for Scottish Areas (2016-based)	National Records	https://www	Table 2	2018	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary.
DATA_Wastewater		Population projections for local authorities: Table 2, 2016 based	Office for Nationa	https://www	Persons	2018	Original population file has been pasted, and existing LA codes have been mapped against the 2018 LA list to ensure they are correct. The data has been filtered for 'all ages' in the AGE GROUP column and local authority codes have been updated where necessary. The units have been changed from thousand-persons to persons.
DATA_Wastewater		UK Informative Inventory Report (1990 to 2017)	Ricardo Energy &	https://uk-a	6.6 Wastewater		NMVOC emissions from municipal wastewater treatment (WWT) plants are estimated using the Tier 1 method given in the 2016 EMEP/EEA Guidebook. The approach uses the default emission factor (15 mg NMVOC/m3 wastewater handled) and activity data estimates based on a time series of waste water generated from residential properties for treatment from the UK water companies.
ECUK_3.02	**ECUK_3.02**	ECUK Data tables U3	Energy Consumpti	https://www	U3	2018	External links removed, columns added for units, type, and year. Type tag as "domestic".
ECUK_4.04	**ECUK_4.04**	ECUK Data tables U4	Energy Consumpti	https://www	U4	2018	External links removed, columns added for units, type, and year. Type tag as "industrial".
ECUK_5.04	**ECUK_5.04**	ECUK Data tables U5	Energy Consumpti	https://www	U5	2018	ECUK data table - units added, year added, external references removed, type added
	Data_Transport_Water						
		Digest of UK Energy Statistics	1.1 Aggregate ene	http://njs.analysisoncba		2018	This dataset provides the total energy consumption, by fuel, for UK National Navigation. This is defined as Fuel oil and gas/diesel oil delivered, other than under international bunker contracts, for fishing vessels, UK oil and gas exploration and production, coastal and inland shipping and for use in ports and harbours. Final fuel consumption from national navigation. DUKES have aligned energy demand for shipping in line with the estimates of marine fuel use in the UK's National Atmospheric Emissions Inventory (NAEI). The NAEI figures use BEIS's estimate of marine fuels and derive the split between international and domestic use ("national navigation") based on an activity based study of the UK's marine fuel use.
		Locations of Canal & River Trust owned or managed waterways within England and W	Km canal by Local	http://data-canalrivertr		2018	Linear data containing two layers with locations of Canal & River Trust owned or managed waterways within England and Wales.
		Department for Transport Statistics Domestic Waterborne Freight Statistics	Waterborne trans	https://www	Table PORT(	2018	Table PORT0701 (a) Waterborne transport within the United Kingdom, goods lifted (tonnes) Note - Coastal or offshore traffic which starts or finishes at a point upstream of the inland waterways boundary is included twice – once in 'UK inland waters traffic' (in the coastwise or one-port components of seagoing traffic by route) and once in 'Coastwise traffic between UK ports' or 'Oneport traffic of UK ports'. This is done to ensure that all traffic on inland waterways is included in the statistics even if the traffic started or finished outside inland waters. To avoid double counting when calculating total waterborne freight transport in the UK in terms of goods lifted, only the internal and foreign components of inland waters traffic are added to the coastwise traffic and one port traffic totals to derive the overall totals.
		Department for Transport Statistics Domestic Waterborne Freight Statistics	Waterborne trans	https://www	Table PORT0701 (b)		Table PORT0701 (b) Waterborne transport within the United Kingdom by cargo category, goods moved (billion tonne-kilometres) To avoid double counting of goods moved in Table PORT0701 (b) from 2000 onwards, only the internal and foreign components of inland waters traffic are added to the coastwise traffic and oneport traffic totals to derive overall totals of waterborne freight transport in the UK in terms of goods moved.
		Department for Transport Statistics Domestic Waterborne Freight Statistics	Internal inland wa	https://www	Table PORT0703		
		Department for Transport Statistics Domestic Waterborne Freight Statistics	All UK major and	https://www	Table PORT0101		

Pathways calculation method

Introduction

The general method for calculating the emissions trajectories is based on factors for the change year-on-year in the city area in terms of the starting data point – for example fuel consumption, numbers of trees/animals, or levels of different types of waste.

The starting point for all the pathways is the Inventory data. These emissions sources are referenced in the Interventions descriptions below. There is one key area where we haven't used this approach. For the energy supply baseline in Pathways, we've apportioned national energy generation trajectories to local authorities by area etc., rather than using the actual reported data per area, to try to come to a better estimation of future capacity for the different scenarios.

When multiple interventions are applied to an inventory area, the effect is the product of all these interventions

Electricity supply method

A key difference with how the inventory and pathway are calculated is that the pathway considers locally-generated electricity to be used locally, in preference to using the grid electricity.

Locally-produced electricity which we have calculated from the source data is used first. When this all used, remaining demand is met with imported electricity. This has a different expected emissions factor each year. The grid factor projections, which change year on year have been taken from BEIS projections to 2100[2].

If too much local electricity is produced, this is considered exported. Electricity to be used locally is used in the following order until total demand for that year is met:

- Solar PV
- Onshore wind
- Hydro
- Offshore Wind
- Wave/Tidal
- Biomass
- Nuclear
- CHP
- Fossil Fuels

Comparison to the Tyndall Centre carbon budget and BEIS LACO_2 data

Please be aware that the scope for the inventory calculated by SCATTER differs from the Emissions of carbon dioxide for Local Authority areas published by BEIS in a few key ways. SCATTER includes other gases to CO_2, uses different starting data, and includes categories not covered by the BEIS dataset. This is also the dataset used by the Tyndall Centre for their budgets.

The key reason for the discrepancy is that the more granular fuel consumption data we use for local authorities doesn't include large industrial installations. Among the exclusions is "A considerable amount of consumption fed directly to power stations and some very large industrial consumers, as this would be disclosive." These are mostly installations using power through a central voltage system.

[2] Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. - Table 1: Electricity emissions factors to 2100, kgCO2e/kWh (March 2019)

Interventions

Forestry

- Metric: Increase in forest land area
- Emissions sources affected: Emissions arising from land classified as “forestry”
- Interventions - Increase in forest land area

  1. 5% increase in forest cover by 2030.
  2. 10% increase in forest cover by 2030.
  3. 16% increase in forest cover by 2030.
  4. 24% increase in forest cover by 2030.

Original land use trajectories from DECC 2050 are used. Each land use type is mapped to a land use type used in the current SCATTER, by km^2. The rate of change in each land use trajectory is calculated for five-year chunks.

Land Management

- Metric: Increase in land used to grow crops for bioenergy
- Emissions sources affected: Emissions arising from land classified as grasslands, cropland, settlements and “other”.
- Interventions

  1. 2% decrease in grassland
  2. 3% decrease in grassland
  3. 4% decrease in grassland
  4. 7% decrease in grassland

Original land use trajectories from DECC 2050 are used. Forestry is treated as a separate lever Each land use type is mapped to a land use type used in the current SCATTER, by km^2 The rate of change in each land use trajectory is calculated between 2020 and 2050 The mapping is as follows: Arable, for food crops (grades 1–3) LU_C Cropland Arable, for 1st gen energy crops (grades 1–3) LU_C Cropland Arable, for 2nd gen energy crops (grades 1–3) LU_C Cropland Grassland, for 2nd gen energy crops (grades 3–4) LU_G Grassland Grassland, for livestock and fallow (grades 3–5) LU_G Grassland Settlements LU_S Settlements Forests LU_F Forestland Other LU_O Other.

Livestock Management

- Metric: Number of livestock
- Emissions sources affected: Total number of dairy cattle; Total number of non-dairy cattle; Total number of sheep; Total number of pigs; Total number of horses; Total number of poultry
- Interventions

  1. 0.2% annual growth in dairy cows & livestock
  2. No change from current levels
  3. 0.2% annual reduction in livestock numbers
  4. 0.5% annual reduction in livestock numbers

Annual rates of change are applied for livestock. These are linear trajectories, but currently modelled in five-year periods. The trajectories are unchanged from the original DECC 2050 pathways and SCATTER V1. Trajectories impact dairy and non-dairy cattle, pigs. horses, and sheep, but not poultry.

Tree-planting

Increase in non-woodland tree planting in the area.

- Metric: hectares of tree canopy
- Emissions sources affected: Tree cover outside woodland.

The baseline data for this is based on the National Forestry Inventory's data[3] on tree cover outside woodland, including small woods, groups of trees, lone trees, and hedgerows. Statistics are for England, Scotland, Wales, GB, individual NFI regions, and separately for urban and rural areas. Where urban/rural classification is available (English Local Authorities)[2], the data has been apportioned according to this; in Wales and Scotland data is apportioned according to Country only. No data is available for Northern Ireland. The Forest Research report and datasets also provide information on the numbers, and mean areas of these tree cover features, plus estimates of lengths and areas of hedgerows.

- Interventions

    1. Tree-planting to increase current coverage by 30% by 2030; no subsequent commitments.
    2. Tree-planting to increase current coverage by 30% by 2030; from 2030-2050 further increase of 5%.
    3. Tree-planting to increase current coverage by 30% by 2030; from 2030-2050 further increase of 10%.
    4. Tree-planting to increase current coverage by 30% by 2030; from 2030-2050 further increase of 20%.

Tree planting rates are calculated based in Manchester City of Trees (2014), A Potential Woodland Study - Phase 1 report.

The sequestration of carbon dioxide per hectare of trees is based on estimates of the tonnes carbon per hectare relationship and per biome estimate of total carbon storage potential for temperate broadleaf and mixed forests, using the original estimates from a Bastin et al's 2019 paper The global tree restoration potential[4], and exclusions of soil organic carbon carried out in the follow-on study by Taylor & Marconi (2020)[5]. The resulting tonnes C increase with 1 hectare canopy, without soil organic carbon, is 81.

Using the example of one urban tree, gaining a canopy cover of 25m^2 – the average according to Forest Research[6] – the lifetime uptake is around 750 $kgCO_2$. We have modelled this uptake profile over the

[3] https://www.forestresearch.gov.uk/tools-and-resources/national-forest-inventory/what-our-woodlands-and-tree-cover-outside-woodlands-are-like-today-8211-nfi-inventory-reports-and-woodland-map-reports/

[4] Bastin, J.F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C.M. and Crowther, T.W., 2019. The global tree restoration potential. Science, 365(6448), pp.76-79. Supplementary material available from: https://science.sciencemag.org/content/sci/suppl/2019/07/02/365.6448.76.DC1/aax0848-Bastin-SM.pdf

[5] Taylor, S.D. and Marconi, S., 2020. Rethinking global carbon storage potential of trees. A comment on Bastin et al.(2019). Annals of Forest Science, 77(2), pp.1-7. Paper available at: https://www.biorxiv.org/content/10.1101/730325v2.full.pdf

[6] https://www.forestresearch.gov.uk/tools-and-resources/national-forest-inventory/what-our-woodlands-and-tree-cover-outside-woodlands-are-like-today-8211-nfi-inventory-reports-and-woodland-map-reports/

duration of the project based on the carbon calculations provided by the Woodland Carbon Code[7] , for the increasing annual sequestration rate as the tree grows.

Demand for heating and cooling

- Metric: TWh electricity and gas use by lighting, appliances and cooking
- Emissions sources affected: Domestic lighting, appliances, and cooking; Petroleum products (2); Domestic lighting, appliances, and cooking; Gas; Domestic lighting, appliances, and cooking; Electricity
- Interventions

1. By 2050, domestic lighting and appliance total energy demand has dropped by 80%.
2. By 2050, domestic lighting and appliance total energy demand has dropped by 66%.
3. By 2050, domestic lighting and appliance total energy demand has dropped by 39%.
4. By 2050, domestic lighting and appliance total energy demand has dropped by 27%.

Reduced net TWh demand from domestic lighting and appliances.

Electrification of lighting, appliances, and cooking

- Metric: TWh electricity and gas use by lighting, appliances and cooking
- Emissions sources affected: Domestic lighting, appliances, and cooking; Petroleum products (2); Domestic lighting, appliances, and cooking: Gas; Domestic lighting, appliances, and cooking: Electricity
- Interventions

1. Small reductions in energy demand from cooking; no change in heat source.
2. Small reductions in efficiency of domestic cooking. Proportion of cooking which is electric increases to 100% in 2050.This lever combines reductions in energy demand from domestic cooking with an anticipated shift to electrified heat.

Scenario 1 assumes small efficiency gains but no shift in the share of domestic cooking which is electric; Scenario 2 increases electrification proportion to with 100% cooking electrified by 2050.

Domestic space heating and hot water – Demand

The key metric used in the *demand* trajectory in SCATTER is the total TWh energy consumed each year by households. Reductions in the total energy (TWh) consumed per household each year are applied to the total energy consumption for domestic water heating. This is the proportion of total energy reported domestic energy consumption for each fuel[8] allocated to hot water using statistics for Energy Consumption in the UK (ECUK)[9].

Total growth or reduction in demand per year is allocated to each fuel based on how much it is used in domestic water heating. The per-annum percentage changes in consumption of each fuel type for each intervention level are below.

[7] https://www.woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration
[8] https://www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level
[9] https://www.gov.uk/government/statistics/energy-consumption-in-the-uk

Level 1 is an increase in domestic hot water demand, and level 2 assumes no change. These are proportionate to the scenarios mapped out in the original DECC 2050 Pathways calculator.

Intervention	Electricity	Solid hydrocarbons	Liquid hydrocarbons	Gaseous hydrocarbons
1	0.102%	0.007%	0.018%	0.245%
2	-	-	-	-
3	(0.072%)	(0.005%)	(0.013%)	(0.173%)
4	(0.171%)	(0.012%)	(0.031%)	(0.412%)

Insulation of new houses

This metric is applied to the current heating demand for your local authority. Numbers of new houses are taken from local authority household projections for England[10]. Where these do not go to 2041, the data has been extrapolated based on the trend. This amounts to a 12% increase between 2020 and 2040 in the number of households across the UK, a 2-3% increase every five years.

Demolition rates are assumed to be 0.1%[11] of current housing stock, roughly 28,000 dwellings per annum.

- Emissions sources affected: Domestic space heating and hot water; Coal (2) ; Domestic space heating and hot water; Petroleum products (2) ; Domestic space heating and hot water; Gas; Domestic space heating and hot water; Electricity; Domestic space heating and hot water; Bioenergy & wastes
- Interventions:
  1. All new houses are built to 2013 building regulations (no change).
  2. 50% new houses are built to 2013 building regulations; 40% to AECB standard; 10% to passivhaus standard.
  3. 30% new houses are built to 2013 building regulations; 40% to AECB standard; 30% to passivhaus standard.
  4. 100% new build is built to passivhaus standard.

We have modelled interventions based on application of combination of the following standards to all new build properties:

2013 building regulations (base case)

Association for Environment Conscious Building (AECB) standard

The AECB standard refers to a standard developed by the Association for Environment Conscious Building, aimed at those wishing to create high-performance buildings using widely available technology at little or no extra cost.

PassivHaus standard

Passivhaus is an international energy performance standard. The core focus of Passivhaus is to dramatically reduce the requirement for space heating and cooling, whilst also creating excellent indoor

10 https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland

11 [7] 2050 Calculator Tool (DECC) IX.A DOMESTIC SPACE HEATING AND HOT WATER http://2050-calculator-tool-wiki.decc.gov.uk/pages/31

comfort levels. This requires very high levels of insulation; extremely high performance windows with insulated frames; airtight building fabric; 'thermal bridge free' construction; and a mechanical ventilation system with highly efficient heat recovery. For more information see the UK Passive House Organisation website.

The key metric used in the insulation trajectory in SCATTER is the average kWh per year consumed by houses in the local area. To carry out these calculations, we partnered with the Association for Environment Conscious Building. Space heat demand has been modelled in PHPP (Passive House Planning Package).

The kwh/year energy consumption assumed for these standards, respectively, are:

	kwh/year
New build 2013 building regulations	10,335
New build AECB standard	2,720
New build Passivhaus standard	1,020

Comparison with EPC scoring (SAP)

The PHPP system has been used to estimate savings in space heat demand from buildings. This is a more accurate and detailed assessment method than the Standard Assessment Procedure (SAP), which is based on the annual energy costs for space heating, water heating, ventilation and lighting (minus savings from energy generation technologies) under standardised conditions, used for generating EPC scores. It uses a scale from 1 to 100. The method used means that the Specific Space Heat Demand of a building is often underestimated.

		PHPP Space heat demand for different housing kwh/yr	PHPP assessment of Specific Space Heat Demand kWh/m2.a	SAP assessment of Specific Space Heat Demand kWh/m2.a	SAP under (-ve) or over (+ve) estimate estimating SHD compared to PHPP %
Bungalow	Original house	15,275	230	161	-30%
	Deep IWI retrofit	4,500	75	44	-41%
	Deep EWI retrofit	3,142	51	32	-37%
Town house	Original house	17,772	117	112	-4%
	Deep IWI retrofit	5,183	40	42	5%
	Deep EWI retrofit	2,106	18	25	39%
Semi-detached	Original house	11,714	179	140	-22%
	Deep IWI retrofit	4,895	62	45	-27%
	Deep EWI retrofit	2,507	26	22	-15%

Retrofit

The options presented allow you to change the proportion of houses that will receive different levels of retrofit assumed in your area in a target year of 2040.

The starting point for this is a weighted average of average kwh/year consumed by house types across England only – which has been applied to all local areas. A possible future improvement would be to localize this starting point per Local Authority, but this has not been done in this iteration as more localized and comparable data was not available.

The house types which have been modelled to generate this average, with the weightings, are:

- Bungalow (17%)
- 3-storey mid-terrace town house (35%)
- 2-storey semi-detached (48%)

The retrofit options are:

- Unimproved (repair & maintenance only)
- “medium” (deep inner wall insulation)
- “deep retrofit” (deep external wall insulation)

The assumed space heating demand (total kwh/household) are as follows:

			kwh/year
House type	Original (unimproved)	Deep inner-wall insulation ("medium retrofit")	Deep external wall insulation ("deep retrofit")
Bungalow	15,275	4,500	3,142
Town house	17,772	5,183	2,106
Semi-detached	11,714	4,895	2,507
Weighted average	14,444	4,927	2,478

Interventions:

1. All current households remain at weighted average heat loss.
2. By 2050, 30% of current stock is retrofitted to a medium level; 20% deep retrofit
3. By 2050, 40% of current stock is retrofitted to a medium level; 40% deep retrofit.
4. By 2050, 10% of current stock is retrofitted to a medium level; 80% deep retrofit.

Technology mix for heating

SCATTER considers thirteen technologies for heating buildings:

1. Gas boiler (old)
2. Gas boiler (new)
3. Resisitive heating
4. Oil-fired boiler
5. Solid-fuel boiler
6. Stirling engine µCHP
7. Fuel-cell µCHP
8. Air-source heat pump
9. Ground-source heat pump
10. Geothermal
11. Community scale gas CHP
12. Community scale solid-fuel CHP
13. District heating from power stations

Trajectories are modelled as a linear trend from the current mix towards the selected end distribution in 2050. In order to estimate the current technology mix, we compared the scenarios defined in the DECC 2050 Calculator with the Energy Technologies Institute Clockwork model[12] results for Manchester.

[12] ETI (2015), UK Energy Systems Model Clockwork and Patchwork Results Charts
http://www.eti.co.uk/programmes/strategy/esme

The scenarios from the 2050 calculator have been organised into order for the trajectories by prioritising high electrification, and district heating, with dependence on solid fuel the lowest priority.

The optimum scenario from the ESME analysis, which includes cost and return estimates (not within the scope of SCATTER) corresponds most closely to level 8, 50% of heating from heat-pumps (air and ground-source); the rest from community scale CHP.

Some scenarios have been excluded on the basis of their dependency on coal, and their similarity to other scenarios.

The primary fuel source, electrification level and heating system mix in 2050 for each scenario is summarised in the table below:

			Gas boiler (old)	**Gas boiler (new)**	**Resistive heating**	**Oil-fired boiler**	**Solid-fuel boiler**	**Stirling engine µCHP**	**Fuel-cell µCHP**	**Air-source heat pump**	**Ground-source heat pump**	**Geothermal**	**Community scale gas CHP**	**Community scale solid-fuel CHP**	**District heating from power stations**
BASELINE (1)	Electrification level	Primary fuel source	44%	39%	7%	6%	2%	-	-	1%	-	-	1%	-	-
2	Very low	Gas		90%	10%										
3	Very low	District					10%	19%				1%	24%	35%	11%
4	Low	Gas			10%				90%						
5	Low	Mixed / None					5%		16%		25%	1%	23%	23%	7%
6	Low	District					15%			14%	20%		15%	25%	11%
7	Medium	Gas						10%	20%		30%		33%		7%
8	Medium	Mixed / None					10%			25%	25%		13%	20%	7%
9	Medium	District								58%	30%	1%			11%
10	High	Solid								50%	30%			20%	
11	High	Gas		20%						60%	20%				
12	High	Mixed / None			10%					60%	30%				
13	High	District			7%					60%	30%				3%

In order to translate these into year-on-year changes to the energy consumption reported at a local level in the BEIS fuel data, we calculated the proportion of space heating with each technology per year, applying technology efficiencies to understand the total demand for each fuel type. The change in demand in fuel each year is applied to the current demand. Technology efficiencies are summarised below:

	Heating / cooling efficiency (annual mean)
Gas boiler (old)	76%
Gas boiler (new)	91%
Resisitive heating	100%
Oil-fired boiler	97%
Solid-fuel boiler	87%
Stirling engine µCHP	63%
Fuel-cell µCHP	45%
Air-source heat pump	200%
Ground-source heat pump	300%
Geothermal	85%
Community scale gas CHP	38%
Community scale solid-fuel CHP	57%
District heating from power stations	90%

Biomass/coal power stations

- Metric: TWh generation
- Emissions sources affected: fossil fuel generation and biomass generation recorded at a national level in DUKES.
- Interventions

1. No change in solid fuel power generation.
2. Solid biomass generation increases by 50% in 2025, dropping off after that; Coal phase-out follows trajectories from the National Grid's Two Degrees scenario.
3. Solid biomass generation doubles in 2025, dropping off after that; Coal phase-out follows trajectories from the National Grid's Two Degrees scenario.
4. Solid biomass generation quadruples in 2025, dropping off after that; Coal phase-out follows trajectories from the National Grid's Two Degrees scenario.
5. Biomass generation replaces fossil fuel powered generation. Trajectories for phase-out are taken from the National Grid Future Energy Scenarios[13] Two Degrees scenario.

Hydroelectric power stations

- Metric: TWh generation
- Emissions sources affected: Hydro, Hydro pumped storage
- Interventions

1. Hydroelectric power generation grows to 19 MWh per hectare inland water in 2030; 20 in 2050
2. Hydroelectric power generation grows to 19 MWh per hectare inland water in 2030; 21 in 2050.
3. Hydroelectric power generation grows to 25 MWh per hectare inland water in 2030; 26 in 2050.
4. Hydroelectric power generation grows to 34 MWh per hectare inland water in 2030; 41 in 2050.

Increasing baseline hydroelectric power generation capacity. The TWh generated per GW capacity is calculated using the assumptions in the National Grid's Two Degrees scenario (2019).

Offshore wind

- Metric: TWh generation
- Emissions sources affected: Offshore wind
- Interventions

1. No change to large-scale offshore wind generation.
2. Large-scale onshore wind generation grows to 3.4 MWh per hectare in 2030; 5.3 MWh in 2050.
3. Large-scale onshore wind generation grows to 8 MWh per hectare in 2030; 5.9 MWh in 2050.
4. Large-scale onshore wind generation grows to 8 MWh per hectare in 2030; 6.9 MWh in 2050.
5. Increasing the rate at which offshore wind generation capacity changes. The TWh generated per GW capacity is calculated using the assumptions in the National Grid's Two Degrees scenario (2019).

Onshore wind

- Metric: TWh generation
- Emissions sources affected: Onshore wind

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[13] https://www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level

- Interventions

1. Large-scale onshore wind generation grows to 26 MWh per hectare in 2030; 1.46 MWh in 2050.
2. Large-scale onshore wind generation grows to 1.56 MWh per hectare in 2030; 1.75 MWh in 2050.
3. Large-scale onshore wind generation grows to 1.75 MWh per hectare in 2030; 1.93 MWh in 2050.
4. Large-scale onshore wind generation grows to 1.9 MWh per hectare in 2030; 2.2 MWh in 2050.

This lever works to increase the rate in installed GW per annum for onshore wind. The TWh generated per GW capacity is calculated using the assumptions in the National Grid's Two Degrees scenario (2019).

Small-scale wind

- Metric: TWh generation
- Emissions sources affected: Onshore wind not from Major Power Producers
- Interventions

1. No change to small-scale onshore wind.
2. Small-scale wind grows to 3 MWh per hectare in 2030; 2.6 in 2050 (from a baseline of 1.2 MWh per hectare.)
3. Small-scale wind grows to 2.6 MWh per hectare in 2030; 2.9 in 2050 (from a baseline of 1.2 MWh per hectare.)
4. Small-scale wind grows to 2.8 MWh per hectare in 2030; 3.3 in 2050 (from a baseline of 1.2 MWh per hectare.)

Total small-scale wind capacity is calculated in GW. The change each year is calculated for each five-year period of time. This change is applied to current reported small-scale wind.

Solar PV – Large

- Metric: TWh generation
- Emissions sources affected: Solar PV from Major Power Producers
- Interventions

1. No change in large-scale solar generation to 2030; growing to 100 kWh per hectare in 2050 (from a baseline of 50 kWh per hectare.)
2. Large-scale solar generation grows to 100 kWh per hectare in 2030; 200 in 2050 (from a baseline of 50 kWh per hectare.)
3. Large-scale solar generation grows to 100 kWh per hectare in 2030; 250 in 2050 (from a baseline of 50 kWh per hectare.)
4. Large-scale solar generation grows to 200 kWh per hectare in 2030; 400 in 2050 (from a baseline of 50 kWh per hectare.)

Solar PV – Small

- Metric: TWh generation
- Emissions sources affected: Solar PV not from Major Power Producers
- Interventions

1. Local solar capacity grows to allow generation equivalent to 750 kWh per household in 2030; 1350 in 2050 (from a baseline of 400 kWh per household.)
2. Local solar capacity grows, generating equivalent to 1200 kWh per household in 2030; 2200 in 2050 (from a baseline of 400 kWh per household.)
3. Local solar capacity grows, generating equivalent to 1550 kWh per household in 2030; 3000 in 2050 (from a baseline of 400 kWh per household.)
4. Local solar capacity grows, generating equivalent to 2500 kWh per household in 2030; 5200 in 2050 (from a baseline of 400 kWh per household.)

Total small-scale solar PV is calculated in TWh generated, based on defined rates of total installed capacity (GW). The TWh/GW capacity generation efficiencies from 2017 - 2050 are taken from the National Grid's Two Degrees scenario (2019) for large scale solar PV, but the year on year rates of change are applied to the domestic / small scale solar PV recorded.

Demand for heating and cooling

- Metric: Change in energy demand for commercial lighting, appliances and catering.
- Emissions sources affected: Commercial space heating, cooling, and hot water; Petroleum products (2); Commercial space heating, cooling, and hot water; Gas; Commercial space heating, cooling, and hot water; Electricity; Commercial space heating, cooling, and hot water; Coal (2); Institutional space heating, cooling, and hot water; Petroleum products (2) Institutional space heating, cooling, and hot water; Gas; Institutional space heating, cooling, and hot water; Electricity; Institutional space heating, cooling, and hot water; Coal (2)
- Interventions

1. In 2050, commercial heating, cooling and hot water demand is 103% of today's levels
2. In 2050, commercial heating, cooling and hot water demand is 83% of today's levels
3. In 2050, commercial heating, cooling and hot water demand is 70% of today's levels
4. In 2050, commercial heating, cooling and hot water demand is 60% of today's levels

Changes are linear between 2020 and 2050.

Technology mix for heating and cooling

- Metric: Change in energy demand for commercial, industrial and institutional lighting, appliances and catering.
- Emissions sources affected: Commercial lighting, appliances, equipment, and catering; Petroleum products (2); Commercial lighting, appliances, equipment, and catering; Gas; Commercial lighting, appliances, equipment, and catering; Electricity; Commercial lighting, appliances, equipment, and catering; Coal (2); Institutional lighting, appliances, equipment, and catering; Petroleum products (2); Institutional lighting, appliances, equipment, and catering; Gas; Institutional lighting, appliances, equipment, and catering; Electricity; Institutional lighting, appliances, equipment, and catering; Coal (2); Institutional lighting, appliances, equipment, and catering; Petroleum products (2); Interventions

SCATTER considers eleven technologies for heating buildings:

- Gas boiler (old)
- Gas boiler (new)

- Resisitive heating
- Oil-fired boiler
- Solid-fuel boiler
- Stirling engine µCHP
- Fuel-cell µCHP
- Air-source heat pump
- Ground-source heat pump
- Geothermal
- Community scale gas CHP
- Community scale solid-fuel CHP
- District heating from power stations

Trajectories are modelled as a linear trend from the current mix towards the selected end distribution in 2050. See Domestic Buildings for more detail on the modelling of these.

Energy demand for lighting, appliances and cooling

- Metric: TWh in energy demand for commercial, industrial and institutional lighting, appliances and catering
- Emissions sources affected: Commercial lighting, appliances, equipment, and catering; Petroleum products (2); Commercial lighting, appliances, equipment, and catering; Gas; Commercial lighting, appliances, equipment, and catering; Electricity; Institutional lighting, appliances, equipment, and catering; Petroleum products (2); Institutional lighting, appliances, equipment, and catering; Gas; Institutional lighting, appliances, equipment, and catering; Electricity
- Interventions

1. Commercial lighting & appliance energy demand increases 28% by 2050
2. Commercial lighting & appliance energy demand increases 15% by 2050
3. Commercial lighting & appliance energy demand decreases -4% by 2050
4. Commercial lighting & appliance energy demand decreases -25% by 2050

Total demand (TWh) from commercial, industrial, and institutional lighting and appliances increases in scenarios 1 and 2; decreases in scenarios 3 & 4.

Electrification of lighting, appliances, and catering

- Metric: Energy demand mix for commercial lighting, appliances and catering through electrification
- Emissions sources affected: Commercial lighting, appliances, equipment, and catering; Petroleum products (2); Commercial lighting, appliances, equipment, and catering; Gas; Commercial lighting, appliances, equipment, and catering; Electricity; Institutional lighting, appliances, equipment, and catering; Petroleum products (2); Institutional lighting, appliances, equipment, and catering; Gas; Institutional lighting, appliances, equipment, and catering; Electricity
- Interventions

1. Share of cooking which is electric is as today.
2. By 2050, 100% of commercial cooking is electrified.

This lever combines reductions in energy demand from commercial cooking with an anticipated shift to electrified heat. Scenario 1 assumes small efficiency gains but no shift in the share of commercial cooking which is electric. Scenario 2 increases electrification proportion to with 100% cooking electrified by 2050. This results in an increase in electricity consumption and decrease in other fuels used for commercial cooking.

Industrial processes – Efficiency

- Metric: Total TWh consumption and energy mix from energy intensity of industry.
- Emissions sources affected: Industrial buildings & facilities; Petroleum products; Industrial buildings & facilities; Gas; Industrial buildings & facilities; Electricity; Industrial buildings & facilities; Coal
- Interventions

1. Industry moves to higher natural gas consumption, with electricity consumption falling before 2035 then remaining constant.
2. Industrial electricity consumption as a share of total energy increases between 2035 and 2050, reaching 40% of total energy consumption.
3. Industrial electricity consumption is 50% of total energy consumption by 2035; 65% by 2050.

This lever impacts the energy consumption trajectories from industrial buildings and facilities, and split by energy demand. The trajectories are focused on electrification of industry.

Industrial processes – Output

- Metric: GHG emissions from industrial processes
- Emissions sources affected: Iron and steel process emissions; Non-ferrous metals process emissions; Mineral products process emissions; Chemicals process emissions; Other industry process emissions
- Interventions

1. Other industry process emissions are reduced at a rate of 2.6% per year.
2. Reductions in process emissions from all industry, with larger emissions reductions in the chemicals industry (0.4% pa) and other industry (6% pa). Metals and minerals industries also reduce process emissions 0.2% pa and 0.1% pa respectively.
3. Reductions in process emissions from all industry: general industry reduces process emissions at a rate of 4.5% per year. Chemicals emissions reduce 1% per year; metals 0.7% per year, and minerals 0.8% per year.

This lever impacts the process emissions from industrial activity. Separate trajectories are modelled for chemicals, metals, and minerals, industries. Growth rates are applied to the different industries' direct greenhouse gas emissions. Growth in "output index" from industry which applies to current process emissions and energy demand. Specific trajectories per industry type, mapped from 2015 - 2025 and 2025 – 2050.

Domestic freight (road and waterways)

- Metric: TWh fuel use by on-road transport; TWh fuel use by waterborne freight
- Emissions sources affected: On-road transportation, waterborne transport
- Interventions

1. 47% increase in distance travelled by road freight; 40% increase in efficiency. In waterborne transportation, 15 %decrease in fuel use.
2. 27% increase in distance travelled by road freight; 60% increase in efficiency. In waterborne transportation, 6 %increase in fuel use.
3. 6% decrease in distance travelled by road freight; 71% increase in efficiency. In waterborne transportation, 25 %increase in fuel use.
4. 22% decrease in distance travelled by road freight; 75% increase in efficiency. In waterborne transportation, 28 %increase in fuel use.

Domestic freight interventions affect both on-land and waterborne freight.

On-land freight interventions are based on the on-road fuel consumption allocated to your Local Authority[14]. For this iteration of SCATTER, it has not been possible to separate the proportion of this attributable to freight. A UK-wide average has been applied to every Local Authority, based on the Local Authority specific data available for road transport fuel consumption[2].

For Waterborne freight, total fuel consumption from national navigation increases as waterborne transport is increased.

Domestic passenger transport – Demand

- Metric: TWh fuel use across all transport
- Emissions sources affected: Petroleum products (2)Road transport; Onroad Sc Petroleum; Coal (2) Rail; Petroleum products (2)Rail
- Interventions

1. No change to total travel demand per person
2. 5% reduction in total distance travelled per individual per year by 2030.
3. 15% reduction in total distance travelled per individual per year by 2030.
4. 25% reduction in total distance travelled per individual per year by 2030.

Domestic passenger transport - Modal Shift

- Metric: TWh fuel use by different transportation options
- Emissions sources affected: Petroleum products (2)Road transport; Onroad Sc Petroleum; Coal (2) Rail; Petroleum products (2)Rail

The initial modal split used is taken from the National Travel Survey's 2017/18 Average Distances Travelled by Mode[15]. The split represents the distribution between average distance travelled per transport mode in Urban Conurbations across England. "Urban conurbation" has been chosen with the intention of representing LA's using the tool who have both urban and rural coverage. Full statistics are available summarized in the Factsheets published by the DfT[16]. The Rural Urban Classification is an Official Statistic and is used to distinguish rural and urban areas. The Classification defines areas as rural if they fall outside of settlements with more than 10,000 resident population[17]. The mode share data is

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[14] https://www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level
[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/822089/nts-2018-factsheets.pdf
[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/822089/nts-2018-factsheets.pdf
[17] https://www.gov.uk/government/statistics/2011-rural-urban-classification

a national breakdown of average mode share, which does not split by local authority, therefore this is not tailored to each local authority area.

The following changes are applied to reach level 4 ambition:

- % walking x3
- % cycling x3
- % using buses x3
- % using railways x1.5

Levels 2 and 3 are mid-points between L1 and L4.

- Interventions

1. No change to current national average modal split by total miles: 74% transportation by cars, vans and motorcycles.
2. Average modal share of cars, vans and motorbikes decreases from current national average 74% total miles to 56% in 2050.
3. Average modal share of cars, vans and motorbikes decreases from current national average 74% total miles to 47% in 2050.
4. Average modal share of cars, vans and motorbikes decreases from current national average 74% total miles to 38% in 2050.

	Trajectory			
Mode	1	2	3	4
Walking	6.3%	12.5%	15.7%	18.8%
Pedal cycles	1.1%	2.2%	2.7%	3.3%
Cars, Vans, and Motorcycles	73.9%	58.8%	51.2%	43.6%
Buses	4.2%	8.4%	10.5%	12.5%
Railways	14.5%	18.1%	20.0%	21.8%

Domestic passenger transport – Technology

- Metric: TWh fuel use by different transportation options
- Emissions sources affected: Petroleum products (2)Road transport; Onroad Sc Petroleum; Coal (2) Rail; Petroleum products (2)Rail
- Interventions

1. Cars, buses and rail is 100% electric by 2050. Slight increase in average train occupancy.
2. Cars, buses and rail is 100% electric by 2040. Slight increase in average train occupancy and bus occupancy.
3. Cars, buses and rail is 100% electric by 2035. Average occupancies increase to 18 people per bus km (from 12), 1.62 people per car-km (up from 1.56), and 0.42 people per rail-km (from 0.32).
4. Cars and buses are 100% electric by 2035, rail is 100% electric by 2030. Average occupancies increase to 18 people per bus km (from 12), 1.65 people per car-km (up from 1.56), and 0.42 people per rail-km (from 0.32).

International aviation

- Metric: TWh fuel use from aviation
- Emissions sources affected: Aviation_fuel_Sc1; Aviation_fuel_Sc3

- Interventions

1. Department for Transport "central" forecast for aviation.
2. Department for Transport "high" forecast for aviation.
3. Department for Transport "low" forecast for aviation.

Department for Transport growth forecasts[18] for international aviation, applied to both in-boundary airport emissions and to scope 3 emissions from people in the local area travelling. A rate of change calculated between aviation in 2030, 2040 and 2050.

The "Central" forecast represents the DfT base-case; "Low" encapsulates 'lower economic growth worldwide with restricted trade, coupled with higher oil prices and failure to agree a global carbon emissions trading scheme'; "High" scenario projects 'Higher passenger demand from all world regions, lower operating costs and a global emissions trading scheme'[19].

International shipping

- Metric: TWh fuel use by on-road transport; TWh fuel use by waterborne freight
- Emissions sources affected: Petroleum products (2)Road transport; Onroad Sc Petroleum 004:Petroleum products_internal; 004:Petroleum products_coastal
- Interventions

1. 47% increase in distance travelled by road freight; 40% increase in efficiency. In waterborne transportation, 15 %decrease in fuel use.
2. 27% increase in distance travelled by road freight; 60% increase in efficiency. In waterborne transportation, 6 %increase in fuel use.
3. 6% decrease in distance travelled by road freight; 71% increase in efficiency. In waterborne transportation, 25 %increase in fuel use.
4. 22% decrease in distance travelled by road freight; 75% increase in efficiency. In waterborne transportation, 28 %increase in fuel use.

For Waterborne shipping, total fuel consumption from national navigation increases as waterborne transport is increased. Road freight trajectories are developed from a combined impact of reduced distance travelled by HGVs (mostly diesel; electric trajectories only begin in the 2040s) with an increased efficiency (i.e. reduced energy demand per vehicle-km). The starting point for road freight efficiency is 5.29 TWh/bn vehicle-km (BEIS 2017), Road transport energy consumption at regional and local authority level, 2015) Baseline trajectory sees this efficiency increased to 3.15 TWh/bn vehicle-km by 2050. For the most ambitious (L4) scenario, the efficiency in 2050 is 1.34TWh/bn vehicle-km.

Road freight trajectories are developed from a combined impact of reduced distance travelled by HGVs (mostly diesel; electric trajectories only begin in the 2040s) with an increased efficiency (i.e. reduced energy demand per vehicle-km). The starting point for road freight efficiency is 5.29 TWh/bn vehicle-km (BEIS (2017), Road transport energy consumption at regional and local authority level, 2015) Baseline trajectory sees this efficiency increased to 3.15 TWh/bn vehicle-km by 2050. For the most ambitious (L4) scenario, the efficiency in 2050 is 1.34TWh/bn vehicle-km.

[18] https://www.gov.uk/government/publications/uk-aviation-forecasts-2017

[19] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/781281/uk-aviation-forecasts-2017.pdf

Increase in rates of recycling

- Metric: Increase in proportion of total waste directed towards recycling.
- Emissions sources affected: Open-loop; Closed-loop; Landfill; Composting; Combustion; Wastewater
- Interventions

1. 65% recycling, 10% landfill, 25% incineration by 2040; remaining constant to 2050
2. 65% recycling, 10% landfill, 25% incineration achieved by 2035 remaining constant to 2050
3. 65% recycling, 10% landfill, 25% incineration achieved by 2035, recycling rates increasing to 75% by 2050
4. 65% recycling, 10% landfill, 25% incineration achieved by 2035, recycling rates increasing to 85% by 2050

This lever interacts with reduction in volume of waste to define the total waste arisings and which waste stream they are captured in. Here, trajectories calculate the percentage recycling, landfill and "other" waste, applying these changes to the waste recorded in each category.

The "base case" is that the EU targets for 65% recycling are reached in 2035[20]; subsequent trajectories have different anticipated dates for reaching this. In Scenario 2, 65% recycling is met between 2045 and 2050. In Scenario 3, recycling increases steadily from 65% just after 2035 to 81% in 2050. In scenario 4, the recycling target is met earlier than 2035 and by 2050 85% all waste is recycled. The scenarios are applied to reported recycled and landfilled waste, as the change in the anticipated % waste recycled.

Reduction in volume of waste

- Metric: Reduction in volume of waste
- Emissions sources affected: Open-loop; Closed-loop; Landfill; Composting; Combustion; Wastewater
- Interventions

1. Total volume of waste is 124% of 2017 levels by 2040.
2. Total volume of waste is 109% of 2017 levels by 2040.
3. Total volume of waste is 86% of 2017 levels by 2040.
4. Total volume of waste is 61% of 2017 levels by 2040.

Total volume of waste arising is calculated by type (Household, Commercial & Industrial, Construction & Demolition) according to defined percentage changes in each. This total is summed for each five-year period. The change in this total each year is applied to all types of reported waste for the local authority.

By simplifying the trajectory, and applying the same reduction in wastage rates uniformly, a level of detail between different types of waste arising has been lost. However, the original waste trajectories are similar.

[20] European Waste targets for 2035 https://www.letsrecycle.com/news/latest-news/eu-set-softer-targets-55-recycling-2025/