The Carbon Plan 2020-2025

Reading Borough Council – our pathway to net zero Carbon

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1. Introduction

The use of energy, water and other natural resources is essential to the operation of Reading Borough Council and in providing services to the community. Whilst vital to the functioning of the organisation, it is crucial that our use of energy and water is managed and minimised to reduce our impact on the environment, limit our expenditure and mitigate our exposure to insecure energy supplies and limited water resources.

The use of certain types of energy directly, or indirectly, produces greenhouse gas emissions, typically in the form of carbon dioxide, such as from the combustion of natural gas in boilers, or from combustion of gas in power stations generating electricity for the National Grid. Greenhouse gases are a main factor is causing man-made climate change, which is having, and will in the future have, a significant impact on our way of life and the world around us. By limiting our energy and water use and thereby restricting our carbon emissions we are helping to safeguard our world for future generations. The urgency and importance of doing so was underlined by the Council's declaration of a climate emergency in February 2019, committing to the ambitious goal of a net zero carbon Reading by 2030.

The Council's Carbon Plan sets out our policy and targets on corporate energy and water management, and identifies actions to achieve these within the time period 2020-2025. The plan includes actions to ensure the authority is compliant with relevant legislation (such as Energy Performance in Buildings legislation) and national reporting requirements (such as Greenhouse Gas Protocols). The Plan will assist the council in making energy and water management an integral part of its decision-making processes, to ensure efficient use of these resources today and in the future.

Crucially, the implementation of the Plan will:

- Contribute to the Corporate Plan aim to 'Build a Council fit for the future' by improving the efficiency of our operations and minimising costs
- Deliver many of the Council's commitments as set out in the Reading Climate Emergency Strategy 2020-25
- Enable the Council to lead by example as we encourage Reading businesses, organisations and residents to reduce their own environmental impacts.

An assessment of 'value at stake' showed that by basing our carbon reduction investments on robust business cases, the council has avoided energy costs of around £11 million since 2008/09, including some £1.5m in 2018/19 alone.

Looking ahead, the estimated 'value at stake' by 2025/26 is £1.5m for buildings alone – this is summarised in figure 1.1 below.

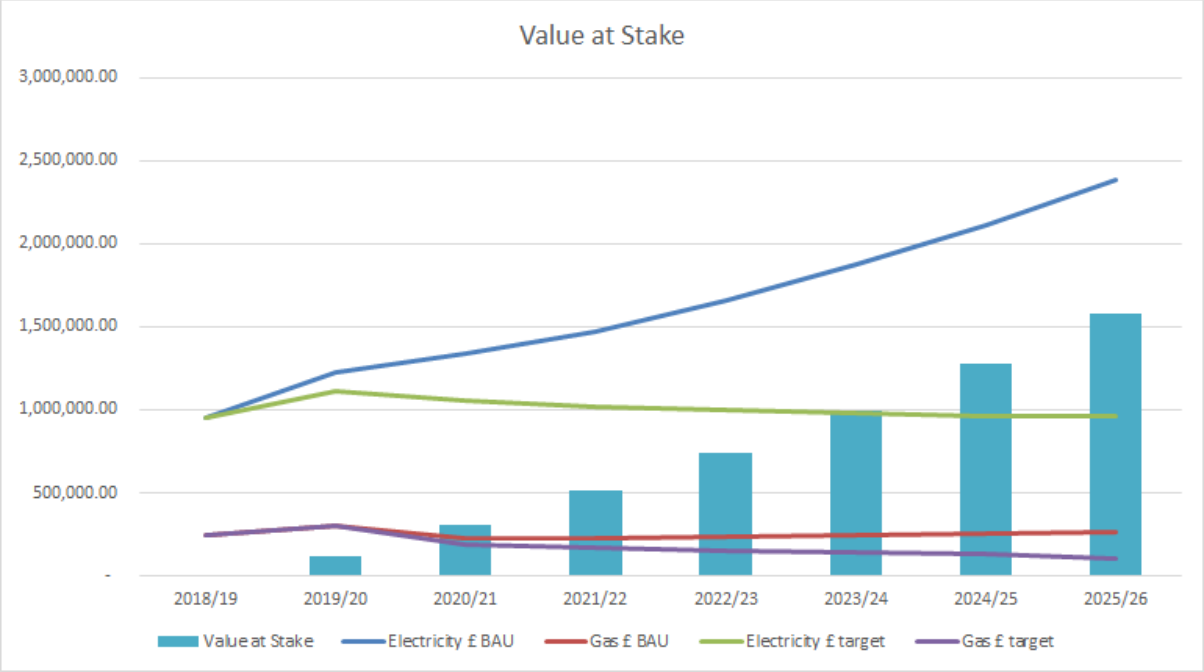

Figure 1:1 – value at stake (£) over the course of 2020-25 Carbon Plan (buildings only)

2. Our Vision and Ambition

In February 2019, Reading Borough Council declared a Climate Emergency and set out on a journey to achieve a carbon neutral borough by 2030.

A key element of this vision was the that the Council would lead by example to bring about the changes needed. It is therefore important that the Council shows that it can make meaningful progress towards being zero carbon in its operations by 2025. Our vision for the Council in this Carbon Plan is therefore to:

> *'lead by example and work in partnership towards achieving net zero carbon operations by 2030'.*

Setting ambitious yet realistic targets for carbon reduction and renewable energy generation by 2025 will be important to keep us on track to the ultimate goal of becoming a net zero organisation by 2030.

The Carbon Plan 2020-25 will work towards four headline targets as follows - by 2025 we will:

- Reduce the organisation's carbon emissions by 85%, against a 2008/9 baseline[1]
- Generate equivalent to 50% of our energy from renewable sources by 2025[2]
- Reduce our use of fossil fuels by 50%, against a 2008/09 baseline[3]
- Achieve a 5% p.a. reduction in water use against a 2019/20 baseline.

By achieving these targets Reading Borough Council will be on track to meet its challenging ambition of becoming a net zero carbon organisation by 2030.

[1] By 2018/19 RBC had achieved a 63% reduction in carbon emissions against a 2008/09 baseline – to reach 85% by 2025 will involve almost halving our current energy use

[2] By 2018-19 RBC was generating c.10% of its energy needs from renewable sources so while a 50% target is ambitious this will be 50% of a much smaller total energy demand in light of the demand reduction measures set out within the Plan

[3] A Policy Committee resolution [reference] requires inclusion of a fossil fuel reduction target in this Carbon Plan - the ability to achieve the proposed fossil fuel reduction target of 50% is, however, heavily dependent on switching the Refuse Collection Vehicle Fleet to EV, which is currently the subject of ongoing feasibility study. In the event that a switch to EV proves impossible during the period of this plan (e.g. for technical reasons), it is unlikely that this target will be met. While this would also make the achievement of the headline 85% carbon reduction in the Plan target more challenging, it would remain within reach assuming that the shortfall could be made up from other areas of our corporate carbon footprint.

3. Managing our resources – progress to date

Since Reading Borough Council signed the Nottingham Declaration on Climate Change in 2006 the authority has undertaken a wide range of work to address energy, water and carbon management, focusing on reducing costs, limiting its impact on the environment, decarbonising our energy supply and integrating these approaches across the organisation. In the last five years, the organisation has been working on the actions set out in the Carbon Plan 2015-20 to achieve a carbon emission reduction target of 50% by 2020, against the 2008/9 baseline.

Reading has a strong track record on carbon emissions reduction, being amongst the top ten boroughs in the Country for reductions since 2005, totalling 228kT CO_2 or 52% of Reading's total reductions. In the latest year for which data is available (2018/19), Reading was 4th out of all the English local authorities by this metric.

During the same period Reading Borough Council has reduced its own emissions faster than the borough with reductions of 63% in the decade from 2008 to 2018, achieving the 50% reduction target in the Carbon Plan 2015-20 three years early.

Reading Borough Council's current corporate energy use is principally through electricity and gas, for buildings and street lighting, with a small volume of fuel oil for heating buildings, with the cost in 2018/19 totalling over £1.8m.

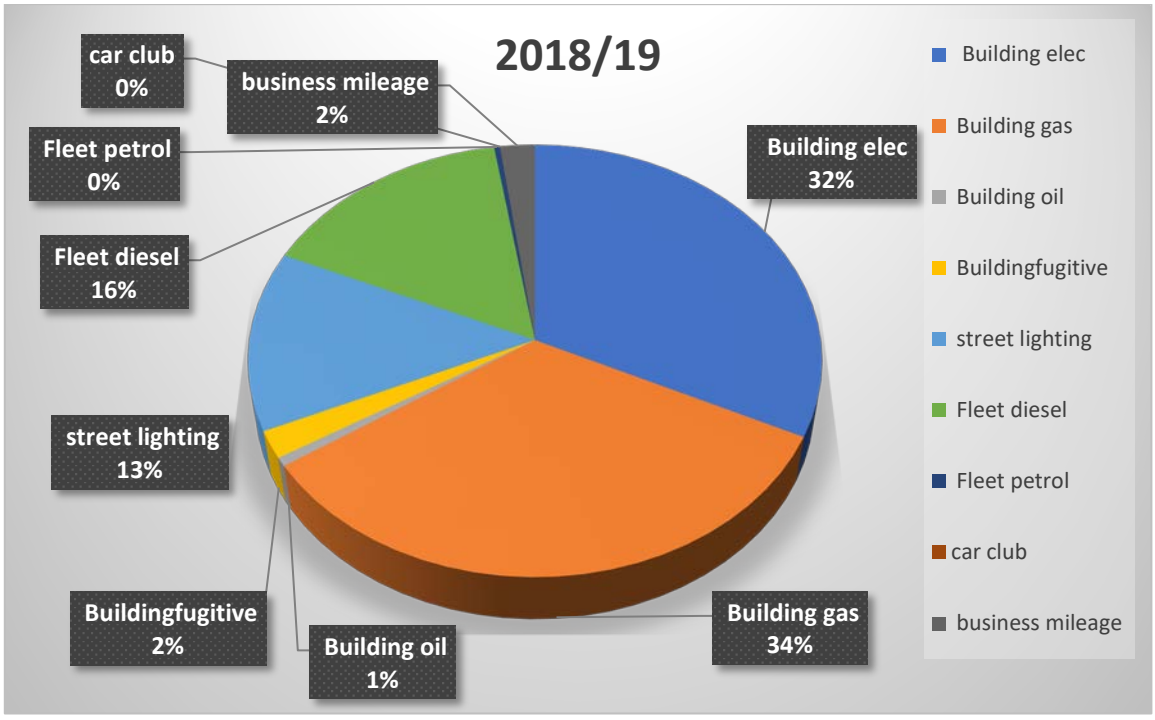

Figure 3.1: Breakdown of Reading Borough Council carbon footprint, 2018/19

The carbon emissions from energy used in buildings accounted for 68% of the Council's carbon footprint in 2018/19, as shown in Figure 3.1 above. Carbon emissions from street lighting have reduced as a proportion of the total since 2008/09. Other energy is used to fuel cars for the RBC fleet and business travel,

which now accounts for a higher proportion of the carbon footprint as emissions from other sectors have been reduced - up from 10% in 2008/9 to 18% in 2018/19.

Unit prices for energy have gradually increased over the last six years, so although energy use in kWh has decreased by nearly 50% since 2008/9, spend on energy has remained relatively stable.

Carbon emissions reduction over the last 10 years has mainly been achieved through reductions across the building and street lighting estate. Reduction in building energy use has accounted for nearly three quarters of the total emissions reduction, whilst street lighting changes are credited with 20% of the total emissions savings, as illustrated in Figures 3.2 & 3.3 below.

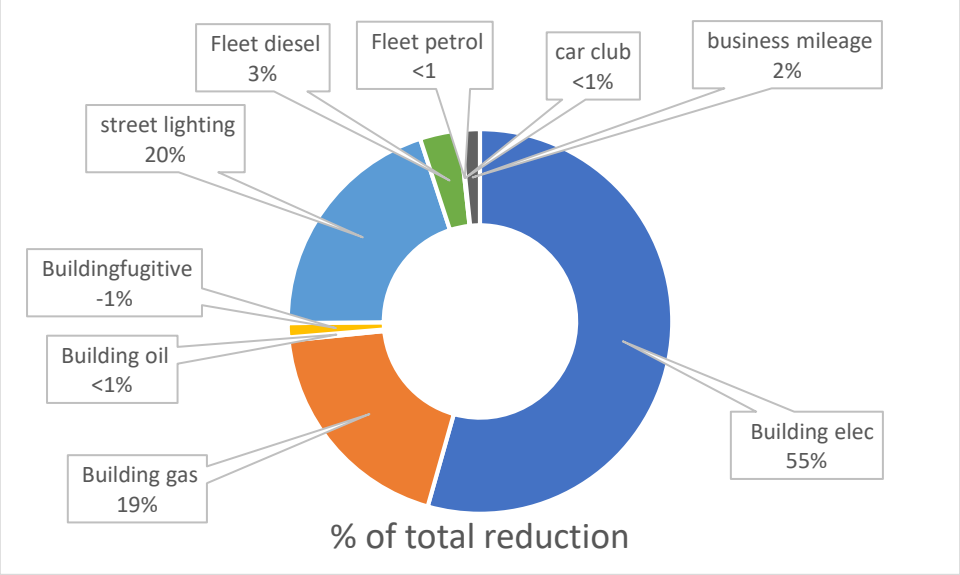

Figure 3.2: breakdown of RBC emissions reduction achieved over the last decade

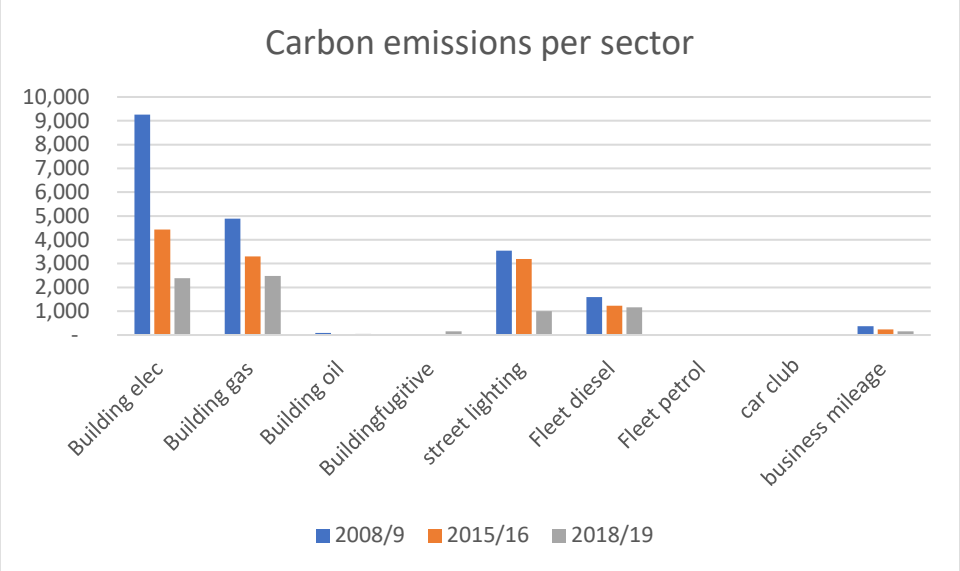

Figure 3.3: change in RBC emissions by source since 2008/09

Areas where the most significant progress in reducing emissions has been made, and a summary of how these have been achieved, are summarised below:

Street lighting

The entire street lighting estate, totalling over 13,000 units, across Reading Borough has been upgraded to LED, resulting in over 50% reduction in electricity consumption, and the ability to have greater remote control of the lighting.

Buildings

The carbon reductions within buildings can be attributed to numerous projects. The Building Rationalisation strategy followed over the last 7 years, resulting in the disposal of assets, relocation and co-location of services into buildings with a higher intensity of use, has reduced the overall demand for energy across the organisation. The key buildings to account for this include the (old) Civic Offices, Central Pool, Arthur Hills Baths and smaller libraries and community centres.

Building refurbishment has been key in the Building Rationalisation programme, where services are brought together in a new hub. Significant investment in energy efficiency measures, principally through Salix funding, has been made in a 'whole building' approach to the refurbishment of the Civic Offices, Reading Town Hall, and 19 Bennet Road depot building. Energy saving measures include insulation, LED lighting and controls, heating upgrades, electrification of heat and solar pv.

Additional Salix funds have been invested in smaller building projects across the council estate, totalling 101 projects, and £1.4m investment.

Renewable energy

To date the Council has installed over 7,500 solar panels on 40+ council, community and school buildings, and 457 houses. In 2018/19 the systems generated 1.6 MWh of electricity, the equivalent to powering over 400 houses with 100% of their electricity needs. The Civic Offices now hosts the Council's largest solar panel system with 572 solar panels, generating an estimated 10% of the building's electricity. Most recently, a roof mounted solar P.V. system was installed at 19 Bennet Road. This represents the first phase of renewable onsite generation at the depot.

Travel & transport

Within the last 5 years, the Council has invested in nine electric vehicles with associated charging points. Investigations are ongoing to establish the best route for full electrification of the vehicle fleet.

4. The Council's route to net zero carbon

In pursuing a successful carbon reduction strategy to date, the Council has focused on schemes offering the best return on investment. While this will continue, it is inevitable that additional carbon reductions and the associated returns will be more challenging to achieve as we approach net zero – the 'low-hanging fruit' has been harvested requiring us to reach higher for future reductions.

To guide us we have structured this Carbon Plan around the actions set out by the Committee for Climate Change in its July 2019 report 'Reducing UK emissions: Progress Report to Parliament'. This identifies four key themes over the next five years to drive further and deeper carbon emissions reductions, and by adopting these we can position the organisation to achieve net zero carbon by 2030 through innovation in demand side management, renewable generation and energy storage solutions.

Policy statement

Reading Borough Council is committed to working to reduce its energy use, Greenhouse Gas emissions and water use across its estate and operations, and to make energy, carbon and water savings an integral part of the everyday decision-making process. Reading Borough Council is dedicated to substantially reduce its dependence on fossil fuels to reach net zero carbon by 2030 and diversify its range of energy supplies, thereby reducing the organisation's exposure to the volatility of the energy markets, limited water resource availability and the financial risks from price fluctuations. We are committed to invest in the generation of renewable energy, to supply energy to both our council operations and our surrounding community. We will ensure that the necessary systems and processes are in place to allow continuous improvement in the council's operations, through effective monitoring and management of energy and water use.

Targets

We will reduce RBC's carbon footprint by 85 % by 2025, and aim for 100 % by 2030, against a 2008/9 baseline, to include provision of sufficient renewable energy to meet net zero carbon emissions by 2030.

To meet these 2025 targets, on an annual basis we will need to reduce RBC's energy use by an average of 4.4% per year, and double our renewable energy generation every two years such that we are generating 50% of our energy from renewable sources by 2025.

We will also adopt a fossil fuel target to reduce our diesel and petrol consumption by 50% by 2025.

In addition, we will seek to reduce our water consumption by 5% per annum against a 2019/20 baseline.

Measuring progress

The Council measures its emissions using the internationally accepted annual reporting process known as the Green House Gas (GHG) emissions reporting protocol. This is carried out in respect of the emissions for which we have control (known as Scope 1&2), but also for managed services, emissions from which are not in our direct control (known as Scope 3). We also monitor the emissions of community schools. The Council will continue to monitor and manage its carbon emissions through the GHG reporting protocol.

We will review progress against our aims and targets annually, reviewing the Policy & Strategy after 3 years and developing a new strategy for the 2025-2030 period as we approach this phase of our journey towards net zero carbon.

Pathway towards net zero carbon – our four key aims

Led by the priorities set out by the national Committee on Climate Change, this Carbon Plan is structured around the following four aims:

i) REDUCE - we will reduce our energy demand through energy efficiency measures, asset disposal and other measures to reduce demand

ii) DECARBONISE – we will reduce emissions from ongoing activities via electrification of heating and vehicle fleets

iii) GENERATE – we will install further renewable energy capacity to meet a higher proportion of our own needs

iv) SMART – we will align consumption with generation, adopting new technologies to help balance changing patterns of supply and demand

4.1 REDUCE

4.1.1 The pathway to reduce energy demand

The first stage of an energy management and carbon reduction strategy is to reduce demand for energy and to make the use of energy as efficient as possible. The biggest reductions to date have been following these principles. Further focussed action needs to happen across the Council's building, street lighting and vehicle estate.

Ensuring that we keep our building, street lighting and vehicles estate under constant review, and rationalising it to ensure that we retain only those assets needed for the operation of services, will help limit our energy demand. Energy efficiency technologies can then be installed in retained assets; including, for example, LED lighting and controls, insulation, heating controls, improved glazing, reduced solar gain and 'A'-rated electrical equipment.

All full building refurbishments and new builds need to be to a high standard of energy efficiency, to ensure long term energy inefficiencies are not engrained from the outset and to avoid the cost of any future retrofit. More efficient technologies are always being produced and where possible we will make investments to ensure that we operate the most energy efficient equipment and plant whilst ensuring that we procure at the right times to avoid unsustainable waste. Additionally, cross-organisation awareness-raising and training will help to make the use of buildings and equipment as efficient as possible.

The following section summarises the principal actions which the council will take to 'Reduce' carbon emissions by 2,987 tCO_2, or 15.1% against the 2008/09 baseline. Figures 4.1 and 4.2 below illustrates these savings graphically.

- Rationalisation of building estate: based on the known or likely building disposals, carbon emissions savings are predicted to be 878 tCO_2, or a further 4.4 % against the 2008/09 baseline. There are significant additional opportunities to make savings within this area, ensuring that the organisation is maximising the use of the most efficient facilities and disposing of inefficient assets. Energy efficiency needs to be a central consideration for development of our asset strategy.
- Dimming & trimming, and inventory update of street lighting: by updating and correcting the street lighting inventory, upgrading remaining assets, along with instituting a 'dimming and trimming' regime across specific areas in Reading, it is estimated that 459 tCO_2 can be saved, or 2.3 % against the 2008/09 baseline.
- Building lighting: within the retained estate, building energy use needs to be addressed. LED technology has developed significantly since the Council first installed it over 10 years ago. All buildings should have the lighting upgraded, and controls installed where appropriate. Typical energy savings from LED lighting range from 40-80%, which in combination with reduced maintenance

costs and longer lamp life can bring significant savings. By upgrading the remaining lighting across all buildings by 2025, it is estimated that 249 tCO_2 saving will be made, or a further 1.3% against the 2008/09 baseline.

- Building small power improvements: electrical equipment, such as monitors, printers, fridges and phone chargers, within buildings when at end of life should be upgraded to the most energy efficient versions possible. Energy ratings should be a central point of consideration when electrical equipment is being procured. By making these improvements across the entire building estate, it is estimated 115 tCO_2, or 0.6% savings are made by 2025.
- Heating demand reduction through building envelope improvements and building cooling and heating improvements: ageing buildings built and/or refurbished when standards were lower than today tend to have high heat loss and therefore higher demand for heat than necessary. By improving the building envelope, heat losses and gains can be significantly reduced thereby reducing the energy needed for heating or cooling. This can be achieved by installing building insulation, improving glazing, insulating pipework and draught sealing buildings. In combination with upgrades to heating and cooling systems and their associated controls, reductions to the carbon footprint will total 526 tCO_2, or a further 2.7% against the 2008/09 baseline.
- Awareness raising: ensuring every member of staff is aware of the need for efficient use of energy, and understands the actions they can take as an individual to reduce their consumption, is predicted to result in 267tCO_2, or a further 1.4% savings against the 2008/09 baseline.
- Rationalisation and downsizing of fleet: a recent Green Fleet Review (GFR) in 2020 analysed the composition and usage of the organisation's vehicle fleet. Based on the size and mileage, the review has recommended that consideration should be given to downsizing the fleet, in particular in the Heavy Commercial Vehicle (HCV) sector. HCVs have high fuel consumption per mile, so should be limited to work which specifically requires such vehicles. The GFR recommends that replacement of HCV with smaller vehicles should be done in combination with electrification. If any HCVs can be downsized and electrified, it is estimated 393 tCO_2 can be saved, or 2% against the 2008/09 baseline, as illustrated in Figure 4.3 below.
- Efficient driving training: driver training to encourage safe and fuel-efficient driving is estimated to help contribute to 100.5 tCO_2, or 0.5 % of saving, as set out in the GFR (2020), and illustrated in Figure 4.3 below.

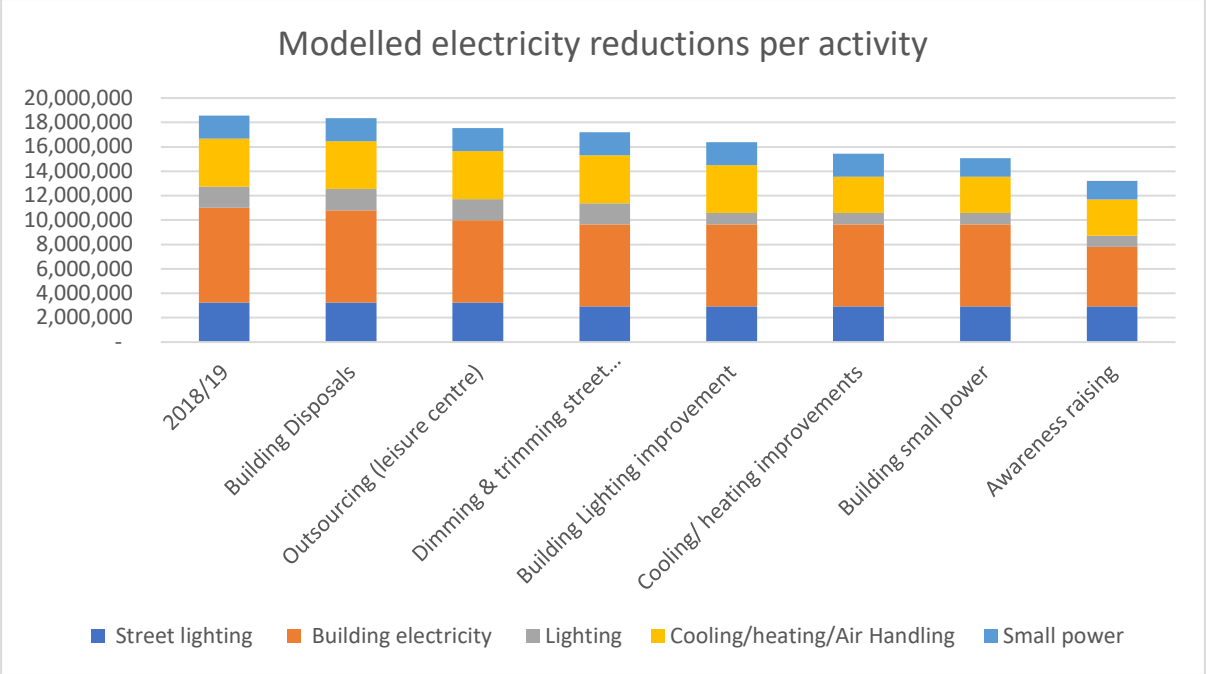

Figure 4.1: kWh electricity savings from different actions across the building and street lighting estate

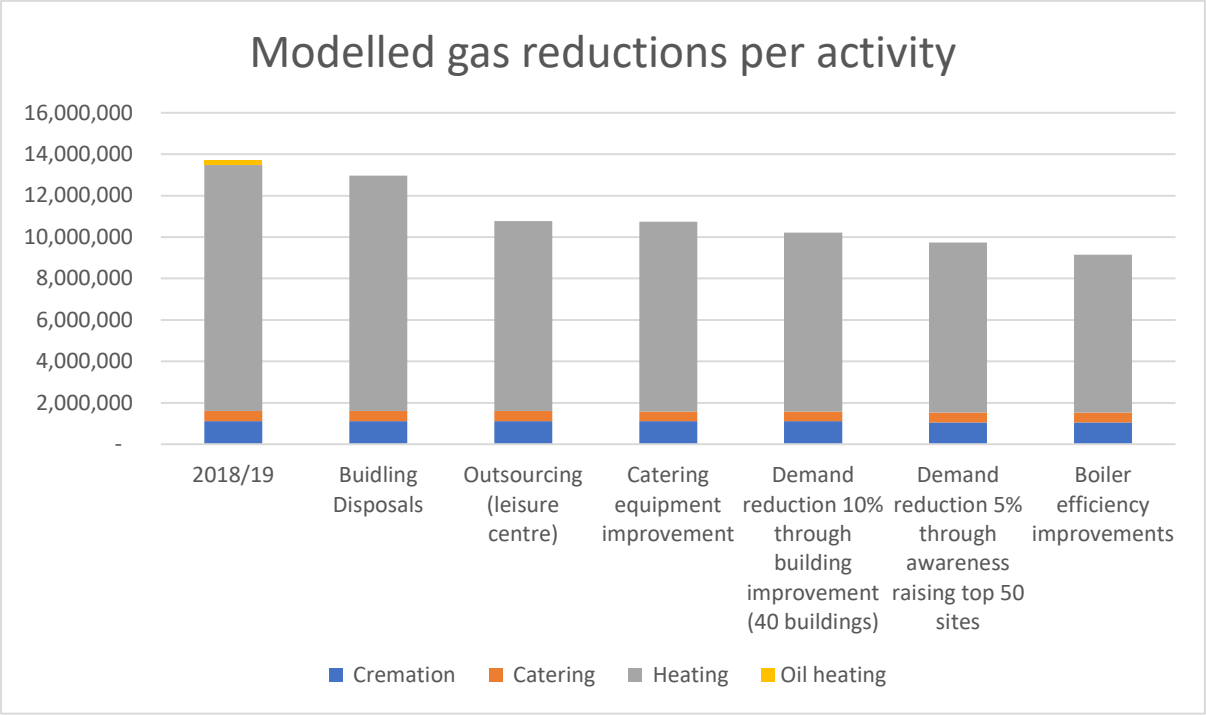

Figure 4.2: kWh gas savings from different actions across the building estate

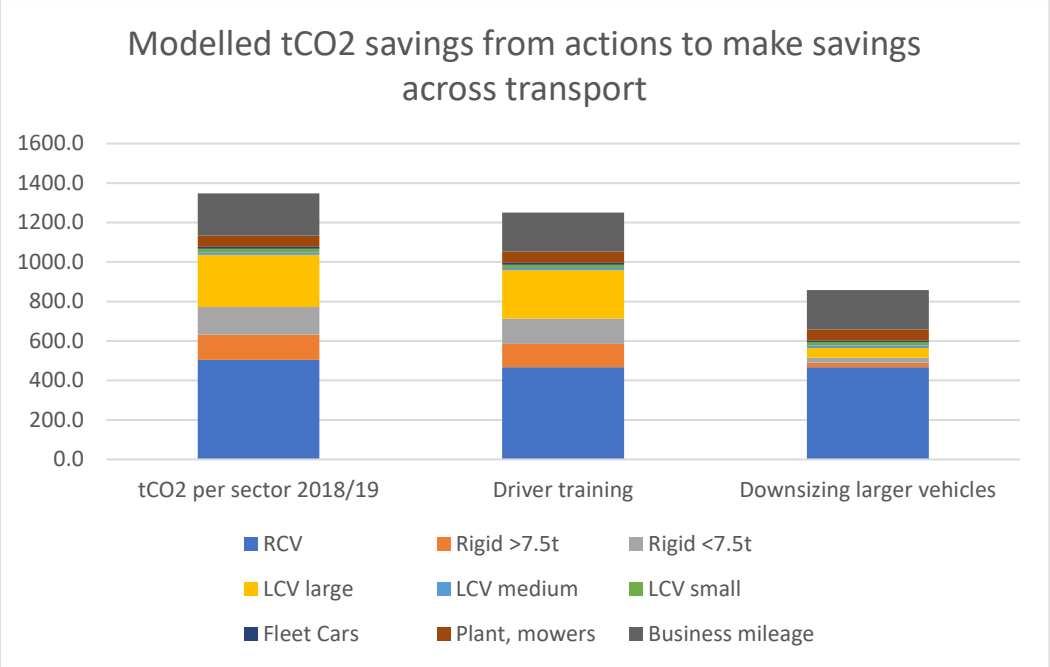

Figure 4.3: potential carbon savings from transport

4.1.2 Action plan

Sector	Action		Predicted saving tCO_2 (% reduction)	Timing
Building estate	Rationalise building estate – disposal of most inefficient assets. Energy efficiency key factor in decision-making		878 (4.4%)	TBC
	Building energy efficiency improvements; Through whole building approach, or individual upgrades	Lighting improvements	249 (1.3%)	2020-25 via Salix pipeline
		Building fabric improvements and heating upgrades	526 (2.7%)	
		Small power equipment and catering equipment – replacement with A* rated models	115 (0.6%)	
	Deep retrofit and new builds to meet or go beyond Planning and Building Regulations requirements		To be established	
	Awareness raising – Carbon literacy programme		267 (1.4%)	2021

Street lighting estate	Rationalise street lighting portfolio – inventory review and corrections	459 (2.3%)	2021
	Dimming & trimming scenarios (reducing lighting levels)		2021/2022
Fleet	Rationalise fleet and appropriate sizing of vehicle – downsizing HCV and LCV. Refer to Green Fleet Review 2020 for detail	393 (2%)	2024/25
	Driver training – safe & efficient driving	100.5 (0.5%)	TBC

4.2 DECARBONSE

4.2.1 The pathway to electrification

Buildings

In addition to reducing our energy demand as far as possible, to meet our targets we also need to reduce direct fossil fuel consumption such as our gas and vehicle fuel consumption. This means that we need to change how we heat buildings and how we fuel or power vehicles.

Gas boilers are the most prevalent means of heating buildings and up until recently, provided among the lowest carbon intensity heating technology for delivering space heating in the winter. The reason for this was that electricity generated remotely in power stations was traditionally produced using fossil fuels, and in particular carbon intensive coal fired power stations. This process of generating electricity is only about 30% efficient with much of the energy from burning the fossil fuels being lost as heat through the generation process, typically visible in the clouds of steam emitted from cooling towers at power stations. Electricity consumed in buildings in 2010 therefore had a 67% higher carbon footprint than the combustion process itself (2010 carbon intensity figures: 540gCO_2 for electricity compared to gas at 180gCO_2). Gas boilers on the other hand directly combust the gas supplied to the site via the gas network and are typically 85-90% efficient.

As electricity generation has shifted away from coal to gas and now renewable sources such as biomass, wind and solar, the carbon intensity of electricity from the National Grid has decreased significantly. With more renewable sources coming online, the carbon intensity of electricity is predicted to half by 2030, whilst natural gas carbon intensity is due to rise, as illustrated in Figure 4.4 below.

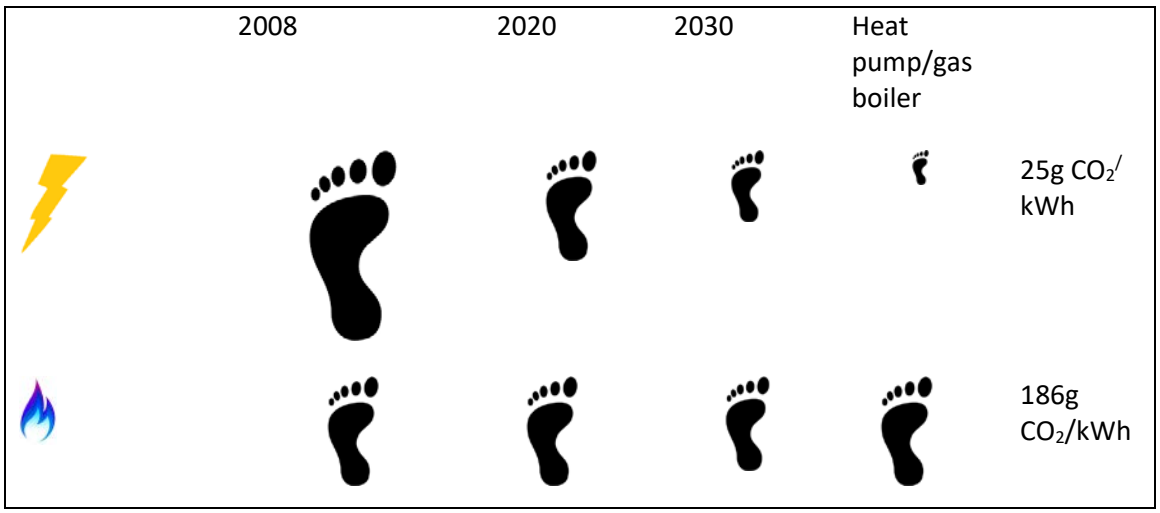

Figure 4.4: Relative Carbon footprint projections for gas vs electricity powered heat

The government, in line with the recent Committee on Climate Change report 'Reducing UK emissions Progress Report to Parliament' (2019), now advocate a move away from gas heating and towards heating by electrical means. Heat pumps are seen as the best technology to fill this gap, as they efficiently use the renewable heat from the natural environment (ground, air or water) for space and water heating. Electricity is used by the heat pump to transfer and compress heat from the natural resource and transfer it to where it is needed. Heat pumps are considered highly efficient, when designed and sized appropriately, as they can be 300-500% efficient (3-5 units of energy are produced for every 1 unit of energy put in), compared to a 90% efficient boiler.

To meet the net zero target, the authority must therefore shift its heating from fossil fuel to electrical, and principally heat pumps. This technology does prove a challenge for retrofitting given that existing heating systems are designed and sized for a very different heat generation technology (gas boilers). It is therefore essential that building heat losses are reduced to a minimum and that the heat delivery system is designed appropriately. Electrical capacity of the building and local infrastructure needs to be considered. The organisation needs to ensure that there is sufficient capacity and capability within the mechanical and electrical engineering professions to manage this transition.

To deploy this technology across the authority, it is proposed that it is introduced in phases, with a small number of key buildings in the first few years, and installed across a significant proportion of the estate by 2025, as illustrated in Figure 4.5 below.

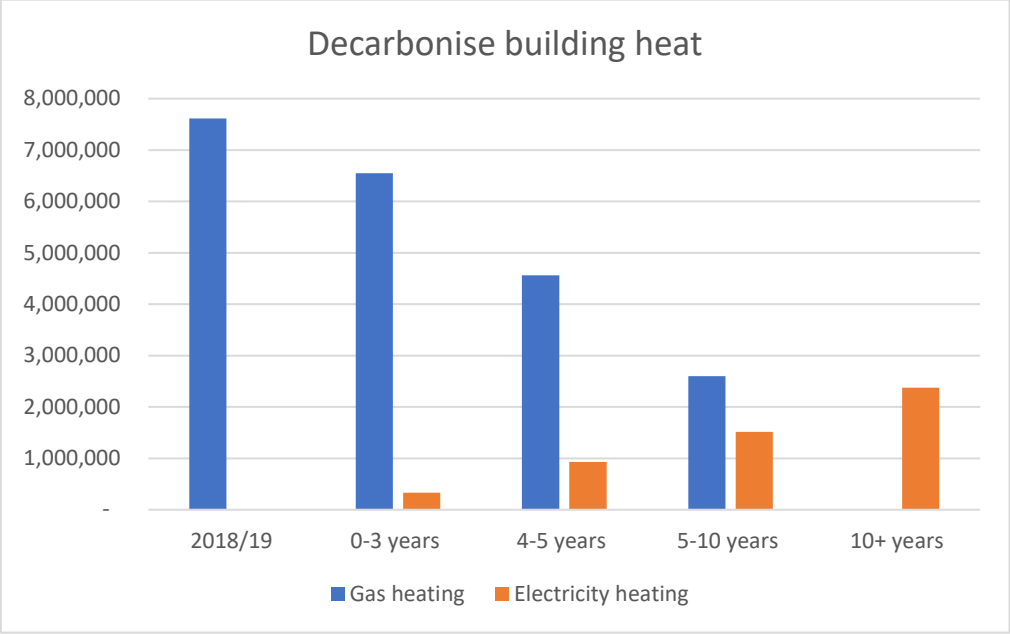

Figure 4.5: planned shift in fuel use, in kWh, following electrification of building heating

Electric vehicles

Electric vehicle technology has advanced rapidly in recent years. With no tailpipe emissions, their carbon emissions are indirect and are associated with the fuel used to generate the electricity for the powering and manufacture of the vehicles. Electric vehicles are significantly more energy efficient than internal combustion engine (ICE) vehicles and the Green Fleet Review (2020) has estimated that the energy use of an all-electric fleet would be at least 75% less than the equivalent ICE fleet.

The Green Fleet Review (2020), on the basis of these more efficient vehicles, in combination with falling carbon intensity of the grid, demonstrates that a phased electrification of the fleet would bring significant contributions to meeting the net zero carbon targets. It is estimated that an all-electric fleet would reduce energy use (kWh) by 75%, and carbon emissions by 90%, as illustrated by Table 4.1 below (GFR 2020). Furthermore, if solar electricity generation is co-located with the electric vehicle charge points, there would be the opportunity to achieve net zero by 2030.

Table 4.1: Impact of electrification of the RBC Fleet on carbon emissions and energy use, based on 2020 prices. Green Fleet Review 2020

Factor	ICE - 2019	BEV - 2030	Change	Reduction
Energy (MWh)	3,667	917	**-2,750**	**-75%**
Energy Cost (£)	£378,783	£108,768	**-£270,016**	**-71%**
GHG Emissions (t)	897	92	**805**	**-90%**

We are already approaching the point where Battery Electric Vehicles (BEVs) up to 3.5 tonnes should be less expensive to buy and run than their ICE equivalent because they will not need expensive emission control and "light-weighting" technology to meet challenging new air quality emission regulations. Over the next 5 years the cost of batteries will continue to fall and their energy density (kWh per kg) will increase. Affordable battery electric cars and vans with a single-charge range of 300 miles or more will become the norm.

BEVs have many fewer moving parts (under 80 moving parts in the drive train of a BEV and over 2,000 in a typical ICE vehicle, giving much lower service costs (experience to date in car and van fleets suggests 30% to 40% lower but some operators suggest 60% to 80% lower for some vehicle categories) and higher reliability. BEVs already have lower energy (fuel) costs; a typical electric car or small van, charged overnight on a standard tariff, costs no more than £0.04/mile or about one third the comparable ICE cost. Using off-peak tariffs BEV energy costs can be as low as £0.02/mile and private users on some tariffs (e.g. Octopus Agile) can occasionally be paid to charge their cars.

With the Refuse Collection Vehicles (RCV) fleet, consisting of 13 vehicles, making up over 37% of the organisation's transport carbon emissions, action in this sector of the fleet is a high priority. The Green Fleet Review has run initial analysis on electrifying the RCV fleet, with results showing that that the reduction in carbon emissions from using eRCVs is substantial even when charged from the UK grid. In the first phase of change over it should be at least 70% but by 2029/30 the decarbonisation of the UK grid is expected to have increased the annual reduction in GHG emissions to at least 90%.

Further detailed analysis of the fleet and the financial implications of the electrification of the fleet is needed, but initial results indicate that there would be a strong business case for the organisation to have an all-electric fleet by 2030 – and this may in any case be driven by national policy which is rumoured to be bringing forward the ban on sales of new petrol/diesel vehicles to 2030. The move to electric vehicles has significant implications for the electrical charging infrastructure at depots, offices and at employees' homes where vans may be parked overnight, and this needs to be considered when planning the fleet change over.

4.2.2 Action plan

Sector	Action	Predicted saving tCO_2 (% reduction)	Timing
Building estate	Electrify heating - Install heat pumps Phase 1 – installation of first four heat pumps in buildings Phase 2 Installation of further 5 heat pumps Phase 3 Installation of further 8 heat pumps Phase 4 Remaining buildings	568 (Phase 1 and 2)	Phase 1 2020-22 Phase 2 2023-25 Phase 3 2025-2030 Phase 4 beyond 2030
	Reducing use of flouracarbon and other GHG gases by substituting with lower GHG equivalents and or reducing size of Heating Ventilation and Air Conditioning systems	n/a (achieved via procurement)	TBC
Fleet	Electrify LCV fleet (small van fleet) Installation of 4X6 load balancing charging banks at Depot Procurement of remaining van fleets As recommendations of GFR 2020	n/a	 2022 2022 By 2025

	Procurement of further EV vans (x24) Procurement of remaining LCV van fleets (x93) As recommendations of GFR 2020	64 193 (totals 1.3%)	2021/22 By 2025
	Electrify fleet cars	TBC	
	Electrify HGV and/or consider biomethane or other options or conversions As recommendations of GFR 2020	Requires further investigation	
	Electrify RCVs – Refuse Freighters (eRCVs) – Phased replacement Phase 1 (trial eRCV vehicle)	Totals 396 (2 %)	2020/21
	Phase 2 (5 eRCVs) Phase 3 (remaining 7 eRCVs)		2021/22 2022//23

4.3 GENERATE

4.3.1 The pathway to renewable energy generation

Clean low carbon energy supply must be at the heart of a zero carbon Council strategy. The Council has installed around 7500 solar panels across its building estate to date, including social housing, and Reading's Civic Offices, which has the largest multi solar array system in Reading, with seven arrays mounted on the roof and a total of >500 solar panels. However, in order to supply the equivalent amount of energy to the electricity being used by the organisation, it must not only cover the electricity we use to power lighting and buildings, but also the energy needed for newly electrified heat and vehicle use, which currently is predominantly fuelled by fossil fuels such as gas, petrol and diesel.

This section is primarily concerned with the plan to increase the provision of renewable electricity. Whilst a key aspect of the renewable energy available locally is the heat stored in the ground, rivers and aquifers, this is dealt with in the decarbonisation section as electricity is used to run the heat pumps which rely on these sources. However, unless this electricity is from a renewable source this is not 'pure' renewable energy.

Since the Feed in Tariff subsidy was introduced in 2010, the cost of solar panel installations has reduced to around a quarter of their original price. Whilst the subsidy has been discontinued for new connections, solar panels are now cost effective without it.

In current financial modelling, solar pv systems need to be sized so that the majority of the renewably generated electricity is supplied to and used onsite, rather than being exported to the National Grid. In practice this means that solar pv system sizes are limited in capacity size to just above the electrical baseload of the building on which they are sited. When taking this into consideration with the seasonality of generation (the majority of electricity generated from solar pv systems occurring in the summer months), a problem exists in the sense that there is space available for systems which generate 'too much' electricity for use at a given site, yet this renewable electricity generation is essential for reducing the carbon emissions of the organisation and the borough. To resolve this issue, we need to work out how to shift excess electricity generation to times when it is needed such as winter evenings, when lighting and heat demands peak, yet solar electricity generation is very low or zero. There is the potential for this problem to be resolved with onsite battery storage.

Wind energy in the national network has increased dramatically due to offshore wind development and it is expected that there will be periods when very low carbon energy is available from the grid. Reading is not generally considered to be a good location for wind generation and indeed the wind turbine at Green Park is not considered to be a high 'yield' turbine. That said, wind remains a good resource in

the UK and the turbine is profitable, providing the largest single contribution of clean renewably generated energy in Reading.

Local community energy organisations in recent years have installed renewable energy assets across the county. Reading Community Energy Society (RCES) has been active within Reading, installing numerous solar pv systems across the borough. Whilst Reading Borough Council does not directly own the renewable energy assets installed by RCES, we have been involved in establishing and supporting the development of RCES and Reading Hydro. Currently the Council owns shares in both and this remains a mutually beneficial way of investing in renewable energy locally. Shares in community energy cost a very similar amount in terms of investment per tonne of carbon but offer wider benefits to the community.

Carbon dioxide emissions are defined by the Greenhouse Gas protocol which defines the emissions as direct and indirect. A host of offsetting products and 'green power' options are available on the market and these are varied in their approach. For the latter, the Council procures 100% 'green' electricity through Renewable Energy Guarantees of Origin (REGOs). Unfortunately these cannot be guaranteed to supply additional renewable energy and may utilise current renewable electricity on the grid, which has been provided through subsidy or obligation. The Council accepts the Energy Saving Trust advice on this matter and therefore does not include the notional emissions saved from this approach in its carbon accounting.

In respect of offsetting strategies, the Council takes the view that local schemes that supply communities within the borough of Reading with renewable energy and/or carbon reduction through shareholding held by the Council or through other mechanisms could be acceptable, and may have a part to play in our strategy as we approach 'net zero' and have to tackle the most difficult residual emissions in the period beyond 2025. However, offsets which lead to reductions in carbon emissions in other parts of the country or internationally are not currently considered appropriate due to the complexity of interactions with the national grid and other government policies, international conventions and Ofgem provisions, hence them not featuring in our plan for 2020-25.

To achieve net zero carbon by 2030, the organisation needs to have a generation capacity of at least 14 MWp. Currently the Council has a 2 MWp capacity. With an additional 5 MWp, the total generation output is predicted to be 5.6 MWh by 2025, which is equivalent to 48% of the organisation's total kWh energy use.

Over the next five years, the council therefore intends to follow a hierarchy of sourcing electricity generation, as illustrated in Figure 4.6 below.

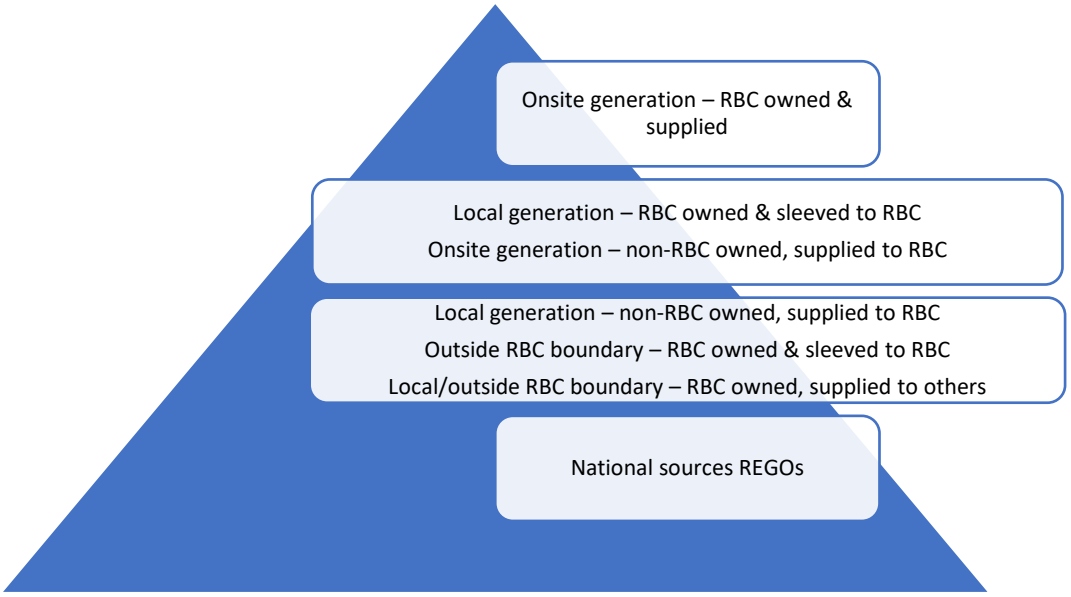

Figure 4.6: Hierarchy of renewable energy generation, with onsite, RBC owned and supplied being the optimal option

4.3.2 Action plan

Sector	Action	Tonnes p.a. of CO_2	Timing
Solar pv	Solar array – Bennet Road depot 228kWp	34	2021
	Solar farm Smallmead (location TBC)	119	2022
	Investment in off-site generation – Reading Bus Depot	17	2021/2022
	Install solar onto Council housing 1000 houses	332	2022/2023
Wind	Investigate land holdings with Reading Community Energy Society for wind options	TBC	2021/2022
Ground/rivers	Reading Hydro – consider further shares and/or PPA with Reading hydro project	TBC	2022
	Ground Source heat pumps – see decarbonise section		
	Consider further shares purchases in Reading Community Energy Society	TBC	
	REGOs & REGO+ (Renewable Energy Guarantee of Origin)	N/A	REGO for 100% electricity – completed 2019 REGO+ - timing TBC
Total		502 tonnes	

4.4 SMART

4.4.1 Planning for the future

As we go forwards local and national energy networks will become more diverse with local renewable energy generation forming a much greater proportion of the energy mix. Alongside this, the capability to store electricity in batteries and heat in buildings gives us more flexibility on when this energy is used. This is crucial when considering the intermittent nature of renewable energy generation.

Whilst a Smart Council is crucial, it is mainly an enabling function to allow the other projects to work effectively and to strengthen business cases. For this reason no incremental carbon savings are shown in this section. But the actions below will give us an increased utilisation of local renewable energy and help to reduce the carbon emissions associated with electricity supplied through the national grid.

The Council will work with the University and other bodies on projects to increasingly align the Councils energy consumption with times when low or zero carbon energy are available. We will also look for ways to supply our communities with renewable energy when we do not need it. As the Council will always need to be connected to the national grid via the local electricity network, we must, in the future, supply more renewable energy than we use to compensate for the carbon emissions of the energy we consume.

Many of the technologies and services that we will need in this new era of nearly and net zero carbon operations are being developed and/or at trial stage and therefore the 'Smart Council' work during the 2020 to 2025 period will seek to establish a series of projects and trials that can lead to reductions in carbon emissions but also establish further RBC owned renewable generation infrastructure that can help to supply our communities, as we already do for our Council tenants.

4.4.2 Action plan

Sector	Action	Timing
Demand side response	Implement fast frequency response demand for largest council loads	2023
Battery storage	Install batteries at Council site – Subject to Reading Zero Carbon Accelerator funding (bid submitted, result awaited)	2022 to 2023
Vehicle to Grid (V2G)	Initial purchase of V2G compatible vehicles	2022
Real time carbon emissions	Through the Reading Zero Carbon accelerator project (subject to successful bid)	2021 to 2023
Machine learning	Smart City Clusters Project	2020

Real time carbon utilisation	Reading Zero Carbon Accelerator Project (subject to successful bid)	2021 to 2023
Power Purchase Agreements (PPAs), sleeving and REGO+	Work with West Mercia Energy (RBCs energy supplier) to align local generation with consumption. Also work jointly with University and Reading Community Energy Society to establish PPAs for our own consumption with local renewable energy suppliers	2020 to 2025
Agile Tariffs	Explore agile tariffs with energy supplier (to align consumption with cheaper, lower carbon periods)	When available
Private wire contract for solar farm	Establish a PPA contract with a local off-taker from solar farm installed at Smallmead facility	2022

5. CONCLUSIONS

Taken as a whole the strategy to reduce, decarbonise, generate and get smart have helped to inform the action plan, which over the period of the strategy has the potential to reduce emissions by 85% compared to the 2008/9 baseline. This would leave us with carbon emissions of no greater than 3000 tonnes, less than half of our existing emissions (see figures 5.1, 5.2 and 5.3 below), a level which would be in line with the expectations set in the Climate Emergency Declaration to achieve net zero carbon by 2030.

A large number of variables remain in play - the nature of our business and size of our estate going forwards in the light of the pandemic, the challenge of forecasting energy costs and network carbon intensity, the size of our capital programme and priorities within that. In view of these uncertainties, we cannot guarantee that this will be our precise trajectory but we will retain the ability to flex our plans in line with research and national developments. But we will also have significant opportunities to use our low carbon investment to leverage in funding from national and other sources, and to ensure that this investment drive the Council's wider aim for a 'green recovery' from the impacts of COVID-19.

The actions set out in this plan will make good business sense as well as environmental sense, reducing future revenue pressures and ensuring that the Council is fit for the future and on track to a net zero carbon Reading, at the forefront of the UK and city governments worldwide in tackling climate change.

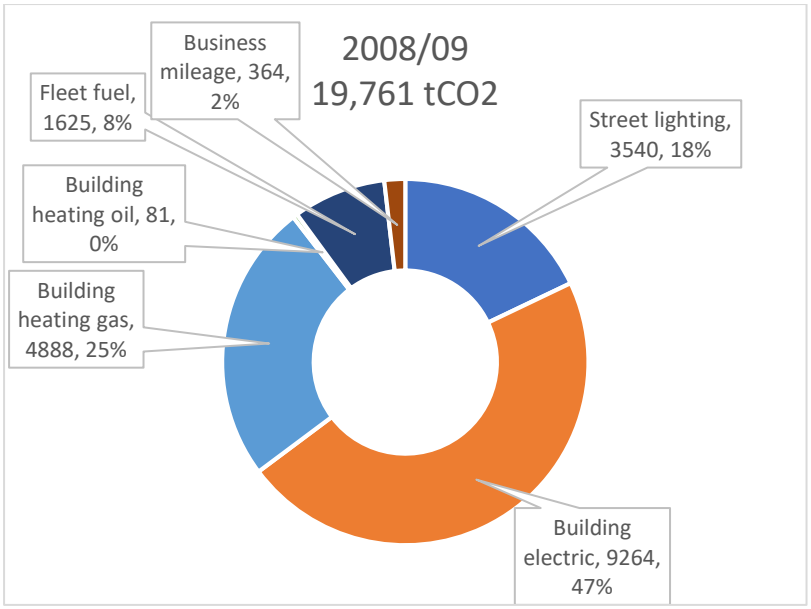

Figure 5.1: Breakdown of RBC carbon footprint for 2008/09

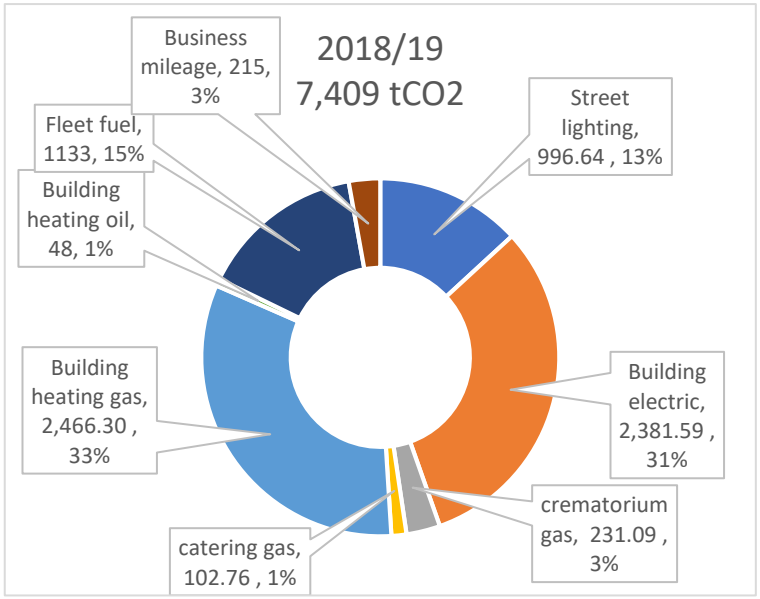

Figure 5.2: Breakdown of RBC carbon footprint for 2018/19

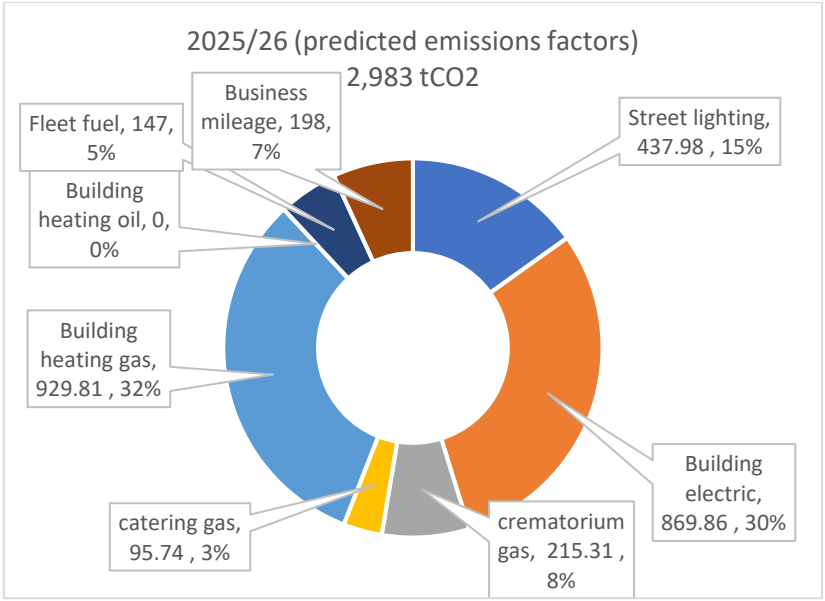

Figure 5.3: Breakdown of RBC carbon footprint for 2025/26