

Carbon Management Plan 2016-2021



Contents

1: Introduction	page 1
2: Progress to date	page 2
3: Aims and approach	page 5
4: Carbon reduction projects	page 7
5: Impact of the Transformation Programme and Office Accommodation Strategy	page 11
6: Measuring the impact of the Carbon Management Plan	page 13
Appendix A	
Carbon Reduction projects delivered between 2011/12 and 2015/16	page 15
Appendix B	
New Carbon Management Plan projects	page 19

Glossary

Building Energy Management Systems (BEMS) are computer-based control systems that help to manage, control and monitor a building's mechanical and electrical equipment such as heating, ventilation, lighting, and power.

Combined Heat and Power (CHP) captures and utilises the heat that is a by-product of the electricity generation process. By generating heat and power simultaneously, CHP can reduce carbon emissions compared to the separate means of conventional generation via a boiler and power station.

Community Infrastructure Levy (CIL) – a planning charge, introduced by the Planning Act 2008 as a tool for local authorities in England and Wales to help deliver infrastructure to support the development of their area.

CRC Energy Efficiency Scheme (also referred to as the 'CRC') is a mandatory carbon emissions reporting and pricing scheme to cover large public and private sector organisations in the UK that use more than 6,000MWh per year of electricity and have at least one half-hourly meter.

Feed-in Tariffs (FITs) – a UK Government scheme which pays a generation and export tariff for the electricity generated and exported from eligible systems such as solar PV, a wind or hydro turbine, or micro CHP.

LED (light-emitting diode) lighting is energy efficient because it emits more lumens per watt than incandescent light bulbs.

Passive infrared sensor (PIR sensor) – an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

Solar thermal systems capture solar energy and provide a renewable source of hot water.

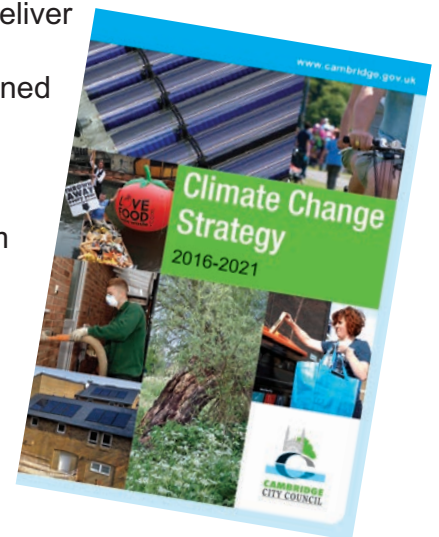
Solar photovoltaic (PV) panels capture the sun's energy and convert it into electricity, which is used to run electrical appliances and lighting.

Variable Speed Drives (VSD) regulate the speed and rotational force of electric motors in response to changing levels of demand for energy from water and air pumps at swimming pools.

Voltage optimisation technology reduces the voltages received by appliances and lights running on electricity, in order to reduce energy use.

1: Introduction

- 1.1 Our climate is changing. It has always changed in response to natural environmental processes, but it is now widely accepted that human activities are leading to climate change of a scale and pace that threatens our way of life. The Intergovernmental Panel on Climate Change (IPCC) finds that average surface temperatures have increased by 0.85°C, over the period 1880 to 2012¹. This increase has led to a range of environmental consequences, from rising sea levels, to increased incidents of extreme weather events. The IPCC concludes that “it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.”²
- 1.2 A recent report by the World Bank concluded that the emissions reduction pledges made by national governments at the UN climate conventions in Copenhagen and Cancun in 2009 and 2010, if fully met, place the world on a trajectory for a global average warming of well over 3°C by 2100. If these pledges are fully implemented there is still about a 20% chance of exceeding 4°C in 2100, and if they are not met the likelihood would be considerably higher³. If average global temperatures increase by 4%, this could have devastating consequences, including global food shortages, flooding of coastal cities⁴, unprecedented heat waves, increased water scarcity, increased intensity of tropical cyclones; and irreversible loss of wildlife and biodiversity, including coral reef systems. It is vital therefore that the recent agreement to limit warming to 1.5%
- reached by national governments at the COP 21 summit in Paris is implemented.
- 1.3 As a local authority, we recognise that we have a responsibility to take positive action and provide strong leadership on averting the dangerous effects of climate change. This is why we have published a Climate Change Strategy setting out the action that we will be taking over the next five years (2016-2021) to help reduce greenhouse gas emissions from the city of Cambridge as a whole. We also, as a publicly funded organisation, have a duty to manage our resources in an efficient and responsible way.
- 1.4 One of the five objectives of the Council’s wider **Climate Change Strategy** is “reducing emissions from the City Council estate and operations”. We have developed this **Carbon Management Plan** for 2016-2021 to help deliver this objective through a planned and strategic approach to reducing emissions from our buildings, vehicles and activities.



1 IPCC, 2013, Climate Change 2013: The Physical Science Basis, p3

2 IPCC, Climate Change 2014: Synthesis Report: Summary for Policy Makers p4

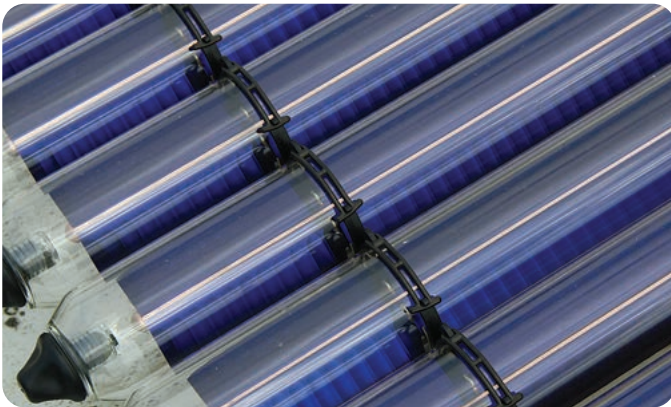
3 World Bank, 2012, Turn Down The Heat: Why a 4°C Warmer World Must be Avoided, p23

4 World Bank, 2012, Turn Down The Heat: Why a 4°C Warmer World Must be Avoided

2: Progress to date

2.1 We have made significant efforts to reduce emissions from our estate and operations over the past seven years. In 2008 we established a dedicated Climate Change Fund. Council officers were invited to bid for funding for innovative projects that will reduce the Council's energy use, costs and emissions. To date, over £800,000 has been allocated to the Climate Change Fund and 29 projects have been supported by the fund.

2.2 In June 2012, we published a Carbon Management Plan for 2011-2016, which set out a more strategic and planned approach to reducing carbon emissions from our estate and operations. The Plan targeted the areas of the Council's activity which contribute most to our carbon emissions



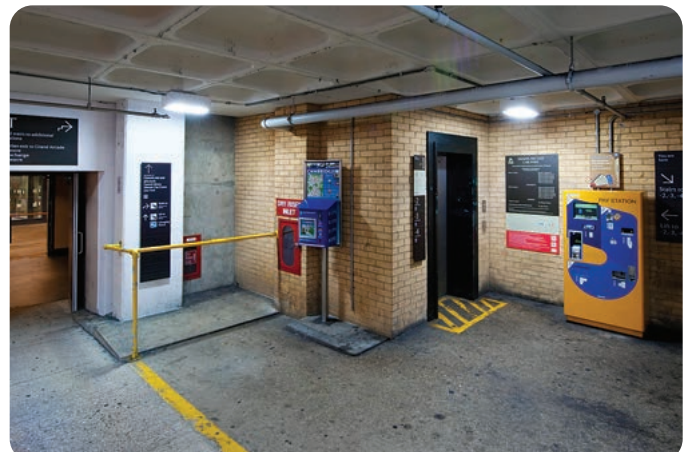
Solar thermal hot water system at Abbey Pool



Inverter for solar photovoltaic system at Cherry Hinton Village Centre

(e.g. swimming pools and leisure centres, car parks, crematorium, vehicle fleet, offices, community centres and sheltered and temporary housing).

2.3 Through the first Carbon Management Plan we delivered a total of 47 carbon reduction projects across our estate and operations between 2011/12 and 2015/16. A full list of all projects delivered is provided at Appendix 1. The key measures delivered through the Plan included:



LED Lighting in Grand Arcade Annex Car Park

- **Renewable energy systems**, including: a solar thermal system⁵ to provide hot water at Abbey Pool; and solar photovoltaic (PV) panels⁶ to provide electricity at Cherry Hinton Village Centre, Brandon Court sheltered housing scheme, New Street Hostel, and Buchan Street Neighbourhood Centre.
- **Lighting improvements**, including: replacing existing lighting at Abbey Pools, the Grand Arcade Annex car park, the Corn Exchange, the Crematorium, and the communal areas of Orwell House enterprise centre and Stanton House and School Court sheltered housing schemes with LED lighting⁷; and installing lighting sensors at Whitefriars and School Court sheltered housing schemes.
- Installing **voltage optimisation**⁸ technology at Abbey Pools, Grafton East Car Park, the Guildhall and Mandela House.
- **Heating improvements**, including: upgrading the boilers at the Meadows Community Centre, Ross Street Community Centre, Abbey Pools and



Solar photovoltaic (PV) panels at Buchan Street Neighbourhood Centre



Solar photovoltaic (PV) panels at Brandon Court
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Cherry Hinton Village Centre to condensing boilers; installing more efficient boilers and improvements to start controls and pipework at Llandaff Chambers and Mill Road Depot; and installing heating controls in the foyer at the Corn Exchange to ensure the heating is only on when and where it needs to be.

- A range of different **energy efficiency improvements** at Council-owned swimming pools and leisure centres, including Abbey Pool, Cherry Hinton Village Centre, Jesus Green Lido and Kings Hedges Learner Pool and Parkside Pools. The measures installed have included: pool covers; Building Energy Management Systems (BEMS)⁹; Variable Speed Drives¹⁰; heat pumps; and refurbishment of an existing Combined Heat and Power (CHP) unit¹¹.
- Installing a **heat recovery system** at the Crematorium, which harnesses excess heat generated to heat the buildings.
- Replacing the **air conditioning system** at Mandela House and upgrading it to a more energy efficient system.

6 Solar photovoltaic (PV) panels capture the sun's energy and convert it into electricity, which is used to run electrical appliances and lighting.

7 LED (light-emitting diodes) lighting is energy efficient because they emit more lumens per watt than incandescent light bulbs.

8 Voltage optimisation technology reduces the voltages received by appliances and lights running on electricity, in order to reduce energy use.

9 Building Energy Management Systems (BEMS) are computer-based control systems that help to manage, control and monitor a building's mechanical and electrical equipment such as heating, ventilation, lighting and power.

10 Variable Speed Drives (VSD) regulate the speed and rotational force of electric motors in response to changing levels of demand for energy from water and air pumps at the pools.

11 Combined Heat and Power (CHP) captures and utilises the heat that is a by-product of the electricity generation process. By generating heat and power simultaneously, CHP can reduce carbon emissions compared to the separate means of conventional generation via a boiler and power station.

- Replacing **20 fleet vehicles** with alternatives with stop-start technology.
 - **Awareness raising campaigns** at all swimming pools to promote a culture of environmental responsibility amongst staff and customers, with the aim of reducing energy and water use.
- 2.4 It is estimated that the 47 carbon reduction projects delivered between 2011/12 and 2015/16 will achieve estimated on-going carbon savings of around 1,870 tCO_{2e} per year.
- 2.5 This figure is only an estimate, because prior to 2013, the Council does not have accurate data on our energy usage, so we are not able to reliably calculate our total carbon emissions for this period. This was because we were previously reliant on the data provided by our energy suppliers, which was based on a combination of irregular meter readings and estimated energy usage data.
- 2.6 During 2012/13, we took steps to ensure that in future we have accurate data for all City Council sites included in the baseline for the Carbon Management Plan. The Council has invested in the installation of Automatic Meter Readers (AMRs), which automatically and remotely read meters, at all major sites that did not previously have them. We also now take visual meter readings at all sites twice a year. As a result of these measures, we now have reliable energy usage data for 2013/14 and 2014/15, and are able to reliably identify our total carbon emissions for these years.
- 2.7 Our data shows that our total energy usage increased by 0.8% between 2013/14 and 2014/15, from 7,974 tonnes of carbon dioxide equivalent (tCO_{2e}) to 8,041 tCO_{2e}. While energy use reduced at the majority of our sites between 2013/14 and 2014/15, our emissions increased slightly over this period due to increased usage of a number of operational buildings. This included:
- Increased electricity use at the Grand Arcade annex car park.
 - Increased electricity usage at some of the Council's sheltered housing accommodation.
 - Increased energy usage at the crematorium, due to an increase in the number of cremations.
 - Increased energy usage at Brown's Field community centre, resulting from increased usage of the centre and longer opening hours.
- 2.8 28 of the projects delivered through the Carbon Management Plan were completed by the end of 2013/14, so it is not possible to capture the impact of these projects on our total carbon emissions. Although the Council implemented 7 carbon reduction projects during 2014/15, the majority of these projects were implemented towards the end of the 2014/15 financial year, so any reduction in emissions resulting from these projects would not be seen until 2015/16.
- 2.9 By investing in energy and fuel saving projects, the Council has been able to achieve significant financial savings. The total cost of all 47 carbon reduction projects delivered between 2011/12 and 2015/16 is £1.73m. Collectively these projects have generated an estimated annual saving of £213,202 in the Council's energy costs, meaning that they will 'pay back' the original investment in just over 8.1 years. Many projects will continue to deliver savings beyond this point.

3: Aims and approach

- 3.1** This new Carbon Management Plan provides the blueprint for reducing energy and fuel consumption and carbon emissions across our estate and activities, between 2016/17 and 2020/21. This will help us to achieve a number of environmental and financial aims:
- Contribute to the delivery of the Council's wider Climate Change Strategy for 2016-2021 and help reduce carbon emissions from the city of Cambridge.
 - Make a contribution to wider international efforts to limit average global temperature increases to less than 2°C compared to 1990 levels by reducing energy usage that is within our direct control.
 - Provide local leadership and encourage other businesses and organisations to take positive action to reduce carbon emissions and tackle climate change by demonstrating what is possible.
 - Manage our financial resources responsibly as a publicly-funded organisation. By reducing our energy consumption and costs, we will achieve financial savings which can help meet our overall financial savings targets and help protect front line services, including those used by vulnerable residents.
 - Reduce our exposure to future financial risk, by protecting ourselves against further increases in energy costs in future and the financial penalties associated with energy use, such as through the Carbon Reduction Commitment¹² or other instruments.
- 3.2** This Carbon Management Plan builds on the experience and learning that we have gained through delivering carbon reduction projects. In 2008 the Council established a dedicated Climate Change Fund to support projects which would reduce energy



The Corn Exchange

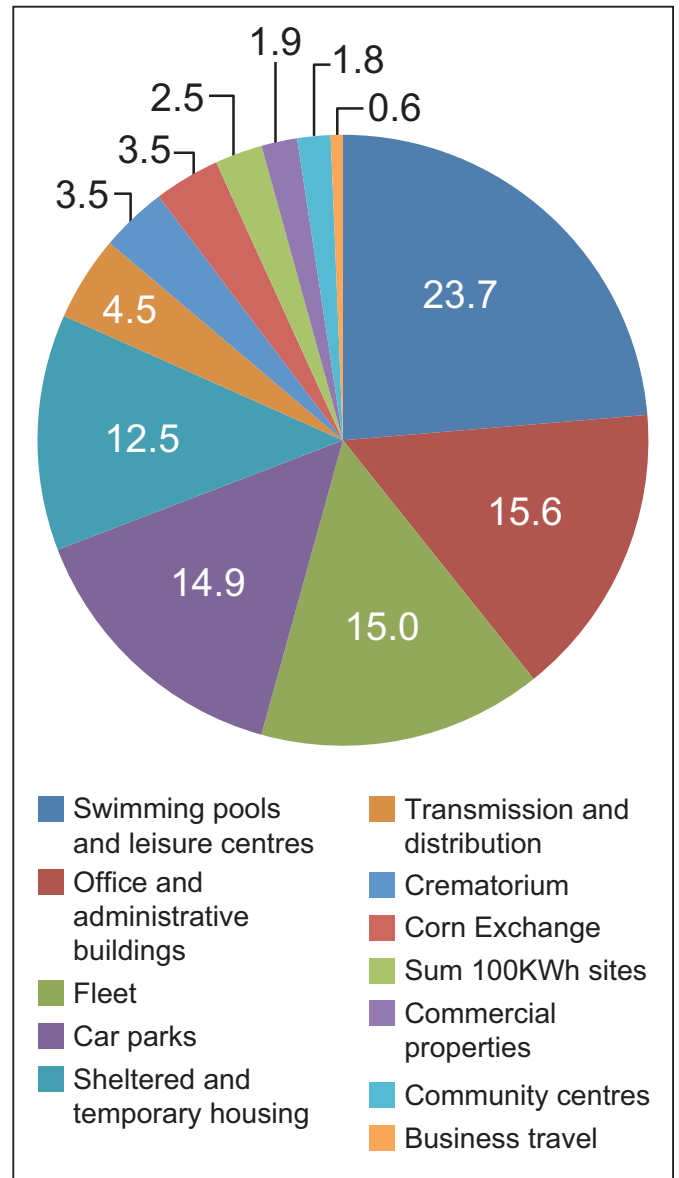
consumption and emissions. The availability of this funding helped stimulate Council officers to identify carbon reduction projects in Council buildings and operations, ranging from rainwater harvesting systems at Arbury Court and Romsey Recreation Ground to installing LED lighting at the Corn Exchange.

- 3.3** In developing and publishing our first Carbon Management Plan in 2012, we sought to maximise the impact of the Council's investment in carbon reduction projects by adopting a more planned and strategic approach over a four year period (2012/13-2015/16). As part of this more strategic approach, the plan focussed on reducing carbon emissions from the buildings and activities which contributed most to our total carbon emissions.

¹² The CRC Energy Efficiency Scheme (also referred to as the 'CRC') is a mandatory carbon emissions reporting and pricing scheme to cover large public and private sector organisations in the UK that use more than 6,000 MWh per year of electricity and have at least one half-hourly meter.

3.4 We intend to continue this targeted approach in this new plan, funding projects which reduce emissions in the buildings and operations which consume the most energy and fuel. As can be seen from Figure 1, swimming pools (23.7%), office and administrative buildings (15.6%), our vehicle fleet (15.0%), car parks (14.9%), sheltered and temporary housing (12.5%), the crematorium (3.5%), commercial properties (1.9%) and community centres (1.8%) accounted for the vast majority of our carbon emissions in 2014/15. 4.5% of our emissions are associated with energy that is lost in the process of transmission and distribution from the site where the electricity was generated to end use at the Council.

Figure 1 – Carbon emissions by site in 2014/15 (as a % of total emissions)



4: Carbon reduction projects

Projects for 2016/17 and 2017/18

- 4.1 We have identified a total of 22 carbon reduction projects which we will aim to deliver in the first two years of the plan in 2016/17 and 2017/18. A full list of all the projects is provided at Appendix B.
- 4.2 For each project we have set out: the estimated reduction in annual carbon emissions it will achieve; the estimated cost; and the estimated annual financial savings it will achieve. It is estimated that in total these 22 projects will reduce carbon emissions from the Council's estate by almost 500 tonnes of carbon dioxide equivalent (tCO_{2e}). It is estimated that they will cost a total of around £1.72 million and deliver annual financial savings of more than £90,000.
- 4.3 The projects have been identified through a combination of site assessments and discussions with building and service managers. As with the previous Carbon Management Plan, these projects are focussed on the sites and services which use the most energy, including: swimming pools, car parks, vehicle fleet, office accommodation, sheltered and temporary housing, the crematorium, community centres and commercial properties.
- 4.4 These projects involve a range of different measures including:
- **Lighting improvements** – including:
 - major projects to replace existing lighting at the Grand Arcade Car Park, Grafton East Car Park, the Guildhall, and Mandela House with LED lighting;
 - smaller scale projects to install LED lighting at community centres (the Meadows Centre and Buchan Street Neighbourhood Centre), and communal areas in sheltered housing schemes

(Rawlyn Court, Ditton Court and Mansel Court) and temporary housing (New Street Hostel and 116 Chesterton Road); and

- other lighting measures such as PIR¹³ motion sensors at the Meadows Centre and New Street hostel.

We intend to invest significantly in LED lighting as our experience to date shows it is a highly cost effective way to achieve significant and reliable energy savings and emissions reductions. It is estimated that these new lighting projects will deliver total carbon reductions of around 335 tCO_{2e}. It is estimated that they will cost a total of around £470,000 and achieve estimated annual financial savings of around £56,000. These measures have an average payback period of around 8.4 years.



The Meadows Community Centre

¹³ A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.



Mandela House

- **Heating improvements** – including:
 - upgrading the boiler at Mandela House to a condensing boiler; improving boiler controls at the housing office at 171 Arbury Road;
 - replacing existing heating systems with separate communal and flat heating systems at Stanton House and School Court sheltered housing schemes; and
 - adjustments to the hot water system at Abbey Pools to allow excess heat generated by the existing solar thermal system to be used to heat hot water for showers.

It is estimated that these heating improvements will deliver a total carbon reduction of more than 40 tCO₂e. It is estimated that they will cost a total of more than £400,000 and achieve estimated



100% electric, zero emissions Environmental Health van

annual financial savings of almost £7000. It should be noted that many of the changes to boilers and heating systems would have been delivered as part of the Council's planned maintenance programme for these buildings, but as part of our commitment to reducing carbon emissions, we will replace them with more energy efficient systems, rather than on a like-for-like basis. As a result the payback period on the financial investment and the cost per tCO₂e saved is higher than for other measures included in this plan.

- **Insulation improvements** – including roof insulation at the Guildhall and the crematorium and wall insulation at New Street Hostel.
- **Vehicle fleet** – The Council currently has a vehicle fleet of 90 vans and 28 refuse trucks, plus additional plant equipment such as tractors and ride-on mowers. In 2016/17, 8 diesel panel vans will be replaced by electric vehicles. The current diesel vehicles were responsible for annual emissions of around 13 tCO₂e. Electric vehicles have several benefits over conventional internal combustion engine vehicles, including a significant reduction of local air pollution, especially in cities, as they do not emit harmful exhaust pipe pollutants. They also have the potential to reduce carbon emissions, compared to diesel vehicles, where the



Council refuse truck

electricity used to charge the vehicle batteries comes from renewable and low carbon energy sources rather than fossil fuels. In the UK there is a broad mix of electricity generation sources, including some low carbon energy provision, and the Council's electricity comes from mostly green sources through its chosen tariff.

A further 7 vehicles (1 panel van, 1 pick-up truck, 4 tipper trucks and 1 tractor) will be replaced in 2016/17 with more fuel efficient vehicles which emit less carbon dioxide. We will also be replacing other vehicles in our fleet with more fuel efficient models in future years, including: 9 refuse trucks, 5 tipper trucks and 4 pick-up trucks in 2017/18; 6 refuse trucks and 1 dumper truck in 2018/19; and 8 tipper trucks and 2 panel vans in 2019/20.

- 4.5 The list of projects in Appendix B is not set in stone and will develop and evolve over the course of the plan period. Experience gained from delivering our first Carbon Management Plan shows that there needs to be a degree of flexibility to the plan, including the scope to change the timing of some projects or remove some projects from the list and replace them with other more viable ones. There are number of reasons for this, including:
- Some projects may need to be rescheduled for operational reasons. For example, the installation of LED lighting at Grand Arcade Car Park was due to be completed in spring 2016, but will now be delivered in spring 2017 for operational reasons.
 - Some projects appear viable on an initial assessment, but further investigation into their feasibility can reveal that there is not a viable business case. For example, the proposed installation of voltage optimisation technology at Mill Road Depot in 2013/14 did not proceed because further site surveys showed that the technology was not appropriate for the site and did not present a strong business case. In response we brought forward the installation of the same technology in Grafton East Car Park to 2013/14.

- 4.6 Through our first Carbon Management Plan, we have generally been picking the "low hanging fruit": the easier to implement carbon reduction projects, which have the shortest financial payback periods and which deliver a high rate of reduction in our emissions for the level of financial investment required. To reduce our energy bills and carbon emissions further, we may need to invest in projects which have longer payback periods or which cost more to achieve the same level of carbon reduction. The average payback period for the 22 projects included in Appendix B is 20 years, which is higher than the average payback period of 12.3 years for projects in the first Carbon Management Plan.
- 4.7 The projects included in this plan also focus on a more limited range of measures and technologies than the previous Carbon Management Plan. This is partly because we have already installed some technologies in all the buildings where they would achieve significant energy savings, so there is limited scope to apply them further. For example, we have installed voltage optimisation systems at Abbey Pools, Grafton East Car Park and Mandela House, but site assessments by the manufacturers have suggested that they would not be viable at any of our other sites. Similarly we have installed a solar thermal system at Abbey Pools, but this technology would not be effective at any of our other buildings as they do not have a comparable demand for hot water. However, we will continue to monitor new carbon reduction technologies as they develop over course of the plan period and assess the viability of applying them to the City Council estate.

Potential further projects

- 4.8 The Plan currently focuses primarily on projects that will be delivered in 2016/17 and 2017/18. It has been simpler to identify viable projects for the next two years than for the medium term, because we have greater certainty over the availability of funding and the operational requirements for our buildings in the short term. As the plan progresses, we anticipate identifying

more projects for delivery in later years of the plan.

4.9 We have already identified further projects which could potentially be delivered during the course of the plan period, but which are not sufficiently developed at this stage to identify precise delivery timescales or costs, financial savings and carbon reductions. Once the viability of these projects has been fully assessed, we would expect to add them to the Carbon Management Plan. Potential projects include:

- A new district heating scheme connecting the University of Cambridge's New Museums Site and the Guildhall and Corn Exchange. Under this scheme, excess heat produced by the onsite electricity generators at the New Museums site could potentially be used to partially heat the Guildhall.
- Installing a range of new carbon reduction measures as part of the specification for the planned redevelopment of Park Street Car Park.
- Installing further measures at our swimming pools, potentially including solar PV panels and replacing the boilers at Parkside Pools with more energy efficient boilers.
- Upgrading the outdoor lighting at Abbey Pool to LED lighting. This project could be funded through a CIL¹⁴ contribution from the proposed Cheddars Lane development, so the timing would be dependent on the delivery of this development.
- Installing cavity wall insulation at the Meadows Community Centre.
- Installing additional insulation as part of the re-roofing of commercial property at Dale's Brewery.

4.10 In developing this Carbon Management Plan, we have also explored the viability of installing solar PV systems at additional sites, including our office accommodation;



The Guildhall

community centres; and sheltered housing schemes. We will not be taking forward the majority of these schemes due to the Government's decision to reduce the Feed in Tariffs (FITs)¹⁵ for solar PV installations from 1 January 2016 onwards by between 68% and 87%, depending on the size of the array of panels. As a result the average payback for our planned solar PV schemes has increased from 8 years to 15 years, which is less favourable than other measures such as LED lighting. Although the cost of solar panels has reduced significantly in recent years, they are still a comparatively costly way of reducing carbon emissions. The cost for each tonne of CO₂e saved through the potential solar PV schemes (£6500 per tCO₂e) is higher than for other measures in plan (which average £2000 per tCO₂e).

4.11 We have identified that there may still be potential to install solar PV systems at some of our sites during the plan period, such as the Guildhall and Parkside pools, where it is more likely that the majority of electricity generated by the panels could be used on site. However, these schemes are subject to further investigation and will not be prioritised for delivery over other schemes which deliver a higher level of carbon reduction for the same level of financial investment.

¹⁴ The Community Infrastructure Levy (CIL) is a planning charge, introduced by the Planning Act 2008 as a tool for local authorities in England and Wales to help deliver infrastructure to support the development of their area.

¹⁵ The Feed-in Tariffs (FITs) scheme is a UK Government scheme which pays a generation and export tariff for the electricity generated and exported from eligible systems such as solar PV, a wind or hydro turbine, or micro CHP.

5: Impact of the Transformation Programme & Office Accommodation Strategy

- 5.1 The Council is currently going through a period of significant change, as it seeks to respond to growing demand for its services at a time when funding from central Government is decreasing. In response the Council is implementing a transformation programme, which is changing the way that some services are delivered in order to achieve financial savings. This includes establishing alternative service delivery models for an increasing number of Council services. This includes shared services and arms-length bodies, such as Cambridge Live which has managed the Corn Exchange, the Folk Festival and other events and other arts activities since April 2015.
- 5.2 Partly as a result of these changes, the Council will be making changes to its office accommodation and operational estate as part of a developing Office Accommodation Strategy. Phase I of the Office Accommodation Strategy was delivered in 2014 with the release of accommodation at Lion House and the transfer of staff to the Guildhall, resulting in a reduction in the total office accommodation occupied by the Council. It is proposed that in Phase II of the Office Accommodation Strategy, the following changes would be made:
- Retaining the Guildhall, Mandela House and the housing office at 171 Arbury Road.
 - Disposing of Hobson House by July 2016 and Mill Road Depot by mid-2017, and vacating the Cherry Hinton Road housing office by April 2016.
- 5.3 As shown in Table 1 below, as a result of the creation of Cambridge Live, the Council will no longer be responsible for the Corn Exchange and Parson Court, which will reduce the Council's carbon emissions by

Table 1: Energy use and greenhouse gas (GHG) emissions for selected sites in 2014/15

Site/building	Total energy use (kWh)	Total GHG emissions (tCO _{2e})	Emissions as a percentage of total GHG emissions
Corn Exchange	1,058,470	292.61	3.64
Parsons Court	72,308	20.98	0.26
Mill Road Depot	914,958	287.53	3.58
Hobson House	309,458	87.96	1.09
City Homes South	94,548	28.19	0.35
TOTAL	2,449,742	717.26	8.92

3.9% compared to our 2014/15 baseline. It is proposed that we will dispose of Hobson House, Mill Road Depot and 89 Cherry Hinton Road, which were responsible for emissions of 404 tCO₂e in 2014/15, which represented a total of 5% of the Council's carbon emissions. This suggests that overall, a combination of the transformation programme and rationalisation of our office accommodation could lead to a reduction in our emission of 8.9% on 2014/15 levels.

5.4 While disposing of these sites will lead to an overall reduction in our office and operational estate, in practice the reduction in our emissions achieved through the Office Accommodation Strategy may be less than 8.9%. This is because:

- Staff in Hobson House will be relocated predominantly into Mandela House, while staff at Cherry Hinton Road will be

relocated to Arbury Road. This is likely to lead to some increase in energy usage at Mandela House and Arbury Road, which will offset some of the reduction achieved by disposing of Hobson House and Cherry Hinton Road.

- Refuse staff and the Garage service based at Mill Road will relocate to the Shared Waste Service Site at Waterbeach, while other Mill Road-based services will relocate to new facilities at the Cowley Road site by March 2017. We do not currently have energy consumption data for these sites, so it is difficult to estimate the impact on our total carbon emissions.
- Some staff in new shared services will relocate to Shared Service offices in partner organisations.

6: Measuring the impact of the Carbon Management Plan

- 6.1 In keeping with the approach recommended by the Department for Energy and Climate Change, we will continue to monitor energy usage and carbon emissions from all sites where the Council pays and are responsible for the energy bills. We will gather data for all these sites, using visual meter readings and half-hourly data from Automatic Meter Readers (AMRs) where installed. We will publish total energy usage and carbon emissions figures annually in our Greenhouse Gas Report.
- 6.2 We will measure any reductions in our energy usage and greenhouse gas emissions against the baseline year for this plan, which is 2014/15. In 2014/15 our total greenhouse gas emissions were 8,041 tonnes of CO₂ Equivalent (CO₂e). This equates to 62.6 kg¹⁶ of CO₂e per resident of Cambridge City.
- 6.3 For each of the projects included in Appendix B, we have provided estimated figures for costs, financial savings and carbon reductions. We have sought to calculate these figures as accurately as possible, but experience from delivering our first Carbon Management Plan demonstrates that as projects are worked up in detail and proceed to implementation, these figures may need to be refined. It is estimated that these projects will cost a total of around £1.72m, deliver annual financial savings of more than £90,000, and reduce our carbon emissions by a total of almost 500 tonnes of carbon dioxide equivalent (tCO₂e).
- 6.4 It should be noted, however, that the actual amount of energy and fuel used at Council sites, and therefore the financial and carbon savings that are realised, may increase or decrease from year to year as a result of other factors. These could include: changes in usage of buildings; changes to service levels; unseasonal variations in weather; or increases in energy costs beyond those already budgeted for.
- 6.5 For this reason, the total estimated financial savings should be viewed as 'cost avoidance', because, depending on circumstances, they may mitigate any increase in our costs rather than result in a net reduction on expenditure. However, where tangible financial savings are achieved, these will be recouped through the Council's budget process.
- 6.6 Similarly, the carbon savings from carbon reduction projects could be seen as 'carbon avoidance' rather than carbon savings, because they will reduce our emissions from what they may have been otherwise, but may not necessarily deliver an annual net reduction in our carbon emissions. However, overall we would expect that the investment we are proposing in carbon reduction projects, together with wider changes in the way the Council delivers services in the future, should lead to a net reduction in our carbon emissions over the period of this plan.
- 6.7 We have set a target of reducing carbon emissions from the Council's estate and operations by 15% from 2014/15 levels by the end of 2020/21, with an aspiration to reduce emissions by 20% over this period. This would be achieved through a combination of:
- the carbon reduction projects identified to date, which could reduce our carbon emissions by around 6% compared to 2014/15 levels;

16 A population estimate of 128,515 has been used based on midyear census information, released June 2015.

- further carbon reduction projects to be identified over the next five years as this plan develops (see 4.9 above for further details); and
- the impact of rationalising our office accommodation and operational estate,

which could reduce our carbon emissions by up to 8%. This will depend on how reduction in energy usage through disposing of assets is offset by increases in energy usage at existing sites and energy usage at shared service partner sites.

Appendix A

Carbon Reduction Projects delivered between 2011/12 and 2015/16

2011/12

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Community centres						
Community Centre energy efficiency improvements	£9,800	£9,800	-	7	£1,100	8.9
Swimming pools						
Pools energy efficiency improvements – Parkside Pools changing areas	£40,000	£35,000	£5,000	40	£10,300	3.9
Car parks						
Grand Arcade Annex Car Park LED lighting	£100,000	£100,000	-	121	£15,366	6.5
Sheltered Housing						
Brandon Court energy efficiency measures	£440,000	£0-	£440,000	42	£6,540	67.3
Brandon Court – solar PV	£130,000	-	£130,000	12	£5,840	22.3
Crematorium						
Crematorium Heat Recovery project	£23,145	£11,600	£11,545	22	£2,629	8.8
Fleet						
Install electric bin lift on replacement refuse vehicle	£5,000	-	£5,000	3	£1,322	3.8
Offices						
Replace boiler at Llandaff Chambers	£28,966	-	£28,966	53	£8,578	3.4
Temporary Housing						
Solar PV installation at New Street Hostel	£23,600	-	£23,600	2	£1,506	15.7

2012/13

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Swimming Pools						
Implement RHI technologies - Non-housing properties	£143,833	-	£143,833	16	£10,800	13.3
Abbey energy efficiency improvements (VSD and BEMS)	£46,000	£24,650	£21,350	137	£20,200	2.3
Cherry Hinton Village Centre Changing Room Refurbishment	£20,000	-	£20,000	24	£3,550	5.6
Jesus Green and Kings Hedges energy efficiency improvements	£23,300	-	£23,300	26	£3,950	5.9
Pool covers for Abbey, Parkside and Kings Hedges Learner Pool	£42,600	£23,270	£19,330	70	£11,400	3.7
Parkside energy efficiency improvements (VSD and BEMS)	£42,640	£42,640	-	136	£20,000	2.1
Corn Exchange						
Corn Exchange – upgrade to LED house lighting	£39,652	£25,700	£13,952	31	£4,500	8.8
Offices						
Mill Road Depot – upgrade to condensing boilers; heating optimum start controls; and pipework inspection and insulation	£33,394	-	£33,394	10	£1,560	21.4
Fleet						
Route optimisation for refuse trucks (HGVs)	£15,000	-	£15,000	TBC	TBC	TBC
Install stop/start technology on 12 replacement light commercial vehicles	£2,100	-	£2,100	1	£1,329	1.6

2013/14

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Sheltered Housing						
Upgrade lighting and install lighting sensors at Stanton House.	£7,000	-	£7,000	3.3	£600	11.7

2013/14 continued

Car Parks						
Voltage Optimisation roll out - Grafton East Car Park	£13,921	£13,921	-	13.8	£2,100	6.6
Upgrade to LEDs in Grafton West Car Park	£30,000	£30,000	-	17.0	£3,132	9.6
Offices						
Voltage Optimisation roll out - Mandela House	£21,960	£21,960	-	20.8	£3,800	5.8
Hobson House Boiler	£42,000	-	£42,000	4.1	£660	63.6
Other						
East Road Garages lighting upgrade	£13,581	-	£13,581	11.7	£1,935	7.0
Community Centres						
Replacing 2 boilers at The Meadows Centre with more efficient types	£12,000	-	£12,000	4.0	£600	20.0

2014/15

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Corn Exchange						
Heating Controls in foyer	£8,213	-	£8,213	1.9	£2,000	4.1
Swimming Pools						
Cherry Hinton Village Centre - Solar PV	£15,072	-	£15,072	4.9	£2,332	6.5
Kings Hedges Learner Pool - Heat Pumps	£24,522	-	£24,522	33.2	£10,063	2.4
Abbey Pools - Voltage Optimisation	£19,874	-	£19,874	41.0	£8,226	2.4
Parkside Pool - Combined Heat and Power (CHP) Refurbishment	£19,750	-	£19,750	176.1	£25,000	0.8
Abbey Pools - LED lighting upgrade	£19,606	-	£19,606	29.9	£7,384	2.7
Pools - Awareness Raising Campaign	£1,000	-	£1,000	40.0	£4,500	0.2

2015/16

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Community centres						
Installing 10kw solar PV installation at the Buchan St Neighbourhood Centre	£16,000	-	£16,000	1.1	£1,200	13.3
Crematorium						
Installing LED lighting at the Crematorium	£2,000	-	£2,000	1.2	£250	8.0

2015/16 continued

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Sheltered Housing						
Installing lighting sensors at Whitefriars sheltered housing	£8,000	-	£8,000	2.4	£500	16.0
Installing lighting sensors and replacing communal lighting with LED lighting at School Court sheltered housing scheme	£8,000	-	£8,000	2.4	£500	16.0
Replacing communal lighting with LED lighting at Stanton House Sheltered Housing	£8,000	-	£8,000	2.4	£500	16.0
Commercial Property						
Replacing hallway lighting with LED lighting and reducing the total number of lamps in the entrance area at Orwell House Enterprise Centre	£400	-	£400	1.2	£250	1.6
Provide alternative hot water provision at Orwell House	£7,000	-	£7,000	3.1	£500	14.0
Offices						
Replacement of the air conditioning system at Mandela House and upgrade to more energy efficient system	£160,000	-	£160,000	TBC	TBC	TBC
Community Centres						
Replacing the remaining boilers at The Meadows and Ross Street community centres to condensing boilers	£26,000	-	£26,000	18.5	£3,000	40.0
Swimming Pools						
Replacing boiler at Abbey Pools	£30,000	-	£30,000	6.2	£1,000	30.0
Replacing boiler at Cherry Hinton Village Centre	£5,000	-	£5,000	1.2	£200	25.0
Fleet						
Replacing 20 fleet vehicles with alternative with stop-start technology (progressive programme since 2012)	£2,100	-	£2,100	3.3	£2,500	0.8

TOTAL: 2011/12 to 2015/16

	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Totals for all schemes	£1,730,029	£338,541	£1,391,488	1,198	£213,202	8.1

Appendix B

New Carbon Management Plan projects

2016/17

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Office Buildings						
The Guildhall - Replacement of roofing and additional insulation	£150,000	-	£150,000	18.5	£3,000	50.0
The Guildhall - Install 20kW solar photovoltaic system	£30,000	£30,000	-	9.4	£2,000	15.0
North Area Housing Office - Improve boiler controls. Measures could include optimum start controls or heating sequencing	£1,000	-	£1,000	1.2	£200	5.0
Car Parks						
Grand Arcade Main Car Park - Replace existing lighting with LED.	£189,227	£189,227	-	165	£27,307	6.9
Grafton East Car Park - Replace existing lighting with LED.	£131,771	£131,771	-	116.4	£18,856	6.9
Community Centres						
Meadows Centre - Lighting improvements, including replacing hallway and other lighting with LED equivalent, and installing PIR motion sensor controls to lighting in hallways and meeting rooms.	£8,500	£8,500	-	7.3	£1,500	5.7
Buchan Street Neighbourhood Centre - Replace lighting with LED lighting	£4,000	£4,000	-	1	£200	20.0
Crematorium						
Upgrade loft insulation	£1,000	£1,000	-	0.6	£100	10.0
Sheltered Housing						
School Court - Replace existing heating systems with separate communal and flat heating systems	£150,000	-	£150,000	12.2	£2,000	75.0

2016/17 continued

Sheltered Housing (continued)

Replace communal lighting with LED equivalent at sheltered housing schemes, including School Court, Rawlyn Court, Ditton Court and Mansel Court	£30,000	-	£30,000	14.5	£3,000	10.0
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Swimming Pools

Abbey Pools - Adjustments to hot water system to allow excess heat generated by the existing solar thermal system to be used to heat hot water for showers	£45,000	-	£45,000	TBC	TBC	TBC
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Temporary Housing

New Street hostel - Install external wall insulation	£50,000	-	£50,000	12.2	£2,000	25.0
Lighting improvements, including: <ul style="list-style-type: none"> • replacing communal lighting with LED equivalent at New Street hostel, • installing PIR motion sensor controls to hallway lighting at New Street, • replacing kitchen lighting with LED equivalent at 116 Chesterton Road 	£4,000	-	£4,000	0.8	£500	8.0

2017/18

<i>Project</i>	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Office Buildings						
Guildhall - Replace existing lighting with LED and combined motion/light sensors	£50,000	£50,000	-	32.3	£5,000	10.0
Guildhall - Improvements to warm air heating system to Council Chamber. Large hall & small hall, sessions court - works to fans/ control systems, addition of heat recovery devices	£200,000	-	£200,000	-	£6,000	30.0
Mandela House - Replace existing lighting with LED and combined motion/light sensors	£50,000	£50,000	-	24.2	£5,000	10.0

2017/18 continued

Office Buildings (continued)						
Mandela House - Upgrade to condensing boiler and pipework and valve insulation	£60,000	£9,000	£51,000	15.4	£2,500	24.0
Sheltered Housing						
Stanton House - Replace existing heating systems with separate communal and flat heating systems	£150,000	-	£150,000	12.2	£2,000	75.0
Vehicle Fleet						
Replacement of fleet vehicles, including 7 electric vans and 6 fuel efficient vans and trucks	£420,000	-	£420,000	TBC	TBC	TBC
All Sites						
Ensure that programming of heating systems at all sites reflects current building usage patterns	Staff time	-	-	30.7	£5,000	1.0
Energy efficiency awareness campaigns, e.g. switch off campaigns	Staff time	-	-	24.2	£5,000	1.0
Building manager energy efficiency training	Staff time	-	-	27.5	£5,000	1.0

TOTAL: 2016/17 to 2017/18

	<i>Cost</i>	<i>Climate Change Fund contribution</i>	<i>Contribution from other sources</i>	<i>Estimated annual carbon savings (tCO₂e)</i>	<i>Estimated annual financial savings</i>	<i>Financial payback (years)</i>
Totals for all schemes	£1,724,498	£473,498	£1,251,000	525.6	£96,163	17.9



To learn more about what the Council is doing to address climate change, visit www.cambridge.gov.uk/climate-change or email sustainablecity@cambridge.gov.uk.

