



# **Charnwood Borough Council**

## **Carbon Management Plan 2015 - 2020**

**FY 2017/18**

**Monitoring Report**

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## Contents

1. Executive Summary.....	4
2. Introduction .....	5
3. Report Context and Scope .....	5
Report scope .....	5
4. Review of Annual Carbon Footprint.....	6
Methodology.....	6
Exclusions.....	7
Results Summary.....	7
Building energy .....	9
Transport.....	10
Waste .....	10
Water .....	10
Electricity.....	11
Natural gas .....	13
Costs.....	14
5. Project Review .....	15
Initial project development .....	15
Project Status.....	16
Overall Commentary.....	17
6. National Action on Climate Change and Carbon Emissions.....	18
7. Conclusion.....	18
Appendix A Project Implementation .....	20
Project 1 – Town Hall LED .....	20
Project 2 – Town Hall – Stage Lighting LED.....	20
Project 3- 5 Town Hall Heating Upgrades .....	20
Project 6 Beehive Lane LED.....	21
Project 7 Other Car Parks.....	22
Project 8 Charnwood Museum LED .....	22
Project 9 – 10 Charnwood Museum Heating Upgrades .....	23
Project 11 -12 Southfield Road ICS .....	23
Project 13 – 15 Woodgate Chambers (former Magistrates Court) .....	23
Project 16 Oak Business Centre.....	24

Project 17 – 21 Sheltered Accommodation Lighting Upgrades .....	24
Commentary .....	25
Further Projects .....	25
Project 22 Fleet Transport Electric Vehicles.....	25
Project 23 Fleet Transport – Low Emissions Diesel.....	27
Project 24 Business Travel.....	27
Project 25 Green Impact Programme.....	28
Appendix B Carbon Management Policy Landscape .....	29
B.1 Wider Policy Landscape and Context.....	29
B.2 International Conventions and Agreements: Current Position for Climate .....	29
United Nations Framework Convention on Climate Change (UNFCCC) .....	29
Kyoto Protocol .....	29
Paris Agreement.....	30
B.3 National Context: Existing UK Climate Change Legislation.....	30
Carbon Budgets.....	30
Clean Growth Strategy .....	32
Industrial Strategy – Building a Britain fit for the future .....	34
B.4 National Context: Committee on Climate Change.....	37
UK Climate Change Legislation Summary and Commentary .....	37
Waste management and resource efficiency .....	38
UK 25-year Environment Plan.....	39
Clean Air Strategy.....	40

## 1. Executive Summary

This report presents Charnwood's carbon footprint for Financial Year 2017/18 and provides a review of progress against the Council's 15% carbon reduction target.

Additionally a review of the individual carbon reduction projects implemented since 2012/13 is provided with an assessment of effectiveness, variants on expectations, reasons for variations and overall contribution to the target.

In 2012/13 the council's footprint was 2,133 tCO<sub>2e</sub> with associated costs of £730,020. In 2017/18 the Council's carbon footprint was 1,436 tCO<sub>2e</sub>, with associated costs of £591,167. This represents a 32% decrease in emissions and a 19% decrease in nominal costs since 2012/13.

Building emission reductions have been achieved in most building energy categories both since the baseline and since 2016/17. Electricity emissions have decreased by 34% and natural gas emissions have also decreased by 20%. Electricity consumption has, however, only decreased by 17% whereas gas consumption has fallen in line with emissions at 20%. The difference in decrease between electricity consumption and reported carbon emissions reflects wider impacts of decarbonisation efforts within the national grid, and therefore in the carbon intensity of grid supplied electricity.

Fleet transport emissions have decreased significantly since the baseline year by 42%. This reflects a combination of a reduction in fleet vehicle numbers and improved efficiency in diesel fuel consumption. Business travel emissions are 28% lower than the baseline figure of 107 tCO<sub>2e</sub> reflecting a sustained reduction in mileage claims for staff travel.

Waste emissions have reduced by 45% against the baseline year reflecting the impact of minimisation of waste and increased diversion from landfill. Water emissions have also decreased significantly since the baseline year by 24%.

## 2. Introduction

Charnwood Borough Council (CBC) has long recognised the need for it to contribute to wider UK Government targets relating to the reduction in greenhouse gas emissions (GHG). The Council was a signatory to the Climate Local Initiative in 2013. More recently it made a 2020 Carbon Pledge committing to achieving a 15% reduction in carbon emissions associated with its own operations. The rationale for this action is clearly set out in the Pledge summary document:

- To help tackle global warming – it's everyone's responsibility
- To save public money being spent on energy bills
- There's a legal requirement – the Climate Change Act requires local authorities to tackle carbon emissions
- To encourage others to tackle carbon emissions

Further details regarding the Carbon Management Plan underpinning the 2020 Carbon Pledge, as well as the performance monitoring information set out in this report, are provided in the next section.

## 3. Report Context and Scope

In 2015, Charnwood Borough Council developed a Carbon Management Plan with support from the Carbon Trust, which aimed at achieving the following goals:

- A 15% reduction in carbon emissions by 2020, against a 2012/13 baseline.
- Become a leader in carbon management in Leicester.
- Provide an integrated, coherent approach to carbon management across the Borough.
- Motivate and inspire staff to reduce carbon emissions.
- Deliver long term financial savings

This paper aims to review the progress made against achieving the 15% reduction target. A number of carbon reduction projects have been carried out to date and Charnwood Borough Council (CBC) are keen to understand the contribution these projects have made to reducing emissions and therefore an evaluation of how effective they have been. Charnwood are also keen to understand what other factors, if any, have affected their emissions since the baseline. When this exercise was undertaken in FY2015/16, a 21% decrease in emissions against the baseline had been achieved with an accompanying 2% reduction in costs. Eleven projects from the CMP had been implemented successfully too, with all but one generating carbon and financial savings for the Council. This reduction was in part due to two factors beyond the Council's control:

- A decrease in the electricity grid emission factor between 2013 and 2016. If the electricity grid emission factor had remained static, CBC carbon emissions would have reduced by only 12% compared to 2012/13. This means that a net reduction of 9% was achieved through CBC project actions alone; a significant step towards their 15% reduction target by 2020.
- 30% warmer temperatures in 2015/16 than in 2012/13, caused a reduction in heating demand in the buildings across the site.

### Report scope

This report includes:

- An inventory of carbon emissions produced in FY 2017/18 as well as an accompanying analysis
- An evaluation of the emissions/energy consumption changes in buildings where carbon reduction projects have been undertaken
- This report also evaluates progress against the following KPIs:
  - Change in carbon emissions from baseline year
  - % increase/decrease carbon emissions from baseline year
  - Achievement against projected carbon savings
  - Number of projects completed
  - Number of projects submitted for approval and progressing towards completion.
  - An evaluation of the emissions/energy consumption changes in the buildings where carbon reduction projects have been undertaken
  - An update on the status of all other projects contained in the CMP appendix

## 4. Review of Annual Carbon Footprint

### Methodology

In order to identify the progress Charnwood Borough Council (CBC) has made in achieving the 15% target reduction in emissions from 2012/13, the same methodology must be used to calculate the FY2017/18 carbon footprint, using the most recent data available.

The carbon emission sources included in this baseline cover energy, water, waste and transport emissions as set out in the table below. The baseline covers emissions in buildings and activities that Charnwood have management control and influence over, for example owner occupied buildings. For this reason, all outsourced activities (such as energy consumption in Leisure Centres or fuel consumption in contractor vehicles) has been excluded. These emissions sources have been categorised into Scopes 1, 2 and 3, in accordance with the World Resources Institute (WRI) Standards and the Greenhouse Gas (GHG) Protocol and emissions have been calculated using 2017 BEIS emission factors. (<https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>).

Emissions sources included in baseline scope	Data sources and quality (source Charnwood Borough Council)
<b>Scope 1 - includes all direct emissions from sources directly controlled by Charnwood Borough Council (Heating fuels consumed on site and transport fuels from owned vehicles)</b>	
Fuel use in buildings and estates, including communal areas of social housing (e.g. gas and oil)	SystemsLink software, utility bills & Automatic metering – good quality data.
Fleet transport emissions (e.g. petrol and diesel)	Fuel cards, receipts & vehicle odometers/log books – good quality data from fuel cards and receipts, less accurate from vehicle mileage/odometers
<b>Scope 2 – includes emissions from purchased energy produced off site</b>	
Electricity consumption in buildings and estates	SystemsLink software, utility bills & Automatic metering – good quality data
<b>Scope 3 – all other emissions</b>	
Business travel (staff own vehicle use)	Expense reports – good quality data

Waste	Provided in collection data from waste contractor – average quality data
Water consumption	SystemsLink software, utility bills & Automatic metering – good quality data

### Exclusions

As in 2013, certain buildings and activities have been excluded from the footprint calculations. This includes emissions from outsourced activities such as sports and leisure facilities and ground maintenance services. Natural gas and electricity data in sheltered housing where consumption is non-communal (i.e. in flats) has also been excluded, as the council has no control over individual persons’ usage.

Only water consumption for CBC managed buildings/spaces has been included in the baseline. It has been assumed that water use in social housing and tenanted commercial accommodation does not directly relate to CBC, but to the leaseholder instead.

Electricity and natural gas consumption figures for the Ark Business Centre, Oak Business Centre and Woodgate Chambers have been adjusted to include communal areas only, as in the baseline 2013 analysis.

As in FY2016/17, it was assumed that all non-hazardous waste collected from Council sites is transported to a waste transfer station and then to a picking line. At this point recyclables are picked out and processed. The remaining waste is then incinerated and used as a biofuel.. Waste costs have been estimated on a £/tonne basis.

### Results Summary

In 2017/18 the Council’s carbon footprint was 1,441 tCO<sub>2e</sub>.

Figure 1 Breakdown of Annual Carbon Emissions by Scope

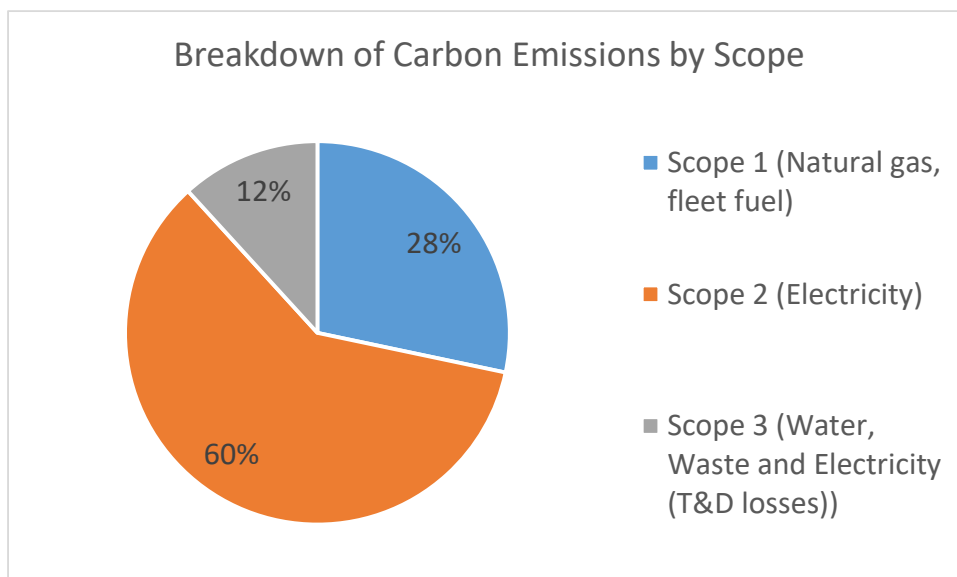
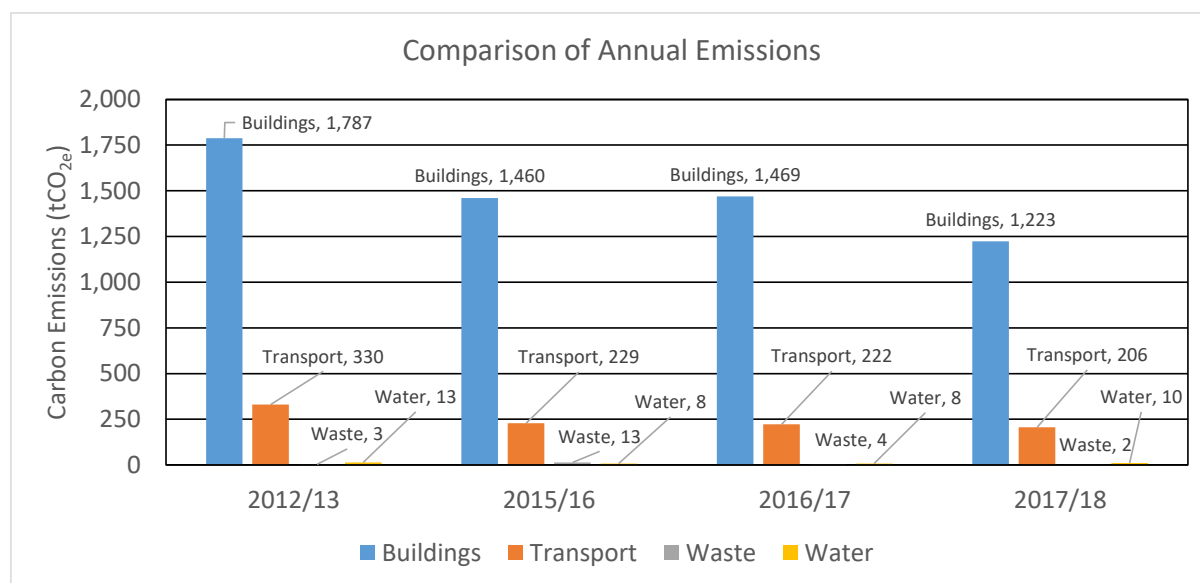


Table 1 Summary of Annual Carbon Emissions

	Scope 1	Scope 2	Scope 3	Total
Emissions (tCO <sub>2e</sub> )	408	864	169	1,441
% of Total	28%	60%	12%	100%
Cost	£93,862	£294,794	£202,512	£617,053
% of Total	15%	48%	37%	100%

Emissions have decreased by 32% between 2012/13 and 2017/18.

Figure 2 Annual Comparison of Emission Sources



A summary of emissions by source for 2017/18 is provided here.

Table 2 Emissions Breakdown in tCO<sub>2e</sub>

Category	2012/13	2016/17	2017/18	% change on previous year	% change on 2012/13 baseline
Building Energy	Historic Buildings	89	78	-24%	-34%
	Council Buildings/Offices	903	754	-8%	-23%
	Car Parks / Toilets	191	138	-22%	-44%
	Housing Landlord Supply	502	393	-23%	-39%
	Hostel / Sheltered Housing Accommodation	70	69	-41%	-41%
	Other	32	37	19	-49%
<b>Total Building Energy</b>	<b>1,787</b>	<b>1,469</b>	<b>1,233</b>	<b>-17%</b>	<b>-32%</b>



Transport	Fleet	223	122	129	6%	-42%
	Business	107	100	77	-23%	-28%
Total Transport		330	222	206	-7%	-38%
Further Scope 3	Waste	3	4	2	-59%	-45%
	Water	13	8	10	23%	-24%
Total Further Scope 3		16	12	12	-4%	-28%
Total		2,133	1,703	1,441	-15%	-32%

In 2017/18 the Council’s carbon related costs total £591,167. This represents a 14% decrease between 2012/13 and 2017/18 which is to be expected given emissions have decreased.

Emission sources vary in their cost intensity therefore it is expected that cost changes (14%) will not match emission changes (32%). For example, water emissions have decreased 59% since the baseline, yet water costs have risen 183% over the same time period.

Table 3 Carbon Related Cost Breakdown

Category		2012/13	2016/17	2017/18	% change on previous year	% change on 2012/13 baseline
Building Energy	Historic Buildings	£20,329	£17,671	£13,486	-24%	-34%
	Council Buildings/Offices	£206,004	£167,233	£169,190	1%	-18%
	Car Parks / Toilets	£45,976	£38,096	£33,369	-12%	-27%
	Housing Landlord Supply	£120,639	£108,642	£94,985	-13%	-21%
	Hostel / Sheltered Housing Accommodation	£16,798	£18,960	£12,745	-33%	-24%
	Other	£7,614	£10,272	£5,873	-43%	-23%
Total Building Energy		£417,360	£360,873	£329,647	-9%	-21%
Transport	Fleet	£105,541	£55,357	£59,009	7%	-44%
	Business	£174,101	£165,982	£136,862	-18%	-21%
Total Transport		£279,642	£221,339	£195,872	-12%	-30%
Further Scope 3	Waste	£2,604	£10,704	£9,988	-7%	384%
	Water	£30,414	£46,767	£55,662	119%	183%
Total Further Scope 3		£33,018	£57,471	£65,649	114%	199%
Total		£730,020	£639,683	£591,167	-8%	-19%

### Building energy

Emission reductions have been achieved across all building energy categories both since the baseline and since last year.

## Transport

Fleet transport emissions have decreased significantly (42%) since the baseline. During this time there has been a large decrease in the number of vehicles owned by the Council, from 101 in 2012/13 to 68 in 2016/17.

A small increase in fleet emissions in comparison to 2016/17 has been seen (6%). This is attributable to operational needs changing between reporting years. This may be a single year anomaly and therefore merits further review in subsequent reporting years.

Business transport emissions have decreased (23%) since last year (FY2016/17). This is in conjunction with decreases in fuel (petrol and diesel) consumption.

Mileage associated with journeys undertaken by council staff for business purposes has decreased by 20% against the baseline year and by 18% in comparison with 2016/17.

Table 4 Mileage figures summary

	2012/13 Mileage	2016/17 Mileage	2017/18 Mileage	% Change against baseline	% Change against 2016/17
Petrol	272,758	190,755	144,190	-47%	-24%
Diesel	67,264	140,571	128,966	92%	-8%
Total	340,022	331,326	273,156	-20%	-18%

The observed mileage decrease against the baseline shows a significant reduction in mileage of petrol vehicles (47% decrease) and an uptake of mileage by diesel vehicles (increase of 92%).

There would appear to be a sustained reduction in business mileage, recognising that requirements for such travel will vary across reporting years.

## Waste

Waste emissions have remained relatively static year on year, reflecting the small overall contribution to overall reported emissions.

Waste collected from Council sites is transported to a waste transfer station and then to a picking line. At this point recyclables are picked out and processed. The remaining waste is then incinerated and used as a biofuel.

Continued reductions against the baseline year rely on sustained reduction in the volume of waste produced and minimising landfill of waste arisings.

Similarly, the cost of waste has increased from the baseline but decreased since last year. Improved data quality has led to an apparent increase in costs. The decrease on last year reflects a reduction in waste sent to landfill. Residual waste is incinerated and used as a biofuel.

## Water

Water emissions make up a relatively small proportion of overall emissions but it is worth noting they have decreased significantly since the baseline (24%).

Water costs have increased substantially year on year, despite reductions in consumption. The reason for the cost increase is not known, but one potential factor could be an increase in the

standing charge for water consumption and general increases in national rates for water supply and treatment.

### Electricity

Electricity emissions (scope 2) make up 60% of total emissions. Electricity emissions have decreased since the baseline (34% reduction). This decrease is in part due to actions within Charnwood to reduce overall electricity consumption. There has also, however, been a reduction in the carbon intensity of grid electricity production (23% reduction in comparison with the baseline year). Taking into account the grid decarbonisation shows that carbon emissions have reduced by 15% in comparison with the baseline year.

Table 5 Electricity consumption summary

	Baseline (2012/13)	2016/17	2017/18	% change on 2012/13 baseline	% change on 2016/17
Total electricity consumption (kWh)	2,966,589	2,870,362	2,473,677	-17%	-14%
Carbon emissions (tCO <sub>2e</sub> )	1,435	1,183	951	-34%	-20%

In some areas of the CBC estate, large increases in electricity have been recorded. This is due to a number of factors, as described in the table below. The table below shows sites where an increase of more than 10,000 kWh since 2012/13 has been observed.

Table 6 Sites with significant increase in electricity consumption compared to 2012/13 baseline

Site	Category	2012/13 (kWh)	2017/18 (kWh)	Absolute change on 2012/13 (kWh)	% change on 2012/13	Notes
Fielding Court - FLATS	Housing Landlord Supply	45933	64,188	18,255	39.7%	Restriction on access for meter readers means that the metered supply is recharged to tenants. This results in significant estimated billing that is revised in arrears once tenant supplied readings are available
Lingdale House Hostel	Hostel / Sheltered Accommodation	67,556	88,749	21,193	31.3%	This building is heated electrically. The overall consumption is

						therefore directly linked to the occupancy level. Weather variations will also influence consumption in colder months
Southfield Rd Offices	Council Buildings / Offices	410,345	451,589	41,244	10.1%	Increase in staff numbers. Air conditioning units and a reception area extension have also been installed since the baseline year
Tuckers Close – Stair Cases	Housing Landlord Supply	13,092	38,361	25,269	193%	Automated metering is not possible at the site. There are a total of 8 meters within the separate entrances on site. Data collection has improved since the baseline year

Sites showing a decrease of more than 10,000 kWh in electricity consumption (since 2012/13) are shown in the table below.

Table 7 Sites with significant decrease in electricity consumption compared to 2012/13 baseline

Site	Category	2012/13 (kWh)	2017/18 (kWh)	Absolute change on 2012/13 (kWh)	% change on 2012/13	Changes to site
Arnold Smith House - Way LTG, Boiler House	Housing Landlord Supply	40,962	24,049	16,913	-41%	Project implemented, LED replacement
Beresford Court, Shepshed - Aged Persons Flats	Housing Landlord Supply	40,412	17,457	22,955	-57%	Project implemented, LED replacement
Beresford Court, Shepshed - CML Area, Block B	Housing Landlord Supply	27,448	15,196	12,252	-45%	Project implemented, LED replacement
Car Park Beehive Lane	Car Parks / Toilets	334,706	225,528	109,178	-33%	Project implemented, LED replacement
Carillon Tower War Memorial, Queen's Park	Historic Buildings	27,017	11,715	15,302	-57%	The site has been closed since November 2017 for a conservation project. It is due to reopen in Easter 2019

## Charnwood Borough Council Monitoring Report

Charnwood Museum	Historic Buildings	91,117	68,520	22,597	-25%	Project implemented, LED replacement. Ongoing benefits from Green Impact Programme
Dudley Court L Lrds Sply	Housing Landlord Supply	40,874	21,743	23,275	-47%	Project implemented, LED replacement
Fielding Court - L Lrds Supply	Housing Landlord Supply	27,949	11,702	16,247	-58%	Unknown / TBC
Hume Street - 40-45 Hume St - CML SPLY	Housing Landlord Supply	13,839	1,523	12,316	-89%	Unknown / TBC
Lifeline Wardens Control - Control Room	Other	23,772	13,569	10,203	-43%	Unknown / TBC
Loughborough Town Hall	Council Buildings / Offices	343,650	299,192	44,458	-13%	Project implemented, LED replacement, benefit from Green Impact Programme. Wider replacement and updating of ICT equipment
Pinfold Gate - Landing And Stairs LTG	Housing Landlord Supply	21,072	4,125	16,947	-80%	Unknown / TBC
School Street, Syston - Stair cases	Housing Landlord Supply	40,004	12,860	27,144	-68%	Unknown / TBC
Sorrel Court, M'Sorrel - CML SPLY	Housing Landlord Supply	53,516	41,756	11,760	-22%	Project implemented; LED replacement
Southfields Rd ICS Building/Contact Centre	Council Buildings / Offices	403,208	365,812	37,396	-9%	Staff relocation from the contact centre to Southfield Rd Offices
St Pauls Court, Syston - L LRDS SPLY	Housing Landlord Supply	50,407	33,069	17,338	-34%	Project implemented; LED replacement
St Peters Court, Syston - CML LTG	Housing Landlord Supply	53,097	33,992	19,105	-36%	Project implemented; LED replacement
Staveley Court - L LRDS SPLY, Block C	Housing Landlord Supply	21,970	4,344	17,626	-80%	Unknown / TBC
Staveley Court - L LRDS SPLY, Block H	Housing Landlord Supply	18,381	3,764	14,617	-80%	Unknown / TBC

### Natural gas

Natural gas emissions make up 19% of total emissions. Natural gas emissions have decreased since the baseline by 21%.

Table 8 Summary of natural gas consumption and emissions

	Baseline (2012/13)	2016/17	2017/18	% change on 2012/13 baseline	% change on 2016/17
Total natural gas consumption (kWh)	1,907,929	1,557,467	1,515,318	-21%	-3%
Carbon emissions (tCO <sub>2e</sub> )	351	287	279	-20%	-3%
Heating degree days	2,607	1,944	2,104	-19%	-8%
Natural gas consumption per heating degree day (kWh/HDD)	732	801	720	-2%	-10%

Natural gas is primarily used in space heating and domestic hot water. Its use therefore is highly dependent on outdoor temperatures, which vary from year to year. Heating degree days can be used to adjust for this factor.

Degree days are a measure of the severity and duration of cold weather. The colder the weather in a given month, the larger the degree-day value for that month. Published degree days in the UK are calculated to a base temperature of 15.5°C for general use within most buildings.

In 2017/18 the number of heating degree days was 19% lower than the 2012/13 baseline figure. This means that 2017/18 was a warmer year than 2012/13. As such we would expect the natural gas consumption to decrease by approximately 19% over the same time period. However, natural gas consumption actually decreases by 21%, hence it can be assumed that the heating systems are being used slightly more efficiently. This is shown by the decrease of 2% in the natural gas consumption per heating degree day.

### Costs

It is worth noting that a substantial cost reduction (£ per unit) in natural gas has occurred since the baseline year. Given energy costs make up 56% of 2017/18 costs and similar in the baseline year (58%), these are a substantial cost base for CBC. The changes are presented in the table below. Other cost data for which information is available, has remained relatively static with the exception of water where substantial cost increases have occurred.

Table 9 Cost Data Summary

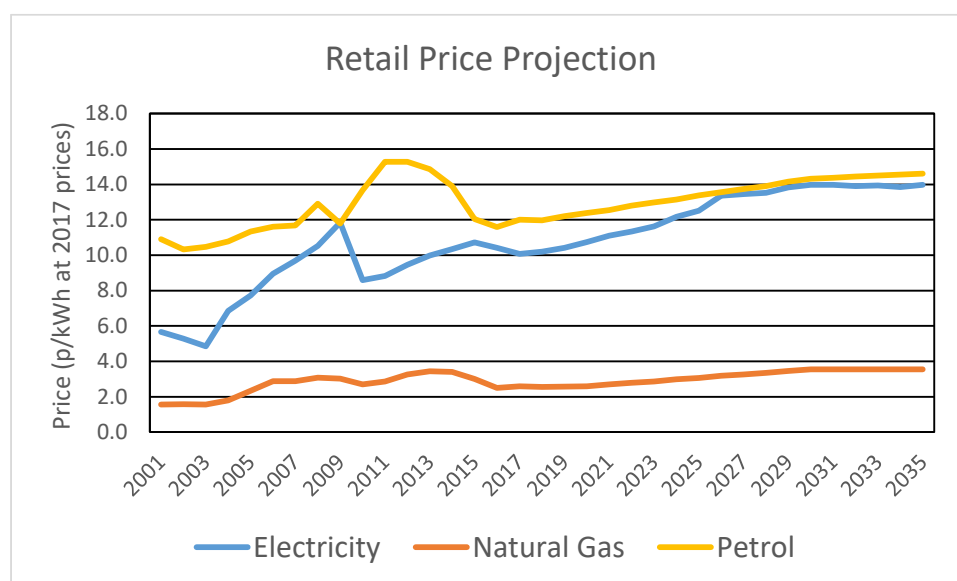
Source	Measured Unit	Baseline Cost Factor £/unit	2017/18 Cost Factor £/unit
Electricity (grid)	kWh	0.12	0.120
Natural gas	kWh	0.04	0.023
Transport Diesel (litres)	Litres	1.19	1.19
Average petrol car	km	0.318	0.305
Average diesel car	km	0.31816	0.319
General waste to landfill	tonnes	Not available / not applicable	160
General waste recycled	tonnes	Not available / not applicable	115

Cardboard/paper recycled	tonnes	Not available / not applicable	12
Refuse derived fuel	tonnes	Not available / not applicable	160
Water consumed (m <sup>3</sup> )	m <sup>3</sup>	2.52	5.94

It is not possible to accurately predict utility costs beyond short term contract periods. This is due to the complex number of factors that influence the retail price of utilities for consumers.

In considering the policy impact of UK Government action, the department for Business Energy Industrial Strategy (BEIS) develops longer range forecasts<sup>1</sup>. These forecasts, under a number of different scenarios, all note an increase across the board, with significant increases in the cost of electricity predicted. As an example, the BEIS forecast for electricity, gas and petrol costs (based on implementation of existing policies can be seen below).

Figure 3 BEIS Energy Price Projections (Current Policy, 2017 prices)



## 5. Project Review

### Initial project development

During development of the CMP a range of carbon reduction projects were identified to assist Charnwood Borough Council in achieving their reduction target. These projects were identified through a variety of means including;

- existing knowledge of the Charnwood staff and service function heads,
- Carbon Trust high level surveys,
- opportunity identification workshops facilitated by the Carbon Trust

<sup>1</sup> <https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017> (Accessed November 2018)

- one to one meetings with key departments at Charnwood

The costs and savings quoted in the plan are high level estimates based on relevant supplier quotations and market research. Additionally, sources such as Energy Technology List claim values (for enhanced capital allowances) and Siemens Energy Efficiency Services Agreements (Carbon Trust/government/industry partnership schemes) are utilised.

### Project Status

A summary of the status of each project identified in the CMP is shown in the table below.

Table 10 Project Status Summary

Project ID	Name	Status	Results
1	Town Hall - LED	Completed in October 2018.	N/A
2	Town Hall - Stage Lighting LED	Completed August 2017.	The stage lighting has been replaced with LEDs at a cost of £27,882. Like for like replacement would have cost £22,000 making the cost differential £5,882. LED expected to produce annual energy cost savings of £2,300. Payback - 2.6 years.
3	Town Hall - Heating System	Completed August 2017.	Broadstone HE automatic boiler replaced with 2 fully condensing boilers and 4 new pump sets. Heating system insulated. Replacing the Broadstone with like for like would have cost £20,000. The chosen solution cost £24,800, £4,800 more. Energy cost savings are expected to be £1,400 annually. Payback - 3.4 years.
4	Town Hall - Pipe Insulation	Completed August 2017.	
5	Town Hall - VSDs on heating pumps	Completed August 2017.	
6	Beehive Lane - LED	Completed October 2018	LED upgrade to remaining lighting on first, second and third floor completed with a total of 77 fittings replaced. Cost of installation £16,885.
7	Other Carparks - LED	Completed November 2017.	The cost of replacing lighting with like for like (Halogens) would be in the region of £21,000. Granby Street lighting upgrade to LED cost £8,941.20 and Browns Lane LED upgrade cost £16,990.60. The total is £25,931.80, £4,931 more than like-for-like



			replacement. With energy cost savings, payback expected- 3.4 years.
8	Charnwood Museum - LED	Completed October 2017.	Track display lighting replaced. Cost of upgrading to LED is £21,372 as opposed to £18,000 to replace with like-for-like, making a difference of £3,372. Energy cost savings estimated to be £1,200. Payback - 2.81 years. Lighting in offices and café to be replaced at a later date.
9	Charnwood Museum - Heating System	Complete January 2016.	Results reported in 2016/17 monitoring report
10	Charnwood Museum - Pipe Insulation	Complete January 2016.	Results reported in 2016/17 monitoring report
11	Southfield Road ICS - LED	Not being implemented	N/A
12	Southfield Road ICS - Server Room Layout	Not being implemented	N/A
13	Woodgate Chambers - LED	Not being implemented	N/A
14	Woodgate Chambers - Boiler	Complete January 2016.	Results reported in 2016/17 monitoring report
15	Woodgate Chambers - Heating Controls	Complete January 2016.	Results reported in 2016/17 monitoring report
16	Oak Business Centre - LED	Completed March 2017	Replacement of existing fittings with LED equivalent
17 - 21	Sheltered Accommodation - LED	Ongoing	Lighting upgrades within communal areas with LED equivalent
22	Fleet Transport EV	Completed 2017/18	Introduction of electric cars and van to Council fleet
23	Fleet Transport - low emission diesel	Completed 2015/16.	Update to fleet transport; 42% decrease in emissions.
24	Business Travel	Completed 2015/16.	Carbon emissions decreased by 28% since baseline
25	Green Impact Programme	Ongoing.	Staff behaviour change

Further commentary on these projects is provided in Appendix A.

### Overall Commentary

In general terms, there has been substantial progress made in achieving sustained carbon emissions reductions through the variety of actions undertaken.

The efficacy of lighting projects in communal areas is generally easier to determine than similar projects undertaken in buildings. This simply reflects the proportion of the metered electricity that is directly attributable to the lighting.

Heating projects typically take some time to deliver sustained change. Replacement of assets such as boilers, as well as enhanced insulation have a direct impact on overall heating energy consumption. However, the control of heating in buildings following such improvements is important in enabling the benefit of such measures to be realised. As an example, improved insulation of pipework will reduce heat losses from the system and should mean a saving in natural gas used in generating the heating. However, if the control system is not capable of efficient timing for periods of heating then the benefits will be lost since the system continues to operate in periods when the building is at its target operating temperature.

## 6. National Action on Climate Change and Carbon Emissions

The actions that have been, and continue to be taken by, Charnwood Borough Council reflect wider actions across the UK in response to national targets set by UK Government. The UK Government itself has made a number of international commitments as part of global action to minimise the impacts of a changing climate.

It is useful to consider this context in order to reflect on progress to date and how the current policy position may change some of the issues that Charnwood will need to address in the medium term.

A summary of relevant UK Government policy is provided in Appendix B. Immediate points of note in UK action to reduce overall GHG emissions include:

- GHG emission reduction at UK level to date has mainly been driven by the Power Sector. It will continue to seek reductions in carbon intensity of energy production through investment in carbon capture use and storage (CCUS), new nuclear and offshore wind
- GHG emission reduction in heat production is expected to require more use of heat pumps (particularly in properties not using natural gas) and extending the use of district heat networks (where a central heat source supplies several buildings)
- Transport emissions will be reduced by the phasing out of petrol and diesel cars in favour of hybrid or battery electric vehicles. This will mean extending national infrastructure for vehicle charging points
- Waste emission reductions will be driven by reductions in biodegradable waste going to landfill. Resource efficiency efforts will look to minimise use of plastic (particularly single use) and increase the role of re-use and re-purposing as well as recycling within the waste management process

## 7. Conclusion

The Council has sustained carbon and cost savings made to date. In 2012/13 the council's footprint was 2,133 tCO<sub>2e</sub> with associated costs of £730,020. In 2017/18 the Council's carbon footprint was 1,436 tCO<sub>2e</sub>, with associated costs of £591,167. This represents a 32% decrease in emissions and a 19% decrease in nominal costs since 2012/13.

There has been an overall reduction in building energy use (both grid electricity and natural gas). This reflects savings achieved in projects such as the programme of LED lighting improvements.

Transport emissions have also fallen. This, in part, reflects the reduction in fleet vehicle use (total fleet being reduced by around one third). However, the other factor has been sustained change in staff behaviour with a reduction in business mileage of 42% over the reporting period.

Waste emissions reduction reflects better end of life disposal routes and a reduction in the volume of waste being sent to landfill.

It is noted that variability in the average temperatures in any given year will directly impact the amount of natural gas used in heating in buildings (and the associated carbon emissions). Aside from ensuring good use of control systems on heating there is little else in the direct control of the Council. Wider work to decarbonise the grid electricity supply is not something that CBC can influence directly. However, the net impact is to assist in the overall reduction in carbon emissions.

## Appendix A Project Implementation

### Project 1 – Town Hall LED

This project has involved the upgrade of a selection of LED front-of-house lighting. A total of 75 fittings have been replaced at a cost of installation £15,617.

This work was completed in October 2018. It is not possible to establish any savings resulting from this measure at this point of reporting (since there is no 12-month period for performance comparison).

### Project 2 – Town Hall – Stage Lighting LED

The stage lighting has been replaced with LEDs at a cost of £27,882. Like for like replacement would have cost £22,000 making the cost differential £5,882. The LED installation was expected to produce annual energy cost savings of £2,300, meaning that the simple payback on the cost differential would be 2.6 years.

Comparison of the pre-installation period April 2017 – July 2017 and the post-installation equivalent period April 2018 – July 2018 shows little discernible difference in energy consumption. This is likely to reflect the greater contribution to overall consumption from other sources (other lighting, ICT etc.)

Table A.1 Town Hall Stage Lighting LED Energy Consumption

Pre-Install	Apr-17	May-17	Jun-17	Jul-17	Total (All months)
	24,098	28,147	23,644	20,414	96,303
Post-install	Apr-18	May-18	Jun-18	Jul-18	Total (All months)
	24,257	28,969	28,993	30,168	112,387

Further details regarding the bulbs replaced and therefore reduction in lighting circuit power (Watts) would offer more insight into the specific savings achieved.

### Project 3- 5 Town Hall Heating Upgrades

The existing Broadstone HE automatic boiler was replaced with 2 fully condensing boilers and 4 new pump sets. The heating system was also insulated. Replacing the existing boiler with a like-for-like replacement would have cost £20,000. The chosen solution cost £24,800, £4,800 more. Energy cost savings are expected to be £1,400 annually. This suggests a simple payback on the marginal replacement cost of 3.4 years.

Works were completed in August 2017. This means less than 12-months data available for performance comparison.

In terms of year on year data consumption in 2017/18 was 675,269 kWh. This is 32% lower than the baseline year (though 10% higher than 2016/17).

As an initial view of performance comparison the periods April-July 2017 and April-July 2018 can be compared.

In terms of monthly consumption, there is limited evidence of savings when looking at these pre and post installation periods. However, the energy use per heating degree day shows a decrease for most months suggesting an improvement in system efficiency.

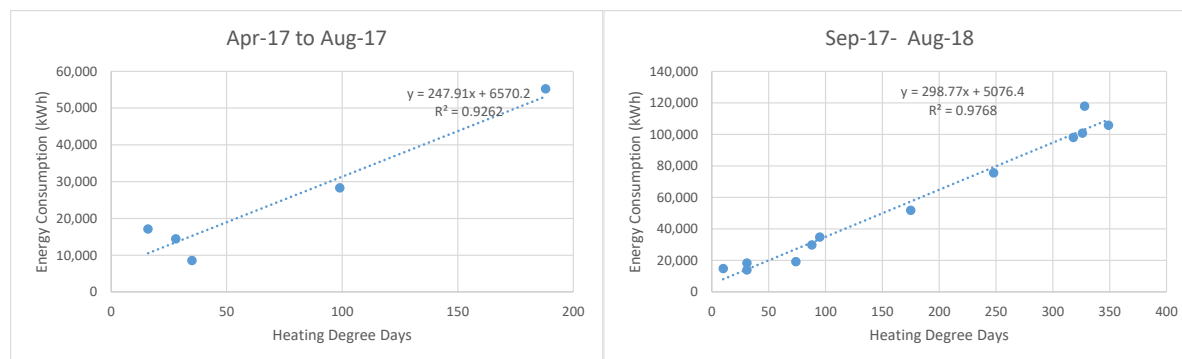
Table A.2 Town Hall Heating Upgrades

Pre-Install	Apr-17	May-17	Jun-17	Jul-17
kWh/month	55,228	28,263	14,425	17,108
kWh/Heating Degree Day	294	285	515	1,069
Installation	Aug-17			
Post-Install	Apr-18	May-18	Jun-18	Jul-18
kWh/month	51,718	29,820	18,282	14,840
kWh/Heating Degree Day	267	281	426	976

The trend analysis here looks at how well the heating system is controlled in respect of external temperature. The closer the grouping of points to the trend line the better the overall performance. It can be seen that there has been a small improvement in this from 0.93 to 0.98 (the R<sup>2</sup> value offers a measure of clustering – a value of 1 would be a perfect fit).

This also points to an improvement in system efficiency; the lower intercept on the y-axis (5,076 rather than 6,570) also suggests that the baseload requirements (typically domestic hot water) has been reduced.

Figure A.1 Town Hall heating energy assessment (pre-install and post install)



A more accurate view of performance will be available in the next reporting period.

### Project 6 Beehive Lane LED

Beehive Lane is a multi-storey car park owned and operated by the Council. The main energy use on the site is electricity for lighting, estimated to be 97% of the electricity load for this building in the 2012/13 baseline year.

Since 2013, occupancy and daylight sensors have been installed across the buildings and the T5 fluorescent lights in the site have been replaced with LED lighting as they reach the end of their lifetime. This programme came to a conclusion in October 2018 with a final round of 77 fittings

replaced at a cost of £16,885. This means that 430 of 434 (99%) light fittings have now been replaced.

The reduction in energy consumption, when viewed against the baseline year can be clearly seen in the site meter data.

Table A.3 Beehive Lane Car Park

Reporting Period	Electricity Consumption (kWh)	% change vs baseline	% change vs. previous year
2012/13	334,706		
2016/17	222,883	-33%	-33%
2017/18	225,528	-33%	1%
2018/19 (Apr – Aug 18)	85,823 (205,975*)	-38%*	-9%*

\* Estimated annual consumption based on year to date figures

#### Project 7 Other Car Parks

A programme of LED lighting upgrades has also been undertaken at the Browns Lane and Granby Street car parks. These works were completed in November 2017. This means only a partial dataset is available for 2017/18 reporting.

As an initial view of performance, the periods of April-August 2017 and April-August 2018 have been compared.

Monthly electricity consumption for the two sites does not show a clear downward trend. This is shown here.

Table A.4 Other Car Parks – electricity consumption trends

Pre-works data	Monthly Electricity (kWh)	Post-works data	Monthly Electricity (kWh)
Apr-17	-10,937*	Apr-18	4,205
May-17	5,505	May-18	3,894
Jun-17	5,179	Jun-18	3,194
Jul-17	1,396	Jul-18	11,054
Aug-17	4,754	Aug-18	9,984

A data anomaly means that there is no accurate figure for Apr-17. The change in consumption figures in July and August 2018 merit further investigation.

A meaningful determination of savings can be obtained once a full 2018/19 dataset is available.

#### Project 8 Charnwood Museum LED

Track display lighting has been replaced with LED lighting as a cost of £21,372 as opposed to £18,000 to replace with like-for-like; this is a marginal cost of £3,372. Energy cost savings were estimated to be £1,200, offering a payback on the marginal cost of 2.8 years. This was completed in October 2017.

Baseline consumption (communal areas only) at the Museum was 91,117 kWh (99,104 kWh in 2016/17). Reported consumption in 2017/18 is 68,520 kWh (25% lower than the baseline).

This suggests a positive impact from the LED project. This will become more apparent when the 2018/19 dataset is available.

### Project 9 – 10 Charnwood Museum Heating Upgrades

In January 2016, the older Powrmatic and conventional boiler heating systems at Charnwood Museum were replaced with high efficiency condensing systems and the insulation on pipes, valves and flanges was replaced. This was predicted to reduce natural gas consumption by 57,000 kWh annually with an initial cost of £15,000.

The benefits of this scheme to date were summarised in the 2016/17 monitoring report (details replicated here).

Table A.5 Charnwood Museum Upgrades – savings to date

Year	Capital Cost (£)	Cumulative Financial Saving (£)	Cumulative Energy Saving (kWh)	Cumulative Carbon Saving (tCO <sub>2e</sub> )	Simple payback (years)
2016	£15,000	£1,469	41,085	37.8	10.2
2017		£2,144	59,954	55.1	7.0

Energy consumption for the period Jan-18 to Aug-18 is 94,433 kWh; this is 70 kWh/degree day (based on the 20-year average figures for the Midland region). If this is sustained for the remainder of the operating year then this means a projected consumption of 148,000 kWh. This would mean similar performance to 2017 and therefore no further significant saving beyond those stated for 2017.

This will need to be verified once actual meter data becomes available.

### Project 11 -12 Southfield Road ICS

These projects are not being implemented.

### Project 13 – 15 Woodgate Chambers (former Magistrates Court)

In January 2016, the existing heating system was replaced with five modern gas condensing boilers and a heat exchanger and improvements were made to optimise various elements of the heating distribution and control system, including boiler optimisation and thermostatic radiator valves. The total capital cost for these upgrades was £29,000. The boiler replacement was predicted to achieving savings of 88,000 kWh of natural gas consumption per year, and the optimisation of the distribution system 32,000 kWh per annum. However, these two projects will interact with each other so anticipated savings are lower than the combined total of these predictions.

A summary of energy consumption figures is provided here.

Table A.6 Woodgate Chambers Natural Gas Consumption

Period	Natural gas consumption (kWh)	Total degree days	Total consumption per degree day
Jan – Dec 2014	334,871	1,866	179
Jan – Dec 2015	275,911	1,937	142
Jan 2016	Boiler upgraded		
Jan – Dec 2016	347,781	2,027	171
Jan – Dec 2017	282,904	1,913	148
Jan – Aug 2018	173,065	1,330	130

It can be seen that overall performance is improving, as system controls have been modified and optimised. In contrast to 2016, for example, in 2018 the boiler was switched off for the period of June – August inclusive.

Further investigation is required to determine the overall performance in 2018, once billing information for the remainder of the year becomes available.

As set against 2015 performance there is no significant level of savings achieved to date.

#### Project 16 Oak Business Centre

In March 2017 a lighting project was implemented at the Oak Business Centre, this involved replacing existing lighting with LEDs.

A summary of progress to date is provided here.

Table A.7 Oak Business Centre (Project Savings)

Site	Apr – Nov 2016 (kWh)	Apr – Nov 2017 (kWh)	% change	Carbon savings (tCO <sub>2e</sub> )	Cost savings (£)
Unit One / Car Park	67,049	64,532	-4%	1	£321
Unit Two	23,894	15,647	-35%	3.4	£1,381
<b>Total</b>	<b>90,943</b>	<b>80,179</b>	<b>-12%</b>	<b>4.4</b>	<b>£1,702</b>

#### Project 17 – 21 Sheltered Accommodation Lighting Upgrades

Commencing in 2015, an upgrade to the communal lighting has been rolled out in sheltered housing blocks managed by Charnwood Council. This has consisted of replacing the existing lighting with LEDs controlled through daylight and occupancy sensors.

A summary of the projects undertaken is provided here.

Table A.8 Sheltered Accommodation Lighting Upgrades

Building	Date Installed	No. of fittings	Cost of fitting + installation	Marginal capital cost	Electricity Savings to Mar-18	% saving	Financial saving to Mar-18	Simple payback (yrs)	Marginal payback (yrs)
Dudley Court	Apr-15	68	£11,766	£7,019	NA	NA	NA	NA	NA
Arnold Smith House	Mar-15	70	£11,348	£7,226	14,885	33%	£1,647	6.9	4.4
Beresford Court	Mar-15	110	£17,832	£11,355	5,380		£646	27.6	17.6
Grays Court	Mar-15	99	£14,377	£10,219	4,283	12%	£514	28.0	20.0
Offranville Court	Aug-15	89	£14,428	£9,187	6,893	43%	£827	17.4	11.1
St Michaels Court	May-15	220	£35,664	£22,709	9,335	39%	£1,120	32.0	20.3
St Pauls Court	Mar-15	40	£6,484	£4,129	14,017	28%	£1,682	3.9	2.5
St. Peters Court	Jun-17	273	£54,676	£44,256	16,561	31%	£1,987	27.5	22.3
Aingarh	Apr-17	102	£18,979	£16,532	4,822	19%	£579	32.8	28.6



Babbington	Feb-17	110	£17,832	£11,363	7,127	38%	£855	20.9	13.3
Martin Court	Jan-18	443	£47,468	£36,437	Less than 12 months data available				
Sorrel Court	Mar-18	197	£24,514	£20,119	Less than 12 months data available				
Val Wilson Flats	Jul-17	77	£29,145	£12,482	2,303	24%	£276	106	45.2
Cordell Road	Jun-17	22	£5,688	£3,566	274	8%	£33	173	108

### Commentary

- Cost of fitting and installation excludes additional upgrade works taking place alongside LED installation (such as rewiring and installation of sub mains, for example)
- Dudley Court data is not available for 2016/17 period due to a defective meter
- Grays Court savings have been lower than anticipated. This is due to lighting being left on continuously due to the absence of motion sensors in the original installation. This was followed up with the lighting manufacturer.
- Payback at St Michaels Court is very high at 32.0 years. This is due to the large number of fittings at the site (220) causing a high capital cost. Both before and after the upgrade occurred the actual electricity consumption at this site was significantly lower per bulb than at the other sites in the portfolio. The combination of these factors has led to the high payback time.
- The installations at Val Wilson Flats and Cordell Road were implemented mid-way through the reporting year. Savings are therefore accrued over a short period and may increase as further data becomes available

### Further Projects

Further lighting replacements works have been completed at a number of other sites:

- Park Road flats (noted as Park Court Flats in the baseline for 2012/13)
- Ling Road flats (these were not included in the 2012/13 baseline)
- General needs blocks (Selbourne Court/Street, Sharpley Road, Wordsworth Road, Peel Drive, Papermill Close, King Edward Road, Factory Street and Dormer Court)

No performance data is available at the point of issue of this report.

Further sites are also scheduled for future works:

- Fielding Court (anticipated for completion in 2018/19)
- Durham Road (to be scheduled)

### Project 22 Fleet Transport Electric Vehicles

Two electric vehicles were added to the Council's vehicle fleet in 2015-16, and one electric van in 2016/17 along with charging points at Beehive Lane car park. These charging points are not currently separately metered so any electricity consumed by them are included in the baseline comparison within Beehive Lane's carbon footprint.

In reviewing the impact of the electric vehicles a number of means of estimation have been used, as was the case in the 2016/17 monitoring report. The four methodologies used to calculate the comparative impact of diesel vehicles are summarised as:

- Method 1: Use DEFRA emission factor based on vehicle mileage for a “Mini” class small car (This is the smallest category of car sometimes referred to as a city car. Examples include: Citroën C1, Fiat/Alfa Romeo 500 and Panda, Peugeot 107), equivalent to the Citroën C1 vehicles in the CBC fleet.
- Method 2: The Citroën C1 mile per gallon efficiency from the Vehicle Certification Agency <http://carfueldata.direct.gov.uk/>
- Method 3: Using the average efficiency of the small diesel cars in the 2014 CBC fleet (2014 data was used due to irregularities in the 2015 data).
- Method 4: The official efficiency of a Volkswagen Golf BlueMotion TDI, a car of equivalent size to the new Nissan Leaf vehicles in the CBC fleet. This has been included since the Nissan Leaf is a bigger vehicle than the Citroën C1 it is replacing.

Method 1 was used in predictions listed in the CBC Carbon Management Plan. The other methods used here provide a point of comparison to evaluate this prediction.

Working assumptions are summarised here.

Table A.9 Electric vehicle analysis (working assumptions)

Parameter	Value	Source
Efficiency of Nissan Leaf	30 kWh/100 miles	US Environmental Protection Agency, 2015 figure
Average efficiency of diesel cars in CBC 2014 fleet	11.7 miles/L	2014 CBC data
Efficiency of Citroën C1	15.2 miles/L	VCA
Efficiency of Volkswagen Golf BlueMotion TDI	18.3 miles/L	VCA
Diesel price	£1.19/Litre	CBC data
Beehive lane electricity price	£0.11/kWh	CBC data for 2017/18
2017 electricity emission factor	0.3844 kgCO <sub>2e</sub> /kWh	Defra
2017 transport diesel emission factor	2.6002 kgCO <sub>2e</sub> /L	Defra
2017 Mini diesel car emission factor	0.1102 kgCO <sub>2e</sub> /km	Defra

The results presented here combine the total mileage of the two Nissan Leaf vehicles (as based on 2017/18 data).

Table A.10 Electric vehicle savings analysis

	Nissan Leaf	Defra 'Mini Class' small car	Citroen C1	CBC Fleet	VW Golf
Annual Mileage	86,087	86,087	86,087	86,087	86,087
Carbon Emissions (tCO <sub>2e</sub> )	9.9	15.3	14.8	19.1	12.2
Carbon Emissions savings from Nissan Leaf (tCO <sub>2e</sub> )		5.3	4.9	9.2	2.3
% Carbon Savings		35%	33%	48%	19%

Annual running costs	£2,872	£6,985	£6,740	£8,756	£5,598
Annual running cost savings from Nissan Leaf (£)		£4,113	£3,868	£5,884	£2,726
% running cost savings		59%	57%	67%	49%

The data here suggests that the purchase of electric vehicles for the Council fleet is a sound long term investment, and if current trends continue it is expected that carbon and financial savings will increase year on year. The precise scale of carbon savings is directly linked to ongoing grid decarbonisation.

#### Project 23 Fleet Transport – Low Emissions Diesel

Since the baseline there has been a large decrease in the number of vehicles owned by the Council, from 101 in 2012/13 to 68 in 2016/17, a 33% reduction in the number of vehicles. Of the current fleet 33 are existing vehicles from the baseline, and 35 are new as of 2016/17. These new vehicles are likely to be of a higher efficiency than their replaced counterparts. This has resulted in a significant decrease in emissions of 42% by 2017/18. Similarly, this has led to a significant decrease in the nominal costs of the fleet, equal to a 44% decrease. The reduction in the overall fleet is likely to have been a more significant factor in these decreases, than the change in existing vehicles to low emission diesel.

#### Project 24 Business Travel

A sustainable travel plan has been written by CBC, in which it outlines schemes to be implemented that could decrease carbon emissions associated with the council’s transport. It is difficult to determine the effect of any one scheme within the travel plan; however, the net impact on business travel can be reviewed.

Table A.11 Business travel mileage

Fuel	2012/13 Mileage	2016/17 Mileage	2017/18 Mileage	% Change against baseline	% Change against 2016/17
Petrol	272,758	190,755	144,190	-47%	-24%
Diesel	67,264	140,571	128,966	92%	-8%
Total	340,022	331,326	273,156	-20%	-18%

Previous Government advice has encouraged drivers to switch to diesel (rather than petrol) vehicles; this can be seen in the general trends in mileage for the two fuels. However, there is now a wider move towards ultralow emission vehicles, with the prospect of a phasing out of new sale diesel and petrol vehicles by 2032. In the short term, there is also greater scrutiny of the higher particulate emissions exhausted by diesel vehicles in comparison to petrol vehicles.

These two factors may result in an increase in petrol related emissions in future business travel.

The significant reduction in overall mileage noted here appears to show a wider impact on staff travel. Subsequent analysis will be required to determine whether this is a sustained trend.

### Project 25 Green Impact Programme

In 2016/17 the Green Impact Programme was continued, aiming to build on the success of the previous year. Staff at Southfield Rd offices and Charnwood Museum participated in the Green Impact behaviour change programme, run in partnership with the National Student's Union. 85 members of staff took part in the programme (12% increase on last year), in five different action teams, resulting in the council earning many awards for their efforts.

The programme has been estimated by NUS to have saved the Council at least 3.0 tCO<sub>2e</sub> and monetary savings of at least £1,700 as a result of putting 118 actions in to place. Actual savings are likely to have exceeded this figure. Due to other changes on the sites implemented during this time, such as upgrades to the heating systems and changes in staff numbers, and a lack of information about staff travel and waste generation, it is not possible to directly attribute reductions in emissions to the behaviour change campaign.

Results from the programme have shown that over 80% of the participants have found the programme either or excellent or good, and have felt good about themselves for engaging in the programme. Furthermore people have become more conscious of sustainability in their day to day life and are more likely to encourage others to be more sustainable.

The green impact programme has continued playing an important role within Charnwood Borough Council, and it is clear that people wish to engage in green strategies and are proud to do so. Results have shown that on average the green impact programme teams have only secured a third of all available points, it is suggested that employees could become more aware of the amount of energy they use and actively engage in activities to minimise this usage, i.e. installing occupancy sensors, turning off equipment and waste reduction.

## Appendix B Carbon Management Policy Landscape

### B.1 Wider Policy Landscape and Context

Action on climate change is taking place across the world. Policy commitments made by national Governments via international agreements has resulted in national policies designed to deliver on these commitments. National requirements must then be translated into local policies and associated objectives.

To understand the current position, and therefore begin to see where CBC can best look to contribute, it is important to look at the policy landscape across the spectrum from international through national to local level. Details are provided in the following sections.

### B.2 International Conventions and Agreements: Current Position for Climate

#### United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is an international environmental treaty that was adopted in 1992 and came into force in 1994 having been ratified by nations worldwide. The 197 nations that have ratified the agreement are known as ‘parties to the convention’. It is linked to three other Conventions:

- Convention on Biological Diversity
- Convention to Combat Desertification
- Ramsar Convention on Wetlands

The ultimate objective of the Convention is to:

*“stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”*

From the outset of this agreement it was recognised that action on climate change needs to be cost effective, and that contributions from different countries will vary according to their circumstances. Leading the way are the so called industrialised countries (mostly those in the Organisation for Economic Cooperation and Development [OECD]) deemed Annex I countries in the language of the UNFCCC.

The UNFCCC does not set any targets for greenhouse gas (GHG) emission reduction by individual countries. It sets out how international treaties or protocols can be negotiated to support international efforts to achieve the overall objective.

For this reason, parties to the Convention meet annually in so called ‘Conference of the Parties’ (COP) to assess progress and seek further action as is thought necessary to meet overall targets.

#### Kyoto Protocol

The first meeting of the parties to the convention took place in Kyoto (COP-1) and the resulting Kyoto Protocol came into force in 2005. It set out emissions reduction targets for Annex I countries, which crucially are binding in international law. Two commitment periods were agreed, the first from 2008 – 2012, the second from 2013 – 2020. There was an Amendment to the Protocol for the second period commitments agreed in Doha (COP-18) but this has not yet come into force.

## Paris Agreement

The Paris Agreement was adopted by those parties attending COP-21 in December 2015. It was signed by 195 UNFCCC members and at the time of writing has been ratified by 170 of these.

The agreement applies to the period beyond 2020 and has three key objectives:

- "(a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
- (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;
- (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."

The wording of the agreement recognises the role of scientific evidence in guiding action, and the need to ensure a peak in global GHG as soon as possible. It notes the need for rapid reduction in GHG beyond that peak in order to avoid major impacts from the changing climate on all signatories.

Those countries that have ratified the agreement are legally bound to prepare, communicate and maintain a nationally determined contribution (NDC). This sets out their targets in terms of overall reduction in nationally reported GHG emissions. A report on progress with the NDC should be produced every five years and ambitions set out at each review should be more far reaching than the previous reporting period.

The UK has ratified the Paris Agreement and committed to the process of progress review that it includes. The NDC for the UK was issued as part of a joint submission by the European Union. It states a commitment to achieve at least a 40% reduction in domestic GHG emissions by 2030 (against a 1990 baseline). 'Domestic' in this case refers to individual countries within the EU. It is useful to note that this 40% reduction is an aggregate figure for the EU member states; the UK's own national commitments, as an example, are for a more significant reduction in its reported GHG emissions by 2030.

### B.3 National Context: Existing UK Climate Change Legislation

The 2008 Climate Change Act commits the UK Government to delivering an 80% reduction in carbon emissions by 2050 (against a 1990 baseline) in order to help mitigate future climate change. It also requires the UK Government to ensure that there is sufficient preparation in seeking to adapt to risks posed by climate change.

In recognising the global impact of greenhouse gas (GHG) emissions the UK Government is also committed within the Act to contribute to global efforts seeking to limit global temperature rise to as little as possible above 2°C.

The Act included a requirement to create the Committee on Climate Change (CCC), which independently assesses carbon targets and advises Government on the evidence base behind them.

### Carbon Budgets

To meet UK level emission GHG reduction targets, the government has set five-yearly carbon budgets which currently run until 2032. They place a limit on the amount of GHGs the UK can legally

emit during each of the five-year time periods (see Table B.1). The UK is currently in the third carbon budget period (20187 to 2022).

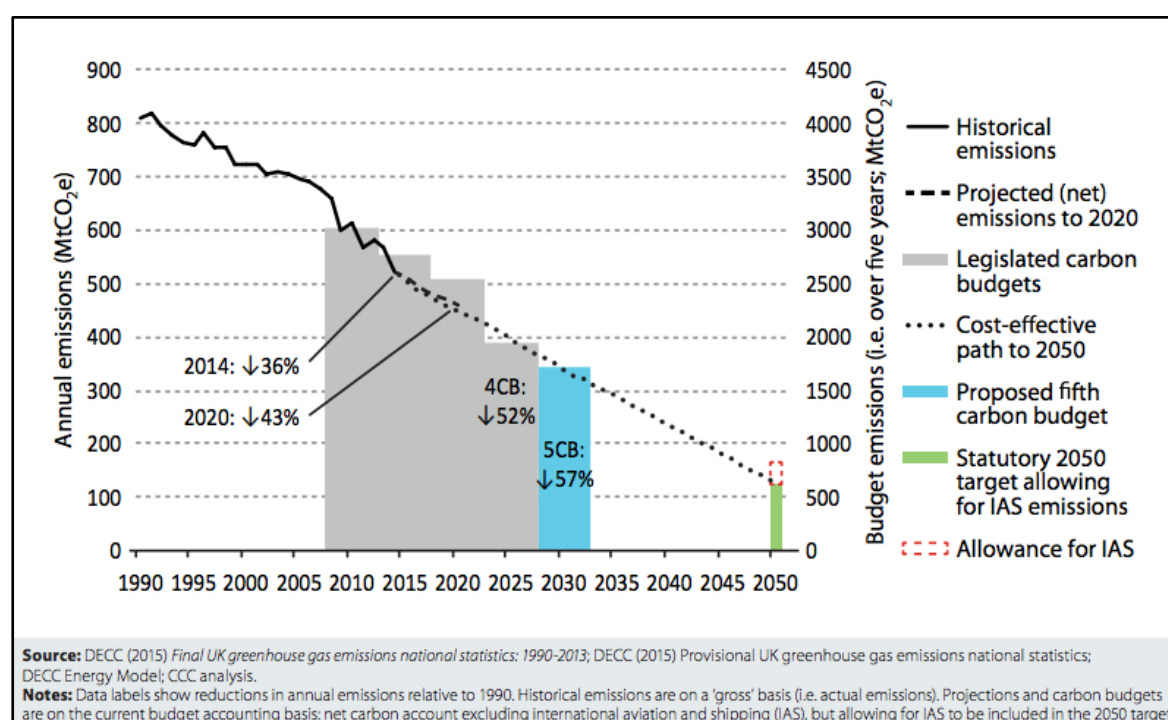
Table B.1 UK Carbon Budgets and overall carbon emission reduction targets

Budget	Time Period	Carbon Budget Level	Reduction below 1990 levels
First Carbon Budget	2008 - 2012	3,018 MtCO <sub>2e</sub>	25%
Second Carbon Budget	2013 – 2017	2,782 MtCO <sub>2e</sub>	31%
Third Carbon Budget	2018 – 2022	2,544 MtCO <sub>2e</sub>	37% by 2020
Fourth Carbon Budget	2023 – 2027	1,950 MtCO <sub>2e</sub>	51% by 2025
Fifth Carbon Budget	2028 – 2032	1,725 MtCO <sub>2e</sub>	57% by 2030

Source: Committee on Climate Change.

The UK met its first carbon budget and is on track to outperform on its second and third budgets (see Figure B.1). UK emissions in 2015 were 38% lower than the 1990 baseline. However, much of the reductions to date have come from relatively low cost options that offer ‘quick wins’ in terms of GHG reduction. As we move towards the higher reduction targets in carbon budgets 4 and 5, so the savings become harder to achieve and (potentially) more costly to implement. Any reduction in action now could result in a slowing in GHG reduction and a failure to meet later targets. This in turn results in more costly interventions to deliver the GHG emission reductions required to meet targets.

Figure B.1 UK carbon budgets and cost-effective path to 2050



Notes:

- 4CB denotes Fourth Carbon Budget
- 5CB denotes Fifth Carbon Budget
- IAS denotes International Aviation and Shipping

## Clean Growth Strategy

The UK Government published its Clean Growth Strategy (CGS) in October 2017. As stated in the Prime Minister's Foreword:

*“Clean growth is not an option, but a duty we owe to the next generation, and economic growth has to go hand-in-hand with greater protection for our forests and beaches, clean air and places of outstanding natural beauty.”*

The CGS, which details how the Government will seek to achieve the fourth and fifth carbon budgets in particular, is required under the terms of the UK's Climate Change Act 2008. The overall purpose of the CGS is to set out at a high level the steps the UK Government will take to ensure that future economic growth is decoupled from GHG emissions. This has two guiding objectives:

- To meet domestic commitments at the lowest possible net cost to UK taxpayers, consumers and businesses; and
- To maximise the social and economic benefits for the UK from this transition.

It is important as it shows the direction of travel anticipated to be required. Much of the action needs to happen in the near future, in order to enable changes in the wider economy that will ensure that later carbon budgets are met, notably from 2023 onwards. There are eight areas of action identified where key policies and proposals will be developed as set out in Table B.2.

Table B.2 Clean Growth Strategy – headline action areas

Headline	Summary of content
Accelerating clean growth	Developing green finance capacity to support investment in innovation, direct investment in low carbon projects and wider availability of green mortgages (linking lending repayments to energy efficiency in properties).
Improving business and industry efficiency	Support business to improve energy productivity via a variety of means including review of building regulations, simplifying carbon and energy reporting for business, and developing wider decarbonisation plans for industry. Direct investment in Carbon Capture Usage and Storage (CCUS) will support development of this technology, alongside funding of research and innovation in energy, resource and process efficiency.
Improving our homes	Strengthen building standards for energy efficiency and extend the Energy Company Obligation (ECO) to deliver more home energy improvements. There is also an intention to build and extend heat networks across the country and phase out fossil fuel use by those homes not on the existing gas grid. Energy efficiency standards for new boilers will be increased to assist in driving overall efficiency and investment will be targeted at low carbon heating solutions for homes and businesses.



Accelerating the shift to low carbon transport	<p>The most significant change in this area is the phasing out of new conventional petrol and diesel cars and vans by 2040. This will be supported by market investment in the ultra-low emission vehicles (ULEV) market, including taxis and buses. Alongside this will be the development of vehicle charging networks and wider investment in cycling and walking networks for shorter journeys. It is explicitly stated that the Government anticipates that the public sector will lead the way in transitioning to zero emission vehicles. Investment will also be targeted in areas of research and development associated with battery storage as well as connected and autonomous vehicles.</p>
Delivering Clean, Smart, Flexible Power	<p>The Government will continue to monitor how energy networks are managed in order to ensure that energy bills are kept as low as possible for consumers. This includes more use of battery storage and smart technologies to enable demand response technologies and grid balancing of supply. As well as the phasing out of unabated coal as a fuel source for electricity generation, there will be investment in nuclear power stations (Hinckley Point C) and encouragement for renewables such as offshore wind.</p>
Enhancing the benefits and value of our natural resources	<p>Future agricultural support will focus on directly addressing climate change impacts and enhancing environmental outcomes. Where practical the Government will seek to extend woodland and forest networks in England and increase the amount of UK grown timber used in construction.</p> <p>A new Resources and Waste Strategy will support the ambition for zero avoidable waste by 2050. This will include aspects of the emerging circular economy and efficiency of resource use.</p>
Leading in the Public Sector	<p>UK Government sees the public sector as having a leading role in delivering and supporting the evolution to a low carbon economy. This includes:</p> <ol style="list-style-type: none"> <li>1. Tighter targets for 2020 for central government and actions to further reduce greenhouse gas emissions beyond this date.</li> <li>2. Introduce a voluntary public sector target of a 30 per cent reduction in carbon emissions by 2020-21 for the wider public sector.</li> <li>3. £255 million of funding for energy efficiency improvements in England and help for public bodies accessing sources of funding.</li> </ol>
Government leadership in driving clean growth	<p>Recognising the requirement for Government to be seen to be driving the entire strategy forward, the Government is also committed to monitor progress via a Clean Growth Inter-Ministerial Group and the use of a 'Great Green Britain' week to promote clean growth.</p> <p>On a practical level, annual GHG reporting will include a measure termed 'Emissions Intensity Ratio' looking at GDP growth and reduced emissions.</p>

### Industrial Strategy – Building a Britain fit for the future

Alongside the Clean Growth Strategy is the Industrial Strategy, published in late 2017, that sets out the UK Government’s priorities in terms of maintaining a thriving economy in the transition to a low carbon economy.

The Government’s view of the changing economy is summarised in terms of five foundations of productivity:

- Ideas – the world’s most innovative economy
- People – good jobs and greater earning power for all
- Infrastructure – a major upgrade to the UK’s infrastructure
- Business environment – the best place to start and grow a business
- Places – prosperous communities across the UK

These underpin four so called Grand Challenges that seek to put the UK at the vanguard of future industries:

- Artificial Intelligence and Data Economy – putting the UK at the forefront of the artificial intelligence and data revolution
- Future of mobility – become a world leader in the way people, goods and services move
- Clean Growth – Maximise the advantages for UK industry from the global shift to clean growth
- Ageing society – Harness the power of innovation to help meet the needs of an ageing society

The five foundations of productivity are wide-ranging and there are a large number of new and ongoing initiatives outlined in the Industrial Strategy. Some of the action areas most relevant to ongoing environmental actions are summarised here.

Table B.3 UK Industrial Strategy – headline action areas

Foundation	Action Area	Commitment / Action Point
Ideas	Investment in research and development	Commit to reach 2.4 per cent of GDP investment in R&D by 2027 and to reach 3 per cent of GDP in the longer term
	Industrial Strategy Challenge Fund	<p>Clean Growth –</p> <p>Transforming construction – creating safer, healthier and less energy intensive buildings</p> <p>Prospering from the energy revolution – Smart energy systems enabling maximum use of clean energy sources via suitable storage systems</p> <p>Transforming food production – efficient food production</p>

		<p>with reduced pollution, waste and soil erosion</p> <p>Audience of the future – Development of immersive technologies such as virtual, augmented and mixed reality</p> <p>Next generation services – Developing applications for artificial intelligence and data analytics within the UK service sectors</p> <p>Data to early diagnosis and precision medicine – Using data to support diagnostic programmes</p> <p>Healthy ageing – Smarter use of data to enable independent lifestyles for the elderly and appropriate care supports</p>
	<p>Higher Education Innovation Funding (HEIF) to reach a total of £250m a year by 2020-21</p>	<p>Supports knowledge-based interactions between universities and colleges and the wider world. Universities use HEIF to respond to business needs and to local opportunities.</p>
	<p>Launch a new competitive £115m Strength in Places Fund</p>	<p>The fund will support collaborative programmes based on research and innovation excellence in places right across the UK which can demonstrate a strong impact on local productivity and enhance collaboration between universities, research organisations, businesses, local government and Local Enterprise Partnerships in England and relevant agencies in the devolved nations.</p>
<p>Infrastructure</p>	<p>Investment in flood protection</p>	<p>£2.6 bn investment in over 1,500 flood defence schemes, protecting up to 7.500 households</p>

	Housing	Support for planning system reforms and investment support for more house building
	Promotion of zero emission vehicles	<p>Plug-in grant available for purchase of battery electric vehicles by individuals and businesses</p> <p>Central government car fleets to be at least 25% electric by 2022</p> <p>Development of £400 m Charging Infrastructure Investment Fund to extend vehicle charging network.</p>
	Clean Air Fund	Help individuals and businesses adapt as measures to improve air quality are implemented in the most challenging areas of air pollution in England
	Circular Economy	Strengthen support for development of a circular economy via the Environment Plan and new strategy for resources and waste
	Digital Connectivity	Investing in new 5G infrastructure and 'full-fibre' broadband networks
	Clean energy	Continued investment in clean sources of energy generation and support as detailed in the Clean Growth Strategy
Business environment	Sector Deals	Launching Sector Deals with life sciences, construction, artificial intelligence and the automotive sector, with the creative industries, industrial digitalisation and a number of other sectors in advanced discussions. These are partnerships with Government designed to foster long term investment
Places	Local Industrial Strategies	Identify local strengths and challenges, future opportunities and the action

		needed to boost productivity, earning power and competitiveness. Continue to work with Local Enterprise Partnerships to set out clearly defined activities and objectives

Note: Details offer view of relevant actions but are not intended to be an exhaustive list

#### B.4 National Context: Committee on Climate Change

The Committee on Climate Change (CCC) is an independent, statutory body established under the Climate Change Act 2008.

The CCC monitors both the pace and scale of action to reduce GHG emissions across the UK and within different sectors of the economy. This means that they look at work to date in tackling climate change and forecast what they think the impacts of existing action will be in future years. It also means they look at the rate of change in the economy, reviewing where investment is being made and the pace at which new areas of development occur (e.g. electric vehicles). Looking at past action, and forecasting where future changes will happen, enables the CCC to look at how effective UK Government policies will be in achieving the overall GHG reduction targets.

An annual report is published with commentary on progress against targets and where the CCC sees cause for optimism or concern in delivering the changes needed to ensure that the UK meets its climate change commitments.

The CCC does not consider climate change action in isolation from the financial impact that change will bring. Its advice seeks to understand the technical requirements for GHG reduction but also which of the actions offers the best impact at least cost to the overall economy. This balance of GHG reduction and cost-effective delivery is crucial to the successful transition to a low carbon economy.

The majority of the advisory work described above can be categorised as mitigation action. The other important aspect of the CCC's work is to advise on adaptation measures. This relates to managing the impacts of climate change by preparing for situations involving flooding, heat waves, water shortages, and new pests and diseases.

#### UK Climate Change Legislation Summary and Commentary

The existing overarching target of an 80% reduction in UK GHG emissions by 2050 and process of setting carbon budgets for the UK as a whole is enshrined in UK law. While Brexit potentially alters the way in which these targets are achieved it does not alter requirements set out for Government in the Climate Change Act.

The view from the Committee on Climate Change (CCC) is that the present UK Government policy position is sufficient to sustain momentum in achieving carbon budget targets into the early 2020s. However, it retains concerns that the lack of policy development since ratification of the Paris Agreement means that targets within the 4th and 5th carbon budgets are unlikely to be met.

It can be anticipated that there will be policy updates from UK Government in the next few years in response to advice from the CCC and ongoing Paris Agreement actions.

#### Waste management and resource efficiency

At a UK level, there is an existing commitment (linked to the EU Waste Framework Directive) to achieve a 50% household waste recycling rate by 2020. Most recent statistics show a total household recycling rate for the UK of 44.3% in 2015, a fall from 44.9% in 2014.

Alongside efforts to increase recycling is a reduction in the amount of waste sent to landfill, with a focus on biodegradable waste in order to avoid resulting methane emissions within landfill sites. Biodegradable municipal waste sent to landfill in 2015 across the UK was 7.7 million tonnes, or 22% of the 1995 baseline figure. The UK is required to meet a target of no more than 35% of biodegradable municipal waste reaching landfill than they did during 1995 by 2020. The Clean Growth Strategy seeks to stop all biodegradable municipal waste reaching landfill by 2030. Landfill tax rates act as an incentive to reduce landfill volumes; a higher rate is charged for each tonne of biodegradable (non-inert) waste (currently £86.10/tonne) and a lower rate for inert waste (such as construction waste) (currently £2.70/tonne).

The combination of increased recycling and reduction in biodegradable waste to landfill, as well as more efficient capture of fugitive GHG emissions from existing landfill sites, has meant an overall reduction in waste related emissions of 73% since 1990. This is the single largest sectoral contribution to overall GHG emission reduction to date.

While good progress has been made there remain further opportunities to reduce impacts in these areas. The CCC progress report highlights the need to continue reductions in biodegradable waste to landfill and maintaining/enhancing methane capture at existing landfill sites. At the same time, an increase in work within the waste chain to reduce overall waste arisings and ensure more effective collection and segregation of waste streams will also offer benefits in terms of potential re-use, recycling and energy recovery.

The need to consider the lifecycle use of resources in the production of the goods and services that we consume has become more prominent in decision-making at UK and international levels. In short it means a rethink of how we can use changing design practices, alongside better re-manufacture, re-use and recycling practices, to ensure that we use fewer resources overall. This concept has been termed the 'circular economy' in contrast to the existing 'linear economy'.

The current economy uses resources in a linear way, which means that things are made with virgin raw materials, used, occasionally recycled and then thrown away. In contrast, a circular economy keeps products and materials circulating within the economy at their highest value for as long as possible, through redesign, re-use, remanufacturing, recycling, delivering products as services and sharing.

The European Commission adopted a Circular Economy Package in December 2015. An overall EU Action Plan sets out the ambition for change among all Member States and a timeline for further specific action in a number of areas including:

- Product design and production processes
- Consumption and waste management, with a focus on:
- Plastics

- Food waste
- Critical raw materials
- Construction and demolition
- Biomass and bio-based products
- Innovation and investment
- Monitoring progress towards a circular economy

Actions in all areas continue to be progressed with further Directives likely to be produced to tackle specific industrial sectors and aspects of resource use, product manufacture and management of waste.

Despite uncertainty around the UK position during Brexit negotiations, the UK Government continues to work towards implementation of aspects of the Circular Economy Package – particularly in terms of waste recycling rates and management of end-of-life plastics.

The Clean Growth Strategy commits to a new Resources and Waste Strategy which will expand on elements of the circular economy and more efficient resource use. This follows on from existing work by Devolved Administrations such as the Scottish Government’s Zero Waste Plan that has been in operation since 2010.

#### UK 25-year Environment Plan

This UK Government plan was published in January 2018. It sets out a long term approach to protecting and enhancing natural landscapes and habitats in England.

The priorities and areas set out in the 25 Year Environment Plan sit alongside the Clean Growth Strategy with interlinking of themes so as to reduce overall GHG emissions, enhance the natural environment and decouple economic growth from carbon intensive activity.

The overall goals set out in the Plan can be summarised as:

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1 Clean air</li> <li>2 Clean and plentiful water</li> <li>3 Thriving plants and wildlife</li> <li>4 A reduced risk of harm from environmental hazards (eg flooding and drought)</li> <li>5 Using resources from nature more sustainably and efficiently</li> </ul> | <ul style="list-style-type: none"> <li>6 Enhanced beauty, heritage and engagement with the natural environment</li> <li>7 Mitigating and adapting to climate change</li> <li>8 Minimising waste</li> <li>9 Managing exposure to chemicals</li> <li>10 Enhancing biosecurity</li> </ul> |
|---|--|

Notable headline action areas relevant to this monitoring report include:

- Reduce unsustainable abstraction of water
  - Work with water industry to increase resilience and manage supply and demand (including reducing leakage rates from supply networks).
  - Seek to determine appropriate targets for personal water consumption and measures needed to achieve this

- Increasing resource efficiency and reducing pollution and waste
  - Develop a new Resources and Waste Strategy in 2018.
  - Consult on tax system or charges that could be used to reduce single use plastic waste.
  - Increase plastic collection and recycling rates
  - Seek to reduce food waste and avoid food waste to landfill by 2030
  - Seek to use residual waste in biofuels for transport and other innovations beyond electricity production
  - Seek to use more heat output from EfW in heat supply networks
  - Reduce carbon intensity of EfW via reduction in amount of plastic in residual waste stream
  - End the sale of conventional diesel and petrol cars and vans by 2040
  
- Protecting and improving the global environment
  - Work to ensure delivery of Paris Agreement goals and robust rules and standards around reporting progress
  - Phase out unabated coal-fired electricity by 2025

### Clean Air Strategy

The UK Government continues to work on a national Clean Air Strategy (as outlined in the 25-year Environment Plan). A UK plan for tackling roadside nitrogen dioxide concentrations was published in July 2017.

The document notes the impact of poor air quality, not only on life expectancy but also in terms of wider health, productivity and wellbeing. It also notes the wider impact of pollution on the environment.

In the specific case of NO<sub>2</sub> it is noted that impacts relate to relative concentrations and therefore are very localised. It is therefore up to Local Authorities to develop local plans to manage and reduce NO<sub>2</sub> levels where it is determined to be an issue. To support this the UK Government will:

- Set up a £255m Implementation Fund - available to support local authorities to prepare their plans and deliver targeted action to improve air quality
- Establish a Clean Air Fund - allow local authorities to bid for additional money to support the implementation of measures to improve air quality.
- Fund £100m for retrofitting and new low emission buses – this is a national programme across England and Wales.

Local authorities where air pollution is above legal limits will have until December 2018 to finalise plans to tackle this.