A NET-ZERO CARBON ROADMAP
FOR CAMBRIDGESHIRE AND PETERBOROUGH

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Background

• Scientific evidence calls for rapid reductions in global carbon[1] emissions if we are to limit average levels of warming to 1.5°C and so avoid the risks associated with dangerous or runaway climate change.

• Globally, the Intergovernmental Panel on Climate Change (IPCC) suggests that we will have used up the global carbon budget that gives us a good chance of limiting warming to 1.5°C degrees within a decade. This science underpins calls for the declaration of a climate emergency.

• Dividing the global carbon budget for a 50% chance of avoiding a 1.5 degree increase in the global surface temperature by population gives Cambridgeshire and Peterborough a total carbon budget of 49 million tonnes from 2021, while using a global budget consistent with a 66% chance of avoiding a 1.5 degree increase gives Cambridge and Peterborough a budget of 32 million tonnes.

• Based only on the fuel and electricity used within its boundaries, Cambridgeshire and Peterborough in 2021 will emit c.4.7 million tonnes of CO2[2]. While this is down from c5.5MtCO2 in 2018, even with continued declines Cambridgeshire and Peterborough is expected to use up its carbon (CO2) budget associated with a 50% chance of staying within 1.5 degree of warming by the end of 2031 (i.e. in 11 years) and with a 66% chance by the end of 2027 (i.e. in 7 years).

• This assessment does not include its broader carbon footprint – for example relating to longer distance travel or the goods and services that are produced elsewhere but consumed within Cambridgeshire and Peterborough (i.e. its Scope 3 emissions).

Baselines and Targets

• Scope 1 and 2 carbon emissions from Cambridgeshire and Peterborough have fallen by 37% since 2000. With on-going decarbonisation of grid electricity, and taking into account forecast levels of population and economic growth within the area, we project that Cambridgeshire and Peterborough's annual emissions output will have fallen by 46% between 2000 and 2050.

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[1] For simplicity, we use the term "carbon" as shorthand for all greenhouse gases, with all figures in this report relating to the carbon dioxide equivalent (CO2e) of all greenhouse gases unless otherwise stated. Note that our assessment therefore differs from other assessments that focus only on CO2.

[2] Carbon budget calculations are made using data on the global CO2 budget and direct (scope 1 and 2) CO2 emissions from Cambridgeshire and Peterborough. In following analysis, we assume the same emissions reduction trajectory is applied to these CO2 and any non-CO2 GHGs related to these direct (scope 1 and 2) emissions.

• If it is to stay within a carbon budget consistent with a 66% chance of avoiding dangerous climate change, Cambridgeshire and Peterborough needs to add to the emissions reductions already achieved to secure 49% reductions on its 2000 level of emissions by 2025, 74% by 2030, 87% by 2035, 94% by 2040, 97% by 2045 and 100% by 2050. In short, the majority of all emissions reductions across the area need to be delivered within the next ten years.

• Without further activity to address its carbon emissions, we project that Cambridgeshire and Peterborough's annual emissions will exceed its carbon budget by 3.8 million tonnes in 2030, and 4.7 million tonnes in 2050.

Cost-Effective Options

• To meet these carbon reduction targets, Cambridgeshire and Peterborough will need to adopt low carbon options that close the gap between its projected emissions in future and net-zero emissions. This can be partially realised through cost- effective options that would more than pay for themselves through the energy cost reductions they would generate whilst generating wide social and environmental benefits in the area.

• More specifically, the analysis shows that Cambridgeshire and Peterborough could close the gap between its projected emissions in 2050 and net-zero emissions by 61% purely through the adoption of cost-effective options in houses, public and commercial buildings, transport and industry.

• Adopting these options would reduce Cambridgeshire and Peterborough's total projected energy bill in 2050 by £607 million per year whilst also creating 16,865years of employment in the area. They could also help to generate wider benefits, including helping to tackle fuel poverty, reducing congestion and productivity losses, improving air quality, and enhancements to public health.

• The most carbon-effective options for the area to deliver these carbon cuts include improved deep retrofitting of heating, lighting and insulation in houses, cooling and insulation in offices, shops and restaurants, and a range of measures across the transport sector including modal shift to non-motorised transport and the wider up-take of electric vehicles.

More Ambitious Options

• The analysis also shows that Cambridgeshire and Peterborough could close the gap to net-zero emissions in 2050 by 83% through the adoption of all of the currently available and technically viable options included in the assessment. Although some of these options would not pay for themselves directly through the energy savings that they would generate, many would create wider social, economic or environmental benefits in the area.

• This means that although it can achieve significant reductions in emissions by focusing on established cost-effective and technically viable measures, Cambridgeshire and

Peterborough still has to identify other more innovative interventions that could deliver the last 17% of shortfall between projected emissions in 2050 and a net-zero target.

• Options identified elsewhere that could be considered in Cambridgeshire and Peterborough include further promoting the use of low carbon vehicles, further electrification of heating and cooking, and planting trees. Carbon emissions could be cut further still through behavioural and consumption-based changes such as the promotion of active travel (e.g. walking and cycling), reductions in meat and dairy consumption and the generation of food waste, and reduced consumption of concrete and steel with more emphasis on green infrastructure.

• The scale of activity and investment needed to reach or even get close to the carbon emissions reduction targets set is significant. We find that across the area, many hundreds of thousands of homes and square-metres of floorspace will require retrofitting and widespread changes will be needed in the travel patterns and the way that people travel.

Next Steps

• Cambridgeshire and Peterborough needs to adopt a clear and ambitious climate action plan. The case for the adoption of such a plan is supported by the evidence that much – but not all – of the action that is required can be based on the exploitation of win-win low-carbon options that will simultaneously improve economic, social and health outcomes across the area.

• The climate action plan should adopt science-based targets for emissions reduction. As well as longer term targets, it should include five-yearly carbon reduction targets.

• The action plan should focus initially on Cambridgeshire and Peterborough's direct (Scope 1 and 2) carbon footprint as these emissions are most directly under the area's influence, but in time it should also widen its scope to consider its broader (Scope 3) carbon footprint.

• The action plan should also set out the ways in which Cambridgeshire and Peterborough will work towards achieving these science-based targets, drawing on the deployment of KPIs listed in this report. Action should also be taken to monitor and report progress on emissions reductions.

• It is important to stress that delivering on these targets will require action across the area and the active support of the public, private and third sectors. An independent Cambridgeshire and Peterborough Climate Commission can help to draw actors together and to build capacities to take and track action. Leadership groups could develop clear plans for the delivery of priority actions in key sectors such as homes, public and commercial buildings, transport and industry. Large organisations and businesses in the area could also be asked to match broader carbon reduction commitments and to report back on progress.

Introduction

Climate science has proven the connection between the concentration of greenhouse gases in the atmosphere and the extent to which the atmosphere traps heat and so leads to global warming. The science tells us – with a very high level of confidence – that such warming will lead to increasingly severe disruption to our weather patterns and water and food systems, and to ecosystems and biodiversity. Perhaps most worryingly, the science predicts that there may be a point where this process becomes self-fuelling, for example where warming leads to the thawing of permafrost such that significant quantities of greenhouse gases are released, leading to further warming. Beyond this point or threshold, the evidence suggests that we may lose control of our future climate and become subject to what has been referred to as dangerous or "runaway" climate change.

Until recently, scientists felt that this threshold existed at around 2ºC of global warming, measured as a global average of surface temperatures. However, more recent scientific assessments (especially by the IPCC in 2018) have suggested that the threshold should instead be set at 1.5ºC. This change in the suggested threshold from 2ºC to 1.5ºC has led to calls for targets for decarbonisation to be made both stricter (e.g. for the UK to move from an 80% decarbonisation target to a net-zero target, which it did in 2019), and to be brought forward (e.g. from 2050 to 2030, which the UK has not done, although many local authorities and other places have set themselves this ambitious goal).

Globally, the IPCC suggests that from 2021 we can only emit 294 billion tonnes of CO2 if we want to give ourselves a 66% chance of avoiding dangerous climate change. We are currently emitting over 37 billion tonnes of CO2 every year, which means that we will have used up our global carbon budget within a decade. It is this realisation – and the ever accumulating science on the scale of the impacts of climate change – that led to calls for organisations and areas to declare a climate emergency and to develop and implement plans to rapidly reduce carbon emissions.

Our Approach

(a) Measuring an Area's Carbon Footprint

Any area's carbon footprint – measured in terms of the total impact of all of its greenhouse gas emissions – can be divided into three types of greenhouse gas emissions.

• Those coming from the fuel (e.g. petrol, diesel or gas) that is directly used within an area and from other sources such as landfill sites or industry within the area. These are known as Scope 1 emissions.

• Those coming from the electricity that is used within the area, even if it is generated somewhere else. These are known as Scope 2 emissions. Together Scope 1 and 2 emissions are sometimes referred to as “territorial” emissions.

• Those associated with the goods and services that are produced elsewhere but imported and consumed within the area. After taking into account the carbon footprint of any goods and services produced in the area but that are exported and consumed elsewhere, these are known as Scope 3 or consumption-based emissions.

In this report[3] we focus on Scope 1 and 2 emissions, and exclude consideration of long-distance travel and of Scope 3 or consumption-based emissions. We do this because Scope 1 and 2 emissions are more directly under the control of actors within an area, and because the carbon accounting and management options for these emissions are better developed. It should also be noted, we do not include emissions from the agricultural sector that are not the result of energy use.

We stress though that emissions from longer distance travel (especially aviation) and consumption are very significant, and also need to be addressed. In addition, emissions from peatlands, a source of emissions that could add as much as 45% to Cambridgeshire and Peterborough’s baseline emissions, are not included in this analysis. Further detail on this challenge can be found in the Initial recommendations report of the Cambridgeshire and Peterborough Independent Commission on Climate, March 2021.

(b) Developing a Baseline of Past, Present and Future Emissions

Having a baseline of carbon emissions is key to tracking progress over time. We use local authority emissions data to chart changes in emissions from 2005 to 2018. We also break this down to show the share of emissions that can be attributed to households, public and commercial buildings, transport and industry.

We then project current emissions levels for the period through to 2050. To do this, we assume on-going decarbonisation of electricity in line with government commitments and a continuation of background trends in a) economic and population growth, and b) energy use and energy efficiency. Specific numbers for the key variables taken into account in the forecasts are presented in the technical annex published separately. As with all forecasts, the level of uncertainty attached increases as the time period in question extends. Even so, it is useful to look into the future to gauge the scale of the challenge to be addressed in each area, especially as it relates to the projected gap between the forecasted emissions levels and those that are required if an area’s emissions are to be consistent with a global strategy to limit average warming to 1.5ºC.

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[3] Further details of the data, assumptions and methodology are set out in a separate technical annex that is available at https://pcancities.org.uk/reports.

(c) Setting Science-Based Carbon Reduction Targets

To set science-based carbon reduction targets for an area, we take the total global level of emissions that the IPCC suggests gives us a 66% chance of limiting average levels of warming to 1.5ºC, and divide it according to the share of the global population living in the area in question.

This enables us to set the total carbon budget for an area that is consistent with a global budget. To set targets for carbon reduction, we then calculate the annual percentage reductions from the current level that are required to enable an area to stay within its overall carbon budget.

(d) Identifying and Evaluating Carbon Reduction Opportunities

Our analysis then includes assessment of the potential contribution of approximately 130 energy saving or low carbon measures for:

• Households and for both public and commercial buildings (including better insulation, improved heating, more efficient appliances, some small-scale renewables)

• Transport (including more walking and cycling, enhanced public transport, electric and more fuel-efficient vehicles)

• Industry (including better lighting, improved process efficiencies and a wide range of other energy efficiency measures).

We stress that the list of options that is assessed may not be exhaustive; other options could be available and the list can potentially be expanded.

For the options included, we assess the costs of their purchase, installation and maintenance, the direct benefits (through energy and fuel savings) of their adoption in different settings and their viable lifetimes. We also consider the scope for, and potential rates of deployment of each option. This allows us to generate league tables of the most carbon- and cost-effective options that could be deployed within an area.

It is important to note that we base the analysis on current capital costs, although future costs and benefits are adjusted for inflation and discounting factors. This could be overly cautious if costs fall and benefits increase as some options become more widely adopted, or optimistic if the costs increase as the rates of deployment increase. It is also important to note that, although we consider the employment generation potential of different options, we do not consider the wider indirect impacts of the different options relating to their social, economic or environmental implications, many of which are beneficial.

Beyond the range of currently available options, we also consider the need for more innovative or “stretch” options to be developed and adopted within the area if it is to meet its carbon reduction targets. These need to be developed in each area, but some of the ideas for innovative options identified elsewhere include targeting a full transition to net-zero homes and public/commercial buildings by 2030, promoting the rapid acceleration of active travel (e.g. walking and cycling), tackling food waste, reducing meat and dairy consumption and reducing concrete and steel consumption/ promoting adoption of green infrastructure.

(e) Aggregating Up

Based on this bottom up analysis of the potential for different options to be adopted within the area, we then aggregate up to assess the potential for decarbonisation within that area, and the costs and benefits of different levels of decarbonisation. We then merge the aggregated analysis of the scope for decarbonisation with the baseline projections of future emissions to highlight the extent to which the gap between the projected and required emissions levels can be met through different levels and forms of action.

To break this gap down, we merge interventions into three broader groupings:

• **Cost-Effective (CE)** options where the direct costs of adoption are outweighed by the direct benefits that they generate through the energy savings they secure, meaning the portfolio of measures as a whole has a positive economic impact in present value. These options may also generate indirect benefits, for example through job creation, fuel poverty reduction and improved air quality and public health.

• **Cost-Neutral (CN)** options where the portfolio of interventions mentioned above is expanded to consider investments that may not be as cost effective on their own terms, but where the range of measures as a whole will have near-zero net cost.

• **Technical Potential (TP)** options where the direct costs are not (at present) covered by the direct benefits. However, the cost of many low carbon options is falling quickly, and again these options could generate important indirect benefits such as those listed above.

As it is unlikely that adopting all of the cost-effective or even technically viable options will enable an area to reach net-zero emissions, we also highlight the need for a fourth group of measures:

• **Innovative or "stretch" options** that include low-carbon measures that are not yet widely adopted. Some of the options within this group may well be cost- and carbon-effective, and they may also generate significant indirect benefits, but whilst we can predict their carbon saving potential, data on their costs and benefits is not yet available.

(f) Developing Targets and Performance Indicators

Linked to the analysis detailed above, we extend our evaluation of potential emissions reductions across Cambridgeshire and Peterborough's economy to substantive, real-life indicators for the levels of investment and deployment required to achieve targets. These Key Performance Indicators (KPIs) illustrate the scale of ambition required to reach the emissions savings presented in the Technical Potential scenario and are disaggregated by sector.

A comparison of the KPIs in this analysis with the targets of the Climate Change Committee's 6th Carbon Budget are found in appendix 1. In some areas, for example in the deployment of electric vehicles and building insulation, analysis for CPCA has higher targets than the CCC suggests for the UK as a whole (on a per capita or rate basis). In other areas, for example around the deployment of heat pumps, the CCC targets are higher. These differences reflect different assumptions in the modelling approaches and differences in the challenges faced by CPCA relative to the UK as whole.

(g) Focusing on Key Sectors

As well as presenting an aggregated picture, we also focus on the emissions saving potential in the housing, public and commercial buildings, transport, and industry sectors. We focus in on overall investment needs and returns, and present more detailed league tables of the most carbon- and cost-effective options that could be adopted in each sector.

Developing a Baseline of Past, Present and Future Emissions for Cambridgeshire and Peterborough

Analysis shows that Cambridgeshire and Peterborough's baseline (Scope 1 and 2) emissions have fallen by 37% since 2000, due to a combination of increasingly decarbonised electricity supply, structural change in the economy, and the gradual adoption of more efficient buildings, vehicles and businesses.

With full decarbonisation of UK electricity by 2045, and taking into account economic growth (GVA growth assumed to average 1.4% p.a over the period through 2050.), population growth (assumed at 0.75% through 2040 and then falling to 0.5% from 2040 through 2050.) and on-going improvements in energy and fuel efficiency, we project that Cambridgeshire and Peterborough's baseline (Scope 1 and 2) emissions will only fall by a further 7% by 2030, 12% by 2040, and 15% by 2050. This is a total of just over 46% between 2000 and 2050.

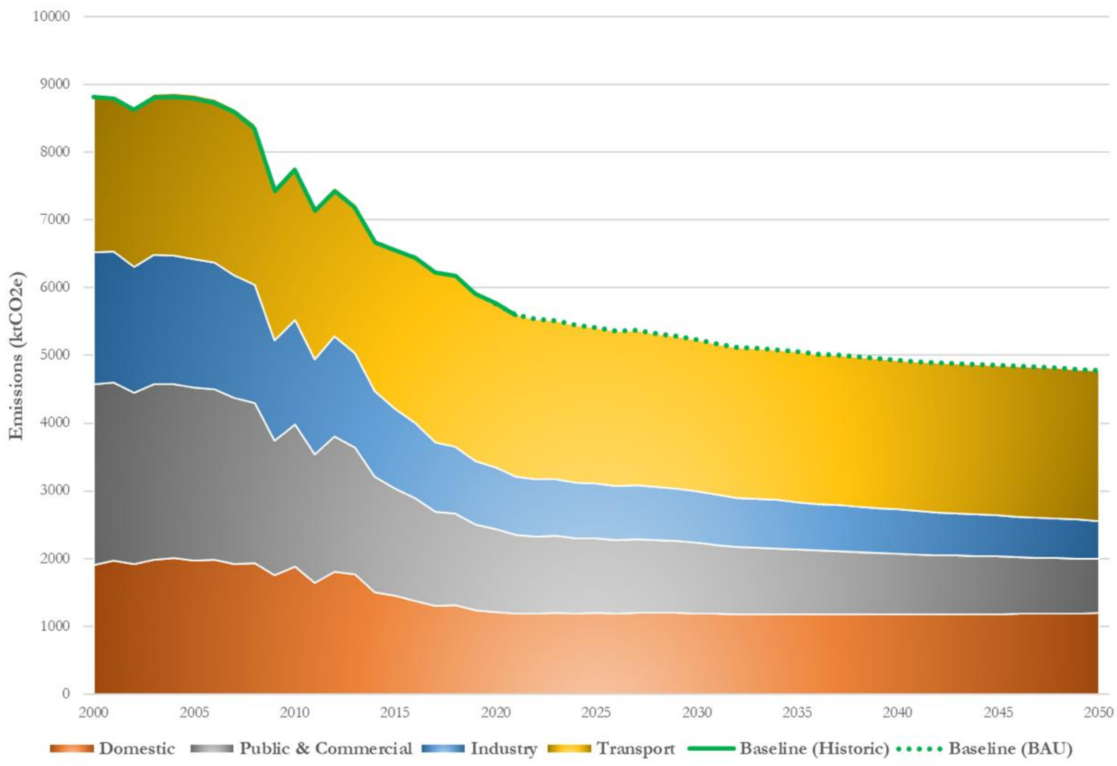

Figure 1: Cambridgeshire and Peterborough's Scope 1 and 2 Carbon Emissions (2000-2050)

Currently, 21% of Cambridgeshire and Peterborough's emissions come from the domestic sector, with transport responsible for 42% of emissions, public and commercial buildings for 21% and industry 16%. Emissions related to land use and agriculture contribute c.0.5% of the total[4]. By 2050, under BAU, we project that the share of emissions from transport and housing will increase (from 42 to 46% and from 21 to 25% respectively), while the share of emissions from public and commercial buildings and industry will fall (from 21 to 17% and from 16 to 12% respectively).

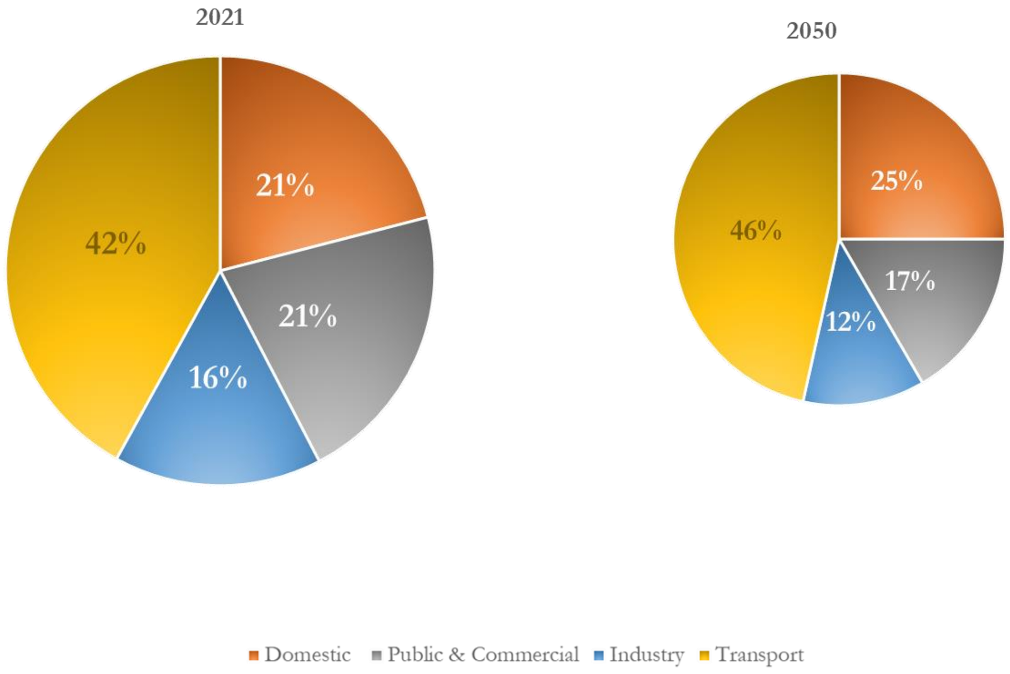

Figure 2: Cambridgeshire and Peterborough's Present and Projected Emissions by Sector

Related to this emissions baseline, after evaluating the range of energy sources Cambridgeshire and Peterborough consumes (spanning electricity, gas, all solid and liquid fuels across sectors) we find that in 2020, £1,871 million was spent on energy across the area. Transport fuels generated the majority of this demand (58%), followed by domestic buildings (21%) then public and commercial buildings and industry at 11% and 9% respectively.

By projecting demand and energy prices into future with reasonable baseline assumptions over population, inflation and on-going efficiency gains across the economy, we find that Cambridgeshire and Peterborough's business-as-usual (BAU) energy expenditure will likely grow to just over £2,119 million per year in 2030 and £2,821 million per year in 2050, with transport expenditure growing to represent 64% of Cambridgeshire and Peterborough's total energy expenditure (see Figure 3 below).

[4] Emissions associated with the manufacture of agricultural inputs such as fertilisers and animal emissions are not included in the analysis.

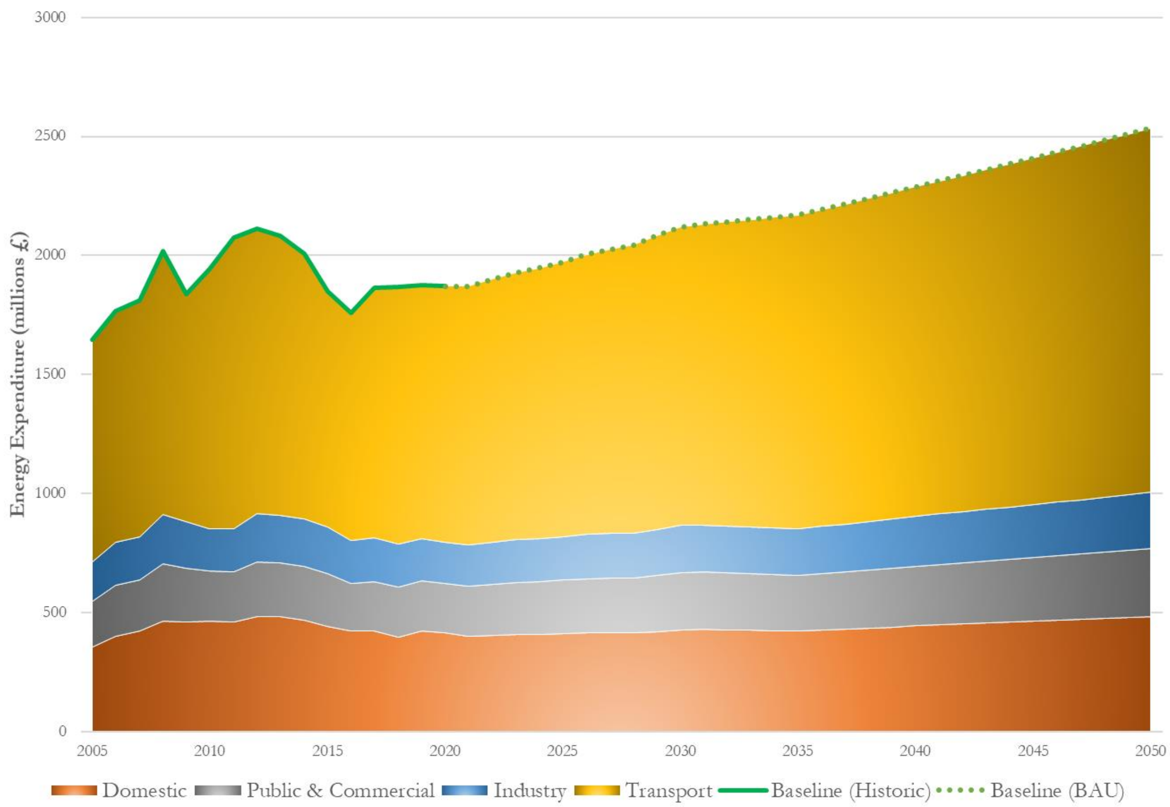

Figure 3: Cambridgeshire and Peterborough's Present and Projected Energy Expenditure by Sector

Setting Science-Based Carbon Reduction Targets for Cambridgeshire and Peterborough

The Intergovernmental Panel on Climate Change (IPCC) has argued that from 2020, keeping within a global carbon budget of 294 gigatonnes (i.e. 294 billion tonnes) of CO2 emissions would give us a 66% chance of limiting average warming to 1.5ºC and therefore avoiding dangerous levels of climate change. If we divide this global figure up on an equal basis by population, and adjust the budget to consider other gases that contribute to climate change, this gives Cambridgeshire and Peterborough a total carbon budget of c.32 megatonnes over the period between the present and 2050 with a 66% chance of avoiding average surface temperature warming of more than 1.5 degrees, or c.49 megatonnes with a 50% chance.

At current rates of emissions, Cambridgeshire and Peterborough would use up its carbon budget associated with a 50% chance of staying within 1.5 degree of warming by 2031 (i.e. in 11 years) and with a 66% chance by 2027 (i.e. in 7 years).

However, Cambridgeshire and Peterborough could stay within its carbon budget consistent with having a 66% chance of avoiding more than 1.5 degrees of warming by reducing its emissions by c.13% year on year. This would mean that to transition from the current position where emissions are 37% lower than 2000 levels, Cambridgeshire and Peterborough should adopt the following carbon reduction targets (on 2000 levels):

- **49% by 2025**
- **74% by 2030**
- **87% by 2035**
- **94% by 2040**
- **97% by 2045**
- **100% by 2050**

Such a trajectory would mean that the majority of all carbon cuts needed for Cambridgeshire and Peterborough to transition to a 1.5ºC consistent pathway need to be delivered in the next 10 years.

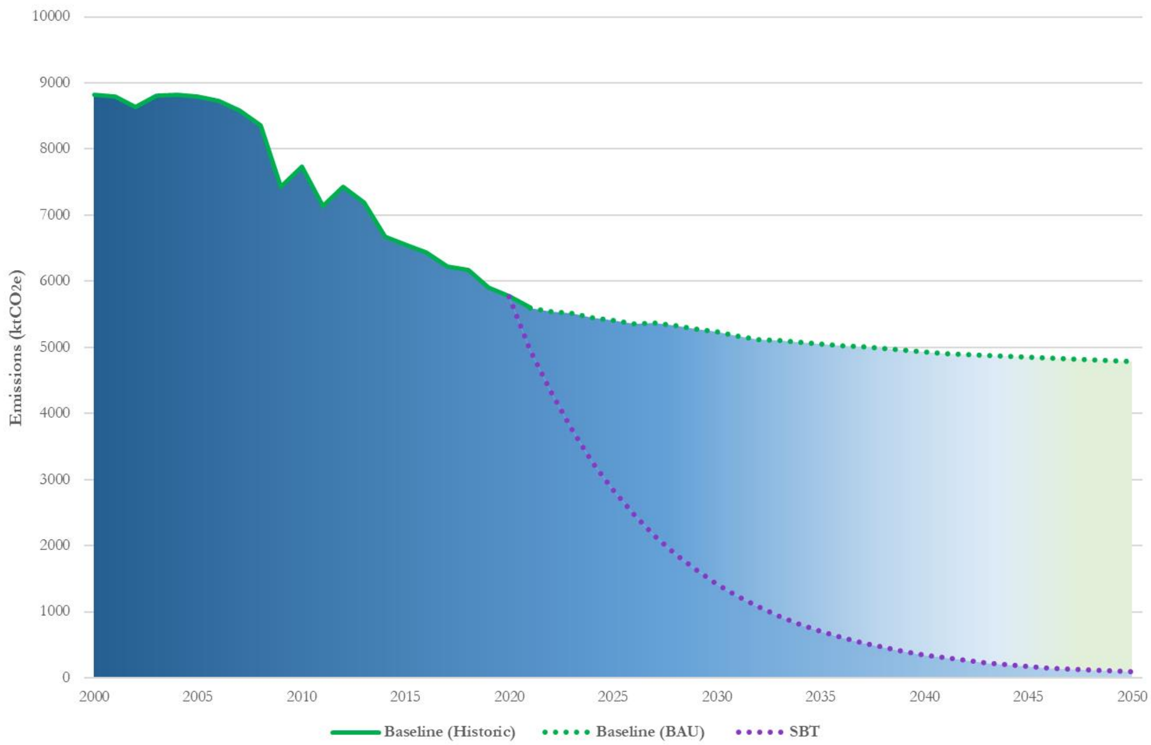

Figure 4: Cambridgeshire and Peterborough’s Baseline and Science-Based-Target Emissions Pathways

Aggregating Up: The Bigger Picture for Cambridgeshire and Peterborough

a) Emissions reductions

Our analysis predicts that the gap between the Cambridgeshire and Peterborough business-as-usual (BAU) emissions in 2050 and the net-zero target could be closed by 61% through the adoption of Cost-Effective (CE) options, by a further 13% through the adoption of additional Cost-Neutral (CN) options at no net cost, and then by an additional 9% through the further adoption of all technically viable (TP) options. This means that Cambridgeshire and Peterborough still has to identify the innovative or stretch options that could deliver the last 17% of the gap between the business-as-usual scenario and net-zero in 2050.

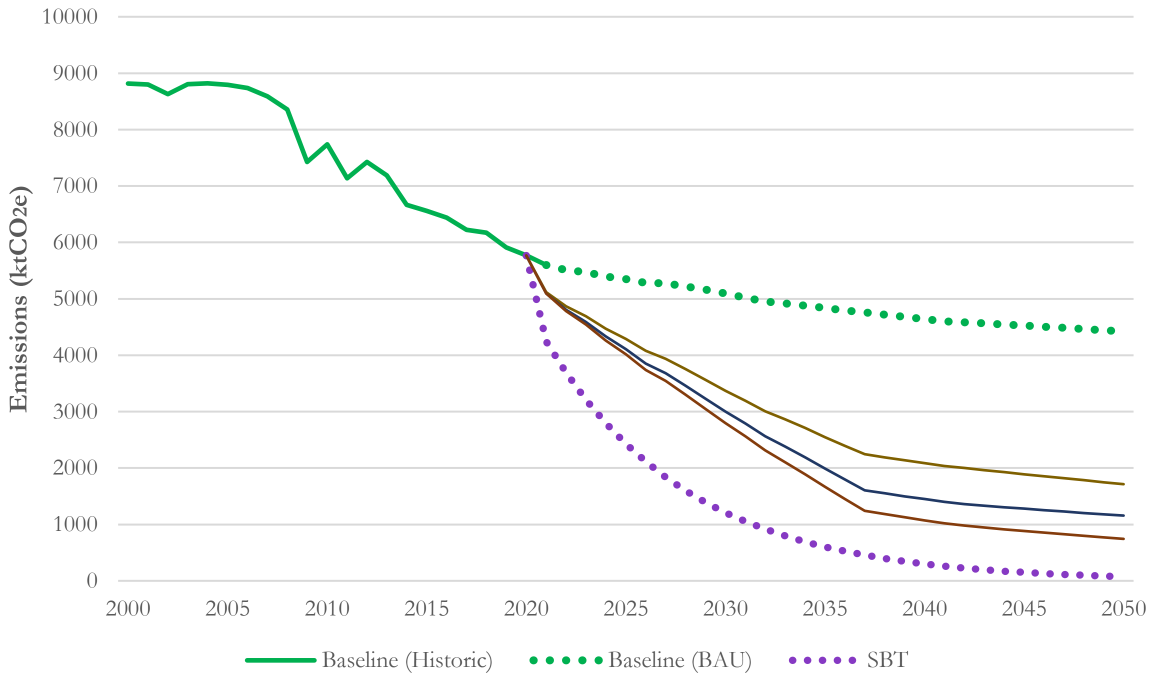

Figure 5: Cambridgeshire and Peterborough's BAU Baseline with Cost-Effective (CE), Cost-Neutral (CN), & Technical Potential (TP) Scenarios

		2025	2030	2035	2040	2045	2050
Reduction on BAU Baseline	CE	20%	34%	47%	55%	58%	61%
	CN	23%	41%	59%	69%	72%	74%
	TP	25%	45%	66%	77%	80%	83%
Reduction on 2021 Emissions	CE	19%	33%	41%	46%	47%	48%
	CN	22%	40%	51%	57%	58%	58%
	TP	24%	44%	57%	64%	65%	66%

Table 1: Cambridgeshire and Peterborough's Potential Five-Year Emissions Reduction Percentages

b) The most carbon- and cost-effect options

Simplified league tables of the most cost- and carbon-effective options in Cambridgeshire and Peterborough are presented below (see Appendices 1 & 2 for more detailed league tables). In these tables, measures are assessed independently according to the maximum potential for each measure identified by the study. This means that interactions between measures are not considered.

Rank	Measure	Cost Effectiveness (£/tCO2e)
1	Compressed air systems in industry	-613
2	Pump upgrades, repairs and maintenance in industry	-573
3	Diesel car to bus (diesel)	-466
4	Fabric improvements in retail buildings	-444
5	Petrol car to bus (diesel)	-410
6	Diesel car to walk	-363
7	Petrol car to walk	-353
8	Diesel car to bicycle	-350
9	Petrol car to bicycle	-339
10	Fabric improvements in public buildings	-335

Table 2: Cambridgeshire and Peterborough's Top Ten Most Cost-Effective Emission Reduction Options

Rank	Measure	Emissions Reduction Potential (ktCO2e)
1	Installing heat pumps in domestic buildings	5,110
2	Insulating domestic buildings	4,456
3	Petrol car to bicycle	3,893
4	Upgraded heating controls in domestic buildings	3,818
5	Petrol car to walk	3,786
6	Petrol car to train	3,265
7	Installing air source heat pumps in office buildings	3,193
8	Electrical upgrades in domestic buildings	

		3,114
9	Diesel car to train	3,044
10	Petrol car to EV	2,788

Table 3: Cambridgeshire and Peterborough's Top Ten Most Carbon-Effective Emission Reduction Options

Some of the ideas for innovative options identified elsewhere that could also be considered for Cambridgeshire and Peterborough include targeting a full transition to net-zero homes and public/commercial buildings by 2030, promoting the rapid acceleration of active travel (e.g. walking and cycling), tackling food waste, reducing meat and dairy consumption and reducing concrete and steel consumption/promoting adoption of green infrastructure. These are highlighted at the end of our report ("Innovative Stretch Measures for Cambridgeshire and Peterborough").

c) Investment needs, paybacks and employment creation

Exploiting the cost-effective options in households, public and commercial buildings, transport, industry and waste could be economically beneficial. Although such measures would require total investments of around £5.1 billion over their lifetimes (equating to investments of £284 million a year across all organisations and households in the area for the next 18 years), once adopted they would reduce Cambridgeshire and Peterborough's total energy bill by £607 million a year in 2050 whilst also creating 15,654 years of employment (c.870 full-time jobs for 18 years).

By expanding this portfolio of measures to include measures that could be adopted at no net cost to Cambridgeshire and Peterborough's economy (the Cost-Neutral scenario), investments of £8.4 billion over their lifetimes (or £468m a year for the next 18 years) would generate 24,081 years of employment (1,338 full-time jobs for 18 years) whilst reducing Cambridgeshire and Peterborough's emissions by 74% of projected 2030 levels.

Exploiting all technically viable options would be more expensive (at least at current prices, c.£11 billion or £663m a year for the next 18 years) but realise further emissions savings – eliminating 84% of the projected shortfall in Cambridgeshire and Peterborough's 2050 emissions, whilst saving hundreds of millions of pounds on an annual basis.

		2025	2030	2035	2040	2045	2050
Cumulative Investment (£M)	CE	1,032	3,283	4,177	4,885	5,025	5,109
	CN	1,570	4,918	6,472	7,828	8,296	8,423
	TP	2,450	7,126	9,464	11,216	11,758	11,929
Annual Energy Expenditure Savings (£M)	CE	309	469	553	575	564	607
	CN	304	495	600	647	667	687
	TP	331	509	626	679	711	743

Table 4: Potential Five-Year Investments and Energy Expenditure Savings

A sectoral break down of these investment needs is presented in Table 5 below, whilst in Table 6 we present the employment creation potential by sector for different levels of investment.

Sector	Scenario	Investment (£M)
Domestic	CE	2,342
	CN	3,932
	TP	5,390
Public and Commercial	CE	1,878
	CN	2,515
	TP	3,335
Industry	CE	290
	CN	554
	TP	1,782
Transport	CE	599
	CN	1,422
	TP	1,422

Table 5: Potential Investments by Sector & Economic Scenario

		Total	Domestic	Industry	Transport	Public and Commercial
Years of employment	**CE**	**15,654**	5,008	993	819	8,834
	CN	**24,081**	8,408	1,896	1,946	11,831
	TP	**35,257**	11,525	6,097	1,946	15,689
Jobs (18-year Period)	**CE**	**870**	278	55	46	491
	CN	**1,338**	467	105	108	657
	TP	**1,959**	640	339	108	872

Table 6: Potential Job Creation by Sector & Economic Scenario

Developing Targets and Performance Indicators

To give an indication of the levels of activity required to deliver on these broader targets, the tables below detail total deployment across different sectors in Cambridgeshire and Peterborough through to 2050. We also give an indication of the rate of deployment required in the area if it is to even come close to its climate targets. These lists are not exhaustive, and also apply by measure; any one building or industrial facility will usually require the application of several measures over the period. These figures effectively become Key Performance Indicators (KPIs) for the delivery of climate action across the area.

Homes

Measure	Total Homes Applied	Mean Annual Rate of Installation over 18 years (homes)
Cavity wall insulation	59,461	3,303
Draught proofing	30,565	1,698
External insulation	69,998	3,889
Floor insulation	144,091	8,005
Boiler upgrades	191,920	10,662
Heat pump installation	276,000	15,333
Internal wall insulation	122,950	6,831
Loft insulation	169,409	9,412
Lighting upgrades	346,511	19,251
Solar thermal	179,614	9,979
Triple glazing	219,382	12,188

Solar PV	490,165	27,231
Smart meters	266,092	14,783

Table 7 (a): Cambridgeshire and Peterborough’s Sectoral Emissions Reduction KPIs for Domestic Homes

Public & Commercial Buildings

Measure	Floorspace Applied (m2)	Mean Annual Rate of Installation (m2)
Heating System Upgrades & Controls	7,805,433	459,143
Lighting Upgrades & Sensors	6,646,114	390,948
Solar PV	3,844,688	226,158
Fabric Improvements	1,909,095	112,300
Solar Thrmal Systems	592,664	34,863
Heat Pumps	848,799	49,929

Table 7 (b): Cambridgeshire and Peterborough’s Sectoral Emissions Reduction KPIs for Public & Commercial Buildings

Transport

Measure	Deployment
Additional EV's Replacing Conventional Private Cars	71,169 per annum
Increase in Public Transport Ridership	12M per annum
High Quality Protected Cycling Highways Built	80 kilometres

Table 7 (c): Cambridgeshire and Peterborough’s Sectoral Emissions Reduction KPIs for Transport

Focusing on Key Sectors

At full deployment (technical potential) across Cambridgeshire and Peterborough, we calculate that there is potential to avoid 82 $MtCO_2e$ in emissions that will otherwise be produced in the area between 2020 and 2050. The transport sector will contribute most significantly toward this total, with a decarbonisation potential of c.46 $MtCO_2e$ at full technical potential through the period.

However, domestic, industry and public and commercial buildings also play a major role; upgrading and retrofitting of Cambridgeshire and Peterborough's built environment (including homes and public and commercial buildings) could reduce emissions by up to c.32 $MtCO_2e$ over the same period at full technical potential, with industry similarly showing the potential to decarbonise over c.5 $MtCO_2e$ under the same conditions.

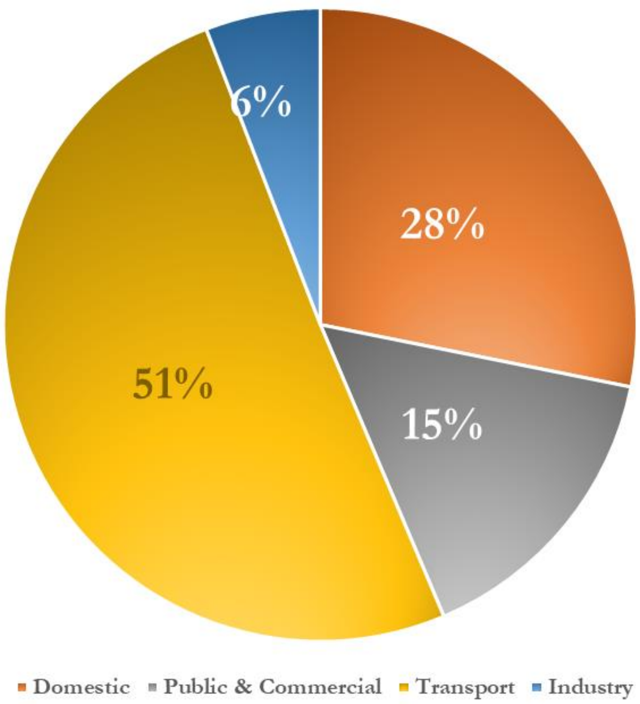

Figure 6: Cambridgeshire and Peterborough's Emissions Reduction Potential (2020-2050) by Sector

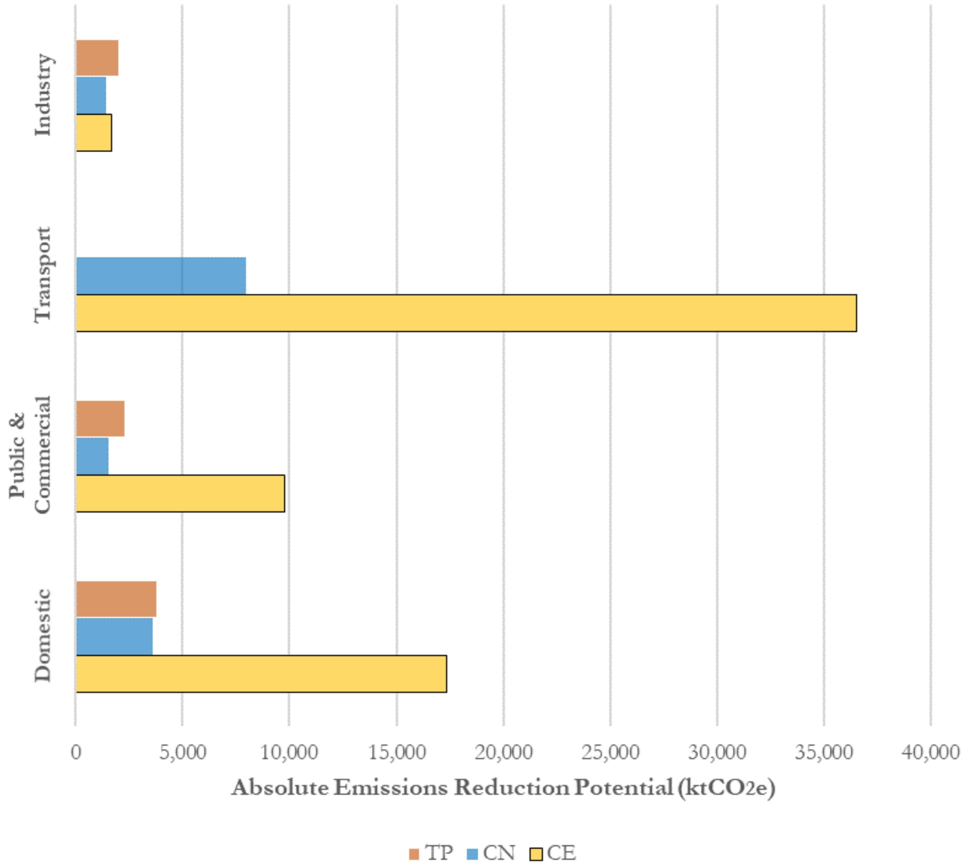

Figure 7: Cambridgeshire and Peterborough’s Emissions Reduction Potential by Sector & Economic Scenario (2020-2050)

In the following section summaries of the emissions reduction potential and economic implications of investment are presented for the four main sectors. For display and continuity purposes, each sector is displayed with a summary of the same metrics: (1) emissions reduction potential over time in the three economic scenarios, (2) five-year totals for cumulative emissions savings, investment requirements and annual energy expenditure reductions, and (3) a simplified table of the most cost-effective low carbon measures applied in each sector across Cambridgeshire and Peterborough.

(a) Housing

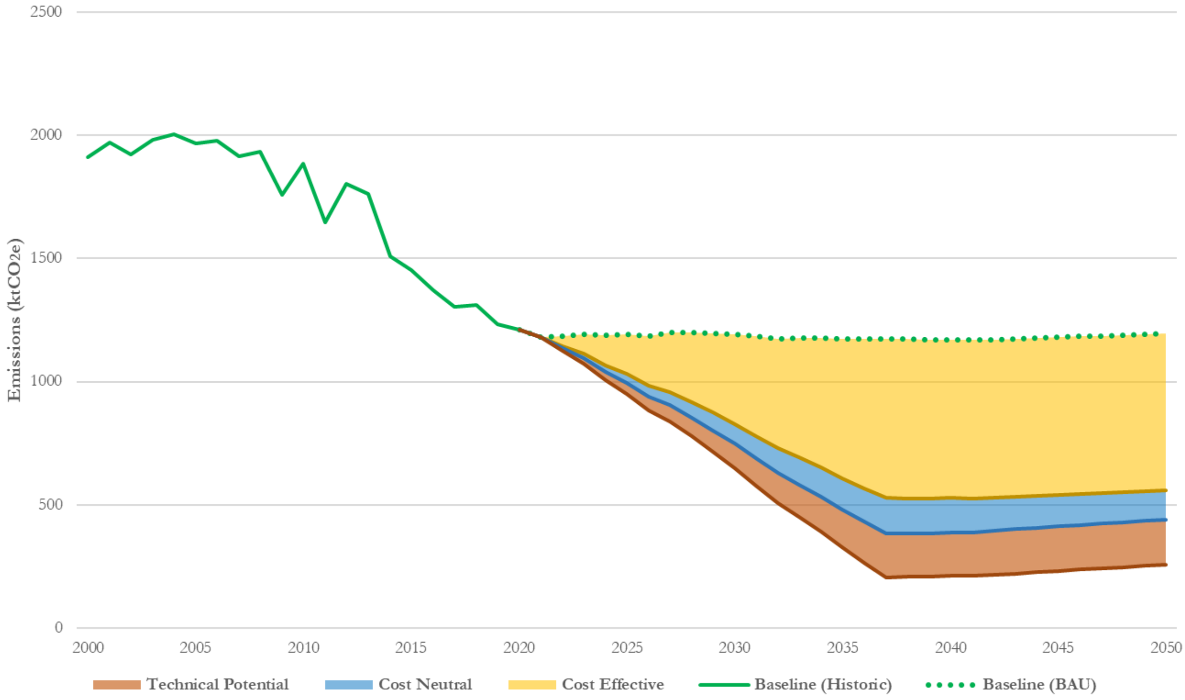

Figure 8: Housing BAU Baseline with Cost-Effective, Cost-Neutral and Technical Potential Scenarios[5]

		2025	2030	2035	2040	2045	2050
Emissions Reductions (ktCO2e)	CE	162	364	566	644	640	635
	CN	198	446	693	783	769	754
	TP	242	545	847	961	949	937
Annual Energy	CE	35	79	122	143	149	155
	CN	43	98	152	177	182	187

[5] Including data for retrofit of existing housing and new build housing, assuming 83% of the 2050 housing stock is already built and 17% is still to be built. These assumptions are sensitive to household size assumptions. Using projections of past trends in household size and home construction increase the proportion of homes built over the period to 2050 to c31%.

In each scenario new builds are assumed to achieve an EPC rating of A, saving each home approximately 40kwh/m2 annually against the baseline scenario in 2021. In line with the CCC, scenarios also include a 2028 phase out of non-natural gas fossil fuel boilers and a 2033 phase out of gas boilers.

Expenditure Savings (£M)	TP	36	81	126	150	160	170
Cumulative Investment (£M)	CE	520	1,171	1,822	2,342	2,342	2,342
	CN	874	1,966	3,058	3,932	3,932	3,932
	TP	1,198	2,695	4,192	5,390	5,390	5,390

Table 8: Housing Emissions Reductions, Expenditure Savings and Investment Levels

Rank	Measure	Cost Effectiveness ($£/tCO_2e$)
1	Electrical upgrades in domestic buildings	-187
2	Lighting improvements in domestic buildings	-162
3	Electricity demand reduction in domestic buildings	-114
4	Insulating domestic buildings	-59
5	Draught-proofing in domestic buildings	-46
6	Glazing improvements in domestic buildings	-36
7	Upgraded heating controls in domestic buildings	-29
8	Installing heat pumps in domestic buildings	-26
9	Solar thermal devices in domestic buildings	-21
10	Upgraded boilers in domestic buildings	-14

Table 9: The Most Cost-Effective Measures for Housing

(b) Public & Commercial Buildings

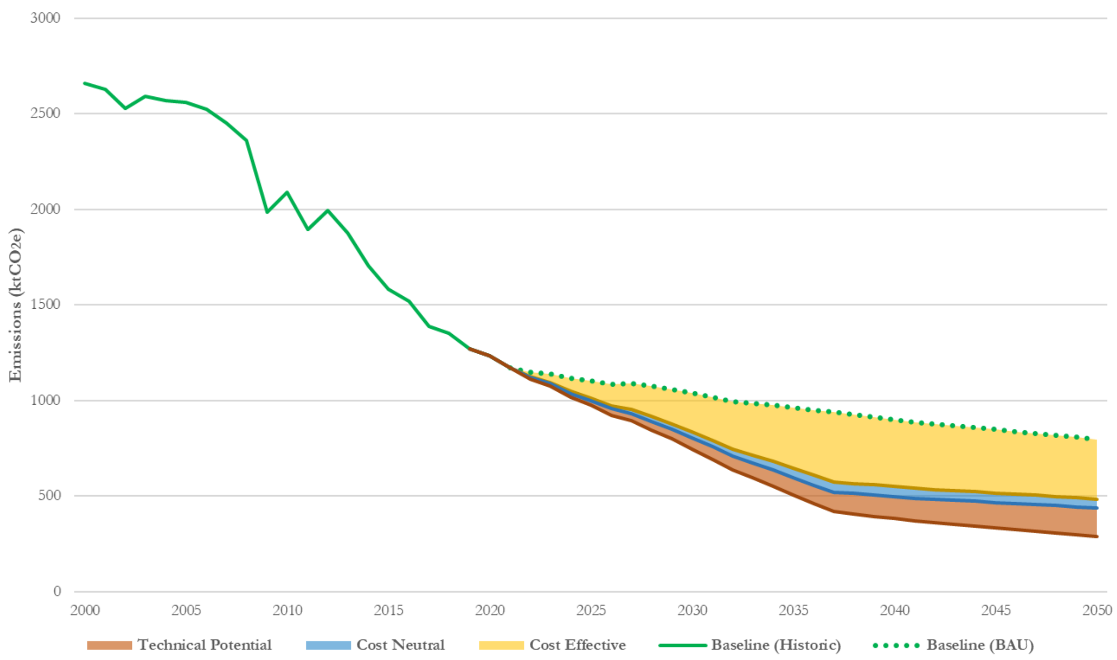

Figure 9: Public and Commercial Buildings BAU Baseline with Cost-Effective, Cost-Neutral and Technical Potential Scenarios

		2025	2030	2035	2040	2045	2050
Emissions Reductions (ktCO2e)	CE	91	204	318	351	331	311
	CN	104	235	365	404	381	358
	TP	130	293	455	518	513	508
Annual Energy Expenditure Savings (£M)	CE	135	146	158	170	184	199
	CN	97	100	103	105	108	111
	TP	130	130	139	149	159	170
Cumulative Investment (£M)	CE	140	1,096	1,514	1,654	1,794	1,878
	CN	212	1,423	1,964	2,176	2,388	2,515
	TP	285	1,868	2,594	2,879	3,164	3,335

Table 10: Public and Commercial Buildings Emissions Reductions, Expenditure Savings and Investment Levels

Rank	Measure	Cost Effectiveness (£/tCO2e)
1	Fabric improvements in retail buildings	-444
2	Fabric improvements in public buildings	-335
3	Improved cooling in retail buildings	-297
4	Lighting improvements in public buildings	-179
5	Improved cooling in office buildings	-152
6	Lighting improvements in retail buildings	-136
7	Heating improvements in public buildings	-110
8	Improved cooling in public buildings	-93
9	Lighting improvements in office buildings	-64
10	Heating improvements in office buildings	-56

Table 11: The Most Cost-Effective Measures for Public and Commercial Buildings

(c) Transport

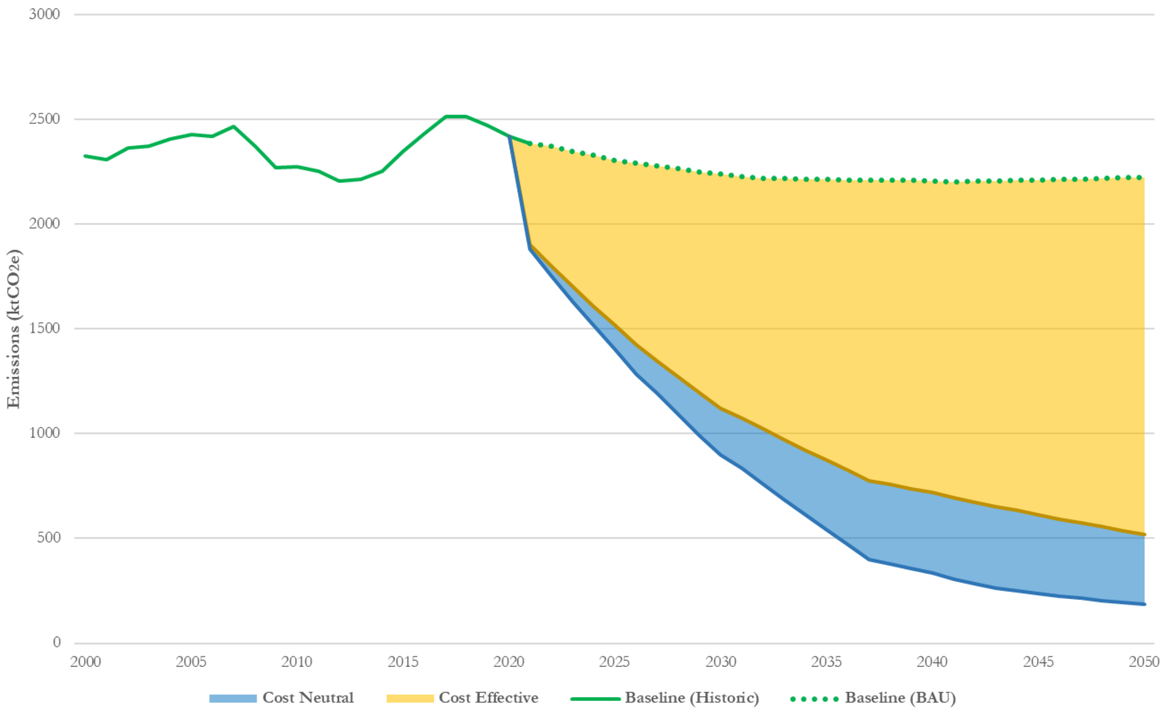

Figure 10: Transport BAU Baseline with Cost-Effective and Cost-Neutral Scenarios[6]

		2025	2030	2035	2040	2045	2050
Emissions Reductions ($ktCO_2e$)	CE	789	1,117	1,344	1,489	1,599	1,621
	CN	904	1,339	1,677	1,875	1,974	1,988
Annual Energy Expenditure Savings (£M)	CE	131	222	244	269	299	329
	CN	157	270	310	331	343	356
Cumulative Investment (£M)	CE	265	459	491	599	599	599
	CN	314	612	670	1,165	1,165	1,422

Table 12: Transport Emissions for Reductions, Expenditure Savings and Investment Levels

[6] Due to the high inherent cost effectiveness of many transport modal shift options, the TP scenario has been removed and emissions pathways are covered by CE and CN only.

Rank	Measure	Cost Effectiveness (£/tCO2e)
1	Diesel car to bus (diesel)	-466
2	Petrol car to bus (diesel)	-410
3	Diesel car to walk	-363
4	Petrol car to walk	-353
5	Diesel car to bicycle	-350
6	Petrol car to bicycle	-339
7	Petrol car to plug-in hybrid	-254
8	Petrol car to train	-155
9	Diesel car to plug-in hybrid	-149
10	Diesel car to train	-149

Table 13: The Most Cost-Effective Measures for Transport

(d) Industry

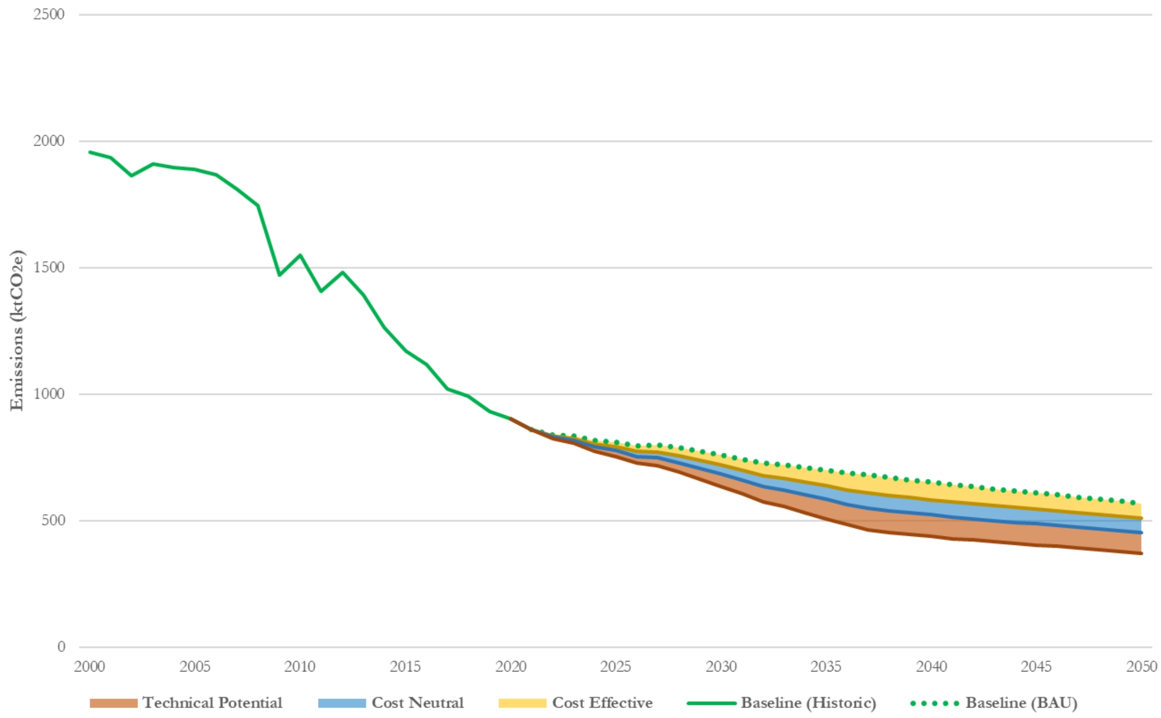

Figure 11: Industry BAU Baseline with Cost-Effective, Cost-Neutral and Technical Potential Scenarios

		2025	2030	2035	2040	2045	2050
Emissions Reductions (ktCO2e)	CE	18	40	45	69	64	63
	CN	33	75	83	129	122	121
	TP	55	124	137	214	205	203
Annual Energy Expenditure Savings (£M)	CE	8	6	29	29	28	27
	CN	7	7	35	34	33	32
	TP	8	8	51	50	48	47
Cumulative Investment (£M)	CE	106	184	290	290	290	290
	CN	171	294	554	554	554	554
	TP	654	1,028	1,782	1,782	1,782	1,782

Table 14: Industry Emissions Reductions, Expenditure Savings and Investment Levels

Rank	Measure	Cost Effectiveness (£/tCO2e)
1	Furnace efficiency and heat recovery mechanisms in industry	-363
2	Improving efficiency of boilers and steam piping in industry	-353
3	Refrigeration efficiency and technical upgrades in industry	-350
4	Condensing & insulation measures to boilers & steam piping in industry	-339
5	Pump upgrades, repairs and maintenance in industry	-155
6	Fan correction, repairs, & upgrades in industry	-149
7	Compressed air systems in industry	-141
8	Compressors and variable speed systems in industry	-138

Table 15: The Most Cost-Effective Measures for Industry

Innovative Stretch Measures for Cambridgeshire and Peterborough

Even with full delivery of the broad programme of cross-sectoral, area-wide low carbon investment described above, there remains an emissions shortfall of 17% between Cambridgeshire and Peterborough's 2050 BAU baseline and the net-zero target. Here we briefly consider the productivity of certain key technologies and interventions that may well be able to plug this gap into the future. Many of these so-called "stretch options" are innovative by nature but they will be required to reach Cambridgeshire and Peterborough's targets in future.

		2025	2030	2035
Annual Emissions Reduction Potential (ktCO2e)	Zero carbon heavy goods transport	7	16	24
	Electrifiction of industrial heating	46	102	159
	Electrification of domestic heating	30	68	106
	Electrification of domestic cooking	8	19	29
	Electrification of commercial and public heating	39	87	135
	3600 Ha Annual Reforestation (2021-30)*	-147	-390	-586

Table 16: Decarbonising Potential of Stretch Measures (*Sequestration Values)

Figure 12 below shows the impact that the adoption of these stretch measures would have on Cambridgeshire and Peterborough's carbon emissions, with the red dotted line showing the business-as-usual baseline, the purple dotted line showing emissions after adoption of all technically viable options and the solid grey line showing emissions after all technically viable and stretch options but without tree planting. This indicates that Cambridgeshire and Peterborough would still have some residual emissions through to 2050.

For illustration, the green shaded area shows that in theory Cambridgeshire and Peterborough could offset these residual emissions through a UK based tree planting scheme; however this would require the planting of 158 million trees, which even with the densest possible planting would require 35,734 hectares of land, equivalent to 10% of the total land area of Cambridgeshire.

Although there are lots of other good reasons to support tree planting (e.g. biodiversity, flood protection or public health), this is not to recommend tree planting at this scale for carbon reduction purposes alone, merely to illustrate the scale of tree planting that would be required to offset just the residual emissions that are left after other low carbon options have been fully deployed across Cambridgeshire and Peterborough.

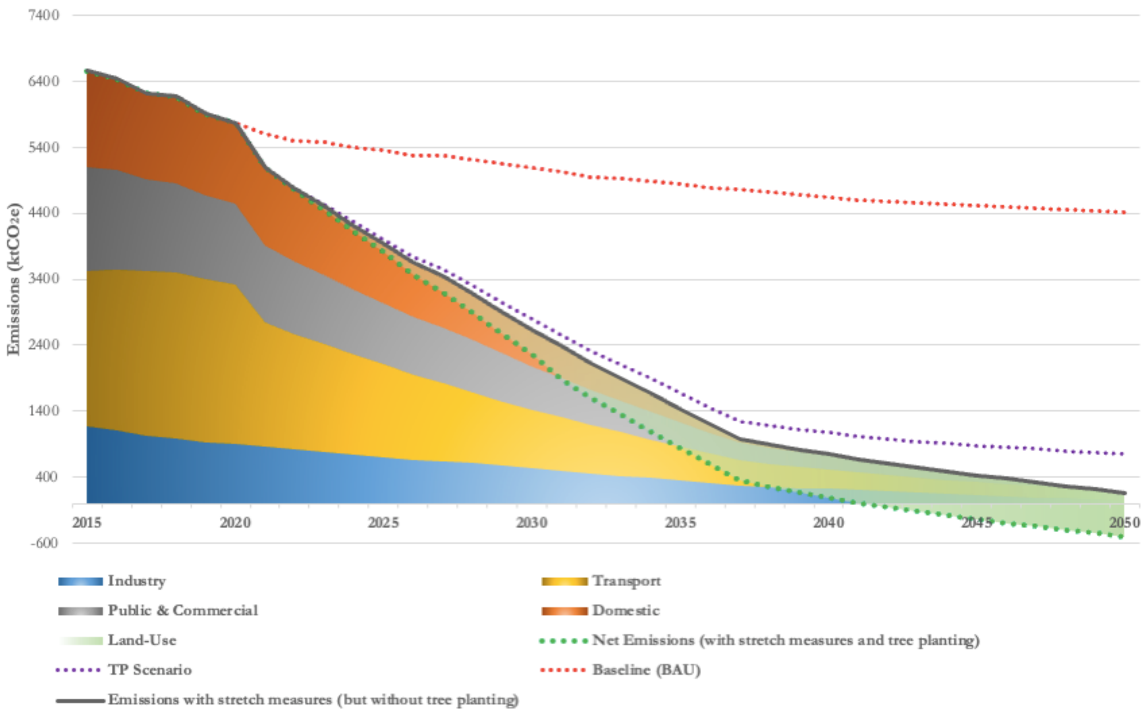

Figure 12: Sectoral Emissions Shortfall Reduction with Stretch Measures

It is important to note that carbon emissions could be cut further still through with the adoption of behavioural and consumption-based changes such as reductions in meat and dairy consumption and the generation of food waste and reduced consumption of concrete and steel with more emphasis on green infrastructure. Such consumption-based changes – which would impact on the broader Scope 3 carbon footprint of the area – could be the focus of future work.

Next Steps for Cambridgeshire and Peterborough

Based on the analysis presented here we recommend that if Cambridgeshire and Peterborough wants to stay within its share of the global carbon budget, it needs to adopt a clear and ambitious climate action plan. The case for the adoption of such a plan is supported by the evidence that much – but not all – of the action that is required can be based on the exploitation of win-win low carbon options that will simultaneously improve economic, social and health outcomes across the area.

A climate action plan for Cambridgeshire and Peterborough should adopt science-based targets for emissions reduction, including both longer term targets and five-yearly carbon reduction targets. The action plan should focus initially on Cambridgeshire and Peterborough's direct (Scope 1 and 2) carbon footprint as these emissions are most directly under the area's influence, but in time it should also widen its scope to consider its broader (Scope 3) carbon footprint. The action plan should clearly set out the ways in which Cambridgeshire and Peterborough will work towards achieving these targets, drawing on the deployment KPIs listed in this report. Action should also be taken to monitor and report progress on emissions reductions.

It is important to stress that delivering on these targets will require action across the area and the active support of the public, private and third sectors. An independent Cambridgeshire and Peterborough Climate Commission can help to draw actors together and to build capacities to take and track action. Leadership groups could develop clear plans for the delivery of priority actions in key sectors such as homes, public and commercial buildings, transport and industry. Large organisations and businesses in the area could also be asked to match broader carbon reduction commitments and to report back on progress.

Appendix 1. Table Comparing the Ambition of The CCC's Sixth Carbon Budget and the Targets Suggested for Cambridgeshire and Peterborough

Sector		CCC's 6th Carbon Budget	Cambridgeshire and Peterborough potential scenario with stretch measures
Transport	EV % of car fleet 2030	43%	52%
Buildings	Insulation interventions of all types per 1000 population per year (2030)	18	17
Buildings	Heat pumps per 1000 people per year (2030)	15	16
Domestic buildings	2028 phase out of non natural gas fossil fuel boilers, 2033 phase out of gas boilers.		
Commercial and public buildings	Phase out of gas boilers in commercial buildings by 2033, phase out of gas boilers in public buildings by 2030		
Afforestation[7]	Hectares per 1000 people per year (annual average through 2050)	0.6	1.2

[7] As stated above, this option is included in this analysis to give an indicataion of the scale of tree planting that would be required to offset the residual emissions left after other low carbon options have been fully deployed across Cambridgeshire and Peterborough.

Appendix 2. League Table of the Most Carbon-Effective Options for Cambridgeshire and Peterborough

Measure	Absolute Emissions Reduction (ktCO2e)
Installing heat pumps in domestic buildings	5,110
Insulating domestic buildings	4,456
Petrol car to bicycle	3,893
Upgraded heating controls in domestic buildings	3,818
Petrol car to walk	3,786
Petrol car to train	3,265
Installing air source heat pumps in office buildings	3,193
Electrical upgrades in domestic buildings	3,114
Diesel car to train	3,044
Petrol car to EV	2,788
Petrol car to bus (electric)	2,688
Diesel car to walk	2,582
Fabric improvements in public buildings	2,558
Diesel car to bicycle	2,499
Fabric improvements in retail buildings	2,498
Petrol car to hybrid	2,353
Petrol car to bus (diesel)	2,326
Upgraded boilers in domestic buildings	2,291
Installing solar PV on domestic buildings	2,269
Diesel car to EV	2,237
Diesel car to bus (electric)	2,219
Petrol car to plug-in hybrid	2,178
Electricity demand reduction in domestic buildings	2,075
Diesel car to plug-in hybrid	1,712

Diesel car to bus (diesel)	1,528
Hybrid car to EV	1,460
Condensing & insulation measures to boilers & steam piping in industry	1,404
Draught-proofing in domestic buildings	1,368
Lighting improvements in domestic buildings	1,364
Heating improvements in public buildings	1,073
Glazing improvements in domestic buildings	1,065
Solar thermal devices in domestic buildings	1,032
Improving efficiency of boilers and steam piping in industry	960
Solar thermal devices in public buildings	777
Improved lighting controls and sensors in public buildings	661
Solar thermal devices in retail buildings	638
Improved cooling in office buildings	617
Lighting improvements in office buildings	608
Upgrading heating controls in office buildings	555
Diesel car to hybrid	540
Improved lighting controls and sensors in retail buildings	458
Improved lighting controls and sensors in office buildings	426
Pump upgrades, repairs and maintenance in industry	415
Lighting improvements in public buildings	375
Heating improvements in retail buildings	342
Fan correction, repairs, & upgrades in industry	296
Compressed air systems in industry	278

Compressors and variable speed systems in industry	214
Furnace efficiency and heat recovery mechanisms in industry	176
Refrigeration efficiency and technical upgrades in industry	89
Installing solar PV in public buildings	89
Fabric improvements in office buildings	61
Improved cooling in public buildings	56
Improved cooling in retail buildings	49
Upgraded heating controls in public buildings	29
Installing solar PV in office buildings	27
Installing air source heat pumps in public buildings	25
Heating improvements in office buildings	23
Upgraded heating controls in retail buildings	21
Installing air source heat pumps in retail buildings	21
Lighting improvements in retail buildings	18
Wind microgeneration associated with retail buildings	18
Solar thermal devices in office buildings	17
Installing solar PV in retail buildings	17

Appendix 3. League Table of the Most Cost-Effective Options for Cambridgeshire and Peterborough

Measure	Cost Effectiveness (£/tCO2e)
Compressed air systems in industry	-613
Pump upgrades, repairs and maintenance in industry	-573
Diesel car to bus (diesel)	-466
Fabric improvements in retail buildings	-444
Petrol car to bus (diesel)	-410
Diesel car to walk	-363
Petrol car to walk	-353
Diesel car to bicycle	-350
Petrol car to bicycle	-339
Fabric improvements in public buildings	-335
Fan correction, repairs, & upgrades in industry	-306
Improved cooling in retail buildings	-297
Petrol car to plug-in hybrid	-254
Compressors and variable speed systems in industry	-221
Electrical upgrades in domestic buildings	-187
Lighting improvements in public buildings	-179
Lighting improvements in domestic buildings	-162
Petrol car to train	-155
Improved cooling in office buildings	-152
Diesel car to plug-in hybrid	-149
Diesel car to train	-149
Petrol car to EV	-141
Petrol car to bus (electric)	-138
Lighting improvements in retail buildings	-136
Petrol car to hybrid	-129

Electricity demand reduction in domestic buildings	-114
Heating improvements in public buildings	-110
Improved cooling in public buildings	-93
Improving efficiency of boilers and steam piping in industry	-70
Lighting improvements in office buildings	-64
Insulating domestic buildings	-59
Heating improvements in office buildings	-56
Diesel car to bus (electric)	-56
Draught-proofing in domestic buildings	-46
Fabric improvements in office buildings	-39
Heating improvements in retail buildings	-37
Diesel car to EV	-37
Glazing improvements in domestic buildings	-36
Upgraded heating controls in domestic buildings	-29
Installing heat pumps in domestic buildings	-26
Upgrading heating controls in office buildings	-25
Diesel car to hybrid	-23
Solar thermal devices in domestic buildings	-21
Upgraded boilers in domestic buildings	-14
Upgraded heating controls in public buildings	-11
Installing air source heat pumps in retail buildings	-8
Hybrid car to EV	-6
Installing solar PV in domestic buildings	0
Upgraded heating controls in retail buildings	2
Installing air source heat pumps in public buildings	8
Refrigeration efficiency and technical upgrades in industry	8
Solar thermal devices in retail buildings	14
Installing solar PV in public buildings	41

Installing air source heat pumps in office buildings	42
Improved lighting controls and sensors in retail buildings	43
Condensing & insulation measures to boilers & steam piping in industry	44
Installing solar PV in office buildings	44
Installing solar PV in retail buildings	53
Improved lighting controls and sensors in office buildings	58
Solar thermal devices in public buildings	75
Solar thermal devices in office buildings	78
Improved lighting controls and sensors in public buildings	171
Wind microgeneration associated with retail buildings	257
Furnace efficiency and heat recovery mechanisms in industry	541