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MEDWAY NET ZERO CARBON - BASELINE & PATHWAY REPORT

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1 EXECUTIVE SUMMARY

This report was commissioned by Medway Council (the Council) to provide the evidence necessary to inform policy decisions in relation to the 'Climate Emergency' declared by the Council on 26 April 2019. The brief called for a carbon emissions[1] Baseline and supporting information to chart potential routes for the Council to reach net zero carbon emissions by 2050[2].

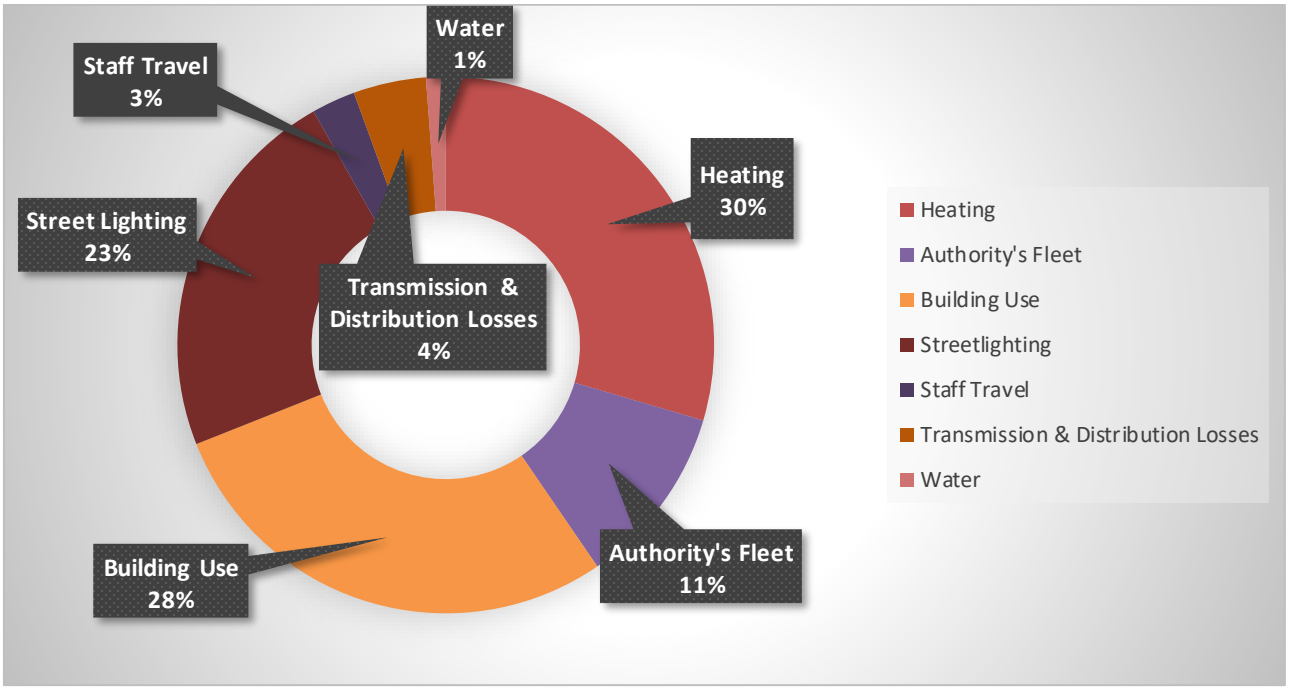
1.1 Carbon Baseline summary

Local Partnerships has established a Baseline position for the Council and has identified actions to ensure that data is consistent and that reporting standards are in accordance with best practice. The Baseline includes Scope 1 and 2 emissions, namely those under the Council's direct control and influence, together with staff business travel, transmission and distribution losses[3] and water (part of what is called 'Scope 3' emissions).

In accordance with the data supplied by the Council, the Baseline for 2018/19 is 12,105 tCO_2e. This figure has been derived by considering a full year of data for 2018/19 and applying the Department for Business, Energy and Industrial Strategy (BEIS) conversion factors for 2018 as per standard practice in the sector.

The main sources of emissions are operational buildings (heating and electricity) which account for 58% of total emissions, with street lighting contributing 23% and fleet 11% as illustrated in Figure 1.

Figure 1 – Medway Council 2018-19 carbon emissions in percentage terms



[1] For simplicity we will be referring to all Green House Gases (GHG) in this report as 'carbon'. However it is good to be reminded 'carbon' and 'GHG' are a lot more than just CO2. See Section 3.1.3 for details.
[2] An additional request to investigate options for reaching net zero by 2030 was explored by Local Partnerships at the Council's request.
[3] Transmission & Distribution Losses are the proportion of the electricity purchased by the Authority that is lost between the power station and the point of use (e.g. buildings or street lighting).

1.2 Pathways to Net Zero Carbon by 2050

In this report we identify and quantify a series of example interventions that will put the Council on a path to reducing its emissions by 95% by 2050. We also provide a range of additional interventions that could be used to close the gap between current emissions and the First Carbon Budget[4]. We have mapped potential pathways to net zero carbon by 2050 and calculated the First Carbon Budget by using the Exponential Reduction Approach, which going forward we will call the 'Exponential Reduction Pathway'. This approach ensures that reductions are in line with a Science Based Target, meaning reductions take place at the rate the latest climate science says is necessary to meet the goals of the Paris Agreement – to limit global warming to well below 2°C above pre-industrial levels and pursue efforts to limit warming to 1.5°C[5]. **By working towards an Exponential Reduction Pathway (i.e. halving emissions every ten years as opposed to reducing emissions by a fixed amount every year – a Lineal Pathway) the Council will be reducing emissions at a rate that is in line with the Medway Climate Emergency Declaration of keeping global temperature rises below 1.5°C.**

Quantified Example Interventions

Table 1 below provides a summary of the example interventions we have been able to estimate carbon savings for in order to get Medway to work towards achieving the First Carbon Budget (2020-2027) derived from an Exponential Reduction Pathway, including estimated costs where possible. Please note that, with the exception of Re:fit[6] Phase 1, these are all desktop estimates subject to actual site visits, detailed design and appropriate procurement. The interventions are sorted by implementation date and biggest carbon saving.

Table 1 – Summary of Interventions to stay within the First Carbon Budget

Intervention	Carbon Savings (tonnes)	Percentage Reduction against Baseline	Implement latest	Estimated cost	Cost per tonne of CO2e saved
Re:fit Phase 1 Buildings	809.00	6.68%	2021-22	£4,567,907.00	£5,646.36
Street Lighting to LED	1484.00	12.25%	2022-23	£11,155,144.00[7]	£7,516.94
Low Carbon Heating	1063.68	8.78%	2022-23	£3,742,757.00	£3,518.69
Further solar PV in Buildings	180.54	1.49%	2022-23	£1,240,815.00	£6,872.80
Further LED Lighting Corporate	118.05	0.97%	2022-23	£354,143.16	£3,000.00
Further LED Lighting Housing	59.90	0.49%	2022-23	£179,689.62	£3,000.00

[4] A carbon budget is a tool used by the UK Government which places a restriction on the total amount of greenhouse gases the UK can emit over a 5-year period. We are extrapolating this concept and applying it at the Council level.
[5] https://sciencebasedtargets.org/what-is-a-science-based-target/
[6] Re:fit is the national framework for Energy Performance Contracting that the Council's Head of Property Services has subscribed to in order to start driving the net zero carbon agenda through the Council's portfolio of buildings
[7] Project has already been approved and funded

Vans Class II and III to EV	51.14	0.42%	2022-23	£580,145.00	£11,345.36
Further LED Lighting Carparks	22.46	0.19%	2022-23	Not available	Not available
River Source Heat Network	143.00	1.18%	2023-24	£889,831.80[8]	£6,222.60
Controls Optimisation	59.50	0.49%	2024-25	£129,406.18	£2,175.00
Heating Controls	39.50	0.33%	2024-25	£32,824.50	£850.00

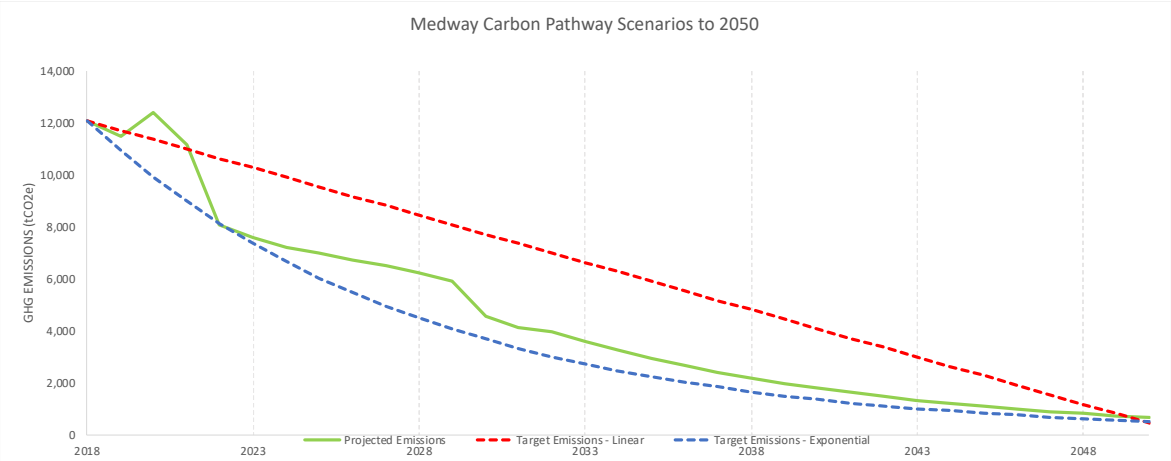
In accordance with the above and if we exclude the funding for the street lighting LED intervention, which has already been approved and funded, the Council will be looking at minimum capital investment of around £11.7m to start working towards meeting this First Carbon Budget. However, most of these example interventions do have a payback and will yield savings, with the heat network potentially providing a good Return on Investment (ROI) and attracting central government grants or operator funding (where the Council provides a concession to the operator). **Please note that in order to keep to the First Carbon Budget and remain within the Exponential Reduction Pathway and the Science Based Target, additional interventions will need to be considered in the next 3 to 5 years (see list of additional potential interventions in the next section), which would necessitate additional capital investment.**

[8] This is just the proportional cost of the carbon savings allocated to Gun Wharf but please note this is part of a larger heat network project worth £40m. This is however a key opportunity for decarbonising heat in the Medway area that will hopefully be supported by Government grants and operators, giving the council a return by selling heat to other public sector organisations in the Medway area or the possibility of simply switching to low carbon heating by giving a concession and entering into a long term purchase agreement with the operator.

Medway Council Pathway with Quantified Example Interventions

Figure 2 below provides the projected Medway Council Pathway (green line) against a target of Lineal and Exponential reduction of emissions, with Medway emissions declining as a direct consequence of the implementation of the identified example interventions. **Please note this modelling assumes continued efforts to keep to carbon budgets set in line with the Exponential Reduction Pathway after the First Carbon Budget.**

Figure 2 – Medway Council Pathway with identified interventions



Points to Note

1. By 2050 emissions are projected to have been reduced to 605 tCO_2e (a 95% reduction), which is consistent with the definition of net-zero by the Office for National Statistics[9] .
2. The Medway Pathway resulting in the implementation of the quantified example interventions only is **not** aligned to a Science Based Target, which as highlighted would need additional investment to meet the First Carbon Budget
3. The apparent 'increase' in the green line in 2020 is as a result of the variance between BEIS forecasts for carbon intensity factors for electricity supplied from the grid (used for the long term projections) and the actual intensity of the grid in 2019, i.e. the grid has decarbonised faster than BEIS forecast.
4. The electrification of the fleet has been included in this modelling but only in the year 2030-31 as requested by Council officials. This is not in the list of 'quantified example interventions' since the year 2030-31 does not relate to the First Carbon Budget

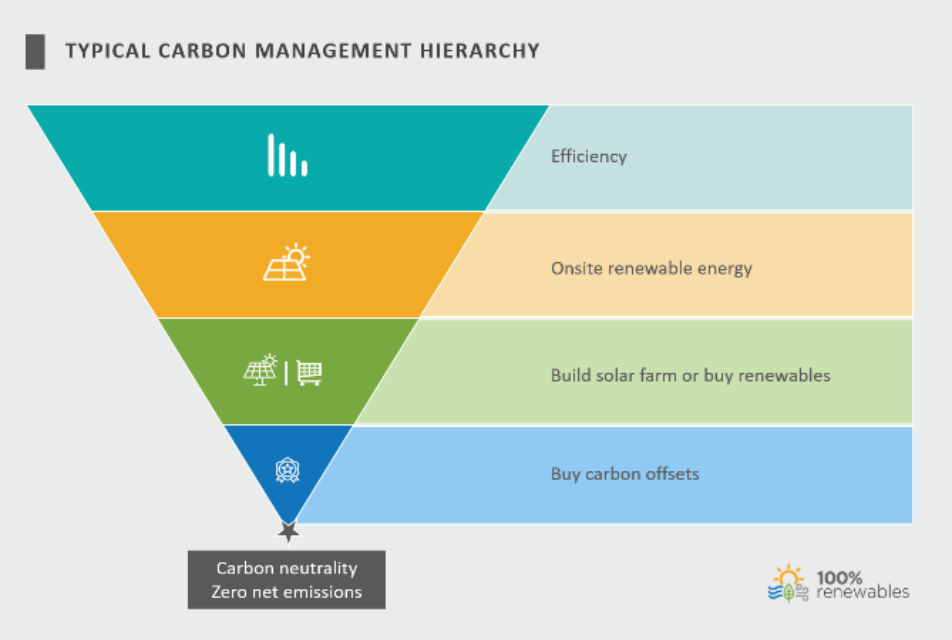
N.B. It is likely that the rates of grid decarbonisation will continue to exceed the forecast in the near future, which will further reduce Medway's final forecast emissions.

9 https://www.ons.gov.uk/economy/environmentalaccounts/articles/netzeroandthedifferentofficialmeasuresoftheuksgreenhousegasemissions/2019-07-24

1.3 Further Action: The Energy Hierarchy and First Carbon Budget

In order to come up with a sound carbon reduction strategy and pathway, one must always follow the Energy Hierarchy as shown in Figure 3. The quantified example interventions presented so far are in line with the hierarchy of carbon management and have a good ROI. They demonstrate significant improvements in efficiency and a first incursion into renewable energy but only onsite, at building level. Further interventions could include additional decarbonisation that might not be as affordable, such as the full electrification of the waste fleet, and investment in large scale solar farms, in Medway or elsewhere (see below).

Figure 3 – Hierarchy of Carbon Management. Source 100%renewables.com.au



Performance against the First Carbon Budget year on year

Table 2 below sets out the performance of the Medway Council Pathway with the proposed example interventions against the First Carbon Budget cycle set in line with the recommended Exponential Pathway. The First Carbon Budget is an eight-year period just in order to bring the Council carbon accounting periods in line with UK Government 5-yearly carbon accounting periods. From then on, we recommend 5-yearly Carbon Budgets to remain aligned with UK Government.

Table 2 – Projected performance against First Carbon Budget (tCO_2e)

Year	2020	2021	2022	2023	2024	2025	2026	2027	Cumulative
Baseline after example Interventions Forecast (tCO_2e)	***12,410***	***11,200***	***8,082***	***7,595***	***7,221***	***6,993***	***6,753***	***6,500***	***66,756***
First Carbon Budget	***9,930***	***8,994***	***8,146***	***7,378***	***6,683***	***6,053***	***5,482***	***4,965***	***57,631***
Surplus (Staying within Budget) /Deficit (Going over budget)	***-2,480***	***-2,206***	***64***	***-217***	***-538***	***-940***	***-1,271***	***-1,535***	***-9,125***

Over the whole cycle, the carbon budget deficit, under current example measures, would be 9,125 tCO_2e [10] over the eight-year period, meaning **additional interventions must be identified and implemented if the Council wants to keep to the Exponential Pathway, the Science Based Target and its Climate Declaration commitment.**

Examples of additional interventions

Options to reduce the First Carbon Budget deficit could include:

1. Bringing forward the low carbon heating programme to start in 2021 as opposed to 2022. This will add 1,064 tCO_2e worth of savings to this First Carbon Budget Period
2. Bring forward the replacement of the waste fleet with electric RCVs to 2023-24. This will reduce the budget deficit by over 4,600 tCO_2e
3. Bring in additional measures to reduce emissions through staff business travel. This could include the introduction of more electric pool cars and e-bikes and the removal or significant reduction in rates paid for business mileage. Introducing measures to halve current emissions from staff business travel from 2021 (for the duration of the First Carbon Budget) would reduce the budget deficit by circa 1,000 tCO_2e
4. Delivery of around 1.5 MW of solar car ports in car parks by 2023 would reduce the deficit further by 1,250 tCO_2e of carbon savings
5. Accelerate the electrification of the rest of the fleet vehicles so that the 4x4s and cars are also replaced with EV equivalents by 2025
6. Investing in large scale solar generation and 'sleeving'[11] the power back to the Council. This could potentially reduce annual emissions by 5,000 to 6,000 tCO_2e but would require considerable investment

How Much Further Action is Required to Achieve Net Zero by 2050?

In order for Medway Council to keep to the Exponential Reduction Pathway, emissions will have to continue to halve every ten years, each period of 5 years associated with a new carbon budget, until the Council eventually gets to 605 tCO_2e in 2050, a reduction of over 95% on current emissions levels. There are likely to be further marginal efficiency gains available over the thirty-year period to 2050. Examples could include more energy efficient appliances, smaller and lighter vehicles and a reduced need for travel as a consequence of further utilisation of digital media. Decarbonisation of heat will also play a key role.

Options for dealing with residual emissions with the knowledge and technology we have today include:

1. Developing renewable energy assets and using the energy generated. We have highlighted these as an additional option to achieve the First Carbon Budget since the marginal returns for these in later years reduce as the grid is increasingly decarbonised, so the exact extent of their contribution will depend on timings.
2. Purchase carbon offsets from the carbon offset market (carbon avoidance) or try one of the nascent 'certified Greenhouse Gas removal' schemes (which does removal as opposed to avoidance, further detail in section 6.5)

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[10] This figure is likely to be slightly overestimated since, as we have already seen in the published conversion factors for 2019, it is likely that grid decarbonisation rates are faster than forecast by BEIS.
[11] Sleeving: Where an intermediary utility company handles the transfer of money and energy to and from a renewable energy project on behalf of the Council. The utility company takes the energy directly from the solar farm project and "sleeves" it to the buyer at its point of intake, for a fee.

3. Purchase Woodland Carbon Units
4. Plant trees to sequester the carbon. Each hectare planted will sequester around 315 tCO_2e over a 100-year lifetime.

1.4 Conclusions and Recommendations

Conclusions

There is evidence to suggest that, given the appropriate resources, Medway Council can reduce its carbon emissions by around 95% by 2050 using interventions that are already available. The residual 5% can be managed through enhanced energy efficiency measures, renewable energy and carbon offsetting, with an emphasis on the former activities, as opposed to the latter.

As per our proposed example interventions, quantified and additional, the technological means exist for Medway Council to follow an Exponential Reduction Pathway with a budget allowance of 57,631 tCO_2e for the period 2020-2027 and in so doing keep to the Science Based Target the Climate Emergency Declaration commits the Council to. However, we understand that, within the current means - both in terms of financial resources and human capital - not all of these interventions are possible or at least at the time where they will have the necessary impact to meet the Budget.

It is of utmost importance that the Council identifies the resources necessary to keep to an Exponential Reduction Pathway, selecting these or other interventions and implementing them in a timely manner so that the Carbon Budget deficit is drastically reduced. From our experience, provided that the First Carbon Budget is met, it is likely Medway Council will be able to achieve subsequent carbon budgets aligned with the Exponential Reduction Pathway in the period up to 2050 and, in so doing, keep to the Science Based Target and the Medway Climate Emergency Declaration, which will avert the worst of climate change.

With regards to offsetting and sequestration there is potential for Medway to explore both solar PV and tree planting as means to achieve its own offsetting. Further work is already underway to utilise and enhance existing green and blue infrastructure as carbon sinks, the results of which are not yet known but should eventually be integrated with this work.

Furthermore, the Council should consider expanding the emissions scopes included in the carbon Baseline and Exponential Reduction Pathway to include further Scope 3 measures as and when suitable data becomes available. Please note the current Medway Council Baseline, calculated as per the Council's instruction (Scope 1 and 2 plus staff travel, Transmission and Distribution Losses and Water from Scope 3) only accounts for 1.4% of the area-wide emissions that the Kent and Medway Energy and Low Emissions Strategy commits Medway to reduce to net zero by 2050[12].

[12] Whilst Medway's Scope 1 and 2 plus staff travel Baseline is 12,105 tCO_2e, the latest figures from the BEIS mapping tool (https://naei.beis.gov.uk/laco2app/) indicate that borough wide emissions are 872,000 tCO_2e.

Recommendations

There are a number of recommendations throughout the report and they are summarised in table 3 below in the order in which they appear (as opposed to their relative importance).

Table 3 – Recommendations

Number	Recommendation
1	To develop a re-baselining policy and threshold, as well as to agree on some carbon intensity metrics
2	To collect transport data in terms of litres of fuel as opposed to miles used and roll out the use of fuel cards where appropriate
3	To undertake the necessary steps to be able to report on fugitive emissions using the Screening Method[13]
4	To follow UK Government Streamlined Energy and Carbon Reporting (SECR) Guidance on reporting emissions
5	To develop an 'Assurance and Verification' policy in line with Government Guidance
6	To combine SECR Carbon Accounting Principles with the GHG Protocol Reporting Methodology, especially for Scope 3 emissions
7	To adopt the following data collection recommendations: • Introduce a Data Collection Tracker tab at the end of the Data Sheet • Add a 'Projects and Savings' Tab to the Data Sheet that links to the Re:fit projects • Introduce a 'comparison tab' in the Data Sheet, which includes potential explanations to changes in the data • Thorough recording of A/C gas top ups so the Council can report on 'fugitive emissions' with confidence following the Screening Method. • Introduce planned maintenance for air conditioning (as opposed to reactive maintenance) if it is not present already. • Consider the formation of a Carbon Reporting Working Group that will ensure early engagement, joint briefing and cooperation across departments to achieve efficiencies and save time when reporting on carbon emissions
8	**To adopt a Science Based Target, Exponential Reduction Pathway and associated Carbon Budget**
9	To set the first budget period to 2027 to enable alignment of future budget cycles with UK Government carbon budgets
10	To adopt the principles inherent in the Carbon Management Hierarchy
11	Consider the below interventions as a matter of urgency: • Prioritise LED upgrades and solar PV across the estate in the next two years • Roll-out the conversion of all suitable heating systems to low carbon heat pumps[14] or equivalent to all of the estate as part of Re:fit Phase 2 • Upgrade or optimise all building controls by 2024-25 • Electrify the waste fleet and all vans ASAP

[13] The Screening Method is listed in HM Government Guidance on Environmental Reporting Guidance (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf) as one of the methods to help organisations estimate emissions from refrigeration, air conditioning and heat pumps. Please see section 3.2.4 for further detail.

[14] Please see Ofgem 'Easy Guide to Heat Pumps' and the Renewable Heat Incentive here: https://www.ofgem.gov.uk/sites/default/files/docs/2015/02/es888_rhi_easyguide_to_heat_pumps.pdf

12	To undertake a carpark review to establish the possibility of installing solar PV, including solar canopies, as well as EV charging points
13	To undertake a landfill review to establish the potential for solar PV
14	To explore the potential for larger scale solar PV generation through acquisition from a third party
15	To be aware that Government guidance on renewable energy tariffs and green energy is inconclusive and wait to switch to a green tariff until the Council is sure this would count towards the net zero target
16	To consider whether there is an opportunity to produce Woodland Carbon Units (WCU) for others as well as meeting the Council's own needs through tree planting, or whether the Council should purchase of WCU from others
17	To consider the use of carbon offsets as necessary to achieve a net zero position, but only when all other means have been exhausted ahead of a 2050 target
18	To undertake a workshop to proactively identify barriers to delivering initiatives at scale and pace and seek solutions to those issues
19	To introduce a quarterly monitoring scorecard to enable carbon reduction to be more proactively managed
20	To include the impact on carbon emissions into wider decision-making processes, potentially via a Carbon Impact Assessment Tool
21	To consider taking a phased approach to the expansion of the Baseline into Scope 3 emissions and in particular assess how to: • Solidify beneficial changes associated with the management of the COVID-19 pandemic into lasting change • Ensure that green ambition is at the heart of the COVID-19 recovery plans for Medway • Undertake an initial 'wide and shallow' assessment of the Council's Scope 3 emissions, paying particular attention to outsourced direct service provision • Develop more sophisticated modelling to account for future population growth and the impact on service requirements • Map the areas of influence the Council has over the wider area through its powers as a local authority and review policies to drive down carbon emissions in the wider area, e.g. planning requirements • Consider how the Council might act as a facilitator for change in the wider area

2 INTRODUCTION

On 26 April 2019, Medway Council (the Council) passed a motion regarding climate change. Amongst other statements, the motion declared a 'Climate Emergency', noting that current targets are inadequate to respond to the challenge of keeping global temperature rises below 1.5°C, and committed Medway to:

- Establish a Medway Climate Change Working Group to respond to this challenge;
- Set more ambitious targets for Medway to become carbon neutral;
- For the Chief Executive to write to the Chancellor of the Exchequer stating the concern of the Council with respect to the Council's declaration and the likely national impact on the economy and on the wellbeing of citizens, requesting government funding be made available to implement swift appropriate actions in response.

The Council has also signed up to the Kent and Medway Energy and Low Emissions Strategy, which commits Medway to net zero by 2050. The strategy has now gone through consultation and was formally adopted on the 20th January 2021. As such, it is important to understand the Council has committed to supporting the reduction to net zero across the geographical area of Medway, not just the Council's own estate.

The Kent Environment Strategy commits the relevant boroughs to a reduction in carbon emissions across Kent and Medway of 34% by 2020 and 60% by 2030, from a 2005 baseline. BEIS 2018 data shows that Medway is on target to achieve the 2020 target with a 33.84% achieved so far. However, meeting the 2030 and 2050 targets will be challenging.

Whilst the Council has been tasked with leading this activity, the remit of this work needs to reflect both the emissions and targets across the unitary authority geographic boundary and not just the council own buildings and operations. Consequently, establishing a carbon Baseline for this geographical boundary will be progressed under the remit of the Kent and Medway Energy and Low Emissions Strategy.

In order to start mapping the journey to net zero carbon for the Council, Local Partnerships has compiled in this report a Baseline reflective of the Council emissions (what we call Scope 1 and 2 in carbon accounting) plus staff business travel (Scope 3, emissions which the Council does not control but can potentially influence). This is so that the Council can track progress towards that target, reviewing completed projects and initiatives against this Baseline at set intervals.

Local Partnerships has also set the first Medway Carbon Budget, 2020-2027, so that it best aligns with HM Government next carbon budget. This Carbon Budget reflects the carbon emissions allowance the Council will have to adhere to in the next seven years in order to make the net zero carbon target possible. This is backed by the 'example interventions', actions that the council can undertake in order to pave the way to becoming net zero carbon by 2050.

Local Partnerships quantified example interventions that have been completed with estimated carbon savings and cost estimates where possible. Some of these have been sourced from the Re:fit service provider, whilst others draw from Local Partnerships Re:fit benchmarks and wider experience in the sector. Local Partnerships has also modelled these interventions to show how this would affect the Medway emissions pathway and compare this to the different potential pathways for the Council to become net zero carbon by 2050. Local Partnerships has also calculated the First Carbon Budget and has mapped out the example interventions and timescales against it so that the Council can approach these targets with an awareness of the potential costs involved and the speed at which the interventions need to be deployed to address the Climate Emergency.

This report thus establishes the Council's carbon emissions Baseline for 2018-19, including the methodology used for the calculations and recommendations for the Council related to recognised carbon accounting/reporting guidance and standards for those areas within the applicable

emissions reporting scope (Scope 1 and 2 emissions) plus staff travel, transmission and distributions losses and water (Scope 3 emissions)[15]. The result is a comprehensive review of where the Council lies in terms of its carbon emissions as well as the introduction of some reporting standards with the intention of establishing a robust carbon accountancy framework going forward. In order for the Council to fully understand the recommended accountancy framework put forward we have included an overview of the different standards and guidance available within the Carbon Baseline section of this report.

The necessary year on year reductions for a net zero carbon by 2050 have been plotted using the Baseline and BEIS predicted Conversion Factors both in a linear and an exponential manner, to show the carbon reductions needed to achieve the net zero carbon target by 2050. These theoretical pathways are then used to compare a potential pathway to net zero that is currently based on a number of quantified example interventions. However it should be noted that these interventions (and the projections) do not fully meet the First Carbon Budget unless additional funding is made available to tackle some if not all of the additional interventions. In addition, please note the model does not include any allowances for population growth, diversification of council services or changes in the definition of emissions reporting scopes by central government policy. **It is thus likely that the proposed interventions (quantified and additional) presented in this report, which add up to tens of millions of pounds, will be the minimum the Council will have to implement to achieve the First Carbon Budget, which is in line with Medway's Climate Declaration.**

There are however advantages to acting early and charting the correct pathway from the start. In addition to the political and reputational capital provided by delivering on the Climate Emergency Declaration right from the start, there are also financial and risk management benefits. Most of the quantified example interventions currently have a good ROI and so does investing on solar farms at this stage of the UK decarbonisation of the grid. If these interventions are postponed, the Council runs the risk of not being able to meet the Net Zero Carbon target as it will be even harder to find the funds for these projects once the ROI and the carbon impact decreases due to the grid decarbonising year on year and other authorities and organisations having taken the investment opportunities that had the best returns.

[15] No advice has been provided in this report for those areas excluded the from emissions reporting scope at this stage (i.e. the rest of the Council's indirect emissions, also called Scope 3). However a workshop has been organised for the 28th of July 2020 to discuss how the council wishes to approach the inclusion of some more of the Scope 3 emissions in its reporting going forward.

3 CARBON BASELINE

Following a comprehensive review of all of the available data, we have been able to compile the Council's carbon Baseline for the year 2018-19, the year prior to the Declaration taking place. The total Scope 1 and 2 carbon emissions plus staff travel, transmission and distribution losses and water for the year 2018-19 is 12,105 tonnes of CO_2e. As per Table 4 below, heating and electricity needs (for both buildings and street lighting) represent the greatest majority of the emissions, roughly 80%, with fuels used by the fleet following with 10.9%. All Scope 3 categories considered add a combined total of 8.2% to the Baseline emissions.

Table 4 – Breakdown of Medway Council Carbon Baseline

Scope	Emissions Type	Emissions (tCO_2e)	Percentage of Total Emissions
Scope 1	Heating	3,576.02	29.5%
	Fugitive Emissions	0.00	0.0%
	Authority's Fleet	1,320.45	10.9%
Scope 2	Electricity	6,216.09	51.4%
Scope 3	Staff Travel	319.52	2.6%
	Transmission & Distribution Losses	529.83	4.4%
	Water	143.20	1.2%
	Total Emissions	***12,105.11***	***100.0%***

3.1 Methodology

After careful consideration of all of the available carbon reporting standards (see section 3.4) and in liaising with the Local Government Association and other local authorities, it has been concluded that the most appropriate standard to follow for carbon emissions reporting in local government is HM Government 'Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance' as updated in March 2019[16]. Although reporting is currently voluntary, local authorities in England were requested by Government to measure and report their carbon emissions from their own estate and operations back in 2013, well before the Carbon Reduction Commitment came to an end in 2019, a fact that is quoted in this guidance.

This UK guidance is based (and heavily reliant) on the GHG Protocol, a global set of standards followed internationally, that adds detail where this is not available in national guidance. Outlined below is a simplified version of the GHG Protocol's main 6 steps that draws from both the 'Corporate' and 'Cities' Standards. This is the process Local Partnerships has followed to ensure that Medway Council's Baseline complies both with UK and international standards.

3.1.1 Step 1 – Setting Organisational Boundaries

Each council operates differently, with some of the services (as well as in some cases the maintenance) being undertaken by external contractors. It is therefore necessary to firmly establish the reporting boundaries of the Council and give due consideration to the inclusion/exclusion of any given 'direct' and 'indirect' emission sources. This is simplified by the fact that Local Partnerships has been instructed to focus on direct operations within the control of the Council (Scope 1 and 2 emissions), plus staff business travel (Scope 3).

Enquiries were made of the relevant members of staff in the Council to clarify boundary and interface issues, for example with respect to fleet emissions reported under Scope 1,

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

responsibilities for the cost of utilities in certain Council buildings occupied by third parties and the relationship between Medway Council and Medway Norse.

With regard to setting the organisational boundaries for reporting, with consideration of where the responsibility for particular emissions might lie, the UK guidance specifies the following main two approaches:

I Financial control boundary

An organisation reports on all sources of environmental impact over which it has financial control. An organisation has financial control over an operation if the organisation has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities.

II Operational control boundary

An organisation reports on all sources of environmental impact over which it has operational control. Your organisation has operational control over a service if your organisation or one of its subsidiaries has the full authority to introduce and implement its operating policies within this particular service[17].

As have most Local Authorities in the UK, the Council has opted to follow the 'financial control boundary' approach where, as indicated above, control is defined or equated to financial or contractual commitments for which the Council is ultimately responsible. It is for this reason that the waste collection operations, which currently Medway Norse delivers for the Council, have been included in the Baseline[19].

Financial Control

An organisation has financial control over an operation or asset if it directly or indirectly has the ability to direct the financial and operating policies of the operation with a view to managing the economic impacts or benefits from its activities. For example, financial control usually exists if the organisation is largely responsible for the financial performance (and risks) of the operation and its assets. This approach follows the guidance set out in International Financial Reporting Standards (IFRS) and in UK Generally Accepted Accounting Principles (GAAP), such that the economic substance of the relationship takes precedence over the legal ownership. Therefore an organisation may have financial control over an operation even if it has less than a 50 per cent ownership interest in that operation.

Financial control is also used for financial reporting purposes, i.e. if an operation is fully consolidated in the reporting organisation's financial statements then it is likely to fall within the organisational boundary for environmental reporting purposes as well. The Council can therefore use its financial accounts as a guide to determining the limits of Scope 1and 2 reporting when deciding to take a financial control approach. It is certainly worth establishing what the boundaries are for the Council's organisation's financial reporting to ensure that carbon reporting boundaries are well aligned to the financial reporting boundaries (although there may some differences in places, which should always be based on sound and documented rationale).[18]

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[17] In addition, both UK guidance and the GHG Protocol describe the 'equity share boundary' approach, where an organisation accounts for GHG emissions from operations according to its share of equity in the operation. This is mainly aimed a private sector organisations, for whom GHG reporting is mandatory.

[18] https://www.zerowastescotland.org.uk/sites/default/files/Organisational%20Boundaries%20-%20carbon%20management%20plans.pdf

[19] Please note Medway Council fully owns the RCV fleet, therefore it has been included in the baseline. Other vehicles used by Medway Norse have not been included as Medway Norse maintains full ownership of these assets

3.1.2 Step 2 – Setting Operational Boundaries

The agreed scope for the Medway Council Baseline is as follows:

Scope 1 – Direct carbon emissions from sources that are owned or controlled by the Council for example, emissions from combustion in owned or controlled boilers, furnaces and vehicles. Also, as per the UK and global guidance, fugitive emissions[20] from air conditioning systems have also been included.

Scope 2 – Indirect carbon emissions as a consequence of the activities of the Council, occurring from sources neither owned nor controlled by the Council, for example electricity purchased for the operation of Council buildings and streetlighting.

Scope 3 – Indirect carbon emissions linked to the activities of the Council, occurring from sources neither owned nor controlled by the Council. In this Baseline exercise and following a request from the Council, we have included staff business travel.

The measurement of Scope 3 emissions is an emerging area and usually represents up to 80% of a Local Authority's total emissions when considered in full. Scope 3 emissions reporting is relatively new, and methodologies are still emerging to allow for measurement in many areas.

The GHG Protocol advises that "...*setting operational boundaries that are comprehensive… will help an organisation to better manage the full spectrum of GHG risks and opportunities that exist along its value chain*"[21]. This is to say that, in establishing the scope of the operational boundaries in a narrow way, the Council could potentially be missing certain opportunities, such as providing climate adaptation services to the community.

In order to address the above, Medway Council will be looking into further expanding its reporting boundary into Scope 3 during a workshop with Local Partnerships on the 28th of July 2020.

3.1.3 Step 3 – Identifying emission sources

A range of GHG's are commonly included within carbon emissions reports. GHGs have a differing capacity to cause global warming – dependent upon radiative properties, molecular weights, and atmospheric residence times. The index of Global Warming Potentials (GWP), as published by the Intergovernmental Panel on Climate Change (IPCC), can be used to assess the relative global warming effect of the emissions of different gases over a defined time period. This period is usually taken to be one hundred years and is calculated relative to the emission of an equal mass of CO_2. The GWP of each GHG may therefore be expressed in CO_2 equivalents (CO_2e) and indicates that for those gases with a high GWP, a relatively small emission can still have a considerable relative impact.

[20] According to the UK Government's Environmental Reporting Guidance, fugitive emissions are intentional and unintentional releases, such as equipment leaks from joints, seals, packing, gaskets, as well as fugitive emissions from coal piles, wastewater treatment, pits, refrigerants, cooling towers, gas processing facilities, etc.. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

[21] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

Once the organisational and operational boundaries above are established, the likely emissions associated with the Council's operation and maintenance activities as a whole must be identified. Initial key emission sources that would be relevant are:

- Stationary energy;
- Transportation;
- Waste;
- Forestry and other land use[22].

The Medway Council Baseline includes all of the above with the exception of the last category. Any land emissions and the potential for the green and blue infrastructure in Medway to act as a carbon sink (and how to potentially increase this ability) are currently being investigated by the Kent Nature Partnership. Please note this is the standard approach across local government, which does not tend to own a lot of animal farming land (where most of the emissions would come in this category). Agricultural land, as well as more generally green and blue infrastructure, come into play when local authorities can start offsetting some of their emissions (see section 6.5).

Additional features within carbon accounting often include the calculation of emission savings or avoidance due to certain supply-based or 'behavioural' actions. These could include the following:

- Installed Onsite Renewables Generation;
- Renewable Energy Tariffs.

In principle, the supply of renewable energy can be assumed to displace the relative proportion of emissions that would have otherwise been released as a result of conventional generation. Thus, within the Baseline, the use of an onsite renewable energy supply (e.g. a PV array on the roof of a council building) would already be captured by a reduction in the overall level of kWh used in that building and therefore a reduction in its associated emissions. With regards to the impact on the Baseline of purchasing electricity through a Renewable Energy Tariff, UK guidance is currently being updated. We cover this topic in more detail in section 6.4.

3.1.4 Step 4 – Selecting an emissions calculation approach

The most common approach for calculating emissions is through the application of documented conversion factors, and this is the approach which has been adopted for the Council, as it is standard practice. Documented conversion factors are represented using a calculated ratio that converts a measure of activity from an emissions source into a volume of carbon emissions, for example, a vehicle's CO_2e emissions per litre of fuel consumed.

3.1.5 Step 5 – Selecting conversion factors

In order to calculate the emissions produced by the various processes and activities accounted for within the Baseline report, it is essential that reliable conversion factors are sourced. Such factors underpin the workings of carbon reporting, and as such it is essential that they are sufficiently reliable, robust and transparent. The key published data source which provides the majority of conversion factors in the UK is the BEIS and Defra's 'Greenhouse Gas Reporting: Conversion Factors'[23] which is updated annually.

[22] http://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

[23] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

An important distinction in this area that the GHG Protocol introduces (and it is unfortunately not observed in the UK) is between the term 'emission factor' and 'conversion factor', as the two are not considered to be synonymous:

- Emission Factor = a numerical value to enable a conversion from an input measure of energy consumption to a volume of associated CO_2 / CO_2e emissions
- Conversion Factor = a numerical value to enable a conversion from a unit of activity / consumption (e.g. consumption of aggregate in cubic metres) into an appropriate unit so that an emission factor can be applied (e.g. conversion from cubic metres into tonnes)

Since the official document referenced above uses the term 'conversion factors' to describe the GHG Protocol 'emissions factors', the adoption of this distinction in terminology is not recommended at this stage. However, the distinction should be noted so that Medway Council can introduce it in future at its discretion.

It is acknowledged that emission factors inherently contain certain assumptions within the applied values. For example, the emission values for vehicle emissions produced per kilometre driven do not account for variables such as driving speeds, vehicle age, use of accessories such as air conditioning, loads and passengers, gradients and weather conditions.

The GHG Protocol recommends that an organisation should use the most accurate calculation and appropriate approach available to the reporting context. Consequently, changes in conversion factors between reporting periods will essentially comprise a change in assumptions and will presumably be reflective of improvements in data accuracy with time. Through reporting year on year, such changes will require consideration in terms of changing baselines and the comparison of 'like-for-like'. For example, standard electricity generation values are anticipated to change in time given the development of the UK's energy generation mix. As such, the corresponding conversion factors are anticipated to evolve and be reflective of such market changes and will help Medway Council along their way to 'net zero' carbon by 2050.

3.1.6 Emissions Baseline

Part of the carbon accounting process involves tracking the changes in emissions over time. In order to allow meaningful and consistent comparisons of emissions, a common approach is to set a performance datum with which to compare current emissions. This performance datum is referred to as the 'Base Year', for which verifiable emissions data should be available. In setting and tracking progress towards a carbon target, it is referred to as a 'Target Base Year' in the GHG Protocol. Organisations typically select a single year to represent the base year (or Baseline, as it most commonly known in the UK).

For consistent tracking, the Baseline emissions may need to be recalculated should an organisation undergo significant structural change, due to changes in calculation methodology or improvements in the accuracy of emission factors / activity data, or should significant errors be identified. Should recalculations be required, Baseline emissions are essentially retrospectively recalculated to reflect the changes that would otherwise compromise the consistency and relevance of the reported carbon emissions. Given the annual updates of conversion factors detailed previously, re-baselining upon this basis each year would be required.

Within the local authority context, significant changes may occur, for example, due to changes in the number, scale and type of services offered within a reporting period, particularly during the process of outsourcing services, or the rationalisation of the Council's buildings portfolio. To enable emissions comparisons which allow for such operational changes, UK guidance recommends the use of carbon intensity metrics. For example, this may include carbon reduction projects' emissions being calculated upon a financial basis (e.g. tonnes of CO_2e per £-spend), or internally on an employee basis (e.g. tonnes of CO_2e per employee). Such an approach would allow a standardised methodology of comparison to reporting and facilitate target setting.

Recommendation 1 – To develop a re-baselining policy and threshold, as well as to agree on some carbon intensity metrics.

3.2 Baseline data and gap analysis

When the Council engaged Local Partnerships regarding compiling a baseline, the parties agreed the timely submission of data (in the right format) was a prerequisite for the success of the exercise. The data packs from different departments initially presented varying degrees of depth and granularity, which were worked through and improved upon within the process. With this we would like to acknowledge the efforts by the Council's officers in collating, amalgamating and presenting data in the right format.

Data availability and any limitations that data gaps create for building the baseline plus any assumptions used, are explored in detail in the sections below.

3.2.1 Energy Data

Energy data was sourced through LASER Energy (LASER), the Council's utility provider, and was originally based on the CRC reporting files that LASER had been compiling for the council. Upon closer inspection Local Partnerships and Council officers realised that the CRC reporting boundary did not coincide with Scope 1 and 2 emissions as per the aforementioned guidance, and a specific energy set was created that included all buildings that were under direct control and occupation by the council, including small buildings.

One of the 'grey areas' in the current guidance was the reporting on energy consumed by schools, which was initially reported under CRC but later dropped off.[24] As the UK guidance remains silent on this and the Council has chosen the Financial boundary approach, energy consumed by schools has been excluded from the Baseline. Schools energy data has been collected so that the savings of any interventions focused around schools can be quantified in the context of the Scope 3 emissions, which the Council will start exploring at a workshop on the 28th of July (2020).

3.2.2 Buildings Data

Asset and appliance data has been collected for all buildings owned and occupied by the Council, including type of lighting and heating available, the use of controls (sensors and Building Management Systems (BMS)) as well as further details on buildings services such as type and age of heating systems, etc. This has been used to enable the modelling of the impact of the different interventions and to provide some data and context to the kind of initiatives the Council will need to achieve net zero carbon, whether that is by 2050 or earlier.

As devolved budget holders both local authority maintained schools are part of Scope 3 reporting, and the same goes for Academy schools. This puts them outside core objectives in terms of net zero for the organisation. However to recognise the obvious influence Medway has over these entities (as opposed to fully independent private organisations in the wider borough) we have also collected buildings data from maintained schools. This will allow the Re:fit service provider to identify some potential measures as part of later interventions.

3.2.3 Transport Data

Council officers have kindly collected and collated transport data pertaining to both council fleet (mostly vans), the waste fleet (partially owned and operated by Medway Norse) and staff business

[24] In May 2015 Treasury decided to exclude schools from the then mandatory Carbon Reduction Commitment, which obliged large users in the public and private sectors, including local authorities to report on their carbon emissions year on year and buy allowances from the Government to cover for those emissions.

travel (which has gone through data protection clearance). Again, since the Council has chosen the Financial reporting boundary approach, and it retains a financial interest in Medway Norse (as well as the ability to set budgets) waste fleet emissions are being reported as the Council's own under Scope 1. On the other hand staff business travel represent the Council's first incursion into Scope 3 emissions.

Fleet emissions and staff business travel emissions have been calculated using a combination of mileage recorded and vehicle type (or number plate, which allows us to find the vehicle type). However, according to BEIS guidance for vehicles where an organisation has data in litres of fuel or kWh electricity consumed, the 'fuels' or 'electricity' conversion factors should be applied, which provide more accurate emissions results. In the private sector the mandatory reporting requirements for recording transport use under the Energy Savings Opportunity Scheme (ESOS), where it is not de-minimis, has led to companies opting for fuel cards. We can see some of the small fleet uses it and we consider it might be a good idea to roll this out so the Council can collect fuel data and be more accurate.

Recommendation 2 – To collect transport data in terms of litres as opposed to miles of fuel used and roll out the use of fuel cards where appropriate.

3.2.4 Fugitive Emissions

These are the emissions caused by small gas escapes from air conditioning systems. As we have learned in section 3.1.3 the global warming potential of certain gases is much greater than that of CO2. This is the case of Hydrofluorocarbons (HFCs) which are used inside the condenser in AC equipment and can leak out over time. There are also regulatory requirements governing the operation of stationary equipment using fluorinated greenhouse gases.

The UK guidance presents two methods for the estimation of emissions from the use of refrigeration, air conditioning equipment and heat pumps. For smaller users, the Screening Method will likely be the easiest way to calculate their emissions. Details on how the Screening Method works can be found in Annex C of the SERC Guidance[25]. Some larger users of refrigerant should have the information necessary to perform a more accurate estimation using the Simplified Material Balance Method.

The Screening Method will help the Council to estimate emissions from refrigeration, air conditioning and heat pumps based on the type of equipment used and emissions factors. This approach requires relatively little actual data collection because default factors are used instead e.g. installation emission factors, annual leak rate. Although there is a high degree of uncertainty with these factors, emissions from this equipment are not significant when compared to the Council's organisation's other emissions sources, so the guidance points out to this as the most appropriate method (as opposed to the Simplified Material Balance Method).

At present neither of these methods are used at the Council and, although facilities management colleagues were able to confirm there had been no major leaks or gas top ups during the Baseline Year (2018-19) this remains an area of weakness in the Baseline as we do not think it is properly understood or monitored. Further guidance on how to measure and report on fugitive emissions can be found in the aforementioned UK Government Guidance.

Recommendation 3 – To undertake the necessary steps to be able to report on fugitive emissions using the Screening Method.

[25] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

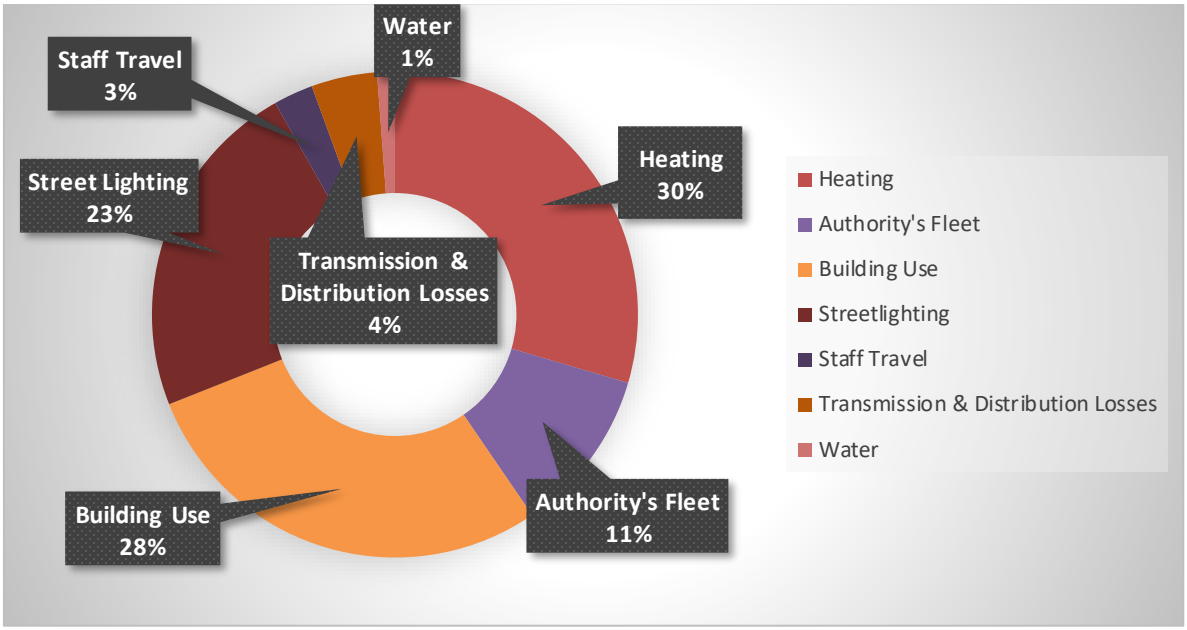
3.3 Baseline year

The Baseline Year for the Council's net zero carbon ambitions was agreed as 2018/19, as this is the year immediately prior to the Climate Emergency Declaration. The energy and fuel consumption data for the year 2018/19 has been used to construct the Baseline, applying the 2018 BEIS conversion factor to the data to derive the Baseline, as per standard industry practice.

3.4 Carbon Baseline breakdown

The aforementioned datasets from the different Council departments were reviewed and integrated into Local Partnerships' Carbon Accounting Tool' (copy supplied separately on Excel format). The below is a graphic representation of the contribution of the different elements of the Council to this Baseline of CO_2e emissions, with electricity and gas consumption in buildings taking the lion share.

Figure 4 – Medway Council 2018-19 carbon emissions in percentage terms



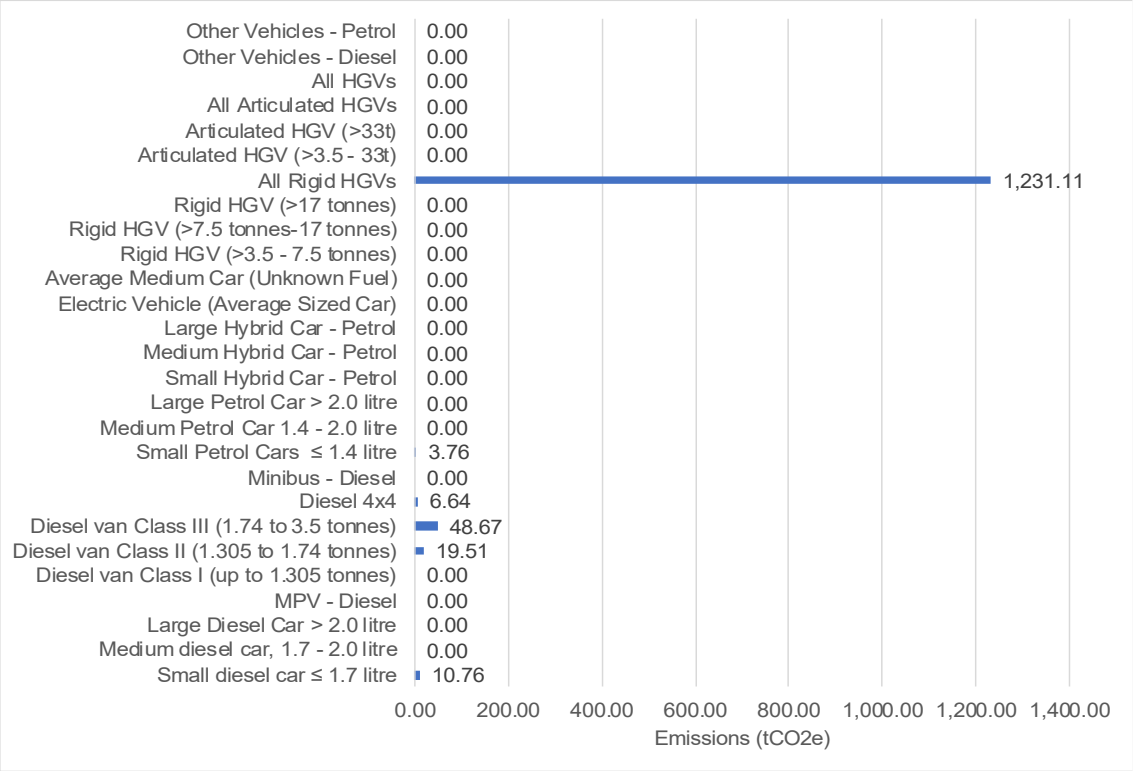
A more detailed breakdown of the Council Baseline per Scope, type of fuel, fuel usage and type of vehicle is in Table 5 below. Most of the heating is provided by gas, which has a lower carbon intensity than oil. (Oil is still present but in a very small percentage.) In terms of transport most of the emissions come from the waste fleet. When it comes to staff travel the majority of the mileage comes from small petrol vehicles, which have lower emissions than bigger, heavier diesel vehicles. Bigger vehicles seem to be more prevalent in the Council's own fleet and this is one of the reasons why we include a recommendation to switch to electric fleet ASAP when it comes to early interventions on the pathway to zero carbon.

Table 5 – Detailed breakdown of Baseline

Scope	Emissions Type	Activity	Emissions (tCO_2e)	Percentage of Type Emissions	Percentage of Total Emissions
Scope 1	Heating	Natural Gas	3,399.76	95.1%	28.1%
		Burning Oil - Kerosene	0.00	0.0%	0.0%
		Gas Oil	176.26	4.9%	1.5%
		Wood Pellets	0.00	0.0%	0.0%
	Fugitive Emissions	HFC-32	0.00	0.0%	0.0%
		R410A	0.00	0.0%	0.0%
		HCFC-22/R22	0.00	0.0%	0.0%
		Other Fugitive Emissions	0.00	0.0%	0.0%
	Authority's Fleet	Small diesel car ≤ 1.7 litre	10.76	0.8%	0.1%
		Medium diesel car, 1.7 - 2.0 litre	0.00	0.0%	0.0%
		Large Diesel Car > 2.0 litre	0.00	0.0%	0.0%
		MPV - Diesel	0.00	0.0%	0.0%
		Diesel van Class I (up to 1.305 tonnes)	0.00	0.0%	0.0%
		Diesel van Class II (1.305 to 1.74 tonnes)	19.51	1.5%	0.2%
		Diesel van Class III (1.74 to 3.5 tonnes)	48.67	3.7%	0.4%
		Diesel 4x4	6.64	0.5%	0.1%
		Minibus - Diesel	0.00	0.0%	0.0%
		Small Petrol Cars ≤ 1.4 litre	3.76	0.3%	0.0%
		Medium Petrol Car 1.4 - 2.0 litre	0.00	0.0%	0.0%
		Large Petrol Car > 2.0 litre	0.00	0.0%	0.0%
		Small Hybrid Car - Petrol	0.00	0.0%	0.0%
		Medium Hybrid Car - Petrol	0.00	0.0%	0.0%
		Large Hybrid Car - Petrol	0.00	0.0%	0.0%
		Electric Vehicle (Average Sized Car)	0.00	0.0%	0.0%
		Average Medium Car (Unknown Fuel)	0.00	0.0%	0.0%
		Rigid HGV (>3.5 - 7.5 tonnes)	0.00	0.0%	0.0%
		Rigid HGV (>7.5 tonnes-17 tonnes)	0.00	0.0%	0.0%
		Rigid HGV (>17 tonnes)	0.00	0.0%	0.0%
		All Rigid HGVs	1,231.11	93.2%	10.2%
		Articulated HGV (>3.5 - 33t)	0.00	0.0%	0.0%
		Articulated HGV (>33t)	0.00	0.0%	0.0%
		All Articulated HGVs	0.00	0.0%	0.0%
		All HGVs	0.00	0.0%	0.0%
		Other Vehicles - Diesel	0.00	0.0%	0.0%
		Other Vehicles - Petrol	0.00	0.0%	0.0%
Scope 2	Electricity	Building Use	3,453.80	55.6%	28.5%
		Streetlighting	2,762.29	44.4%	22.8%
Scope 3	Staff Travel	Small Petrol Motorbike (Mopeds/Scooters up to 125cc)	0.00	0.0%	0.0%
		Medium Petrol Motorbike (125-500cc)	0.00	0.0%	0.0%
		Average Medium Car (unknown fuel)	0.00	0.0%	0.0%
		Small Petrol Cars ≤ 1.4 litre	117.18	36.7%	1.0%
		Medium Petrol Car 1.4 - 2.0 litre	83.29	26.1%	0.7%
		Large Petrol Car > 2.0 litre	6.92	2.2%	0.1%
		Small Diesel Car ≤ 1.7 litre	53.09	16.6%	0.4%
		Medium Diesel Car 1.7 - 2.0 litre	34.80	10.9%	0.3%
		Large Diesel Car > 2.0 litre	24.22	7.6%	0.2%
		Small Hybrid Car - Petrol	0.00	0.0%	0.0%
		Medium Hybrid Car - Petrol	0.00	0.0%	0.0%
		Large Hybrid Car - Petrol	0.00	0.0%	0.0%
		Electric Vehicle (Average Sized Car)	0.01	0.0%	0.0%
	Transmission & Distribution Losses	T&D Losses - Scope 2 Electricity	529.83	100.0%	4.4%
		T&D Losses - EV	0.00	0.0%	0.0%
	Water	Water Supply	48.46	33.8%	0.4%
		Water Treatment	94.75	66.2%	0.8%

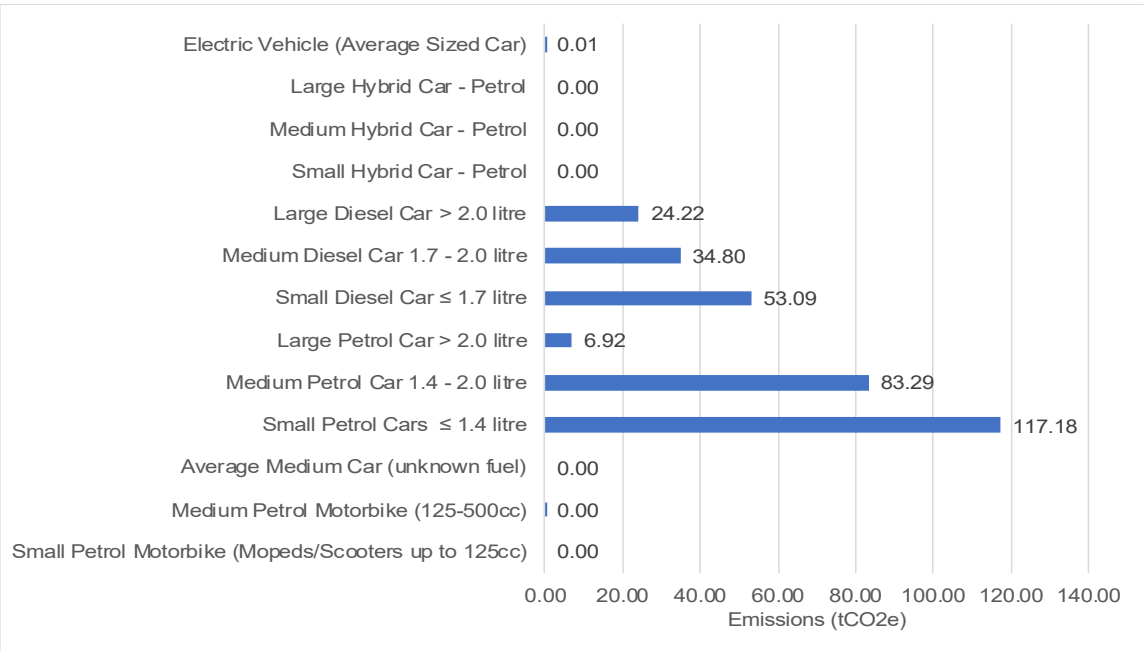
This table and the chart presented in Figure 5 also illustrate that the emissions from the waste vehicles clearly outweigh anything else in terms of Council fleet. Next steps need to include an investigation of the potential cost and estimated savings that could be achieved from the electrification (or conversion to hydrogen) of this part of the Council fleet.

Figure 5 – Medway Council 2018-19 carbon emissions from Council Fleet



When it comes to staff travel, even though the largest proportion of emissions comes from small petrol cars, emissions from staff travel are spread over a number of vehicle categories. With the roll out of electric vehicle (EV) charging points in Council building carparks (which the Council is anticipated to deliver through Re:fit), new ways of working and the Government intention to phase out the sale of petrol and diesel cars, the carbon emissions from this category will be reduced in coming years. In addition, the relevant policy needs to be amended to allow EV owners to still claim essential car user allowance. This could be used to incentivise a switch to EV by staff.

Figure 6 – Medway Council 2018-19 carbon emissions from Staff Business Travel



3.5 Reporting guidance review

As emissions reporting for local authorities (as well as any reduction targets) are currently voluntary, there is not one specific set of guidance that must be adhered to. Whilst the UK Government has produced (and continues to update) guidance on reporting for the public sector, including local authorities, there are also global standards, such as the GHG Protocol, that would be suitable to follow, especially if the Council were to begin reporting Scope 3 emissions more extensively. Also, carbon accounting is a discipline under development with examples most commonly found in the private sector, which we will continue to investigate during the course of 2020-21 with a view to adopt a specific methodology for the Council. In this section we review some of the guidance and standards currently available so that the Council can evaluate their merits and propose a different mix of reporting criteria to that currently used at its discretion.

3.5.1 Greenhouse Gas Protocol

Originally published in 2001 and with numerous revisions to this date, the Greenhouse Gas Protocol (GHG Protocol) and associated 'Standards' are prepared jointly by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) and is reportedly the most widely used international carbon accounting tool. The guidance documents are complemented by a number of cross-sector and sector-specific calculation tools that are consistent with those proposed by the Intergovernmental Panel on Climate Change (IPCC).

The Standards currently consist of the following products:

- Corporate Standard
- GHG Protocol for Cities
- Mitigation Goal Standard
- Corporate Value Chain (Scope 3) Standard
- Policy and Action Standard
- Policy and Action Standard
- Project Protocol

The most relevant standard to this project is the GHG Protocol for Cities, which supersedes the International Local Government Greenhouse Gas Emissions Analysis Protocol (community section) published by ICLEI – Local Governments for Sustainability in 2009 (and the International Standard for Determining Greenhouse Gas Emissions for Cities published by the World Bank, United Nations Environment Programme (UNEP), and UN-Habitat, United Nations Human Settlements Programme, in 2010).

The Standards are globally recognised tools and are based upon step-by-step approaches to carbon accounting at the corporate, organisational and project level. As these tools are taken to represent current best practice they have been considered as the basis of our methodology as stated in section 3.1 above.

3.5.2 BEIS Emissions Pledge Guidance

Within the Clean Growth Strategy, the government introduced a voluntary target for carbon emissions reduction that is better known as the 'Emissions Reduction Pledge 2020'. This was set as a 30% reduction by 2020 compared to a 2009/10 Baseline and invited the 'wider public sector' to participate, including all local authorities. Attached to the Pledge are two documents[26], one of which provides guidance for emissions reporting specifically for the public sector and higher education. Although relatively short-lived (in theory this guidance is for reporting between 2018 and 2020) this document contains the BEIS reporting principles which, on the whole, the Council should be following, including quoting the 'grey fleet' (use of employees' own cars for which fuel costs are

[26] https://www.gov.uk/government/publications/emissions-reduction-pledge-2020-emissions-reporting-in-public-and-higher-education-sectors

claimed back via expenses, i.e. staff business travel) as an example of Scope 3 emissions, which the Council has included in its Baseline.

Generally this guidance comprises very similar steps to the GHG Protocol when it comes to gathering and reporting emissions data, with slightly different names that might be more reflective of local authorities' language, i.e. 'defining the state', 'emissions data' (deciding what to include under each scope), 'setting the Baseline year' (recommends 2009/10), and finally 'emissions reporting' using any relevant template the local authority had already been using, e.g. former National Indicator 185. Further guidance is then offered in terms of performance against the 2020 target and how to register etc. A second document provides an overview of the potential effect on emissions of the introduction different payback measures and what will happen beyond energy efficiency.

Whist this guidance is current and specific to the public sector, in our opinion it does not have the depth to form part of a long-term carbon accounting framework. As the guidance itself recognises the government is still to set a robust reporting framework, which should include carbon accountancy principles and guidance on how to use them.

3.5.3 UK SECR Guidance (Streamlined Energy and Carbon Reporting)

The accounting standard adopted for the Council's Baseline is one that aligns principally with HM Government's 'Environment Reporting Guidelines: Including streamlined energy and carbon reporting guidance' (2019 update)[27] regarding how organisations with voluntary reporting on a range of environmental matters, including voluntary energy and carbon emissions, can approach their reporting. This Guidance, co-authored by Defra and BEIS, refers specifically to local authorities and proposes a number of accounting and reporting principles: Relevant, Quantitative, Accuracy, Completeness, Consistent, Comparable, and Transparent, which correspond with the GHG Protocol. We elaborate further on the meaning and implications of this UK Government Guidance in section 3.7.

The SECR guidance also establishes a step by step approach to reporting, as follows:

- Step 1 Determine the boundaries of your organisation
- Step 2 Determine the period for which you should collect data
- Step 3 Determine the key environmental impacts for your organisation
- Step 4 Measure
- Step 5 Report

In addition, this document provides detail on how to undertake each of those steps, defining for example the different types of 'boundary' (financial control, operational control, etc), which local authorities have now been using for a number of years. Furthermore, this document provides detailed guidance on the use of 'carbon intensity factors' which, as recommended earlier in this report, might be of use to be able to meaningfully compare emissions over time. Guidance is also provided on 'upstream' and 'downstream' emissions, which will be necessary to consider if the Council decides in due course to report on a wider range of Scope 3 emissions.

Whilst this guidance is not as detailed or internationally recognised as the GHG Protocol, we believe it should be the Council's first reference point for guidance until BEIS publishes the 'robust

[27] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

reporting framework' as mentioned in the Emissions Reduction Pledge 2020 High Level Assessment[28].

3.5.4 Carbon Trust

The Carbon Trust approach to carbon reporting has long been building on existing international standards for the measurement of carbon emissions. The Carbon Trust Standard was launched in June 2008 and makes direct reference to the GHG Protocol and ISO14064 – Greenhouse Gases. The Carbon Trust approach is based upon the following five main steps:

1. define the methodology;
2. specify the boundary and scope of coverage;
3. collect emissions data and calculate the footprint;
4. verify results (optional); and
5. disclose the footprint (optional).

This is very similar to both the SECR Guidance and the GHG Protocol methodology but, in our opinion, lacks the recognition of actual Government guidance or the global dimension of the GHG Protocol.

3.5.5 BS ISO 14064-1:2019

This part of the ISO14064 series, named 'Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals'[29], details principles and requirements for designing, developing, managing, and reporting for organisation level GHG inventories. This standard incorporates many key concepts and requirements of the GHG Protocol above and is therefore consistent with our proposed approach for the Council, as set out.

3.6 Reporting Obligations

With the Carbon Reduction Commitment (CRC) now phased out (last submission was 2018-19), the only remaining reporting required of local authorities is the voluntary reporting on their own estate and operations (Scope 1 and Scope 2 emissions). It is anticipated that Government Policy in this area could change as it strives to meet the binding 2050 targets.

Our recommendation is for the Council to follow the SECR guidance as laid out in the document 'Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance, March 2019'[30]. UK Government guidance is in line with the international Greenhouse Gas Protocol, with the latest guidance document drawing from this international standard on accountancy principles, boundary analysis and voluntary reporting.

Recommendation 4 – Follow UK Government SECR Guidance on reporting emissions.

In particular, the Council should be aware of the guidance on developing a baseline recalculation policy and the setting of a threshold that will trigger the recalculation (page 18 of the March 2019 version of the Guidelines). Local Authorities are also provided with guidance on 'Assurance and

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28 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/721974/High_Level_Potential_Assessment-final_July2018.pdf

29 https://shop.bsigroup.com/ProductDetail/?pid=000000000030327038

30 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

verification' (pages 19 and 20 of the March 2019 version of the Guidelines), which stresses the importance of third party, independent reviewers.

Recommendation 5 – Develop an 'Assurance and Verification' policy in line with Government Guidance

3.7 Proposed Accounting Principles

The GHG Protocol takes its accounting principles from the Corporate Standard, adapted to fit public sector clients and now more specifically cities. The principles and their implications are very similar to those proposed by the UK Government which, according to the aforementioned SECR guidance, are based on the GHG Protocol. Table 6 below provides a comparison between the two.

Table 6– Accounting Principles Comparison

GHG Protocol	SECR Guidance
Relevance: The reported GHG emissions shall appropriately reflect emissions occurring as a result of activities and consumption patterns of the city. The inventory will also serve the decision-making needs of the city, taking into consideration relevant local, subnational, and national regulations. The principle of relevance applies when selecting data sources and determining and prioritising data collection improvements.	Relevant: Ensure the data collected and reported appropriately reflects the environmental impacts of your organisation and serves the decision-making needs of users — both internal and external to your organisation.
	Quantitative: KPIs need to be measurable. Targets can be set to reduce a particular impact. In this way the effectiveness of environmental policies and management systems can be evaluated and validated. Each chapter provides the details for that subject area. Quantitative information should be accompanied by a narrative, explaining its purpose, impacts, and giving comparators where appropriate.
Accuracy: The calculation of GHG emissions shall not systematically overstate or understate actual GHG emissions. Accuracy should be sufficient enough to give decision makers and the public reasonable assurance of the integrity of the reported information. Uncertainties in the quantification process shall be reduced to the extent that it is possible and practical.	Accuracy: Seek to reduce uncertainties in your reported figures where practical. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information.
Completeness: Cities shall account for all required emissions sources within the inventory boundary. Any exclusion of emission sources shall be justified and clearly explained. Notation keys shall be used when an emission source is excluded, and/or not occurring.	Completeness: Quantify and report on all sources of environmental impact within the reporting boundary that you have defined. Disclose and justify any specific exclusions.
Consistency: Emissions calculations shall be consistent in approach, boundary, and methodology. Using consistent methodologies for calculating GHG emissions enables meaningful documentation of emission changes over time, trend analysis, and	Consistent: Use consistent methodologies to allow for meaningful comparisons of environmental impact data over time. Document any changes to the data, changes in your organisational boundary, methods, or any other relevant factors.

GHG Protocol	SECR Guidance
comparisons between cities. Calculating emissions should follow the methodological approaches provided by the GPC. Any deviation from the preferred methodologies shall be disclosed and justified.	
	Comparable: Organisations should report data using accepted KPIs rather than inventing their own versions of potentially standard indicators. The narrative part of a report provides the opportunity for an organisation to discuss any tensions which exist between providing comparable data and reporting organisation-specific KPIs. Use of accepted KPIs will aid you in benchmarking your organization and will aid users of your report to judge your performance against that of your peers.
Transparency: Activity data, emission sources, emission factors, and accounting methodologies require adequate documentation and disclosure to enable verification. The information should be sufficient to allow individuals outside of the inventory process to use the same source data and derive the same results. All exclusions shall be clearly identified, disclosed and justified.	Transparent: This is essential to producing a credible report. Address all relevant issues in a factual and coherent manner, keeping a record of all assumptions, calculations, and methodologies used. Internal processes, systems and procedures are important, and the quantitative data will be greatly enhanced if accompanied by a description of how and why the data are collected. Report on any relevant assumptions and make appropriate references to methodologies and data sources used. There is more on transparency in Step 5 on reporting.

In Local Partnerships' opinion, the SECR principles, although indeed very similar to the GHG Protocol, better reflect the voluntary nature of carbon reporting for local authorities at present. The language used is also made to fit a number of organisations and naturally tie in with other UK Government guidance. As a result, we recommend that the Council use SECR's accountancy principles as stated above, combined with the GHG Protocol reporting methodology (the six steps approach) covered earlier.

In addition, we recommend that the Council takes into consideration additional guidance contained within the GHG Protocol, which we believe will become more relevant as we advance on our path to become a net zero carbon nation by 2050, namely that within the requirements of any accountancy framework, an organisation will need to make important decisions in terms of setting the inventory boundary, choosing calculation methods, deciding whether to include additional Scope 3 sources, etc. Trade-offs between these principles may be required based on the objectives or needs of the organisation. For example, achieving a complete inventory may at times require using less accurate data. Having said that, over time, as both the accuracy and completeness of emissions data increase, the need for trade-offs between these accounting principles will likely diminish.

Recommendation 6 – Combine SECR Carbon Accounting Principles with the GHG Protocol Reporting Methodology, especially for Scope 3 emissions.

3.8 Data Collection Recommendations

Through the building of the Baseline we identified a number of practices that would help create a robust reporting framework for the Council (and potentially some additional carbon savings) going forward, and which we suggest are implemented:

1. In order to contribute to the 'Transparency' accountancy principle, which will become increasingly important as members of the public scrutinise local government plans to address the 'climate emergency', it is good practice to introduce a Data Collection Tracker tab at the end of the Data Sheet used to collect energy and buildings data so that the data collection exercise can be picked up from anyone in the Council and members of the public can see how each service area is involved in the process of calculating emissions.
2. A 'Projects and Savings' Tab that links to the Re:fit projects could be a useful addition to the Data Sheet. As Re:fit is an energy performance contract, the standard approach will mean that the Council can record actual, guaranteed savings that have been measured and verified.
3. Introduce a 'comparison tab' in the Data Sheet, which includes potential explanations to changes in the data (e.g. discrepancies between the LASER reports and the Baseline Data Sheet or between the Baseline Data Sheet and earlier input from different departments).
4. Thorough recording of A/C gas top ups will allow the Council to report on 'fugitive emissions' with confidence. The elimination of air conditioning leaks has made the significant contributions to carbon savings in a given year for other councils. It is therefore, suggested that, in addition to investigating further and reporting on this 'fugitive emissions' as per the Screening Method, planned maintenance for air conditioning (as opposed to reactive maintenance) is introduced across the portfolio if it is not present already.
5. Early engagement, joint briefing and cooperation across departments is key when it comes to Baseline and future updates, especially as the Council increases the amount of Scope 3 emissions reported every year. The formation of a Carbon Reporting Working Group could be a way of achieving some efficiencies and saving some time next time around.

Recommendation 7 – Adopt the following data collection recommendations:

- **Introduce a Data Collection Tracker tab at the end of the Data Sheet**
- **Add a 'Projects and Savings' Tab to the Data Sheet that links to the Re:fit projects**
- **Introduce a 'comparison tab' in the Data Sheet, which includes potential explanations to changes in the data**
- **Thorough recording of A/C gas top ups so the Council can report on 'fugitive emissions' with confidence following the Screening Method.**
- **Introduce planned maintenance for air conditioning (as opposed to reactive maintenance) if it is not present already.**
- **Consider the formation of a Carbon Reporting Working Group that will ensure early engagement, joint briefing and cooperation across departments to achieve efficiencies and save time when reporting carbon emissions**

4 PATHWAYS TO NET ZERO CARBON

4.1 Uncertainty in modelling pathways to net zero carbon

As part of our proposal Local Partnerships offered to help the Council map out a way of achieving the 'net zero' target by 2050. The Council made a request to investigate a potential pathway to zero carbon by 2030 as well but, after carrying out the analysis, this was deemed unachievable with the current level of resources and human capital. Pathways will of course be very dependent on factors outside our control, such as the structure of the Council going forward, property investments vs. rationalisation, diversification vs. amalgamation of services, etc.. In addition, there is an element of population growth expected, which could translate into a service expansion that would potentially increase emissions. On the other hand, technological developments, efficiencies, new ways of working and the decarbonisation of the grid can help keep emissions down[31].

Projecting potential pathways of emissions to 'net zero' by 2050 is therefore difficult, and modelling all of such variables virtually impossible, but we have endeavoured to do so by presenting two alternative approaches as well as a number of example interventions we can calculate emissions reductions for. This kind of scenario modelling is also really useful in order to calculate an appropriate 'carbon budget', which represents the council's permitted amount of carbon emissions over a given period of time, a 'first step' towards net zero carbon. Adopting carbon budgets, which can be reviewed and adjusted at certain intervals, aligns with HM Government current approach to the nation's pathway to net zero carbon.

At present, the Baseline for the Council as calculated by Local Partnerships is based on a boundary that includes Scope 1 and 2, which will always be the responsibility of the authority, plus a limited amount of Scope 3 emissions, which currently the Council can choose to include or exclude. However, it is worth noting that, as the UK Government addresses its 2050 commitments, the emissions local authorities would be made responsible for might change, with local government potentially being required to take responsibility for emissions reductions on other services such as education. **Therefore the actual scale of the interventions required may be higher.**

The potential pathways presented in this report are based on the best available information at the time of writing this report. However, by their very nature, they will not be a true and accurate forecast of actual emissions as these will be affected by a range of factors over time including for example:

1. Changes to service delivery models following the COVID-19 outbreak
2. Property rationalisation or investment into new buildings
3. Changes in services and transport needs from those services
4. Changes to service provision required of local authorities over the period 2020-2050
5. Significant changes to the population in the Council area (either overall numbers or demographics) – driving changes to service volumes
6. The accuracy of BEIS projected energy intensity conversion factors for electricity

Projecting these pathways is important as they show us the kind of carbon emissions reduction the Council needs to achieve year on year, helping us understand the scale of the challenge different targets bring and manage the likely carbon emissions. They are thus an important tool in visualising emissions over time, setting targets and tracking progress towards those targets.

[31] For the purposes of this exercise we have assume that the above will counteract and cancel each other.

4.2 Methodology

The different pathways are produced by a Local Partnerships proprietary modelling tool.

In producing the pathways the following data sources have been used:

1. The 2018/19 carbon emissions Baseline data including the underlying energy consumption data from both buildings and transport
2. BEIS actual conversion factors for the year 2018 and 2019
3. BEIS forecast data for projected conversion factors for electricity for the period from 2020-2050.
4. Additional data supplied by Medway Council on:

    a. Fleet (type of vehicles, mileage and fuel use)
    b. Staff travel mileage, inc. types of vehicles (data-protection validated)
    c. Details on Estate and building services
    d. Cabinet report on street lighting

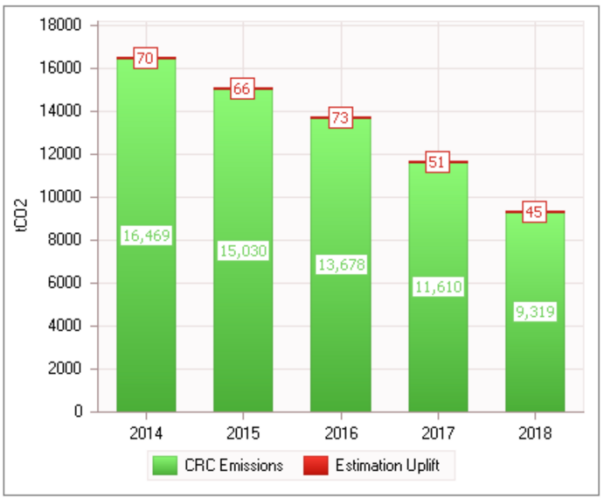
5. Estimates supplied by the Re:fit service provider on:

    a. Re:fit Phase 1 cost and savings
    b. Potential cost and savings of introducing heat pumps across all suitable council buildings
    c. Estimates on the potential for solar PV across the Council's Estate
    d. Prices for the replacement of fleet with EV and average savings for refuse collection vehicles (RCVs)

4.3 Progress to Date and the role of Grid Decarbonisation

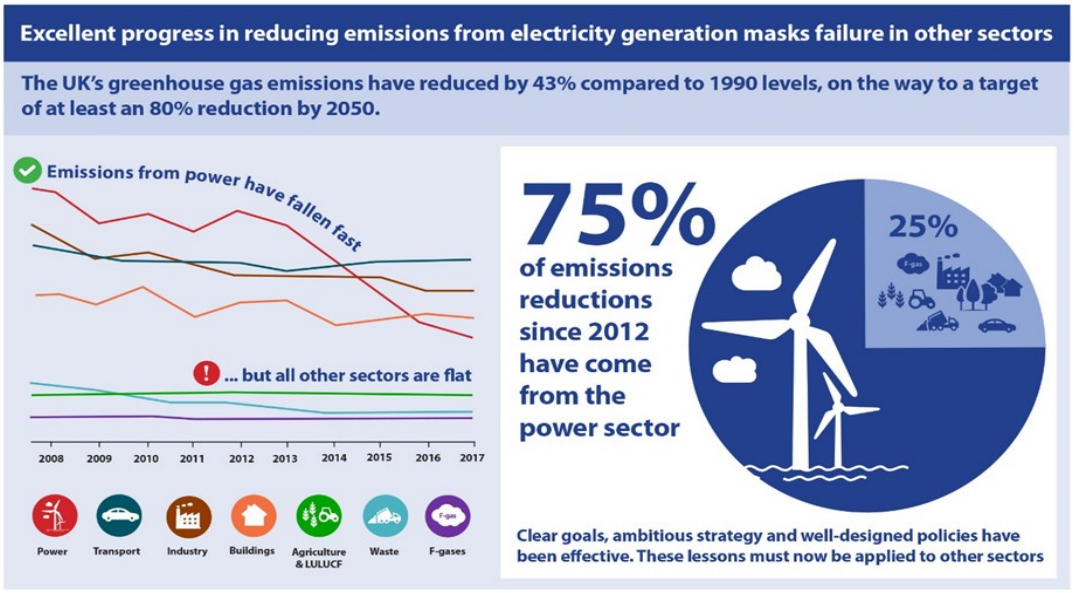
The Council, as well as most local authorities, has been undertaking initiatives to reduce their carbon emissions for a number of years, and has seen emissions fall. Boiler and lighting upgrades are at the core of the efforts from Property Services, with works in Gun Wharf but also other Council properties. In addition an on-going programme has seen circa 5,000 street lamps being replaced with LED over the last few years. This has resulted in emissions falling in this manner:

Figure 7 - Medway CRC Emissions Reporting 2014-2018. Source – LASER



However, it would not be fair to assume that all emissions reductions in the past are as a direct consequence of work by the Council to reduce emissions. The UK has seen rapid decarbonisation of its electricity supply over the last 8 years. Figure 8 produced by the Committee on Climate Change sets out the progress towards decarbonisation made by the main sectors of the economy since 2012.

Figure 8 – UK progress towards decarbonisation32



In the period between 2014 and 2019 grid supplied electricity energy intensity factors[33] almost halved. During the same period Medway Council reduced its carbon emissions by around 43% whilst its energy consumption only really reduced by 11% as we can see in the analysis by utilities provider LASER in figure 9 below. This is to say that the majority of the carbon savings achieved in the last five years have been as a result of external factors, rather than direct interventions by the Council.

Figure 9 - Medway CRC Data. Source – LASER

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Medway Council

Medway - CRC Figures - April 2014 to March 2019

Changes in Consumption (kWh)

	2014/15	2015/16	2016/17	2017/18	2018/19
Electricity	25,796,574	24,570,572	24,098,074	22,759,477	21,717,823
Electricity - Self Supply	6,985	31,284	149,085	447,661	619,097
Gas	14,704,839	15,317,153	15,542,785	15,083,448	13,751,140
Sub total	**40,508,398**	**39,919,010**	**39,789,944**	**38,290,585**	**36,088,061**
Percentage difference from 2014/15	**Baseline**	**-1.45%**	**-1.77%**	**-5.47%**	**-10.91%**

Changes in Carbon emissions (tCO2)

	2014/15	2015/16	2016/17	2017/18	2018/19
Electricity	13,822.12	12,258.83	10,818.50	8,725.47	6,659.96
Electricity - Self Supply	3.77	14.34	61.06	156.17	173.95
Gas	2,713.88	2,822.61	2,871.86	2,779.42	2,530.08
Sub total	**16,539.77**	**15,095.78**	**13,751.42**	**11,661.06**	**9,363.99**
Percentage difference since 2014/15	**Baseline**	**-8.73%**	**-16.86%**	**-29.50%**	**-43.39%**

[32] Source: Committee on Climate Change 2018 progress report to Parliament – June 2018

[33] Also called 'emission factor' it assigns a certain value of carbon emissions to each unit of energy consumed according to type, e.g. natural gas conversion factor or grid electricity conversion factor. These are published annually by the UK Government https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

The UK Government has committed the UK to be a net zero emitter of carbon by 2050. In order to achieve that, decarbonisation of electricity generation will be a pre-requisite. The UK Government has continued to make progress with deployment of renewable energy and there are a number of measures in place or in the pipeline that should provide confidence that grid decarbonisation is likely to continue for the foreseeable future. These measures include:

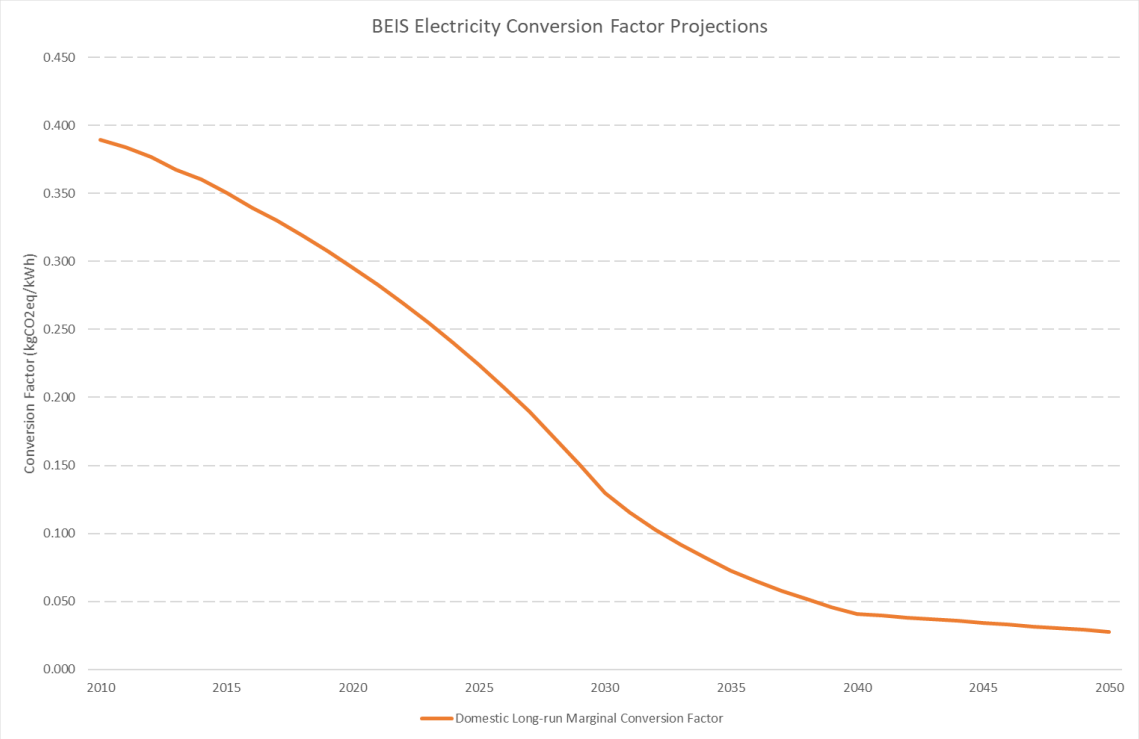
1. Offshore wind sector deal – aiming to triple current capacity to 30 GW by 2030.

2. Introduction of the Smart Export Guarantee Scheme – guaranteeing both an export market and a positive tariff at all times for small generators under 5 MW.

3. Announcement that there will be an allocation for mature technologies in the next round of Contract for Difference Auctions in 2021. This in effect provides a mechanism for price guarantees for both onshore wind and solar PV schemes that are successful in the auction.

BEIS last revised the forecasts for electricity conversion factors in 2010. Decarbonisation has been happening at a rate slightly higher than the forecast figures. The future forecasts are shown at Figure 10.

Figure 10 – Forecast for electricity grid decarbonisation 2010-2050.



Grid decarbonisation looks set to continue, but the rates of decarbonisation are likely to be less pronounced as almost all coal fired power stations have already been removed from the generation mix. In order to achieve net zero by 2050 the UK will have to increase its supply of renewable energy to around four times current levels, to allow for removal of the of gas fired power stations from the generation mix.

4.4 A pathway with no carbon reduction interventions

The graph below, Figure 11, shows the current pathway for the Council with no interventions, just relying on the aforementioned decarbonisation of the grid that makes the carbon content of every

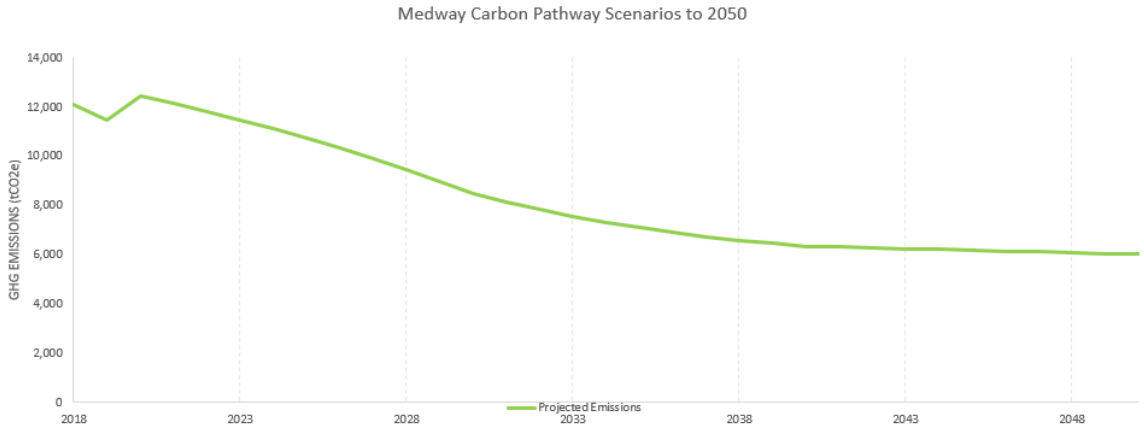
kWh used by the Council have a lower level of carbon associated with it. The grid decarbonisation rate is based on the BEIS long run marginal projections.[34]

Whilst policies are in place to ensure ongoing grid decarbonisation the actual rates may vary from the marginal projections and that will impact the pathway of the graph at Figure 10.

This methodology takes the Baseline data (2018-19) and uses the 'actual' conversion factors as issued by BEIS year on year, in this case 2018 and 2019's. From that year onwards BEIS 'projected' conversion factors are used, which were issued in 2010. Grid decarbonisation has actually occurred at a rate faster than shown in the BEIS 2010 projected conversion factors, which explains the apparent increase of emissions in 2020. **This is not an increase in actual emissions**, but an adjustment as forecast conversion factors take over from actual ones.

This pathway gives us an idea of what emissions would be like in 2050 if there were no interventions or change in services and their emissions due to population growth or rationalisation. The only factor changing over time is the carbon intensity of electricity.

Figure 11 – Medway Council decarbonisation pathway with no interventions



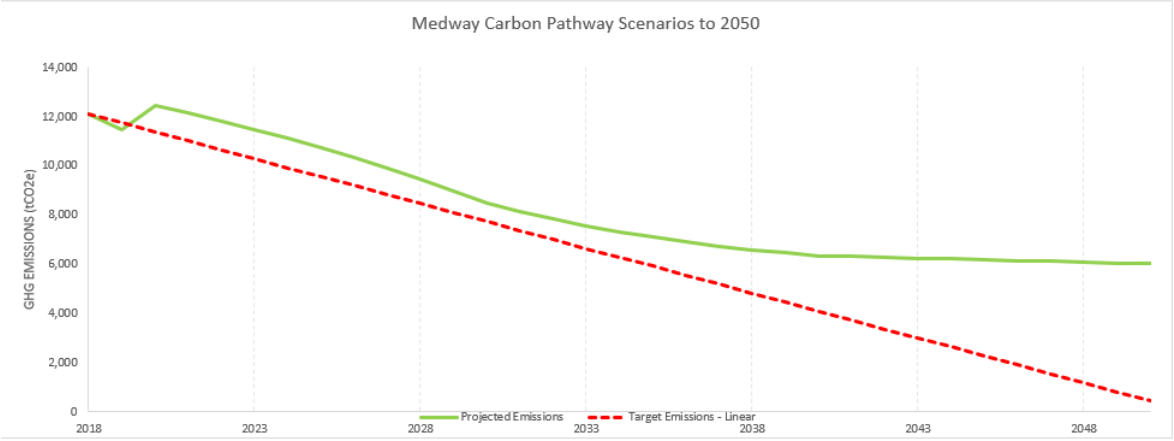
This pathway indicates that, without further intervention from the Council and assuming no other changes in the level of energy consumption of the Council, the carbon emissions in 2050 would be 6,020 tCO_2e p.a. Most of these remaining emissions would be Scope 1 as grid decarbonisation would have already taken place. In the early years, projects which tackle Scope 2 emissions (electricity) are attractive, but they have diminishing returns and, from 2030-2035, it will be important to tackle Scope 1 emissions if the net zero target is to be met.

4.5 A Linear Pathway

In order for the Council to achieve net zero by 2050, a year-on-year reduction of 390 tonnes CO_2e would be required, starting from the Baseline year of 2018-19, equivalent to an annual reduction of 3.23%.

[34] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794738/background-documentation-guidance-on-valuation-of-energy-use-and-greenhouse-gas-emissions.pdf
https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Figure 12 – Linear Pathway to Zero Carbon 2050 against emissions trajectory with no interventions



However a linear approach to reducing carbon emissions will not guarantee that achieving net zero carbon by 2050 will give us the scale of reductions required to keep global warming below 1.5 to 2 degrees C from pre-industrial levels which, according to the scientific consensus, is imperative if we want to avoid runaway climate change. Besides the impact of certain interventions, such as investing in solar farms, being greater now, the danger of the Linear Pathway is that reductions get harder and harder to achieve towards the end.

4.6 Exponential Reduction Pathway – A Science Based Target

In November 2019 a collaboration of the universities of Cambridge, Bath, Nottingham, Strathclyde, Oxford and Imperial College London published a study under the combined banner of UK Fires entitled Absolute Zero[35]. The purpose of the paper is to consider how the UK can deliver its climate change commitments with only incremental changes to today's technologies. The paper states:

> *"30 years is a short time for such a big change. Politicians in the UK and internationally talk about climate change as if it can be solved by new energy technologies alone, and the UK government reports are over-confident about how much progress has been achieved. In reality most UK cuts in emissions have been as a result of Mrs Thatcher's decision to switch from coal to gas fired electricity and to allow UK heavy industry to close. The UK has been successful in reducing methane emissions – by separating our organic waste and using it in anaerobic digesters to make gas for energy, but new technologies are developing slowly.*
>
> *There are no invisible solutions to climate change so we urgently need to engage everyone in the process of delivering the changes that will lead to zero emissions"*

The paper goes on to provide useful and informative suggestions about how the UK can achieve the 2050 net zero target, and we will draw on these further in later sections of the report.

The Exponential Roadmap[36] was produced for the Global Climate Action Summit in 2018 and sets out practical steps and an Exponential Reduction Pathway to reducing global greenhouse gas emissions consistent with limiting global warming to 1.5°C, what is commonly known as a Science Based Target (SBT). The report is a largely Swedish collaboration of academia and industry and

[35] Absolute Zero – UK FIRES
[36] https://exponentialroadmap.org/

was hailed by Manuel-Pulgar-Vidal leader of WWF's global climate and energy programme as follows:

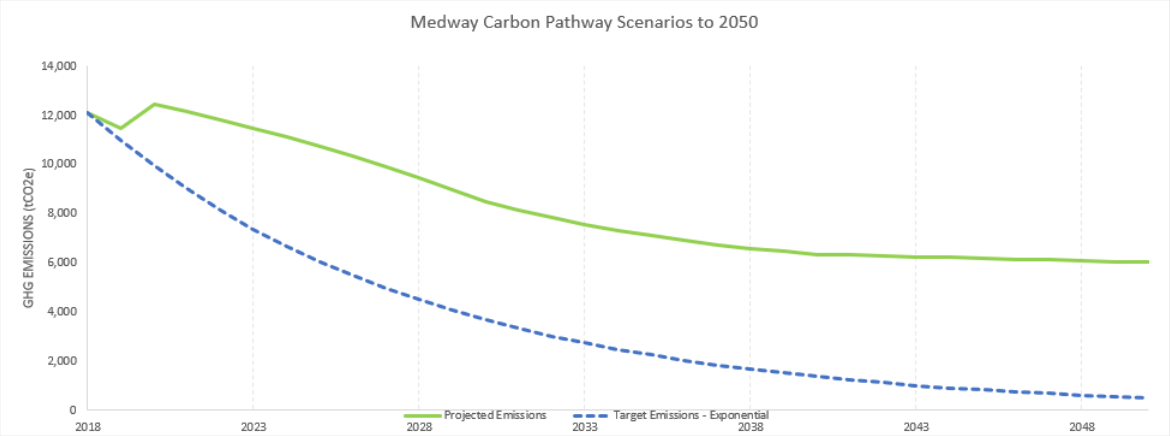
> *"We need a vision for a world free from fossil-fuels and a pathway to achieve it. As co-chair of the United Nations Climate Action Summit's ambition advisory group I welcome this report because it provides just that."*

At the heart of the roadmap is the presumption that we need to apply scale and pace to the things we already know how to do. This would include the deployment of renewable energy and electric vehicles as well as energy efficiency measures, the aim being to drive exponential growth in these areas. The underlying principle is that in order to reach the 2050 net zero target we need to peak global greenhouse gas emissions in 2020 and then halve them by 2030, halve again by 2040 and halve again by 2050. In order to get there we can break the challenge down into:

a) Things we know how to do and understand; and
b) Tough but realistic interim targets.

As we saw in the CRC graph from laser, the Council has already passed the peak of its Scope 1 & 2 carbon emissions; seeing a reduction of around 43% since 2014/15. The underlying principle of a halving of further emissions every 10 years does present a coherent approach to tackling the remainder of the emissions in a way that would avoid temperatures going over 1.5 degrees C above pre-industrial levels, therefore a Science Based Target in line with Medway's Climate Emergency Declaration.

Figure 13 – Exponential Reduction Pathway to Zero Carbon 2050 against emissions trajectory with no interventions

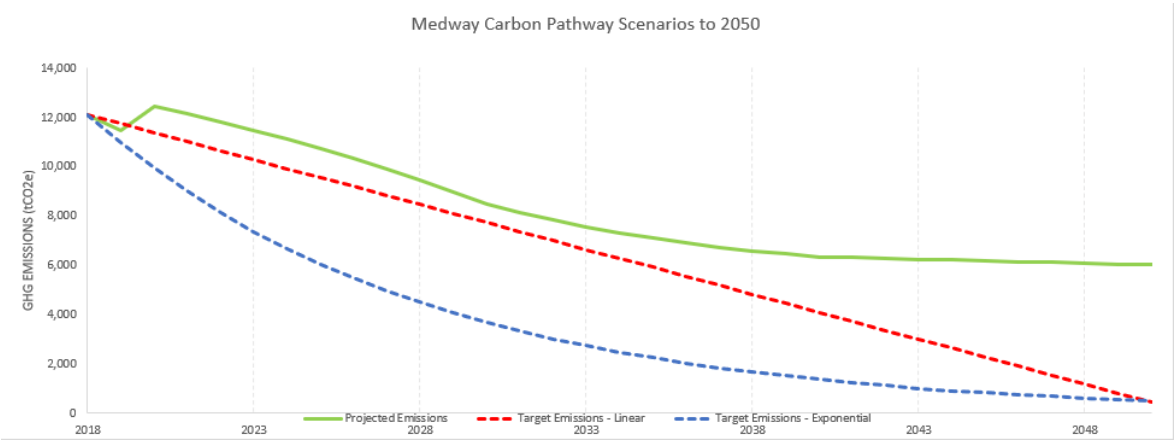


4.7 Adopting a pathway approach

As we have seen, the roadmap to net zero can follow different pathways. The Linear Pathway, a simple regression with its fixed reduction year on year, might not deliver the carbon savings we need as fast as we need them, and it might leave us with a bigger problem later on, due to diminishing returns.

On the other hand, an approach based more on exponential decay (shown with a dotted blue line in Figure 14 below) recognises that there are measures which we can take today at scale and pace which are cost effective and represent good practice. This approach works hardest in the early years, recognising that some of the latter reductions are likely to be harder to achieve, and takes a more realistic view that around 5% of emissions will be too difficult to reduce and will need treating in other ways, which we will explore later in this report.

Figure 14 – Alternative Pathway options against emissions trajectory with no interventions



The gap between the green line (current trajectory with no interventions) and dotted red (linear target/pathway) or blue line (exponential reduction/pathway, which marks the recommended budget) shows the scale of the task. In the next section we will look at the kind of interventions the Council will need to be able to bring its trajectory closer to these pathways that show the way to net zero carbon. Our recommendation is that the Council plans enough interventions to follow the Science Based Target or Exponential Reduction Pathway as close as possible and reviews its approach and Carbon Budget at five years intervals from 2027.

We believe that setting up the Pathway and carbon budgets in line with the Science Based Target for the following reasons:

1. It is the only pathway that will deliver carbon savings at the rate needed to keep temperatures below 1.5 – 2 degrees C and thus the only option compliant with Medway's own Climate Emergency Declaration.

2. The scope of the emissions at this stage is relatively focused, i.e. Scope 1 & 2 plus staff business travel. All of these are areas where there are tried and tested options for emissions reductions that are largely cost effective to apply. We believe that now it is the time to be ambitious with technologies that have a good ROI.

3. By grouping actions of a similar nature together (e.g. converting boilers into heat pumps or rolling out solar PV to all suitable council buildings) there is more opportunity for the Council to achieve economies of scale in its delivery.

4. If Scope 3, or further area-wide emissions reductions are incorporated at a later stage, these are likely to be harder to achieve. Tackling the relatively straightforward elements of the emissions in the current scopes during the early years of the programme will leave more resource and capacity for dealing with more complex issues later.

5. The UK has met its first two carbon budgets and is on track to meet third carbon budget ending in 2022. However, the Committee on Climate Change (CCC) in its Progress Report to Parliament in 2019 stated *"Current policies and plans are **insufficient** to meet the fourth or fifth carbon budgets (covering 2023-2027 and 2028-2032)."*[37]. On this basis it is considered likely that UK-wide carbon budgets will be under increasing pressure in future years and that central government will devolve some of this responsibility to local authorities.

[37] https://www.theccc.org.uk/wp-content/uploads/2019/07/CCC-2019-Progress-Report-to-Parliament-Infographic.pdf

6. The CCC recommends carbon budgets to the UK Government, which the Government then reviews and either approves or amends. The CCC approach to budget setting is less stringent than that set out in the Paris Agreement[38] as the UK carbon budgets do not currently make allowance for developing nations to take a larger share of the available budget to build infrastructure. UK carbon budgets do not allow for emissions from either aviation or shipping either, both of which are hard to tackle and will have to be apportioned amongst nations eventually. Bearing these factors in mind it is more likely that, once global agreements start being enforced, the overall UK carbon budget will be tightened rather than increased over the period up to 2050, with the Council eventually having to bear a proportional share of the additional effort.

7. The CCC June update report specifically plans for sixth carbon budget that will give consideration to the impact of the Covid-19 pandemic. We anticipate that the pandemic would have had an impact on Council emissions but the extent of this impact and any repercussions on Medway's carbon budget are not yet known.

Recommendation 8 – Adoption of a Science Based Target, Exponential Reduction Pathway and associated Carbon Budget.

4.8 Setting the First Carbon Budget

Having introduced the concepts of a Science Based Target and Exponential Reduction Pathway it is time to determine what the associated carbon budget would be. This section looks to set the first Medway Carbon Budget in order to keep to the recommended Science Based Target and Exponential Reduction Pathway.

4.8.1 Budget Period

Carbon budgets are usually in five-year cycles. For this report the Council have two options for setting their timescales:

Option 1 – Equal five-year budget cycles. Starting in 2020 and ending in 2050. A total of six complete budget cycles

Option 2 – Alignment with UK carbon budget cycles. An initial eight-year budget starting in 2020 and ending in 2027, followed by four five-year cycles and an eight-year cycle at the end of the period

Table 7 below sets out the pros and cons of each approach.

Table 7 – Advantages and disadvantages of different budget periods

Option	Advantages	Disadvantages
1. Equal five-year budget cycles starting in 2020	Simple Equal periods across the implementation period allowing for direct comparison of budgets	Not aligned to UK carbon budget cycle

[38] https://www.research.manchester.ac.uk/portal/files/82366490/quantifying%20scotland%20s%20carbon%20budgets%20for%20paris.pdf

2. Alignment with UK Government carbon budget cycles	Alignment with UK carbon budget cycles and therefore more likely to be aligned with any new statutory reporting requirements Longer 'set up' and 'run off' budget cycles to allow for carbon budget to be embedded in the decision making and more time for final alignment Reducing the total number of budget cycles from six to five reduces the temptation to push measures back into subsequent budget cycles.	Uneven budget periods at the beginning and end of the process

In light of the above we recommend that the Council selects option 2, as this may avoid future adjustments to facilitate new reporting requirements and will also allow a full implementation period in the first budget cycle.

Recommendation 9 – Set the first budget period to 2027 to enable alignment of future budget cycles with UK Government carbon budgets.

The First Carbon Budget that we propose for the Council is set out in accordance with option 2. **To allow for project set up time and delivery timescales our model does not assume any significant savings before 2022, so this budget period allows for a full five years of savings and allows sufficient time for the measures set out in 5.3 to be implemented.**

4.8.2 Exponential Reduction Pathway to Net Zero and the first Medway Carbon Budget

In section 4.7 we recommended the adoption of the Exponential Reduction Pathway for budget setting purposes. The Linear approach allows a higher budget allowance in the early years than the exponential budget. The difference in the First Carbon Budget period is shown in Table 8 below.

Table 8 – Alternative carbon budgets

Year	2020	2021	2022	2023	2024	2025	2026	2027	Cumulative
Emissions Forecast (No Interventions) (tCO_2e)	***12,434***	***12,128***	***11,805***	***11,463***	***11,102***	***10,720***	***10,317***	***9,891***	***89,860***
Linear Pathway Budget	***11,377***	***11,013***	***10,649***	***10,285***	***9,921***	***9,557***	***9,193***	***8,829***	***80,823***
Exponential Reduction Pathway Budget	***9,930***	***8,994***	***8,146***	***7,378***	***6,683***	***6,053***	***5,482***	***4,965***	***57,631***

As stated at the end of section 4.7 our recommendation is that the Council adopts the Carbon Budget associated with the Exponential Reduction Pathway and the Science Based Target for the reasons outlined in that same section 4.7.

5 EXAMPLE INTERVENTIONS

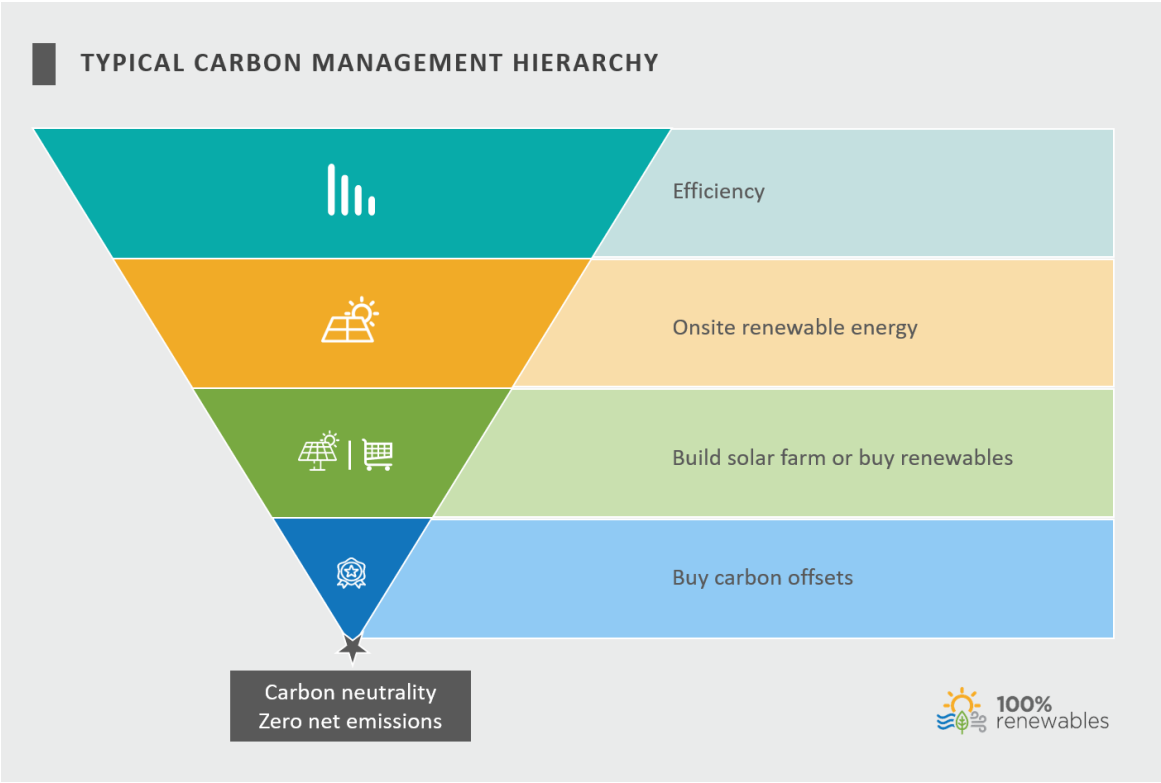
5.1 Methodology

As we saw in Figure 11 relying solely on grid decarbonisation will not be sufficient to achieve net zero carbon for the Council by 2050. In this section we examine some example interventions that the council could apply to its Baseline during the period corresponding to the First Carbon Budget (2020-2027) in order to get as close as possible to the Exponential Reduction Pathway to net zero with the information and technology we have today. Wherever possible, we have calculated the potential carbon savings of the example interventions and estimated their cost, but please note this is a high level assessment to simply show both the scale of the challenge and the art of the possible. Where available, these figures will be subject to site inspections, design processes and quotations/tenders that go beyond the scope of this report.

5.2 Applying the Carbon Management Hierarchy

Figure 15 below sets out the hierarchy of carbon management principles. This should be the starting point in establishing how to prioritise interventions. In order to arrive to net zero carbon the Council's assets need to be made as efficient as possible before trying to meet the remaining demand with clean energy, onsite or purchased. Only those 'hard to treat' assets that cannot convert to non-emitting fuels such as hydrogen or electricity that has been decarbonised at the point of production, should then be offset. Allowing these offsets at the end of the process is what makes the target 'net zero carbon' rather than just 'zero carbon'.

Figure 15 Carbon Management Hierarchy



Source 100%renewables.com.au

5.2.1 Step 1 – Efficiency

Under this category we will propose interventions around the most common energy efficiency measures (low carbon Heating, Ventilation and Air Conditioning (HVAC) systems, LED lighting) and demand management through smart controls (Building Management Systems - BMS, Internet of Things – IoT, energy monitoring and water conservation). This list and the proposed interventions are by no means exhaustive but based on key technologies we have lots of data for. We expect the Council's Re:fit service provider will be able to identify additional savings via suitable technologies in as part of the Re:fit programme.

Consideration also needs to be given to the levels of redundancy in many of the things we use (both in terms of sizing and the time they are idle). This redundancy represents a significant overuse of carbon since, if assets were more heavily utilised, we would achieve higher efficiencies and need fewer of them, therefore saving the emissions from usage, manufacture and decommissioning.

This ranges from oversized buildings to the damaging prevalence of heavier vehicles in recent years. Over specification results in functional inefficiency and production of additional materials, resulting in unnecessary carbon emissions. In this way, increasing utilisation rates by sharing facilities and assets is another way of achieving efficiency. Although this might not be possible until the COVID-19 crisis subsides we believe these kind of efficiencies should be considered as part of the Covid-19 economic recovery and will allow further savings in coming years.

5.2.2 Steps 2 and 3 – Renewable Energy

Where energy consumption cannot be reduced then opportunities to generate renewable energy should be considered. Where there are no options for onsite generation of renewable energy consideration should be given to procuring renewable energy from alternative sources. This could mean investing in solar farms, in the borough or elsewhere, or switching the supply of electricity to a renewable energy contract. We explore this topic in detail in section 6.2.

Only when these measures have been applied should the Council consider whether any carbon offset activity is necessary.

5.2.3 Step 4 – Offsets

Only when we have exhausted the potential of all interventions under the categories of efficiency and renewable energy should the Council consider whether any carbon offset activity is necessary. We provide an overview of this market and make some further recommendations in sections 6.5 and 6.6.

Recommendation 10 – Adoption of the principles inherent in the Carbon Management Hierarchy

5.3 Interventions per target area

In section 3.4 we set out the main areas of carbon emissions. As we start to focus on projects to deliver carbon emissions savings, we need to target interventions in the main areas of emissions. Table 9 below sets out the main areas of emissions as follows:

Table 9 – Medway Council emissions summary

Source	Type (predominant)	tCO_2e	% of total emissions
Buildings	Electricity	3,454	28.5%
Buildings	Gas and other heating fuel	3,576	29.5%
Street lighting	Electricity	2,762	23.7%
Fleet	Diesel	1,320	10.9%
Staff Business Travel	Petrol and diesel	320	2.6%

In total, buildings account for 58% of total emissions, with street lighting contributing 23% and transport (both fleet and staff travel) circa14%. We then need to consider the types of interventions that can be made in each of these areas and their potential impact.

5.3.1 Building Related Emissions

A combination of gas and oil heating plus electricity usage make operational buildings the largest single source of carbon emissions for the Council and they are therefore also the most significant target for emissions reductions.

We have not had the opportunity to physically survey and review all building stock and this was outside the scope of our commission, so our recommendations at this stage are based on a desk-based review of the information available relating to the council portfolio of buildings we did get data for. The methodology below sets out our approach.

I Methodology

The assessment has been split into two phases. The first set of interventions comprises the activities recommended for implementation in the First Carbon Budget period ending in 2027. For this initial phase the approach has been to assess what is likely to be deliverable, taking into account our experience in energy efficiency through the Re:fit programme. This in turn has two distinct phases: Re:fit Phase 1, which has started to be scoped and from which we have survey data[39], and other projected Re:fit projects where the impact of the example interventions has been derived from benchmark information. As mentioned earlier we expect the Re:fit service provider will expand on the range of these interventions and add to the savings that can be achieved during the period covered by the First Carbon Budget.

The Display Energy Certificates (DEC, a good source of benchmarking information) for the buildings were reviewed but it was concluded that too many were either not available or not applicable to make this a viable data set. An alternative benchmarking method based on publicly available Chartered Institute of Building Services Engineers (CIBSE) benchmarks, which gives us the average kWh consumption per m2 of the different types of public sector buildings based on DEC ratings, was therefore selected. However we did not have enough floor area information to make this work either.

The usual process would have meant taking the existing gas and energy consumption and dividing it by the building's floor area to enable a comparison to take place with CIBSE benchmark figures.

[39] This data comes from what is known as a High Level Appraisal (HLA) in the Re:fit process. The HLA provides initial detail regarding the capital investment and anticipated savings of the measures being considered. The next stage of the Re:fit process is to produce an Investment Grade Proposal (IGP), which is the detailed design and business case, including guaranteed costs and savings.

The buildings are then categorised into the three groups below, taking account of the building type, and the relative variance from CIBSE benchmarks:

- Good practice – Gas benchmark 30% lower than CIBSE benchmark and below, electricity benchmark 40% lower than CIBSE benchmark and below
- Standard – Within 30% of the gas CIBSE benchmark and 40% of the electricity CIBSE benchmark
- Underperforming - Gas benchmark 30% higher than CIBSE benchmark and below, electricity benchmark 40% higher than CIBSE benchmark and below

Once the buildings are categorised we use benchmark data from previous Re:fit projects to calculate the potential savings and cost of key measures proposed in this first intervention in addition to those scoped by the Re:fit service provider. (The Re:fit framework delivers guaranteed energy performance projects in a variety of settings, providing Local Partnerships with a high-quality pool of recent and relevant data on the likely impact of energy efficiency measures on different types of buildings as well as cost.) Since we could not benchmark the buildings with the information available, we assumed they were all in the 'standard' category and applied the relevant benchmarks for each type of measure.

Table 10 below sets out the rough carbon savings expected from each of the building categories:

Table 10 – Anticipated emissions savings by building category

Category	Anticipated emissions savings
Good Practice	-15%
Standard	**-20%**
Under performing	**-25%**

II Building Related Savings – Re:fit

The Re:fit service provider's analysis concluded that an initial programme of works to the 12 buildings currently in Re:fit Phase 1 (please see Appendix 1) would yield savings in the region of 800 tCO_2e pa. The indicative capital cost of these works would be in the region of £4.5m with the combined initiatives providing a payback within 12 years (excluding any council staff recovery costs).

In line with the principles in section 5.2 key measures would include, amongst others:

Efficiency

- Upgrades to existing heating controls which would reduce the number of hours the heating is on without affecting comfort
- Building Management Systems (BMS) – this is improved control of lighting, heating and electrical plant to save on operation hours and thus energy and carbon
- LED lighting upgrades to reduce the wattage and increase the efficacy of lighting
- Replacement of older and end of life boilers with heat pumps, increasing combustion efficiency and thus reducing gas consumption and carbon emissions

Renewable energy

- Roof mounted solar PV for all buildings in Appendix 1 except for Guildhall Museum and Cuxton Library[40]

[40] Please note PV in buildings is usually sized to the buildings consumption as the rate paid by the grid for exporting a small scale makes it uneconomical in most cases to over-size them

Further analysis (i.e. the benchmarking mentioned earlier) by Local Partnerships and the Re:fit service provider shows that additional savings could be obtained from running similar initiatives across the rest of the portfolio, touching on both efficiency and renewable energy. In addition we have included here early estimates for a river source heat network that could contribute over 3,000 tonnes of carbon savings to the borough. However at this stage we have only included the estimated savings pertaining to applying this low carbon solution to Gun Wharf, since we are only considering Scope 1 and 2 emissions. This initiative will become key once the Council signs up to the borough-wide target and has the potential to offer a good financial return too.

We estimate that further LED replacements across the portfolio, the introduction of low carbon heating (heat pumps) wherever possible, continuous upgrade and optimisation of HVAC controls, and finally the rolling out of rooftop solar PV to all the major buildings, could save in excess of 1,500 tonnes of CO2e at an approximate cost of circa £6m. The possibility of a river source heat network would add to the renewable energy efforts and deliver an additional 143 tonnes of carbon savings just for Gun Wharf. However these savings will only materialise if the whole scheme goes ahead, with the costings included in Table 11 for Gun Wharf (£890K) just a proportion of those of the entire scheme (circa £19m).

The Council has obtained funding from the Heat Networks Delivery Unit (HNDU, part of BEIS) to explore the techno-economic feasibility of this heat network. We will know more about whether the network is actually feasible towards the end of 2021, at which point we can request further funding from HNDU for a commercialisation study. The Re:fit partner has also highlighted there is a possibility for the operator to fund the network in exchange for a long-term contract with the Council so the energy can be bought back at an agreed price, what is called a 'concession' model. This and other possibilities are explored at the commercialisation study stage, which will take approximately another year (2022). All going well, the heat network could start to be built in 2023 and it would be expected to provide a service (and subsequent reductions on carbon emissions) for a period of 40 years +.

III Property Rationalisation Savings

One of the additional opportunities the Council has in order to realise additional emissions savings, would be to reduce its overall property footprint. Post COVID-19 this can probably be achieved by increasing levels of home working on a more permanent basis. There is an argument that this could simply redirect emissions to Scope 3, as staff will use more electricity at home, and the heating in domestic properties might be less efficient and not zoned, however this is likely to be more than offset by the reduced emissions from commuting.

This is an uncertain area and savings would be impossible to estimate at this time but it is an area the Council could look into to help them close any gaps between the adopted interventions and the Science Based Target and Exponential Reduction Pathway.

5.3.2 Street Lighting

Almost 25% of the Council's total carbon emissions come from street lighting, a network that comprises 25,667 street lights. In 2018, Medway Council secured Prudential Borrowing for a column replacement scheme across financial years 2018/19 and 2019/20. As part of this scheme, those columns which did not already have LED lanterns would be converted to LED. This would increase the number of LED lanterns on the network to approximately 4,526. With additional lanterns being replaced over the past 2 years, the total now stands at over 5000.

However some of the older LED lanterns have been in place up to 10 years and therefore could not support a Central Management System (CMS) for dimming and trimming light levels that could increase the carbon savings of the upgrade considerably. In total it is anticipated that approximately 23,100 lanterns will need conversion. Local Partnerships was informed that Cabinet has now approved Prudential Borrowing for a programme of works that will see these upgrades completed during 2020-2021, a programme which will deliver savings of 28,188 tonnes of carbon over the next 20 years at a total cost of £ 11,155,144.

As the results of the tender, detailed programme and further breakdown of these savings were not yet publicly available at the time of writing this report, for the purposes of this exercise we have assumed that the replacement will be completed in 2021-22 with savings materialising from 2022-23 on an equal basis, i.e. 1,484 tonnes per year. This assumption can be revised in subsequent updates of the Baseline and Pathway. Provided the LED replacement programme is completed in full and grid decarbonisation takes place at the forecast rates it is feasible that the Council could offset remaining emissions from street lighting in 2050 as they would not amount to much. Alternatively, photocells could be fitted to lamps or the infrastructure could be connected to some form of renewable energy generation.

5.3.3 Transport

Included in the Baseline are two forms of vehicle emissions:

a) Emissions from vehicles owned/leased by the Council (Fleet) – 11.6% of total emissions
b) Emission incurred by staff using their own vehicles on Council business (Business Mileage) – 2.7% of total emissions

I Fleet Vehicles

The fleet vehicles undertake around 775,000 miles pa, of which around 535,000 are currently undertaken by the waste vehicles, representing circa 70% of the mileage. The emissions from waste vehicles are circa 1,300 tonnes, whereas emissions from the rest of the fleet are just under 90 tonnes, i.e. the waste fleet emissions currently accounts for 93% of all fleet emissions.

This fact, which was already flagged by the Energy Savings Trust (EST) in their review of the Council's fleet back in March 2019 which produced very similar figures (some of the vehicles have been replaced since), is perhaps one of the reasons why the Council is investigating replacement options for the fleet, including more efficient vehicles that will reduce emissions as vehicles come to end of life.

In terms of carbon savings, electric vehicles still produce emissions unless the electricity they are charged with is fully decarbonised at point of use, otherwise BEIS has specific conversion factors for electricity for EV. Furthermore their emissions would depend on the life of the battery and that, in turn, from the type of route, number of stops, gradients on the streets, etc. Benchmarks have been obtained from the Re:fit service provider that indicate that, on average, electrification of fleet can achieve 65% to 85% savings when compared to the diesel equivalent. This means that, at present, electrifying the 46 vehicles in the 2013 waste fleet could deliver roughly 800 to 1070 tonnes of carbon, 7% to 9% of the total Baseline, being a very sizeable prize in terms of carbon reduction.

The scale of fleet vehicle replacement will be largely dependent on service design requirements including materials collected, containers, frequency, operational efficiencies (double shifting), respond to forthcoming legislative changes (e.g. Draft Environmental Bill weekly separate food collection), anticipated population growth and the potential benefits for local air pollution. Operationally a depot with suitable space for charging infrastructure and access to repair/maintenance should also be considered.

With regards to the rest of the fleet, we have been advised by one of the Re:fit contractors that the standard replacement for vans of the sort and size the Council operates, vans Class II and III, is the Nissan van eNV200 (see below). This vehicle is perhaps slightly smaller than some of the vans in the Council's fleet. However it would be good to be reminded of the principle of Efficiency in the Carbon Management Hierarchy (avoid over specification and only specify what is functionally necessary), i.e. vans should only be as large as is necessary to do the job since reducing the size and weight of vehicle will reduce their fuel consumption.

Regarding the rest of the fleet (4x4 pick up trucks and cars), in accordance to the latest UK Government Target, all vehicles must be ULEV by 2035. Assuming fleet vehicles have a maximum life of seven years it can be assumed that all emissions after 2042 would be EV emissions. In reality some of these may be hydrogen (an emerging technology, not enough is known about it at the moment) or other ULEV types, but in the absence of data from other sources we have assumed they will be replaced with EV and have added the relevant emissions.

The Council can viably bring forward some of these savings into the early years of delivery by starting to replace all of its Class II and III vans with EV. As the majority of vehicles are leased by the Council this could be done as leases expire. This intervention could deliver carbon savings in the region of 50 tonnes per year at current levels of usage at a cost of just over £500K for an outright purchase. See table 11.

Our understanding is that the Council is currently undertaking a detailed fleet review. We have the following suggestions which might help with the net zero carbon target:

a) Identify areas where routing of the RCV vehicles could be changed or improved to reduce mileage
b) Establish which vehicles should be changed for EVs at the next point of exchange (First Carbon Budget)
c) Identify vehicles which should be changed for EVs during the authority's Second Carbon Budget (i.e. 2027-2032)
d) Account for all remaining vehicles, which should be assumed will be replaced to ULEVs (potentially hydrogen) during the Third and Fourth Carbon Budgets.

In addition, the EST review mentioned earlier included additional recommendations such as:

- introducing fleet and driver performance indicators
- driver league tables
- targeted training
- route benchmarking; and
- annual emission targets

For the purpose of the modelling we have assumed:

1. Replacement of all Class II and III vans with EV equivalents by 2023
2. Replacement of all waste fleet RCVs vehicles with EV equivalents by 2030-31
3. Replacement of all other fleet vehicles with ULEV equivalents by 2042[41]

These are of course just example interventions, so the Council can choose to focus their efforts elsewhere or swap categories and timings.

[41] Government consulting on bringing forward the phasing out of all tailpipe emissions vehicles from 2035. This timescale allows 7 years for replacement after that date

II Staff Business Travel

Staff business travel currently comprises 2.6% of the Council's overall Baseline and it is the only Scope 3 emission included in the Baseline at this stage, albeit one the Council can have quite a lot of influence over. Fundamentally the Council cannot determine the vehicles its staff drive, it can however take alternative approaches to reducing staff business mileage as follows:

- Phasing out mileage payments for petrol and diesel vehicles – but providing ULEV pool cars, e-bikes and remote working options (Leeds City Council are currently implementing this approach)
- Include routing reviews in any fleet review
- Introducing tax efficient salary sacrifice loan schemes to enable staff to purchase bikes and ULEVs to replace existing cars[42]
- Provision of sufficient, suitably rated, EV charge points at the workplace to encourage EV usage, especially amongst staff with no access to off-street parking

The alternative (and the approach taken in the modelling to this point) is to assume that staff will start to replace their vehicles with ULEVs from 2020 onwards with around 5% uptake p.a.[43], with all vehicles therefore replaced by 2040.

5.4 Examples of quantifiable interventions for the First Carbon Budget

Within section 5.3 we have laid out a number of potential interventions for the Council to meet a Science Based Target, stay within the First Carbon Budget and as close as possible to the Exponential Reduction Pathway in order to achieve net zero carbon by 2050 in a way that does not risk temperatures rising beyond 1.5 degrees C. This has been done following both the carbon management hierarchy and focusing on the major 3 areas of emissions, namely buildings, street lighting and transport.

The interventions identified in 5.3 include the following measures:

1. Building related measures including:
    a. upgrades to controls and BMS
    b. LED lighting schemes
    c. replacement of old gas and oil boilers with low carbon alternatives such as heat pumps or electric boilers
    d. roof mounted PV systems
    e. the introduction of a heat network powered by River Medway
2. Street lighting upgrades to LED
3. Fleet review and replacement of all vans and RCV vehicles with electric vehicles

In this section we present a summary of some of these interventions individually, as well as their estimated carbon savings and rough cost where possible. As we will explain in detail in Section 7, the idea of using paybacks when investing in zero carbon is now outdated and not conducive to achieving these targets. In order to show the relative cost of the measures we use the metric ££s per tonne of carbon saved.

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[42] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/709655/ultra-low-emission-vehicles-tax-benefits.pdf

[43] This is an assumption based on the Government's dates to ban all combustion engines in vehicles and how long the average car lasts after is replaced.

This is not to say that some of these measures do not have a ROI – from the table below we will expect all of LED, PV and boiler controls to pay for themselves within their expected life and produce net savings. However, accurate paybacks will necessitate of site visits/design and go beyond the scope of this report. **Finally please note staying close to the Exponential Reduction Pathway does necessitate implementing these measures (and more) at roughly the selected times since the carbon savings achieved on electricity measures, LED or PV for examples, do diminish as the grid decarbonises.**

Table 11 – Summary of Interventions to stay within the First Carbon Budget

Intervention	Carbon Savings (tonnes)	Percentage Reduction against Baseline	Implement latest	Estimated cost	Cost per tonne of CO2e saved
Re:fit Phase 1 Buildings	809.00	6.68%	2021-22	£4,567,907.00	£5,646.36
Street Lighting to LED	1484.00	12.25%	2022-23	£11,155,144.00[44]	£7,516.94
Low Carbon Heating	1063.68	8.78%	2022-23	£3,742,757.00	£3,518.69
Further solar PV in Buildings	180.54	1.49%	2022-23	£1,240,815.00	£6,872.80
Further LED Lighting Corporate	118.05	0.97%	2022-23	£354,143.16	£3,000.00
Further LED Lighting Housing	59.90	0.49%	2022-23	£179,689.62	£3,000.00
Vans Class II and III to EV	51.14	0.42%	2022-23	£580,145.00	£11,345.36
Further LED Lighting Carparks	22.46	0.19%	2022-23	Not available	Not available
River Source Heat Network	143.00	1.18%	2023-24	£889,831.80[45]	£6,222.60
Controls Optimisation	59.50	0.49%	2024-25	£129,406.18	£2,175.00
Heating Controls	39.50	0.33%	2024-25	£32,824.50	£850.00

These are just examples, one of many potential mixes of interventions in order to work towards a First Carbon Budget that aligns with the Science Based Target and the Exponential Reduction Pathway, ensuring that the Council acts on time to avoid the worst of climate change. It does however fulfil the need for the Council to know that in order to achieve the net zero target with

[44] Project has already been approved and funded

[45] This is just the proportional cost of the carbon savings allocated to Gun Wharf but please note this is part of a larger heat network project worth £40m. This is however a key opportunity for decarbonising heat in the Medway area that will hopefully be supported by Government grants and operators, giving the council a return by selling heat to other public sector organisations in the Medway area or the possibility of simply switching to low carbon heating by giving a concession and entering into a long term purchase agreement with the operator.

interventions that afford a degree of permanency (investments rather than paying third parties for renewable energy or carbon offsets) the Council can expect to have to invest £11.7m[46] (in addition to the £11.1m already committed for the LED street lighting project) to start working towards the Exponential Reduction Pathway to zero carbon.

All of the aforementioned interventions will lead to reductions in carbon emissions that, together with the additional projects identified through Re:fit and additional efficiencies, will help us keep roughly within the First Carbon Budget. Applying the identified savings to the forecast emissions allows us to compare the 'forecast' (the no interventions' scenario) with the emissions after implementing these interventions (forecast minus savings) and the First Carbon Budget. As we can see below the identified interventions are enough to deliver almost all of the reductions needed in the period corresponding to the First Carbon Budget.

Table 12 – Difference between First Carbon Budget and forecasts with and without identified interventions (tCO_2e)

Year	2020	2021	2022	2023	2024	2025	2026	2027	Cumulative
No Interventions Forecast (tCO_2e)	12,434	12,128	11,805	11,463	11,102	10,720	10,317	9,891	89,860
Total identified savings (tCO_2e)	24	928	3,723	3,868	3,881	3,727	3,564	3,391	23,104
Forecast with Interventions (tCO_2e)	12,410	11,200	8,082	7,595	7,221	6,993	6,753	6,500	66,756
Exponential Budget	9,930	8,994	8,146	7,378	6,683	6,053	5,482	4,965	57,631
Variance (tCO_2e)	-2,480	-2,206	64	-217	-538	-940	-1,2071	-1,535	-9,125

Figure 16 - Difference between First Carbon Budget and forecast with and without identified interventions (tCO_2e)

[46] The £23m excludes the funding already agreed for the street lighting project but includes the proportion of funding for the heat network that pertains to the carbon savings for Gun Wharf as mentioned above. The £42m figure includes the full cost of the heat network (£18,854,480), which should (as well as the other interventions mentioned above, such as PV and LED) have a ROI.

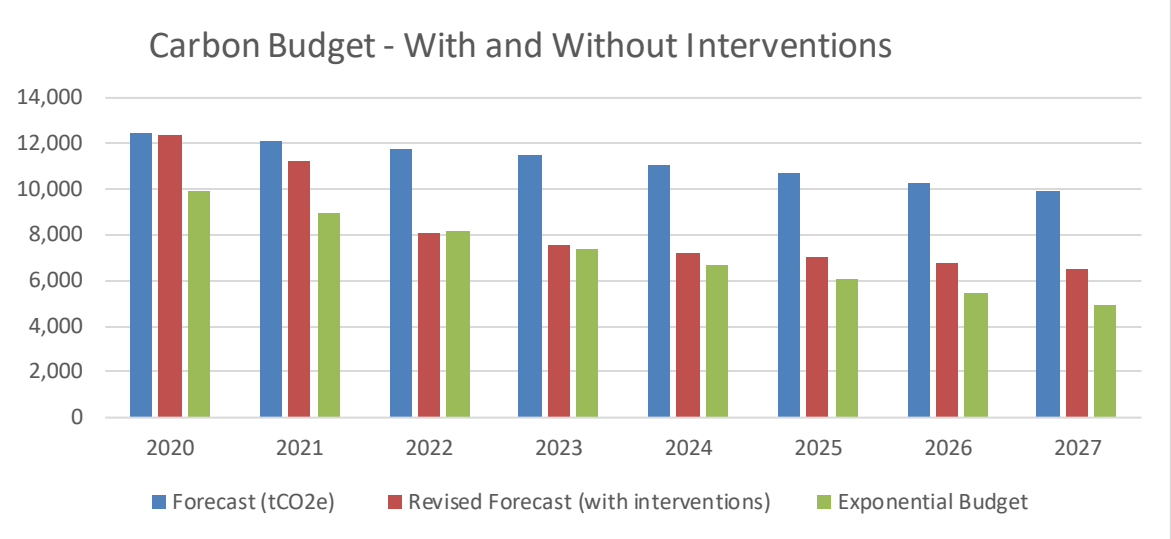


Table 12 and Figure 16 above demonstrate that, once the annual fluctuations to do with programming the different interventions are removed, there is currently excess emissions of 9,125 tonnes against the First Carbon Budget of 57,631 tonnes for the 8 year period. Whilst it is possible for the Council to meet the First Carbon Budget, the quantified example interventions are not enough so officers and councillors will need to decide the preferred approach/mix of interventions and act quickly. It is likely that the Council will need to undertake an options appraisal to determine which interventions are easier to implement and would have a better ROI. The option appraisal should consider factors such as the degree of permanence of the different interventions and whether a move to purchasing all electricity from renewable energy sources might affect future decision making, either financially or in terms of carbon savings. The recommendations contained in our menu of quantified example interventions are summarised below.

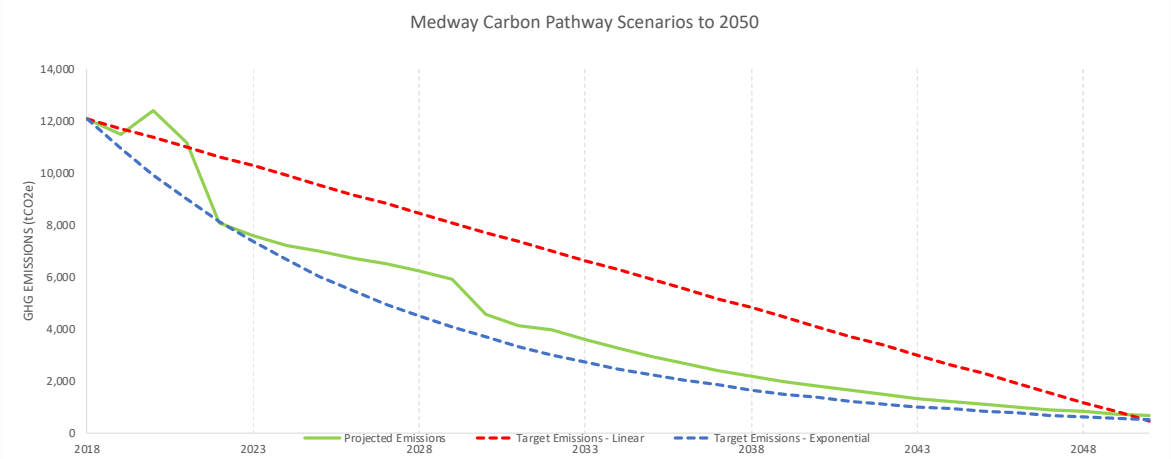
Recommendation 11 – Consider the below interventions as a matter of urgency:

- **Prioritise LED upgrades and PV across the Estate in the next year or two**
- **Roll-out the conversion of all suitable heating systems to low carbon heat pumps or equivalent to all of the Estate as part of Re:fit Phase 2**
- **Upgrade or optimise all building controls by 2024-25.**
- **Electrify the waste fleet and all vans ASAP**

5.5 Medway Council Pathway with quantified example interventions

So far, this report has analysed the existing emissions and how they are projected to change over time, identifying practical steps to enable the Council to get close to its goal of achieving net zero by 2050 based on some example interventions we have quantified. Figure 17 sets out the Exponential Reduction and Lineal Pathway together with the projected emissions derived from implementing the quantified example interventions (but excluding any of the potential further measures mentioned), what we would call the Medway Council Pathway (green line below).

Figure 17 –Medway Council Pathway with Quantified Example Interventions



Points to Note

1. By 2050 emissions are projected to have been reduced to 605 tCO_2e (a 95% reduction on the baseline year 2018/19)

2. The Medway Pathway resulting in the implementation of the quantified example interventions only is **not** aligned to a Science Based Target[47], which as highlighted would need additional investment to meet the First Carbon Budget

3. The apparent 'increase' in the green line in 2020 is as a result of the variance between the higher BEIS forecasts for carbon intensity factors for electricity supplied from the grid (used for 2020 onwards) and the actual decarbonisation factors (used for 2018 and 2019, which were the only ones available at the time this report was written). The emissions look higher as they are valued at a forecast conversion factor, making the line spike artificially as the graph switches to plot from actual to forecast emission figures. Decarbonisation rates have fallen around 15% faster in recent years than forecast.

4. The electrification of the fleet has been included in this modelling but only in the year 2030-31 as requested by Council officials. This is not in the list of 'example interventions' since the year 2030-31 does not relate to the First Carbon Budget

N.B. It is likely that the rates of grid decarbonisation will continue to exceed the forecast in the short to mid-term, which will bring the green line closer to the budget pathway and help close the small gap needed to keep to the First Carbon Budget in full.

[47] https://sciencebasedtargets.org

5.6 Options for further action

5.6.1 How Much Further Action is Required to meet the First Carbon Budget

Table 13 below sets out the carbon budget fluctuations within the First Carbon Budget cycle. The First Carbon Budget is an eight-year period to bring the Council's carbon accounting periods in line with UK Government carbon accounting periods.

Table 13 – First Carbon Budget fluctuations (tCO_2e)

Year	2020	2021	2022	2023	2024	2025	2026	2027	Cumulative
Baseline after example interventions (tCO_2e)	***12,410***	***11,200***	***8,082***	***7,595***	***7,221***	***6,993***	***6,753***	***6,500***	***66,756***
First Carbon Budget	***9,930***	***8,994***	***8,146***	***7,378***	***6,683***	***6,053***	***5,482***	***4,965***	***57,631***
Surplus/ Deficit	***-2,480***	***-2,206***	***64***	***-217***	***-538***	***-940***	***-1,271***	***-1,535***	***-9,125***

Currently there is an identified deficit of **9,125 tCO_2e** against the total First Carbon Budget over 8 years.[48], meaning **additional interventions must be identified and implemented if the Council wants to keep to the Exponential Pathway, the Science Based Target and its Climate Declaration target.**

In addition to further Re:fit projects, efficiencies and potential property rationalisation, additional example interventions to eliminate the budget deficit in the early years would include:

1. Bringing forward the low carbon heating programme to start in 2021 as opposed to 2022. This will add 1,064 tCO_2e worth of savings to this First Carbon Budget Period.
2. Bring forward the replacement of the waste fleet with electric RCVs to 2023-24. This will reduce the budget deficit by over 4,600 tCO_2e
3. Bring in additional measures to reduce emissions through staff business travel. This could include the introduction of more electric pool cars and e bikes and the removal or significant reduction in rates paid for business mileage. Introducing measures to halve current emissions from staff business travel from 2021 (for the duration of the First Carbon Budget) would reduce the budget deficit by around 1,000 tCO_2e.
4. Delivery of around 1.5 MW of solar car ports in car parks by 2023 would add 1,250 tCO_2e of carbon savings (150,000 sqft of PV or the equivalent to 1,200 parking spaces, schemes suitable for large shopping areas or business and innovation parks. Please see Table 15 for further details.)
5. Accelerate the electrification of the rest of the fleet vehicles so that the 4x4s and cars are also replaced with EV equivalents by 2025
6. Investing on large scale solar generation and 'sleeving'[49] the power back to the Council. This could potentially reduce annual emissions by 5,000 to 6,000 tCO_2e but would require considerable investment

[48] This figure is likely to be slightly overestimated as grid decarbonisation rates have proven faster than forecast. E.g. Current grid carbon intensity factors for 2020 are at the forecast levels for 2023. If we assume decarbonisation continues at this rate grid purchased electricity will account for slightly less emissions.

[49] Where an intermediary utility company handles the transfer of money and energy to and from a renewable energy project on behalf of the Council. The utility company takes the energy directly from the solar farm project and "sleeves" it to the buyer at its point of intake, for a fee.

5.6.2 How Much Further Action is Required to Achieve Net Zero?

In order to keep to the Exponential Reduction Pathway emissions will have to continue to halve every ten years, each 5 year period associated with a new carbon budget, until the Council eventually gets to 610 tCO_2e in 2050, a reduction of over 95% on current emissions levels. There are likely to be further marginal efficiency gains available over the thirty-year period to 2050. Examples could include more energy efficient appliances, smaller and lighter vehicles and a reduced need for travel as a consequence of further utilisation of digital media. Decarbonisation of heat will also play a key role.

Options for dealing with the residual emissions include:

1. Developing renewable energy assets and using the energy generated. We have highlighted these as an additional option to achieve the First Carbon Budget since the marginal returns for these in later years reduce as the grid is increasingly decarbonised, so the exact extent of their contribution will depend on timings.
2. Purchase carbon offsets from the carbon offset market (carbon avoidance) or try one of the nascent 'certified Greenhouse Gas removal' schemes (which does removal as opposed to avoidance)
3. Purchase Woodland Carbon Units
4. Plant trees to sequester the carbon. Each hectare planted will sequester around 315 tCO_2e over a 100-year lifetime.

The following section explores these in greater detail.

6 INTERVENTIONS FOR FUTURE BUDGETS

At the end of the First Carbon Budget period, the Council should have reduced its emissions to around 4,954 tCO_2e p.a. This section of the report looks at measures beyond the First Carbon Budget which could be undertaken in order to achieve a net zero position by 2050.

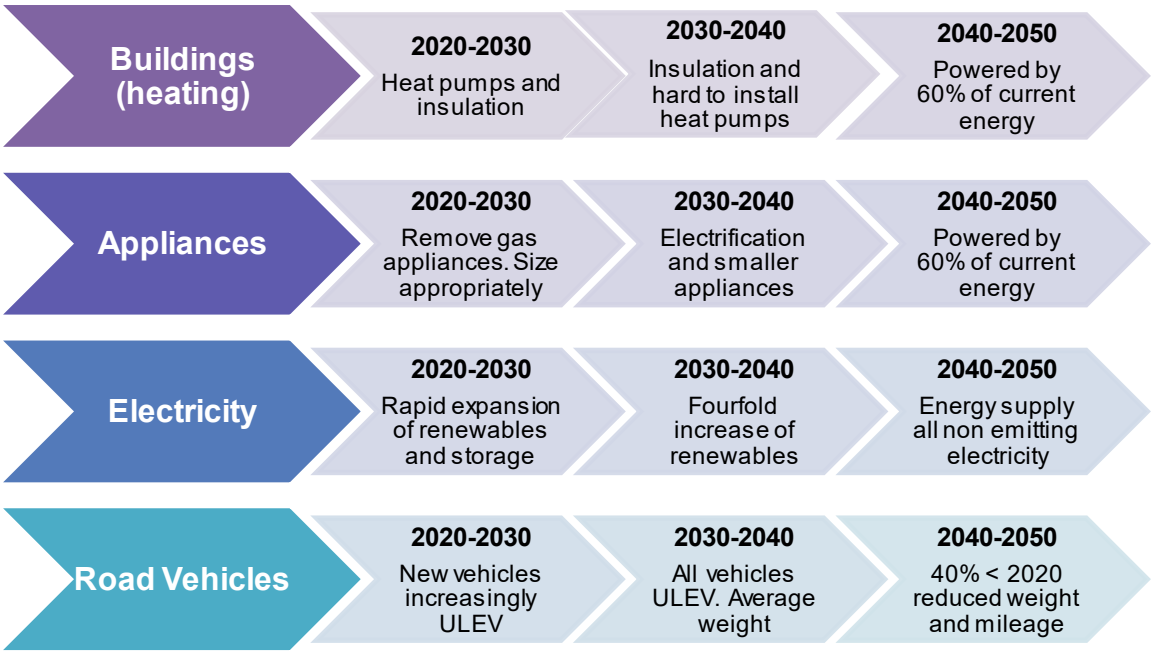
Defining zero carbon

To become "zero carbon", it is assumed that all sectors will need to reduce emissions by at least 95% from current levels, with the residual 5% being reduced over the period 2050 to 2100. This is due to the difficulty in making further marginal reductions at these reduced levels[50]. For completeness, "net zero carbon" or "carbon neutral" commonly refers to the position achieved via carbon offsetting instruments[51].

6.1 Further Energy Reduction Measures

Drawing on the information from the UK FIRES[52] Absolute Zero paper[53] Figure 18 below extracts the kind of measures and timescales which are likely to be required in order to meet net zero emissions for items in scope for the current Baseline (Scope 1 and 2 plus staff travel).

Figure 18 – UK FIRES roadmap to net zero



[50] http://www.manchesterclimate.com/sites/default/files/Manchester%20Carbon%20Budget.pdf

[51] Please note that whilst carbon neutrality is considered a synonym for net zero carbon emissions, one key difference is that carbon neutrality can be achieved at the domestic level with offsets from other jurisdictions, while net zero emissions does not have the same connotation (though theoretically could be met via offsets) https://www.ons.gov.uk/economy/environmentalaccounts/articles/netzeroandthedifferentofficialmeasuresoftheuksgreenhousegasemissions/2019-07-24

[52] UK FIRES is a major research programme, comprising a consortium of subscribing industrial partners from resource-intensive sectors working with academics from Cambridge, Imperial College, Oxford, Bath, Nottingham and Strathclyde.

[53] Absolute Zero – UK FIRES

Before any offsetting is considered the council should look to address the projected figure of 610 tCO_2e still remaining by 2050. This is not a large number and is likely that the marginal gains required will come from the actions identified in Figure 18 above. The focus is on reducing overall consumption through efficiency measures.

6.2 Renewable Energy Generation

With grid decarbonisation continuing throughout the period, the maximum carbon benefits from installation of renewable energy generation would be achieved by undertaking installations early in the programme.

6.2.1 Type of Generation

Onshore wind and solar PV are the most cost-effective solutions in the UK at present. Any other renewable energy potential identified is likely to be small scale in nature and unlikely to make a significant impact overall on the council's carbon emissions.

Onshore wind development in England has been almost impossible since 2016 due to the extensive nature of community support required to bring wind schemes forward[54]. As the latest Government announcements seem to call for a 'revival', the Re:fit service provider will be tasked with looking into the feasibility of on-shore and off-shore wind in the Medway area.

In the remainder of this section we will concentrate on solar PV generation as it is cost effective, deploys rapidly, and has a manageable risk profile in development.

6.2.2 Scale of carbon reduction benefits from solar PV

The scale will depend on which opportunities are pursued. Any south facing solar PV scheme in and around Medway will produce approximately 1,050kWh p.a. for every kW installed. Table 14 below sets out the annual potential generation for different sizes of solar scheme.

Emissions benefits will decrease over time as grid decarbonisation and panel degradation occur. Table 14 assumes 2025 is year 1 and provides the emissions reduction values for year 1 and year 15 for comparison purposes. However**, if the Council went down the route of purchasing green electricity, then all emissions benefits would be lost.**

Table 14 – Potential carbon reduction benefits from solar PV in Medway

Scheme size	Annual Output (kwh)	tCO2e in 2025	t CO2e in 2040
10 kW	10,500 kwh	2.4	0.4
50 kW	52,500 kwh	12	2
1 MW	1,050,000 kwh	235	43
5 MW	5,250,000 kwh	1,176	214
20 MW	19,900,000 kwh	4,704	859

[54] Energy Act 2016

6.2.3 Solar PV Opportunity Types

Solar PV is suitable for installation on buildings, in car parks and in solar farm settings. The scale of deployment and its associated costs are dictated by the type of scheme. Table 15 below summaries the types of solar deployment opportunity.

Table 15 – Solar PV deployment opportunities

Type	Scale	Costs	Benefits	Risks and Issues
Roof mounted	Up to 50kW	High – Typically around £1,000/kW – but scaffold costs can increase this significantly	Direct wire to use electricity on site. Utilises a non-income generating asset Relatively discreet	Scaffold costs can be prohibitive Difficult and expensive to maintain Not all buildings structurally suitable Planning and conservation area issues
Car park	10kW – 2 MW	High – around £1,000/kW, but depends on nature of structure and extent of disruption to car park surfaces	Potential for direct wire connections. Increases income from car park areas. Some settings are relatively straightforward Visible and good for connecting to EV charging	Issues with existing surfaces and landscaping Installation around existing use Potential reduction in parking spaces Shading issues Potential for vandalism or theft
Solar Farms	20 MW+	Low – typically construction costs including grid and development in the public sector are around £700/kW Acquired sites can start from around £550/kW	Significant scale presents opportunity for revenue income and carbon savings Economies of scale in construction and efficient design enables production to be maximised. Maintenance contract may enable local jobs and cheaper maintenance of smaller systems in the borough	Loss of existing income from land or need to acquire new land for the scheme Public perception if poorly sited

Opportunities for building mounted solar PV have been included in section 5.3 above. Future efforts should therefore concentrate on the potential opportunities in relation to carpark PV schemes and solar farms.

6.2.4 Car Park PV and EV Charging

The Council engaged the Re:fit service provider to undertake a desktop assessment of EV charging points across all Council owned car park locations in Medway. The review looks at potential suitability in relation to shading issues from local features, proximity to local Council buildings (for direct wire connections) and potential size. The Council should make sure the use of solar canopies in open air carparks is investigated.

The output of the assessment for EV charging points is known as a High Level Appraisal (HLA) in the Re:fit process. The HLA will provide the Council with detail regarding the capital investment, and anticipated performance of the EV infrastructure. The next stage of the Re:fit process to design an EV scheme is to produce an Investment Grade Proposal (IGP), which is the detailed design and business case, including the performance guarantee and the Measurement and Verification Plan. If the Council instructs an IGP, it could be available by the summer of 2021.

Recommendation 12 – Undertake a carpark review to establish the possibility of installing solar PV, including solar canopies, as well as EV charging points.

6.2.5 Solar Farm opportunities – Owned sites

Medway's former Re:fit service provider screened the Council's land for potential to develop renewable energy schemes earlier in 2020 using Re:fit, and they did not identify any large, vacant plots at that stage. However, the market for solar PV is undergoing significant changes, with ongoing reductions in capital costs and changes to the nature of network connections. In addition, due to the pressing need to reduce carbon emissions, we would recommend that the Council undertakes a review of landfill to assess the current potential for solar PV on the basis of a large scheme if this has not been done already, e.g. the two landfill sites at Capstone County Park and Queen Elizabeth Fields

Recommendation 13 – Undertake a landfill review to establish the potential for solar PV.

If a suitable site is then identified next steps would then include:

1. Obtain budget estimates from UKPN (the Distribution Network Operator (DNO) for the Medway area) for 20 MW and 40 MW connections
2. Review land rights and viability of taking occupation of a proportion of the site
3. Site visit to ascertain preferred locations
4. Pre-application discussions with local planners
5. Preparation of an outline financial model to demonstrate viability

If these steps identified the potential for a scheme, then a grid application should be made to UKPN.

6.2.6 Solar Farm Opportunities – Acquiring Sites

A number of local authorities have acquired solar farms in recent years directly from developers. This can be done either at 'shovel ready' or 'connected'. Table 16 below sets out some of the pros and cons of acquiring vs. developing solar farms. One point of note is that the construction costs for solar farms in the private sector are around 30% cheaper than the best figures seen by public sector bodies seeking to build solar farms.

Table 16 – Factors affecting decision to develop or purchase solar farm assets

Option	Potential Advantages	Things to consider
Self-develop on your own land	• No rental payments • No need to acquire land rights and establish clean title • No onerous restrictions or lease end date • Likely to be within the geographical boundary of the authority	• Do you have a site which is suitable in terms of size, location and planning policy? • Will you be forgoing an existing income stream? • Do you have another use for the site? • Reputational issues if the site is in proximity to housing or has been promised for another use • Do you have the skills and capacity for the development?

		• Are you prepared to risk the development costs? • Design, procurement and construction risks to be managed
Develop a site on third party land	• Identify site for its suitability (both size and location) rather than its ownership • Wider search area and therefore more chance of finding a viable grid connection or private wire	• Viability model will need to account for landowner rent • Capacity to acquire the site on appropriate terms for the development • Time constraints introduced through the land acquisition period (for example option periods) • Asset lifespan limited by lease arrangements • Do you have the skills and capacity for the development? • Are you prepared to risk the development costs? • Design, procurement and construction risks to be managed
Acquire project rights from a third party	• Removes development risk, avoiding potentially abortive costs and providing certainty • Land rights, accepted grid offer, and planning consent will be in place significantly reducing capacity required in the authority to deliver the project	• Viability model will need to account for the landowner rent and for costs of acquiring the project rights • Asset lifespan limited by lease arrangements • Design, procurement and construction risks still to be managed • Project rights are well sought after in a competitive market. A local authority can potentially lack credibility as a purchaser compared to a financial institution who has undertaken several similar transactions • Rights are unlikely to be available at a scale or location which is preferable to the authority (bear in mind for example managing construction of a project several hundred miles away) and flexibility may be required
Acquire a completed project from a third party	• Removes development and construction risks, avoiding potentially abortive costs and providing certainty • Land rights, accepted grid offer, planning consent and functioning asset will be in place significantly reducing capacity required in the authority to deliver the project • Private sector developers often prefer to sell post construction and	• Viability model will need to account for the landowner rent and for costs of acquiring the project – although this may be less than the combined cost of acquiring project rights and constructing the asset through public procurement • Asset lifespan limited by lease arrangements • Projects are well sought after in a competitive market. A local authority can potentially lack credibility as a purchaser compared to a financial institution who has undertaken several similar transactions

	commissioning • Private sector contractors can procure more freely and consequently often build at a price significantly lower than the public sector. Quality may also be higher due to ongoing relationships with construction companies	• Authorities will only have the ability to bid on existing projects and cannot therefore drive scale or location

There are a number of solar developers in the UK who are currently actively developing sites and will sell them either at ready to build or post connection. These represent around two thirds of the development market and it is anticipated that they will sell around 4GW of solar farm project rights over the next five-year period. Local Partnerships would be happy to help the Council investigate this option and advise the Council in an independent manner.

6.2.7 Solar Farms and carbon Emissions

How the power from the site is traded will directly affect how the Council is able to account for the carbon benefits from such a scheme in its carbon budgets and pathway to net zero. Where schemes are connected by direct wire to a Council building/s these will clearly displace grid produced electricity with its associated carbon intensity factor.

Where a PV generation site is not directly connected to a Council building/s it is still possible to purchase the power via a power purchase agreement (PPA) and in this instance we would anticipate that this would displace grid produced electricity with its associated carbon intensity factor.

We discuss emissions reduction actions for sites which are not supplying electricity to the Council further in section 6.5 below on Sequestration and Offsetting

Recommendation 14 – Explore the potential for larger scale solar PV generation through acquisition from a third party.

6.3 Renewable Energy Electricity Purchase

6.3.1 Electricity Supply

'A green tariff means that some or all of the electricity you buy is 'matched' by purchases of renewable energy that your energy supplier makes on your behalf. These could come from a variety of renewable energy sources such as wind farms and hydroelectric power stations.' (Energy Savings Trust)[55]

By definition, green electricity is produced exclusively from renewable energy sources (solar energy, wind power, hydraulic energy, biomass, geothermal energy, etc.). Where it can be demonstrated that electricity supplies are from solely renewable energy sources the Council would

[55] Energy Savings Trust https://energysavingtrust.org.uk/home-energy-efficiency/switching-utilities/buying-green-electricity

be able to claim 'reduced emissions'. (Government guidance on this subject is still being developed, so green tariffs should still be treated with some caution).

Increasingly organisations and individuals are seeking to purchase renewable energy, which in turn is driving the move towards decarbonisation of the electricity supply. It is worth checking in detail the energy supplier's fuel mix because there are 'different shades of green'. Energy companies are required by law to publish details of their fuel mix, so you can find out if the electricity you use is matched 100% with renewable energy.

I REGOs

Renewable Energy Guarantees of Origin (REGOs), are certificates to prove electricity has been generated from renewable sources. It should be noted that a 'green' tariff must always be a REGO-backed tariff. Electricity suppliers should use their REGOs to demonstrate to customers the renewable content of electricity they have supplied each year. The supplier of renewable energy will receive one REGO per MWh of electricity generated and when an energy provider sells renewable energy, they should be selling those REGOs in a bundle with the electricity.

The REGO scheme is run by Ofgem in the UK. All EU Member States need to have such a scheme. In the EU these schemes are called GoOs (Guarantees of Origin). Ofgem is required by legislation to recognise overseas GoOs if they are presented for the purposes of Fuel Mix Disclosure (FMD). Ofgem's administration of the REGO scheme and fuel mix disclosure is not affected by the UK's exit from the EU, i.e. Ofgem will continue to issue REGOs and accept guarantees of origin (GoOs) from EU members. However, REGOs issued in the UK will no longer be recognised by EU member states after the UK's exit from the EU in a 'no-deal' scenario. During the transition period, UK REGOs are recognised by EU member states, currently until 31 December 2020.

REGO certificates can be sold to suppliers separately from renewable electricity. Current pricing for REGO certificates is around 10- 30p, with each certificate representing 1 MWh of generation. As an illustration, 30p/MWh would add approximately 0.2% to the unit price of a 14p/kWh tariff, so a REGO does not represent the true cost of renewable power. With the average domestic customer using 3.1 MWh of electricity a year, a supplier could buy cheap fossil fuel electricity on the wholesale market and separately purchase REGO certificates to match this usage for a nominal amount and state their customer's tariff is 100 per cent renewable. This is a common trap in the "green" tariff market sector.

II 'Backed by our own green electricity'

Another tactic used by some suppliers of "green" electricity is to invest in some renewable energy assets such as solar farms or wind turbines and supplement this with power from other, non-renewable, generators like coal and gas power stations, meaning there is some green power in their fuel mix, but the rest is 'brown' (a term used for fossil-fuel power). In this way they can say that their 'green tariff' is backed by their own renewable energy supply. As demand for green tariffs increase the mix becomes increasingly diluted.

III Safe use of REGOs

Our research indicates that there are few suppliers, including Ecotricity and Good Energy, who generate, or have contracts with generators to buy enough renewable electricity to indeed match customers usage. These tariffs are generally more expensive, or as Ofgem puts it 'their higher prices are directly due to the support they give to generating renewable electricity', but they are 100% renewable energy.

The key is to look for providers who have REGOs to match demand, and to **ensure your energy supplier's buys a unit of electricity from a renewable energy source for every unit of electricity they sell**. The Fuel Mix Disclosure is administered by Ofgem and therefore reliable. The requirement to disclose the fuel mix is part of the Electricity (Fuel Mix Disclosure) Regulations 2005, which introduced a requirement on all electricity suppliers in the UK to disclose to their customers the mix of fuels used to generate the electricity supplied annually.

There are several **'true green' energy tariffs** on the market, and they are all available from smaller suppliers such as **Good Energy, Green Energy UK and Ecotricity**. None of the big six utility firms currently offers a 'true green' energy deal.

As well as the above suppliers, the following organisations claim to offer green tariffs for businesses/large organisations:

- Bristol Energy
- British Gas
- Bulb
- CNG
- Crown Gas Power
- Octopus Energy
- Opus Energy
- SSE
- Yu Energy

Please note we have not investigated the fuel mix or REGO provision from these suppliers.

6.3.2 Green tariff gas supplies

The market for gas from renewable sources is in its infancy as it is difficult and expensive to generate gas from renewable sources. However, several suppliers offer blended gas mixes. For example, 6% of Good energy gas is bio-methane from anaerobic digestion (AD).

AD tanks allow waste food, vegetable matter and animal waste to break down in an environment that's free from oxygen. This process produces methane, which is then extracted from the AD and injected into the gas grid. Once it's in the grid, biogas can be used in the same way as natural gas: it's burnt to heat our homes and cook our food. Burning biomethane does release carbon dioxide, but because it releases the same amount of carbon dioxide that the organic matter used to produce it absorbed while it grew, it doesn't break the carbon balance.

Capturing methane and injecting it into the gas network – or using it as a fuel for generating electricity – helps reduce the amount of methane released into the atmosphere. Methane is a much more powerful greenhouse gas than carbon dioxide, so burning it to produce CO_2 reduces overall carbon emissions.

Currently there are insufficient biogas producers to meet UK customers' demand. Other 'green gas' options work through offsetting, by purchasing and retiring carbon credits from verified 'carbon mitigation projects' around the world that prevent carbon emissions. 'Retiring the credits' takes them out of circulation, avoiding their being double counted.

Case Study - Carbon Neutral Gas from Good Energy

This gas tariff promises the emissions from the gas used will be neutralised through investment in 'verified carbon reduction schemes.' They call it 'carbon neutral gas'. This is made of two parts. 6% of the gas they source is biogas. This is produced by breaking down organic matter such as farm waste, putting to use potent greenhouse gases such as methane that would otherwise be released into the atmosphere. For the rest, they 'neutralise' emissions by investing in verified carbon reduction schemes in Malawi, Vietnam and Nepal. Whilst some of the schemes are Gold standard certified, others provide no independent verification of emissions savings.

6.4 Reducing carbon emissions through purchasing renewable energy

Government guidance on emissions from green tariffs is still being updated. The current text in the SECR guidance states in italics '*please use the grid average conversion factor for calculating emissions from purchased electricity'* whilst at the same time signposting to the more detailed 2009[56] guidance. Furthermore, the current text in the Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance, March 2019 (ERG19)[57] seems to indicate green tariffs can be used to report an emissions reduction but this is caveated as follows:

In accordance with the 2009 Guidance, you may report an emissions reduction in your **reported net CO2e figure** for any renewable electricity that you have generated and exported to the national grid or a third party. The emission reduction should be calculated using the grid average factor. Total emissions reductions from generated and exported renewable electricity (and green tariffs if appropriate) must not be greater than gross Scope 2 emissions.' The more detailed guidance is now 11 years old and has not been updated to refer to innovations since its publication such as the REGOs.

Changes to the GHG Protocol in 2015 meant that organisations can now report using the 'market-based method' which includes reporting on the fuel mix that is behind their electricity supply. This opens the door to organisations that have a 100% REGO-backed electricity supply to claim zero carbon for their electricity. This market-based approach is referenced in the UK Government guidance, on page 49 of the March 2019 version of the Guidelines, although it is not clear that simply buying electricity from one of the 100% REGO-backed suppliers would qualify.

With the ongoing reduction in the grid electricity carbon intensity factors (see Figure 10 in section 4.3 above) purchasing green electricity tariffs would have a decreasing carbon benefit over time and may serve to disincentivise the delivery of projects which drive efficiency and reductions in consumption. The main reasons for purchasing a green tariff at this time would be:

a) To drive forward the delivery of renewable energy on the grid through increasing overall customer demand levels (although in the short term this may also drive up price)
b) To meet the First Carbon Budget if that cannot be achieved through other means
c) To bring forward the carbon neutrality target date from 2050

Our advice on switching to a renewable energy tariffs would thus be to wait until the Government finalises guidance on this part of the reporting. This should not stop the Council from looking into green tariffs, the issue of REGO certificates and start identifying the kind of supplier (or Power Purchase Agreement directly with a generator) that would allow the council to claim reduced emissions with confidence.

Recommendation 15 – Be aware that Government guidance on renewable energy tariffs and green energy is inconclusive and wait to switch to a green tariff till it is sure this would count towards the net zero target.

6.5 Carbon Sequestration/Removal and Offsetting

Carbon sequestration or certified GHG removal is a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere. Carbon sequestration can be achieved either biologically (e.g. growing trees/afforestation, restoring peatland or through other natural inorganic reactions) or mechanically (e.g. engineered removal

[56] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69282/pb13309-ghg-guidance-0909011.pdf
[57] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

through carbon capture and storage). Carbon offsets on the other hand revolve around funding projects that reduce greenhouse gas emissions, what is known as 'avoidance' (as opposed to 'removal').

Sequestration/removals and offsets are measured in tonnes of carbon dioxide-equivalent (CO_2e). One tonne of carbon offset represents the reduction of one tonne of carbon dioxide or its equivalent in other greenhouse gases.

The certified GHG removal market is not yet as developed as the carbon offset market since, other than afforestation/habitat management and carbon sequestration and storage, it relies on a number of geo-engineering processes that are not yet mature. Also the GHG Protocol is yet to publish a standard and guidance on this subject so currently we can only account for 'removal potential' rather than actual removal.

There are two markets for carbon offsets. In the larger, compliance market, companies, governments, or other entities buy carbon offsets in order to comply with caps on the total amount of carbon dioxide they are allowed to emit. For instance, an entity could be complying with obligations of Annex 1 Parties under the Kyoto Protocol or of liable entities under the EU Emission Trading Scheme, among others. In the much smaller, voluntary market, individuals, companies, or governments purchase carbon offsets to mitigate their own greenhouse gas emissions from transportation, electricity use, and other sources.

Offsets typically support projects that reduce the emission of greenhouse gases or avoid their increase in the short- or long-term. There are a wide variety of potential projects and Table 17 below sets out some of the more popular ones.

Table 17 - Types of offset projects

Category	Examples
Renewable Energy	• Wind turbines • Solar PV • Hydroelectric power • Biofuels
Methane Collection and Combustion Methane is a more powerful GHG than CO_2. Projects which collect natural methane and burn it are therefore allowable.	Natural sources of methane include: • Ruminant farm animals • Anaerobic digestion of waste • Rotting vegetation • Landfill
Energy Efficiency projects that lower overall demand (note these are not on your own estate)	Examples include • Combined heat and power plant • Energy efficient buildings e.g. improving insulation or replacing conventional lighting with LED fittings • Improving energy efficiency in new buildings
Destruction of industrial pollutants	Industrial pollutants such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are far more potent that carbon dioxide as GHGs by volume. Because these pollutants are easily captured and destroyed at their source, they present a large and low-cost source of carbon offsets

Land use, land-use change and forestry These schemes create natural carbon sinks.	• Avoided deforestation - protection of existing forests. • Reforestation – restoration of forests on land that was once forested. • Afforestation – creation of forests on land that was previously unforested, typically for longer than a generation. • Soil management projects attempt to preserve or increase the amount of carbon sequestered in soil. Including peat restoration.

6.5.1 Basic Terminology and Concepts

The following terminology and concepts will aid with the understanding of carbon offsets.

- **Vintage**. The vintage is the year in which the carbon emissions reduction takes place. Emissions reductions could be occurring in the future, meaning that the project developer anticipates future emissions, or could have already occurred, meaning that the purchaser is compensating the project developer for already-reduced emissions.

- **Source**. The source refers to the project or technology used in offsetting the carbon emissions. Projects can include land-use, methane, biomass, renewable energy and industrial energy efficiency. Projects may also have secondary benefits (co-benefits). For example, projects that reduce agricultural greenhouse gas emissions may improve water quality by reducing fertilizer usage.

- **Certification regime**. The certification regime describes the systems and procedures that are used to certify and register carbon offsets. Different methodologies are used for measuring and verifying emissions reductions, depending on project type, size and location.

- **Carbon retirement** involves retiring allowances from emission trading schemes (i.e. registering them as having been used) as a method for offsetting carbon emissions and ensuring that double counting does not occur.

6.5.2 UK Government Guidance on Accounting for Emissions Reductions via Offset

The document 'Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance, March 2019 (ERG19)'[58] provides the **reporting and accounting framework** that public sector bodies in the UK reporting on carbon should use and provides the following guidance:

1. Buying and retiring carbon offsets and Woodland Carbon units (section 6.5.4) are considered 'emission reduction actions', like exporting renewable energy. As such it is suggested these are reported against the gross emissions figure, to arrive to a net emissions figure, i.e. the Council will need to show this as a reduction against the reported in year emissions, rather than reporting a lower or net zero figure to start with.

2. The guidance recognises that purchasing offsets may be a financially attractive and practical way of achieving lower carbon emissions. It goes on to state that these 'may be deducted' from gross emissions when they meet Defra's 'good quality criteria' (see Table 21 below).

[58] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

3. In addition to meeting the 'good quality criteria' offsets must be clear about their quantum and whether they are compliant with the Kyoto Protocol (Kyoto-compliant)[59]

    a) If the credit is Kyoto-compliant it must state which external GHG programme has approved them (e.g. Clean Development Mechanism), the name of the supplier and date the units were retired from the registry. Supporting evidence is required.

    b) If the credit is not Kyoto-compliant, in addition to the information in point a) above there is a need to provide details of who developed the quantification methodology, how the project was validated and verified, and how the rest of the 'good quality criteria' is met.

Table 18 - Defra Good Quality Criteria for Carbon Offset

Defra's 'Good Quality' Criteria for Carbon Offset

Carbon offsets must meet the following criteria:

- **Additionality** – Projects must demonstrate that they have produced a saving in carbon that would not have happened otherwise i.e. the project could not take place without the carbon finance from selling credits. The project must not be required by legislation or to demonstrate compliance against legally binding targets. This should be demonstrated via a project methodology developed by a recognised body.
- **Avoiding leakage –** The project must demonstrate that it has not caused an increase in carbon emissions elsewhere. Leakage is when the carbon saving made at a project/location/time increases emissions elsewhere. An assessment must be made of any effects from the project whether up stream or downstream. This must be taken into account in determining the total emissions that can be sold from that project.
- **Permanence -** If the project could be impermanent, (e.g. forestry projects are at risk of disease or fire) then this must be addressed by the project developer or offset provider. To achieve this, projects with a risk of carbon loss should undertake a risk assessment and identify actions to minimise and compensate for loss.
- **Validation and verification -** The project must receive **independent verification**. The verifier must be an accredited and recognised independent third party. Purchasers of credits should also ensure that robust, independent validation and verification procedures were in place to check projects were implemented according to the methodology (validation) and subsequently monitored to ensure that emission reductions were properly measured (verification)
- **Timing –** Carbon credits should be ex-post, that is, they must only have been issued from the project **after** the emissions reduction has taken place.
- **Avoiding double counting –** A registry must be used to register, track and permanently cancel credits to avoid **double counting** or double selling. Projects must not be double counted against another policy or mandatory targets.

Transparency - Credits should be supported by publicly-available information on a registry to set out the underlying projects (when they were considered approved and implemented), the quantification methodology applied, independent validation and verification procedures, project documentation, proof of credit ownership and date of retirement of credits.

[59] Kyoto-compliant offsets are Certified Emission Reduction (CER) products, known as 'Certified Carbon Credits'. These are fully traceable, and verified by the United Nations (UN). Examples of standards within the compliance market, as quoted by the guidance, are: Clean Development Mechanism (CDM), Joint Implementation (JI) and European Union Allowances.

6.5.3 Recognition Schemes for Good Quality Offsets

The International Carbon Reduction and Offset Alliance (ICORA)[60] provides a clear set of best practice guidelines and promotes best practice in the carbon market. There are two markets in operation, the compliance market and the voluntary market. The schemes that would be most relevant to the Council are those generating carbon credits for Voluntary Emission Reductions (VER).

High quality international certifying standards are independently audited by the Quality Assurance Standard[61] which requires timely and transparent carbon credit retirements. Good quality schemes include:

a) **Gold Standard** Verified Emissions Reduction (known as Gold Standard or GS VER)[62] - Launched in May 2006 by WWF-UK it is only available for projects in developing countries. Projects are focused on renewable energy and energy efficient projects with strong sustainable development benefits.

b) **Verified Carbon Standard** (VCS)[63] - developed by the Climate Group and International Emissions Trading Association (IETA). It provides real, quantifiable, additional and permanent project-based emission reductions. Credits are managed through registries to register, transfer and retire Voluntary Carbon Units (VCUs).

c) **Voluntary Offset Standard**[64] - Launched in 2007 it is based on the existing standards promoted by the United Nationals Framework Convention on Climate Change (UNFCCC) and brings the voluntary market up to the level of the regulated and standardized procedures of the (Kyoto) compliance market. VOS endorses the existing gold standard methodology.

d) **Climate, Community and Biodiversity** Standards (CCB)[65] - developed by the Climate Community and Biodiversity Alliance for land-based projects that can simultaneously deliver compelling climate biodiversity and community benefits. It uses methodologies of the intergovernmental panel on climate change good practice guidance (IPCC GPG) and the Kyoto Protocol.

6.5.4 Woodland Carbon Units

The Woodland Carbon Code**[66]** is the voluntary standard for UK woodland creation projects where claims are made about the carbon dioxide they sequester. Independent validation and verification to this standard provides assurance and clarity about the carbon savings of these sustainably managed woodlands through the issue of Woodland Carbon Units (WCU).

WCUs are the only available option that will ensure that any woodland planted will count towards any future emissions reduction targets or regulatory requirements.

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60 Carbon Offsetting
61 https://qasaudit.com
62 https://www.goldstandard.org
63 https://verra.org/project/vcs-program/
64 Voluntary Offset Standard | Global Greenhouse Warming
65 Climate, Community & Biodiversity Standards - Verra
66 Home - UK Woodland Carbon Code

I Emissions Reporting

WCUs cannot be treated as carbon offsets as all UK domestic woodland projects fail to meet the additionality requirements through being considered as necessary to meet UK's legally binding targets[67].

Whilst new UK woodland cannot be classified as an offset it does not mean that the Council cannot use these carbon sequestration projects to reduce its gross emissions This reduction would not be as an offset but as a separate line in the report and would only be available if the Council did not sell those WCUs in the open market or to the Government through the Woodland Carbon Guarantee. Areas of woodland planted need to remain as woodland, or timber has to be harvested and used for a lasting purpose such as construction to avoid future release of the embedded carbon.

Table 19 below is an extract from the Woodland Carbon Code website[68] and sets out an example of how to compliantly report WCUs.

Table 19 – Emissions Reporting for WCUs

Example carbon Emissions Reporting for WCUs

An organisation's carbon emissions report following UK government guidance should show a company's gross emissions for a given year and then list any compensatory activities. These could be Kyoto compliant or voluntary offsets as well as Woodland Carbon Units or electricity generation exported.

Example Company Net Carbon Emissions Report (Source: Environmental Reporting Guidelines Annex H: Example Reporting Format)

Reporting Period	**2016-2017**	**2015-2016**
Scopes of Emissions Reported on	Scope 1, 2 and 3	Scope 1, 2 and 3
Gross Emissions	**89,510**	**91, 390**
Exported Renewable Energy Generation	(18)	(15)
Offsets	(5,000)	0
Woodland Carbon Units	(100)	
Net Emissions	**84,392**	**91,375**

Qualifying text for Woodland Carbon Units should include:

- The number of Woodland Carbon Units and their vintage
- The Name and ID number of the project that created them

[67] This requirement is set out in ERG 19 and elaborated by the Committee On Climate Change Net-Zero land use report which concludes "at least 17%" of the UK's land area, together with improved woodland management, would sequester an additional 14M tCO_2e each year. This figure is based on planting 30,000 hectares annually from 2024.

[68] 2.7 Carbon statements and reporting - UK Woodland Carbon Code

- A link to the UK Woodland Carbon Registry project page
- A link to the UK Woodland Carbon Registry retirement page, demonstrating the retirement of these units
- The name of the validator/verifier

II Potential Future Market

It is increasingly recognised that WCUs have a value and that this value could increase. Recent information published by the Royal Institution of Chartered Surveyors (RICS) states:

"*The Government's aspiration to seek the development of the domestic carbon market has been highlighted through the commitment set out in the 2018 autumn statement to offer a "Woodland Carbon Guarantee" for WCUs with £50million to be committed over the next 30years. The details of this scheme are still awaited but likely to be announced later this summer.*

However, traded market values are still a long way short of the Government's non-traded Carbon Values which many argue better reflect the "real" value of carbon if it were to be exchanged. The Department of Business, Energy and Industrial Strategy guidance uses a 2018 non-traded price of £67/ tCO_2e as against a traded value of £5/ tCO_2e. This is then projected to rise to £156 tCO2e for both traded and non-traded by 2040.

The expectation therefore is that there is the opportunity to secure an asset of real commercial value as carbon continues to increase in importance."[69]

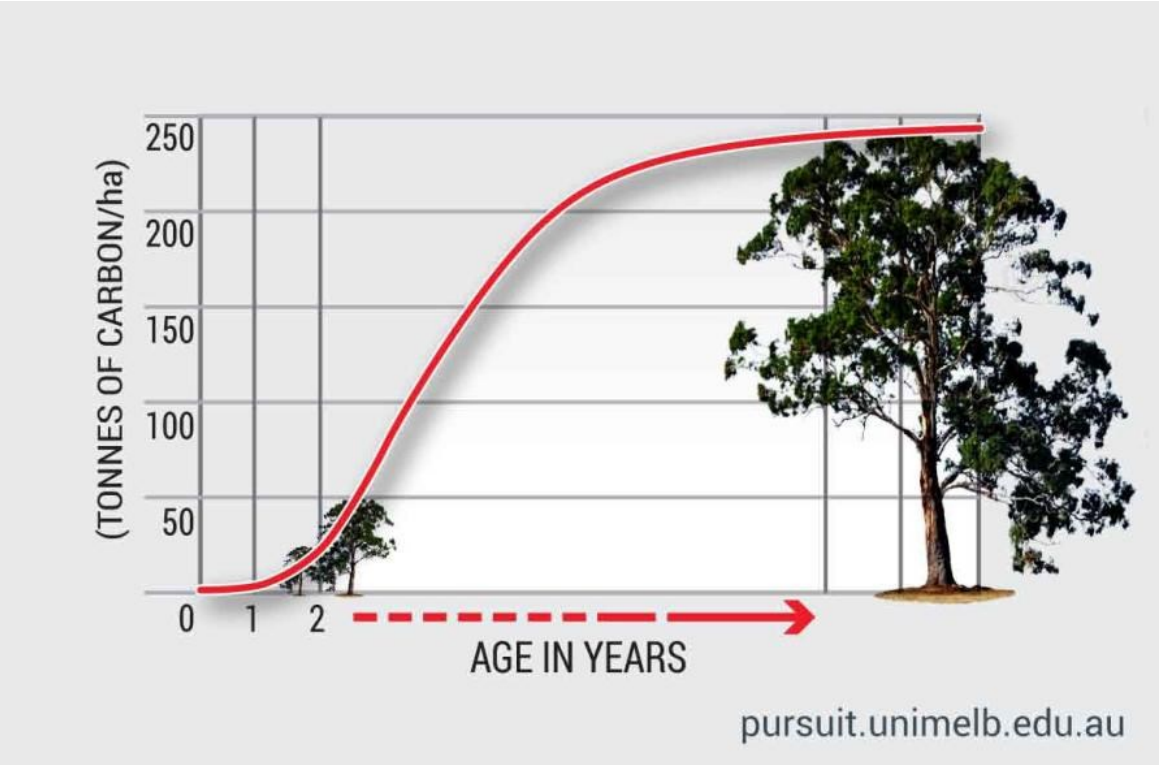
Recommendation 16 – Consider whether there is an opportunity to produce Woodland Carbon Units for others as well as meeting the Council's own needs through tree planting, or whether the Council should purchase of WCUs from others.

III Sequestration Rates

Using woodland to sequester carbon dioxide is complex. Each new stand of trees will absorb CO_2 for a period of years, before becoming a carbon sink (or store) that has to be left in place to ensure the carbon that has been captured is locked away. Figure 19 illustrates a typical sequestration curve for woodland.

Figure 19 – Carbon Sequestration in Woodland

[69] Carbon – is the answer growing in the trees?



Source: University of Melbourne

The speed of sequestration and the quantity of carbon captured depend on a number of factors including the species planted and the management regime. Typically, commercial forestry in the UK sequesters carbon more rapidly than broadleaf woodland, but the sequestration happens over a shorter timeframe. Where c*ommercial forestry is felled the use to which the timber is put will determine the rate at which CO_2 is released back into the atmosphere (i.e. carbon in timber products is still locked away).*

The RICS information cited above advises projects in the UK "have created over 20,000ha of woodland which are predicted to sequester 6.3m tonnes of carbon dioxide equivalent (tCO_2e) from the atmosphere over their lifetime of up to 100 years.

This 63,000 tCO2e per year needs to be compared to the UK's (current) annual emissions of 468m tCO2e per year. Whilst new woodlands are never going to compensate for the UK's current level of emissions, they are a very important part of the picture as the Government moves towards its commitment to net zero emissions. This is before we even consider the many additional benefits to biodiversity, landscape and quality of life that our woodlands provide."

It goes on to state *"On this basis a woodland area of 10ha would lock up some 3,150 tCO_2e*."

6.5.5 Costs of Carbon Offsets

As per the UK Government guidance offsets will need to be Kyoto-Compliant or meet the Defra's 'good quality criteria'. Offsets of this type are currently trading at values between £7-£12/ tCO_2e.

WCUs are currently trading at £5 to £15 per tCO_2e

6.6 The Need for Offsetting and Managing Associated Risks

Offsetting should be considered as the last tool to be used in the pathway to net zero emissions, having first exhausted the avenues to reduce consumption and produce renewable energy.

It is important however to recognise that small amounts of residual emissions are likely at the end of the programme and offsetting provides a means to achieve net zero.

There are considerable reputational risks associated with carbon offsetting including:

- Many schemes are not auditable and do not deliver the level of benefits originally suggested. The European Union has removed offsetting from calculations from 2021 onwards as a 2017 study demonstrated that 85% of projects failed to deliver the benefits originally set out
- Offsetting can be seen as outsourcing or exporting the issue of environmental harm to others. Where this takes place elsewhere in the world it can also be perceived as colonial
- Offsetting by planting trees is not immediate, whereas the harm is, and mechanical methods[70] are not sufficiently mature to be reliable
- Offsetting can act as a distraction, rather than encouraging people to tackle the issue of emissions reduction. It can reduce the imperative to act in more direct ways
- It is difficult to show that the offsetting scheme would not have happened (e.g. transitioning to solar as an energy source) without the intervention, and therefore that any scheme has definitely resulted in a reduction in carbon emissions
- Carbon sequestration can be hard to quantify with certainty
- Trees are temporary and can delay rather than remove the problems associated with carbon emissions all together

It is important therefore that offsetting is used as a balancing exercise only to deal with small quantities of residual emissions.

Recommendation 17 – Consider the use of carbon offsets as necessary to achieve a net zero position, but only when all other means have been exhausted ahead of a 2050 target.

[70] Low seedling survival and growth may result in restoration failures and various mechanical site preparation techniques for treatment of soils and vegetation are tools used to help counteract this.

7 DELIVERING ON THE CLIMATE EMERGENCY DECLARATION

7.1 Declarations of Climate Emergency

Declaring a climate emergency has become the statement of choice for both governments and scientists to acknowledge the scientific evidence pointing towards the fact that the potential devastating effects of climate change are such that humanity is in a climate emergency. The first such declaration was made in December 2016.

Since then over 1,400 local governments in 28 countries have made climate emergency declarations. During the period November 2018 - April 2020 around 70% of Local Authorities in England made declarations related to climate emergency, with the Council making formal statements on climate change in April 2020 as well.

7.2 Delivering enduring change

Responding to global warming is the largest challenge of our lifetimes and will require actions to reduce emissions and actions to adapt to a changing climate. Whilst this report is focused on reducing emissions and programmes of physical intervention and grid decarbonisation will help us along the way, we will only be successful in averting the effects of runaway climate change if we are also able to change the attitudes and behaviours of people.

7.2.1 The role of change management in climate response

Tackling climate change will require behaviours to be adapted across the board. Attitudes to travel, waste and over consumption amongst others will need to change if we are to be successful. To date some campaigns, such as the campaign against single use plastics, capture the public imagination, whereas others are considered less palatable and do not. The recent and rapid changes associated with attempts to manage the COVID-19 pandemic have demonstrated that, if the case is strong enough, change can occur rapidly. A number of the changes brought about by the response to COVID-19 are conducive to tackling the climate emergency and present an opportunity for step change in areas including air pollution, homeworking and emissions from transport.

In managing their own carbon emissions reductions, the Council needs to consider the most effective means of embedding carbon accounting in its decision making and driving behavioural change, starting with Council management processes and its own staff. Actively choosing to recognise the change process and proactively seeking to help people through the change process will improve the speed of transition and increase the chances of success.

7.2.2 Basics of Change Management

Behavioural change management requires an understanding of how individuals react to change and adopting strategies for dealing with that. It is also important to realise that not everyone will react in the same way and therefore developing an understanding of drivers and barriers for different groups is important. Fundamentally most individuals are resistant to change, but the extent varies significantly.

Typical steps for behavioural change management would include:

1. Developing a clear understanding of what you want to achieve and what will be different after the change. Sustainable change requires people to want to change, so it will only happen under the right conditions
2. Understand there are four potential drivers for and barriers to individual change:

i. Benefits - understanding benefits from the perspective of those being asked to change
ii. Losses - understanding the losses from the perspective of those being asked to change
iii. A belief we can succeed if we work together
iv. Social norms and peer pressure

3. Emotions – reactions to change are fundamentally emotional and it is important to acknowledge and understand the subjective nature of the process
4. Provide the right support and encouragement
5. Analyse the different groups and what works for them, customise your approach
6. Share your successes and encourage those who have made a change to advocate

It is worth bearing these principles in mind when behavioural change is required to deliver the benefits.

7.2.3 Internal Change Management

Whilst some of the measures necessary to deliver the greenhouse gas emissions reductions can be achieved without significant involvement from staff, many others will only be possible with behavioural change. Changes required as a consequence of climate response will need to be sensitively managed and integrated with other change management processes. All staff have a role to play and necessary change and targets could, for example, be embedded within service plans.

7.2.4 External Change Management

This report is focused largely on Scope 1 and 2 emissions, which are largely internal to the Council, so the need to drive change in the wider community is limited right now. If subsequent work is undertaken in relation to development of Scope 3 emissions reporting after the workshop on the 28th of July, then external behavioural change will be key to its success.

7.2.5 Barriers to change at 'Scale and Pace'

In its 2020 Progress Report to Parliament[71] the Committee on Climate Change (CCC) stated that *"Despite well-intentioned ambition the UK has fallen behind in progress to tackle and prepare for climate change."* It goes on to advise that *"Current policies and plans are insufficient to meet the fourth or fifth carbon budgets*". And for the UK to meet its legally binding net zero target by 2050 the annual rate of emissions reduction will need to be *"30% faster than has been achieved on average since 1990."*

If the Council does not want to fall behind as well, it is going to need to act at scale and pace. For this it would be advisable to identify the barriers that will slow down progress and remove or amend them. Many of these barriers are part of our normal way of doing things and we need to find a different lens if we are going to create a different outcome.

Examples of institutional barriers to scale and pace would include:

1. Financial payback periods which are considerably shorter than the duration of any financial benefits.
2. An assumption that all emissions reduction projects have to provide a financial payback. This is not the case for schemes such as school building programmes or highways projects, but emissions projects are usually expected to provide a financial return on investment.

[71] Reducing UK emissions - 2019 Progress Report to Parliament - Committee on Climate Change

3. HR and expenses policies. For example, mileage payments for use of personal vehicles. These often allow more generous payments for more polluting vehicles.
4. Delays to energy efficiency projects due to organisational uncertainty. For example, not having a clear programme of property rationalisation and the potential relocation of the main office may lead to delays in investment in most of them until the uncertainty is resolved.

There are likely to be other barriers of this nature and it is recommended that a workshop is held to identify them and the ways in which they could be removed or modified.

Recommendation 18 – Undertake a workshop to proactively identify barriers to delivering initiatives at scale and pace and seek solutions to those issues.

7.3 Carbon Budgets and decision making

Transparency and regular monitoring are the key to delivery. **For monitoring to be effective it needs to be sufficiently granular to allow individual financial budget holders to be accountable for their carbon emissions**. To become truly effective in driving down carbon it is important that other initiatives do not drive the carbon emissions back up. Carbon emissions management needs to be integrated into the business as usual decision making and management processes if it is to become effective.

Carbon budgets should thus be treated like financial budgets, allowing sufficient granularity for budget holders to become accountable for their carbon emissions alongside their financial budget. It is recommended to develop the new integrated carbon data to enable quarterly reporting. We would recommend that the same principles apply to carbon budgets as apply to other central resources, i.e. where possible they are either in a central budget or they are disaggregated. Where disaggregation occurs this could be done on the same basis as the associated financial costs, i.e. each project or initiative would have a financial and a carbon cost associated with it.

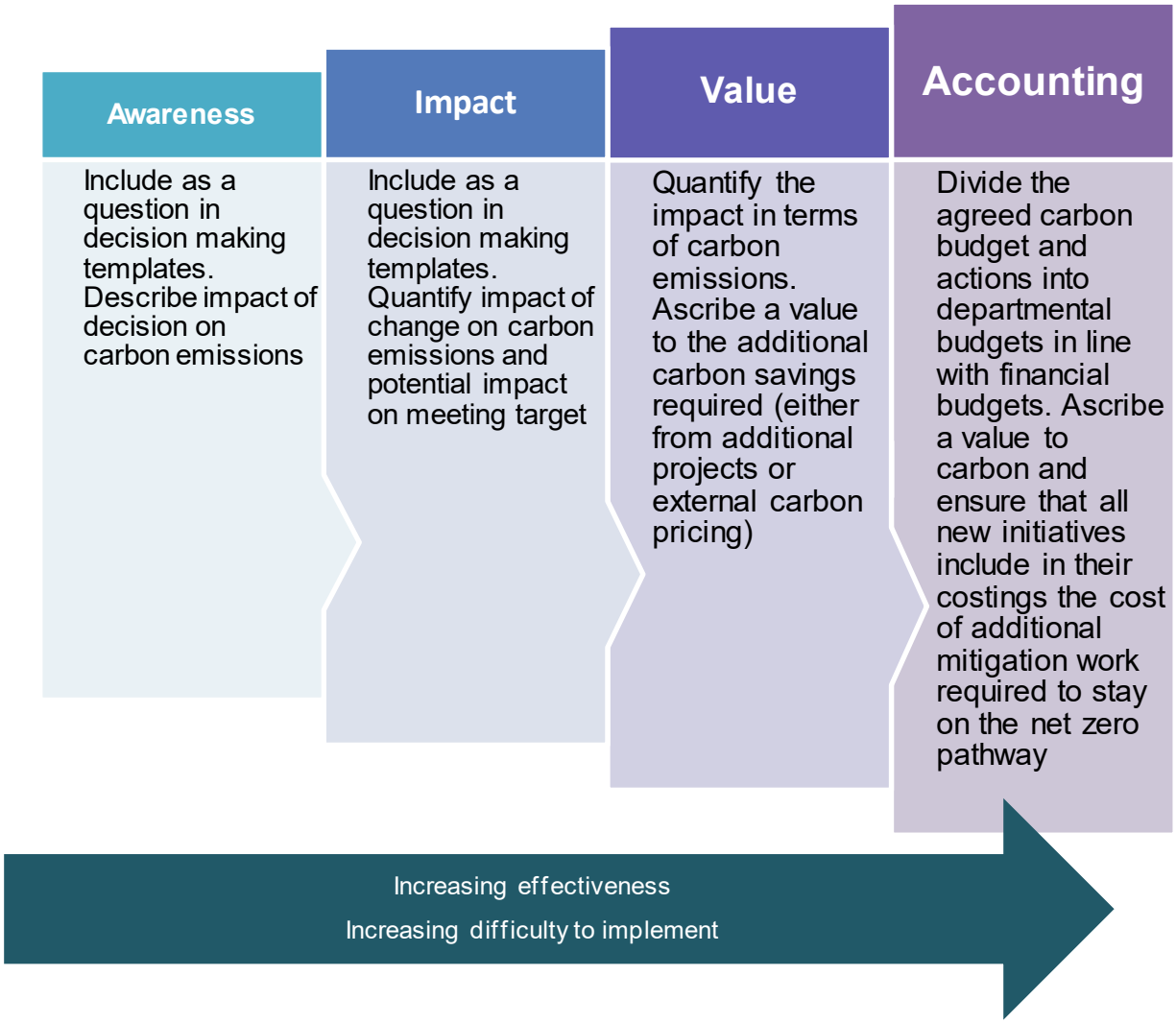
All future decisions of the Council should consider their impact on carbon emissions and be able to quantify the impact on the net zero pathway and carbon budgets. The cost of carbon should be considered in the decision-making process and, where a decision will increase the need for carbon emissions, the quantum and means of mitigation and associated costs should be identified and included in the business case.

Increasingly local authorities are integrating carbon considerations into their decision making. By including the impact on carbon emissions into wider decision-making processes the Council could ensure that future decisions do not inadvertently impact emissions targets.

Recommendation 19 – Include the impact on carbon emissions into wider decision-making processes, potentially via a Carbon Impact Assessment Tool

There are different ways in which emissions considerations can be integrated into decision making and Figure 20 below sets out the options and likely impacts.

Figure 20 – Options/phases for integrating emissions reductions into decision making



7.4 Reporting Obligations and Reporting Frequency

At present there is no formal requirement on councils to report on carbon emissions. It is however increasingly likely that this will be reintroduced as national Government strives to make progress towards its net zero challenge.

Currently progress against carbon emissions targets is reported voluntarily annually. This reporting has proved useful in the past in demonstrating that carbon emissions savings are being achieved (N185, CRC). The timing of reporting is also important, with the need for both formal annual carbon accounting and more regular progress monitoring reports. It is recommended that this is increased to quarterly to allow in-year progress monitoring. In order to do this a simplified package of indicators should be developed, with as much automation as possible. There is a seasonal factor to carbon emissions (being higher in the winter due to heating and additional lighting) and this will need to be reflected in quarterly budgets.

Once carbon budgets have been embedded within the decision-making process, potentially via a Carbon Impact Assessment Tool, there will also be more of a reason for carbon reporting to be done on a quarterly basis, with a quarterly scorecard to show in-year progress towards delivery of the carbon savings and whether the Council is staying on target or going over budget. This will allow the Council to ensure that carbon reduction projects are delivered on time, investigate any

discrepancies, and take remedial action in year so that the Council is able to stick to the carbon budgets and the chosen pathway to net zero carbon.

Recommendation 20 – Introduce a quarterly monitoring scorecard to enable carbon reduction to be more proactively managed.

7.5 Increasing the ambition

Since this is a relatively new topic to the Council, the initial carbon emissions Baseline has been drawn tightly in terms of both scope and boundary. The Greenhouse Gas Protocol defines scope and boundary as follows:

A. Boundaries: Carbon accounting and reporting boundaries can have several dimensions, i.e. organizational, operational, geographic, business unit, and target boundaries. The inventory boundary determines which emissions are accounted and reported by the company.

B. Scope: Defines the operational boundaries in relation to indirect and direct carbon emissions (i.e. in this instance Scope 1 and 2 emissions plus staff business travel).

This is a very sensible starting point as it allows any inconsistencies between data collection and data quality to be ironed out before moving on.

The 2050 zero emissions target is fully aligned to the UK Government target, but less stretching than some in the sector have chosen to adopt. Ambition could be increased either by seeking to drive the pace faster and achieve net zero carbon earlier than 2050 (bringing the 2050 target forward to 2030 was indeed explored as previously explained) or by increasing the scope and boundary of measures that are included. Within Medway currently the Council's chosen scope represents around 1.3% of the overall emissions[72]. Future phases could consider how to facilitate reductions in the borough as a whole.

Taking a phased approach to the implementation of further measures is recommended, with the following as good places to start:

1. Urgently assess how beneficial changes associated with the management of the COVID-19 pandemic may be solidified into lasting change
2. Ensure that green ambition is at the heart of the COVID-19 recovery plans for Medway
3. Pursue an initial 'wide and shallow' assessment of the Council's Scope 3 emissions, paying particular attention to outsourced direct service provision (this will be explored at the workshop on 28th July)
4. Develop more sophisticated modelling to account for future population growth and the impact on service requirements
5. Undertake a mapping exercise of areas of influence the Council has over the wider area through its powers as a local authority. Use this exercise to review policies to drive down carbon emissions where possible in the wider area. Examples could include direct measures such as planning policy relating to transport and energy, developer contributions, licensing activities such as taxis and houses in multiple occupation.

[72] Whilst Medway's Scope 1 and 2 plus staff travel Baseline is 11,650 tCO_2e, the latest figures from the BEIS mapping tool (https://naei.beis.gov.uk/laco2app/) indicate that borough wide emissions are 871,800 tCO2e.

6. Consider how the Council might act as a facilitator for change in the wider area

Recommendation 21 – Consider taking a phased approach to the expansion of the Baseline into Scope 3 emissions and in particular assess how to:

- **Solidify beneficial changes associated with the management of the COVID-19 pandemic into lasting change**
- **Ensure that green ambition is at the heart of the COVID-19 recovery plans for Medway**
- **Undertake an initial 'wide and shallow' assessment of the Council's Scope 3 emissions, paying particular attention to outsourced direct service provision**
- **Develop more sophisticated modelling to account for future population growth and the impact on service requirements**
- **Map the areas of influence the Council has over the wider area through its powers as a local authority and review policies to drive down carbon emissions in the wider area, e.g. planning requirements**
- **Consider how the Council might act as a facilitator for change in the wider area**

8 CONCLUSIONS & RECOMMENDATIONS

8.1 Main conclusions

There is evidence to suggest that, given the appropriate resources, Medway Council can reduce its carbon emissions by around 95% by 2050 using interventions that are already available. The residual 5% can be managed through enhanced energy efficiency measures, renewable energy and carbon offsetting, with an emphasis on the former activities, as opposed to the latter.

As per our proposed example interventions, quantified and additional, the technological means exist for Medway Council to follow an Exponential Reduction Pathway with a budget allowance of 57,631 tCO_2e for the period 2020-2027 and in so doing keep to the Science Based Target the Climate Emergency Declaration commits the Council to. However we understand that, within the current means - both in terms of financial resources and human capital - not all of these interventions are possible or at least at the time where they will have the necessary impact to meet the Budget.

It is of utmost importance that the Council identifies the resources necessary to keep to an Exponential Reduction Pathway, selecting these or other interventions and implementing them in a timely manner so that the Carbon Budget deficit is drastically reduced. From our experience, provided that the First Carbon Budget is met, it is likely Medway Council will be able to achieve subsequent carbon budgets aligned with the Exponential Reduction Pathway in the period up to 2050 and, in so doing, keep to the Science Based Target and the Medway Climate Emergency Declaration, which will avert the worse of climate change.

With regards to offsetting and sequestration there is potential for Medway to explore both solar PV and tree planting as means to achieve its own offsetting. Further work is already underway to utilise and enhance existing green and blue infrastructure as carbon sinks, the results of which are not yet known but should eventually be integrated with this work.

Furthermore, the Council should consider expanding the emissions scopes included in the carbon Baseline and Exponential Reduction Pathway to include further Scope 3 measures as and when suitable data becomes available. Please note the current Medway Council Baseline, calculated as per the Council's instruction (Scope 1 and 2 plus staff travel, Transmission and Distribution Losses and Water from Scope 3) only accounts for 1.4% of the area-wide emissions that the Kent and Medway Energy and Low Emissions Strategy commits Medway to reduce to net zero by 2050[73].

8.2 Recommendations

There are a number of recommendations through the report and they are summarised in table 20 below

Table 20 – Main recommendations

Number	Recommendation
1	To develop a re-baselining policy and threshold, as well as to agree on some carbon intensity metrics
2	To collect transport data in terms of litres of fuel as opposed to miles used and roll out the use of fuel cards where appropriate
3	To undertake the necessary steps to be able to report on fugitive emissions using the Screening Method

[73] Whilst Medway's Scope 1 and 2 plus staff travel Baseline is 12,105 tCO_2e, the latest figures from the BEIS mapping tool (https://naei.beis.gov.uk/laco2app/) indicate that borough wide emissions are 872,000 tCO_2e.

4	To follow UK Government SECR Guidance on reporting emissions
5	To develop a baseline recalculation policy and set a threshold that will trigger it
6	To combine SECR Carbon Accounting Principles with the GHG Protocol Reporting Methodology, especially for Scope 3 emissions
7	To adopt the following data collection recommendations: • Introduce a Data Collection Tracker tab at the end of the Data Sheet • Add a 'Projects and Savings' Tab to the Data Sheet that links to the Re:fit projects • Introduce a 'comparison tab' in the Data Sheet, which includes potential explanations to changes in the data • Thorough recording of A/C gas top ups so the Council can report on 'fugitive emissions' with confidence following the Screening Method. • Introduce planned maintenance for air conditioning (as opposed to reactive maintenance) if it is not present already. • Consider the formation of a Carbon Reporting Working Group that will ensure early engagement, joint briefing and cooperation across departments to achieve efficiencies and save time when reporting carbon emissions
8	To adopt of a Science Based Target, Exponential Reduction Pathway and associated Carbon Budget
9	To set the first budget period to 2027 to enable alignment of future budget cycles with UK Government carbon budgets
10	To adopt the principles inherent in the Carbon Management Hierarchy
11	Consider the below interventions as a matter of urgency: • Prioritise LED upgrades and PV across the Estate in the next year or two • Roll-out the conversion of all suitable heating systems to low carbon heat pumps or equivalent to all of the Estate as part of Re:fit Phase 2 • Upgrade or optimise all building controls by 2024-25 • Electrify the waste fleet and all vans ASAP
12	To undertake a carpark review to establish the possibility of installing solar PV, including solar canopies, as well as EV charging points
13	To undertake a landfill review to establish the potential for solar PV
14	To explore the potential for larger scale solar PV generation through acquisition from a third party
15	To be aware that Government guidance on renewable energy tariffs and green energy in inconclusive and wait to switch to a green tariff till the Council is sure this would count towards the net zero target
16	To consider whether there is an opportunity to produce Woodland Carbon Units for others as well as meeting the Council's own needs through tree planting, or whether the Council should purchase of WCUs from others
17	To consider the use of carbon offsets as necessary to achieve a net zero position, but only when all other means have been exhausted ahead of a 2050 target
18	To undertake a workshop to proactively identify barriers to delivering initiatives at scale and pace and seek solutions to those issues
19	To introduce a quarterly monitoring scorecard to enable carbon reduction to be more proactively managed

20	To include the impact on carbon emissions into wider decision-making processes, potentially via a Carbon Impact Assessment Tool
21	To consider taking a phased approach to the expansion of carbon management beyond the scope of the existing Baseline and in particular assess: • How beneficial changes associated with the management of the COVID-19 pandemic may be solidified into lasting change • Ensure that green ambition is at the heart of the COVID-19 recovery plans for Medway • Undertake an initial 'wide and shallow' assessment of the Council's Scope 3 emissions, paying particular attention to outsourced direct service provision • Develop more sophisticated modelling to account for future population growth and the impact on service requirements • Undertake a mapping exercise of areas of influence the Council has over the wider area through its powers as a local authority. Use this exercise to review policies to drive down carbon emissions where possible in the wider area, e.g. planning requirements • Consider how the Council might act as a facilitator for change in the wider area

Glossary of Abbreviations

AD – Anaerobic Digestor
THE COUNCIL – Medway Council
BEIS – Department for Business, Energy and Industrial Strategy
BMS – Building management system
Carbon Intensity Factors – conversion factor for carbon in supplied electricity
CCB – Climate, Community and Biodiversity Standards
CCC – Committee on Climate Change
CIBSE – Chartered Institute of Building Services Engineers
CRC – Carbon Reduction Commitment
DEC – Display Energy Certificate
DEFRA – Department for the Environment, Farming and Rural Affairs
ERG19 – UK Government Environmental Reporting Guidelines, March 2019
EV – Electric Vehicle
ESOS – Energy Savings Opportunity Scheme
GAAP – Generally Accepted Accounting Principles
GHG – Greenhouse Gas
Grid Decarbonisation – rate at which renewable energy is replacing fossil fuels in grid supplied electricity
GS VER – Gold Standard Verified Emissions Reduction
GW – Gigawatt
Ha - Hectare
HFC – Hydrofluorocarbons
ICORA – International Carbon Reduction and Offset Alliance
IETA – International Emissions Trading Association
IFRS – International Financial Reporting Standards
IPCC GPG – International Panel on Climate Change – Good Practice Guidance
kW – Kilowatt
LED – Light-emitting diode (a form of energy efficient light bulb)
MW – Megawatt
PFC – Perfluorocarbons
PPA – Power Purchase Agreement
PV – Photovoltaic
Re:fit – Energy Performance Framework Contract
REGO – Renewable Energy Guarantee of Origin
RICS – Royal Institution of Chartered Surveyors
ROI – Return on Investment
SECR – Streamlined Energy and Carbon Reporting
tCO_2e – equivalent tonnes of carbon dioxide (measure of greenhouse gas emissions)
UKCP18 – UK Climate Predictions 2018 – issued by the Met Office
UKPN – UK Power Networks – Distribution Network Operator for part of Medway
ULEV – Ultra low emission vehicle
UNFCCC – United Nations Framework Convention on Climate Change
VCS – Verified Carbon Standard
VCU – Voluntary Carbon Units
VER – Verified Emissions Reduction

WCU – Woodland Carbon Units
WWF – Worldwide Fund for Nature

Appendix 1 – Re:fit Phase 1

The following buildings are the ones that Re:fit Programme Phase 1 will be targeting during 2021:

Premises name	Premises address
Medway Leisure Centre	Mill Rd, Gillingham ME7 1HF
The Central Theatre	170 High St, Chatham ME4 4AS
Gillingham Library	3 High St, Gillingham ME7 1BG
Wigmore Library	208 Fairview Ave, Gillingham ME8 0PX
Rochester AEC and Library	Community Hub Rochester, Eastgate, Rochester ME1 1EW
Guildhall Museum	17 High St, Rochester ME1 1PY
Medway Crematorium	Robin Hood Lane (Upper), Chatham ME5 9QU
Cuxton Library	Bush Road, Cuxton, Rochester ME2 1EY
Chattenden Community Centre	Swinton Avenue, Chattenden ME3 8PH
Gun Wharf	Gun Wharf, Dock Rd, Chatham, ME4 4TR
Lordswood Library	Kestrel Road, Lordswood, Chatham ME5 8TH
Brook Theatre	Old Town Hall, Chatham ME4 4SE

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