Proposal for a Cambridgeshire Carbon Advisory Service and Strategic Business Case for a Cambridgeshire Decarbonisation Fund

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Executive Summary

The imperative and urgency to reach net-zero has never been clearer. Decarbonising our local environment and practises is a momentous task, however Cambridgeshire County Council and its various public sector partners and stakeholders together, are uniquely placed to collaborate positively and holistically towards tackling the climate crisis at a local level. Thus, the Cambridgeshire local system has an exciting and critical opportunity to drive the achievement of a net-zero Cambridgeshire by 2045 and serve as a model for other local areas across the country and elsewhere. This report recommends the establishment of a Carbon Advisory Service, which will support local businesses to decarbonise. In conjunction, this report sets out the strategic business case for a Cambridgeshire Decarbonisation Fund, which will offset residual 'hard to reduce' emissions and support investment in local community infrastructure and nature-based projects which will avoid, reduce, or sequester carbon.

There are two main principles which should guide decarbonisation efforts across Cambridgeshire. Firstly, carbon saving projects should be prioritised in the order 'avoid, reduce, sequester' to maximise long-term impact of interventions. Secondly, alongside providing a platform to offset current carbon emissions, there must be robust and verifiable plans to decarbonise all scopes of emissions in the long term. Towards this second principle, the establishment of a 'Carbon Advisory Service' to run alongside and in collaboration with the Cambridgeshire Decarbonisation Fund is proposed. The Carbon Advisory Service will provide businesses, particularly small and medium sized enterprises (SMEs), with assistance in calculating their emissions, and a tailored framework for reducing these emissions. Participating businesses will then be invited to offset any residual 'hard to reduce' emissions through the Decarbonisation Fund.

In the introduction, the motivation for the formation of a Carbon Advisory Service is shown, as well as context around what a Decarbonisation Fund is and the aims and essential components of such a fund, and how these two services could be highly complementary. The remainder of the report is divided into 2 main sections. The first provides a detailed justification for establishment of a Carbon Advisory Service, including how it will improve upon existing resources available to local businesses, using a case study of services available in Suffolk and Norfolk. The section concludes with some specific recommendations. The rest of the report is concerned with the Cambridgeshire Decarbonisation Fund, which covers i) the strategic business case for the establishment of the fund, ii) how decarbonisation projects will be verified and validated, including two case studies, and iii) the financial structure of the fund. The report concludes with a brief summary and a list of recommendations for the setting up of

a Carbon Advisory Service and Decarbonisation Fund for Cambridgeshire, these recommendations are included below.

Recommendations:

1. The establishment of a local Carbon Advisory Service to support small and medium sized businesses in Cambridgeshire to decarbonise, through the provision of the following services:
    a. Free tailored advice, and signposting relevant external resources and services.
    b. Assistance with carbon accounting and the creation of action plans.
    c. Energy audits and business-specific recommendations.
    d. Assistance with the purchase of carbon credits from the Cambridgeshire Decarbonisation Fund, where appropriate.
    e. Assistance with procurement and accessing financial support for carbon-reduction projects.
    f. An accreditation service with tiered certification.
    g. Training and networking opportunities and regular updates on funding, technology and environmental legislation.
    h. Support with publicity and follow-up on businesses progression towards set targets.
2. The Carbon Advisory Service should act as a gateway to the Decarbonisation Fund, ensuring that businesses reduce their emissions as far as possible before offsetting any residual 'hard to reduce' emissions through the purchase of carbon credits.
3. The Decarbonisation Fund should support emissions-reduction projects that would otherwise not be financially viable (i.e., would not produce revenue or financial savings which outweigh the cost of the project). Projects which do not require the sale of carbon credits to be financially viable should be performed separately to the running of this Fund.
4. The Decarbonisation Fund should set a single carbon price through a portfolio approach, where more carbon expensive projects (with high social / environmental value) are supported by projects with a lower project cost per tonne of CO2.
5. The Decarbonisation Fund should organise and perform the necessary assessments, measurements and predictions required for validation and verification of the decarbonisation projects in the decarbonisation fund portfolio.
6. The Decarbonisation Fund should register projects with established certification organisations where relevant and cost-effective, and otherwise use/adapt relevant publicly available methodologies from such organisations for validation and verification.

7. The initial funding provided for the establishment of the Decarbonisation Fund should be maximised, as this will enable the biggest environmental impact and largest financial returns in the long-term.
8. A diverse portfolio of initial funding should be sought for the establishment of the Decarbonisation Fund, combining both public and private sources to ensure that the Fund is resilient.

Glossary

BEE Anglia - Business Energy Efficiency Anglia is a programme run by Suffolk County Council with funding from the European Regional Development Fund which provides advice and support to help businesses to become more energy efficient.

Carbon accounting - when a business estimates its carbon footprint, such as through the use of an online calculator.

Carbon Advisory Service (CAS) - the proposed service aimed at SMEs which will provide advice and support to assist businesses moving toward net zero emissions and act as the gateway of the Decarbonisation Fund.

Carbon audit - when a trained professional visits a business and identifies energy saving measures.

Carbon Charter - an accreditation awards scheme available in Suffolk and Norfolk which supports businesses to reduce their greenhouse gas emissions and provides locally-recognised certification.

Carbon credit - a token created by organisations who undertake carbon-reduction projects. These credits can be sold to others to "offset" some of their emissions. One credit is typically equivalent to removing one tonne of "CO_2 equivalent".

CCC - Cambridgeshire County Council

CO_2 equivalent (CO_2e) - a measure of greenhouse gas emissions which includes effects from all types of gases (like methane, nitrous oxides, HFCs) rather than just CO_2. CO_2e is the amount of only carbon dioxide required to cause the same level of warming.

Global heating - phrase used to refer to changes taking place to the world's climate due to human activity.

Net-zero - when there is no net addition of carbon to the atmosphere i.e., the amount of carbon added to the atmosphere is equivalent to the amount of carbon removed from the atmosphere.

Offset - a process in which an emitter can purchase carbon credits to counteract some or all of the emissions they are responsible for.

SMEs - small and medium sized enterprises, those companies which have fewer than 250 (full-time equivalent) employees and a turnover of ≤ € 50 m or balance sheet total ≤ € 43 m, as defined by the European Union.

WCC - Woodland Carbon Code

1. Introduction

In recent years, there have been increasing calls for global action towards net-zero, with major summits on global heating garnering significant attention and producing ambitious deals and targets. This was highlighted at the most recent COP26 summit in Glasgow, the first global summit to commit to reduce the use of coal, an activity which is responsible for 40% of global CO_2 emissions.[1] Other commitments were also made, ranging from increasing support to developing countries most affected by global heating, new green finance schemes, and methane removal targets.[2]

To avoid/mitigate the catastrophic effects of global heating, it is critical to reach global targets for curbing emissions. In the 2015 Paris agreement, nations committed to limiting temperature rises to 2 °C and pursuing efforts towards 1.5 °C, compared to pre-industrial levels.[3] In practical terms, this necessitates rapid emissions reductions now and reaching net-zero by 2050, i.e., no net addition of carbon into the atmosphere from 2050 onwards. There are also intermediate global targets of a 55% reduction of emissions by 2030 compared to 1990 levels.[4] The UK is on its way to achieving this by already managing to reduce emissions by 51% compared to 1990 levels, by some measures.[5]

The UK has its own targets for reducing global heating: UK emissions must be reduced by 78% compared to 1990 levels by 2035[6] - this is enshrined in law. The UK also released a Transport Decarbonisation plan in Spring 2021 which brings forward many previously set targets of decarbonising various aspects of the national transport infrastructure.[7] The UK government also has a £2bn Green Homes Grant scheme to help make UK homes more energy efficient.[8]

While government funding has financed projects achieving some significant carbon reductions, it is likely that given the high costs of truly decarbonising the economy, private funding will also be needed. Locally the Cambridgeshire public sector system has a critical role to play in achieving net-zero

[1] https://www.google.com/url?q=https://ukcop26.org/cop26-keeps-1-5c-alive-and-finalises-paris-agreement/&sa=D&source=docs&ust=1637797835733000&usg=AOvVaw3IB6j1pO3osXIbdp42au5R
[2] https://unfccc.int/documents
[3] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[4] https://ec.europa.eu/clima/eu-action/international-action-climate-change/climate-negotiations/paris-agreement_en
[5] https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2020
[6] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035
[7] https://www.gov.uk/government/publications/transport-decarbonisation-plan
[8] https://www.gov.uk/guidance/apply-for-the-green-homes-grant-scheme

emissions, and an opportunity to be a leader in shaping public-private partnerships towards shared climate goals.

A 2020 CUSPE report[9] proposed a Cambridgeshire Decarbonisation Fund as a way of harnessing private funding to aid decarbonisation, allowing businesses a say in shaping their local environment; providing them with a range of co-benefits; and playing a positive role towards mitigating global heating. This report proposes that a Cambridgeshire Carbon Advisory Service is established alongside the Decarbonisation Fund, to assist SMEs in calculating and reducing their own emissions. Such an Advisory Service will fill a gap in the market to provide this advice and expertise to SMEs, who often do not have adequate resources in-house. The Carbon Advisory Service would act as a gateway to the Decarbonisation Fund, ensuring that businesses first decarbonise as much as possible, with remaining residual 'hard to reduce' emissions subsequently offset via the Fund. Carbon offsetting would be achieved through the sale of carbon credits generated by carbon mitigation projects, located in the Cambridgeshire region, supported by the Decarbonisation Fund. This report also builds upon last year's proposal of a Cambridge Decarbonisation Fund, detailing the strategic business case for such a Decarbonisation Fund. Methods for the verification and validation of carbon credits produced, and how such a fund would be managed, financed, and scaled are also investigated.

[9] https://data.cambridgeshireinsight.org.uk/dataset/cambridgeshire-policy-challenges-cambridge-university-science-and-policy-exchange-cuspe

2. Establishment of a Carbon Advisory Service

2.1. Justification

The Cambridgeshire Decarbonisation Fund is intended to provide a source of funding for projects that support the drive towards achieving net zero emissions in Cambridgeshire, while at the same time allowing local businesses to offset 'hard to reduce' carbon emissions and attain recognition for doing so. This raises two related questions:

1) How should the Fund determine which emissions are 'hard to reduce' and are eligible to offset through the Fund?
2) How can the Cambridgeshire public sector and its partners support and encourage businesses to identify and eliminate emissions that do not qualify as 'hard to reduce'?

An option to address these questions is the establishment of a Carbon Advisory Service (CAS), with five main functions:

1) Assist businesses in calculating their emissions
2) Recommend measures to reduce emissions
3) Enable the purchase of carbon offsets from the Cambridgeshire Decarbonisation Fund where appropriate
4) Support businesses to carry out these reductions
5) Assess and certify businesses progress in reducing net emissions

2.1.1. Opportunities, challenges and needs

While the Decarbonisation Fund will be important in offsetting 'hard to reduce' emissions, there is also a clear opportunity to achieve significant emissions reductions by helping local businesses decarbonise. This opportunity is particularly pertinent to SMEs: unlike larger businesses they rarely have an in-house sustainability advisor, lack capital to invest in decarbonisation measures, and are not obliged to report emissions under schemes like the Energy Savings Opportunity Scheme (ESOS).[10] 50% of emissions from UK businesses come from SMEs,[11] and a study commissioned by the Department of Energy and Climate Change found that *"the average SME could reduce its energy bill by 18-25% by installing energy efficiency measures with an average payback of less than 1.5 years. And it is estimated 40% of these savings would require zero capital cost."*[12]

[10] https://www.gov.uk/guidance/energy-savings-opportunity-scheme-esos
[11] https://www.british-business-bank.co.uk/wp-content/uploads/2021/10/J0026_Net_Zero_Report_AW.pdf
[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/417410/DECC_advice_guide.pdf

Despite these potential 'easy wins' for decarbonisation, SMEs have generally not taken steps to reduce their emissions. According to estimates from the British Business Bank, 76% have not yet implemented comprehensive decarbonisation strategies and just 3% of SMEs surveyed say they have measured their carbon footprint in the past five years and set an emissions reduction target.[13] This is largely down to two barriers:

- **Lack of expertise and information:** research by the Zero Carbon Business Partnership found that 70% of SMEs *"said that they could not find an online source of help for SME decarbonisation that was accessible and high-quality."*.[14] There is limited proactivity from businesses to improve their own knowledge and capability, with 56% surveyed saying they have taken no actions to change this.[13]
- **Cost:** 35% of businesses state cost as a barrier to reducing emissions,[13] often lacking the capital to make upfront investments despite the long-term savings.

Despite these barriers, SMEs that do take steps to reduce their emissions can experience multiple benefits, alongside the broader benefits to the area of decarbonisation:

- Long-term cost savings through efficiency improvements, including potential for an average reduction in energy bills of up to 25%.[12]
- Improved consumer perceptions, with associated potential uplift in business.
- Improved ability to attract high-quality employees, particularly among the younger generation.
- Ability to respond to procurement pressure from large businesses, which increasingly require emissions reporting and reductions from partners in their supply chain, as part of Scope 3 reporting.
- Stay ahead of the curve for potential future reporting requirements, including the possible extension of ESOS to medium-sized enterprises.[15]

A Carbon Advisory Service is well-placed to tackle these barriers, enabling businesses and the region to access the associated benefits of decarbonisation.

2.1.2. Links to Cambridgeshire County Council target outcomes

The proposed Carbon Advisory Service provides clear steps to meeting Cambridgeshire County Council's target outcomes:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/392908/Barriers_to_Energy_Efficiency_FINAL_2014-12-10.pdf

[13] https://www.british-business-bank.co.uk/wp-content/uploads/2021/10/J0026_Net_Zero_Report_AW.pdf

[14] https://www.edie.net/news/6/New-coalition-to-help-UK-SMEs-align-with-net-zero-amid-Covid-19-recovery/

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/999452/strengthening-energy-savings-opportunity-scheme-consultation.pdf

- *Cambridgeshire: A well-connected, safe, clean, green environment:* Supporting businesses to improve environmental quality, both locally (e.g., reducing car use in local area for business-related transport, or switching to electric vehicles) and on wider scale by reducing greenhouse gas emissions and associated global heating-related impacts for Cambridgeshire.
- *A good quality of life for everyone:* The evidence is clear that improved environmental quality supports both physical and mental wellbeing for local residents.
- *Communities at the heart of everything we do:* This scheme supports a local, community-centred energy transition by supporting small local businesses to decarbonise (with cost savings and potential uplift in business), and channelling carbon offsetting payments towards local schemes, which offer further co-benefits for the area.

2.1.3. Carbon Advisory Service in context: links to existing strategies and policies

The proposed Carbon Advisory Service is designed to align with existing policy around decarbonisation, from the international to organisational level:

- **International:** supports the UN Race to Zero strategy,[16] aiming for individual businesses to become carbon neutral by 2050, and supports businesses to meet the 'Starting Line' criteria for the strategy.
- **National:** supports businesses to make the SME Climate Commitment, included within the UK Business Climate Hub strategy for net zero by 2050.[17] This is aligned with the UN Race to Zero.
- **Regional:** supports Priority Areas (specifically within Mitigation and Natural Capital) within Cambridgeshire County Council's Climate Change and Environment Strategy.[18]
- **Organisational:** builds on the 2019 CUSPE report, establishing and discussing the target for net zero for Cambridgeshire by 2050.[19] Further builds on the 2020 CUSPE report on a Cambridgeshire Decarbonisation Fund, specifically recommendation 5 from the report: "Support businesses to reduce their emissions at source where possible but use the fund for the hard-to-treat residual emissions".[20] Supports the establishment of a Cambridgeshire Decarbonisation Fund as outlined in this report.

[16] https://unfccc.int/climate-action/race-to-zero-campaign

[17] https://businessclimatehub.org/smes/

[18] https://www.cambridgeshire.gov.uk/residents/climate-change-energy-and-environment/climate-change-and-environment-strategy

[19] https://data.cambridgeshireinsight.org.uk/sites/default/files/2019%20CUSPE%20Policy%20Challenge%20-%20Net%20Zero%20Cambridgeshire.pdf

[20] https://data.cambridgeshireinsight.org.uk/sites/default/files/2020%20CUSPE%20Policy%20Challenge%20-%20Proposal%20for%20a%20Cambridgeshire%20Decarbonisation%20Fund%20to%20Support%20the%20Achievement%20of%20Net-Zero%20Cambridgeshire%20by%202050.pdf

2.1.4. Review and case study of existing resources

The following sections provide a review of energy efficiency and decarbonisation resources available to SMEs, and discuss the gap between the provision of information and the implementation of energy reduction measures. The services provided by neighbouring Suffolk and Norfolk County Councils to address this gap are outlined in a case study in Appendix B. Recommendations for the proposed Cambridgeshire Carbon Advisory Service are then provided.

2.2. Summary of existing carbon advisory tools and services

Research carried out for this report has identified tens of charities, non-for-profit organisations and businesses operating in the carbon advisory sector (Figure 1). These organisations act from the local/regional to international level, providing a plethora of free and paid-for tools and services to businesses.

Figure 1: Example charities, non-for-profit organisations and businesses operating in the carbon advisory sector. Organisations outlined in red provide tools/services locally/regionally and are not accessible to businesses in Cambridgeshire.

Each organisation has its own unique focus, from developing software for emissions calculations and performance tracking (Ecometrica, Greenstone and xtonnes), to supporting businesses in making carbon commitments (SME Climate Hub, Science Based Targets Initiative and Carbon Trust). Despite this variety, the tools/services offered by these organisations can be classified into five major themes:

- Calculating emissions
- Making recommendations

- Assistance with funding/procurement
- Taking sustained action
- Certification

Within each theme, there is a spectrum of specificity in the tool/service offered, ranging from generic to personalised (see appendix A).

2.2.1. Evaluation of existing carbon advisory tools and services

As this sector is dense with players, existing tools and services were evaluated to determine whether there is scope for a new service which addresses unmet needs of local businesses.

i. Impacts of existing carbon advisory tools and services

Collectively, existing tools and services have been accessed by thousands of businesses and have resulted in sizable carbon reduction. The differences in metrics and data analysis used by each carbon advisory organisation prevents us from providing overall figures, but examples include:

- The Carbon Literacy Project has certified 23,000 individuals, with a 5-15% carbon saving per person.[21]
- Through the B Corp Climate Collective, over 1600 businesses have committed to become net zero by 2030.[22]
- BEE Anglia has provided grant funding to support emissions reductions measures which save in excess of 3 kt CO2e per year.[23]
- The NUS Green Impact has worked with over 500 organisations.[24]

Thus, carbon advisory services have the potential to be wide-reaching and can appreciably contribute towards the uptake of low carbon practises.

ii. Opportunities for the provision of carbon advisory tools and services

- Recent international events have elevated the urgency to reach net zero in the national awareness, with a YouGov survey conducted in November 2021 indicating that 66% of UK adults believe that the UK should try as hard as possible to reduce its carbon emissions as much as possible, even if other industrialised nations do not.[25]

[21] https://carbonliteracy.com/about-us/
[22] https://www.bcorpclimatecollective.org
[23] Interview with Ned Harrison, BEE Anglia Project Manager.
[24] https://greenimpact.nus.org.uk
[25] https://docs.cdn.yougov.com/bcqrt8by0y/YouGov%20-

- COP26 has emphasised the role that businesses have to play in the transition to a low carbon future, and hundreds of UK SMEs have pledged to take part in the UN's Race to Zero campaign.[26]
- Consumers are increasingly placing value on a business' commitments to reducing their carbon footprint, with 66% of consumers stating they would feel more positive about companies that can demonstrate they are making efforts to reduce the carbon footprint of their products.[27]
- It is becoming increasingly clear that younger prospective employees are taking into account a business' carbon commitments when accepting job offers.[28]

Despite these striking motivations for SMEs to strive towards net zero, there are considerable barriers to SMEs taking action:

- Only 3% of SMEs have measured their carbon footprint in the past five years and subsequently set an emissions reduction target.[29]
- 40% of SMEs do not have a plan in place for becoming more sustainable, and 30% have no intention of forming one.[30]
- 35% of SMEs state cost as a barrier for reducing carbon emission.[29]
- 12% of SMEs state lack of information as a barrier to taking action.[29]

Carbon advisory services are well-placed to tackle all of these barriers. Furthermore, with growing pressure from employees, customers, other businesses (considering their scope 3 emissions), and potentially regulatory pressure for SMEs to reduce their carbon footprint, there is likely to be increasing demand for such services.

iii. Gaps in the provision of carbon advisory tools and services:

- The current carbon advisory sector is dense, complicated, and fragmented (see Appendix A) – there are myriad organisations offering a plethora of tools/services, but no 'one stop shop' where SMEs can receive the full spectrum of guidance: from initial carbon accounting through to follow-up on their certified decarbonisation strategy.

[26] https://smeclimatehub.org/uk/

[27] https://www.carbontrust.com/news-and-events/news/research-reveals-consumer-demand-for-climate-change-labelling

[28] https://static1.squarespace.com/static/56b4a7472b8dde3df5b7013f/t/5819e8b303596e3016ca0d9c/1478092981243/2016+Cone+Communications+Millennial+Employee+Engagement+Study_Press+Release+and+Fact+Sheet.pdf

[29] https://www.british-business-bank.co.uk/research/smaller-businesses-and-the-transition-to-net-zero/

[30] https://www.forbes.com/sites/davidrvetter/2021/02/15/30-of-uk-small-firms-have-no-plans-to-become-sustainable-survey-finds/?sh=3c80fc984ae0

- Navigating this minefield of information is particularly challenging and time-consuming for SMEs who are unlikely to have the staff time or resource to invest in assimilating the barrage of information, nor the in-house expertise to independently construct their own carbon reduction strategies. Lack of knowledge and understanding is cited as a key barrier to small business owners in making the changes to build more sustainable businesses.[31]
- There are a range of logos/accreditation marks which businesses can display to demonstrate their commitment to sustainable action (NUS Green Impact, Carbon Charter, The Science Based Targets Initiative, SME Climate Hub). Unified, regional certification has the potential to be better recognised and respected by employees, consumers and the wider public, thus providing greater benefit to businesses.

From this assessment, it is clear there is an opportunity to offer a comprehensive, unifying service which, through a team of trained advisors and a dedicated website, can support Cambridgeshire businesses (with a specific focus on SMEs) towards low carbon operations. Such a service is already provided by other councils around the UK, including in Suffolk and Norfolk via the BEE Anglia advisory service and Carbon Charter accreditation scheme. These services work hand-in-hand to provide expert advice, conduct energy audits and provide locally-recognised accreditation for cutting emissions, and assist local businesses with accessing funding for the implementation of carbon reduction measures. A detailed case study covering i) the services available to businesses in Suffolk and Norfolk via BEE Anglia and the Carbon Charter, ii) how these programmes are structured and funded, and iii) some of the environmental outcomes and ways in which local businesses have benefited, is provided in Appendix B.

2.3. Recommendations

From the above assessment of the spectrum of existing carbon advisory tools and services available to businesses and a detailed case study of the services provided by Suffolk County Council (Appendix B), it was identified that Cambridgeshire SMEs lack support that is:

- Integrated - offers support throughout the decarbonisation process, from initial assessment to implementation and review.
- Personalised - offers support that is tailored to the requirements of the individual business.
- Local - operated and delivered at a Cambridgeshire level, enabling understanding of local business needs and building connections and community support within the county.

[31] https://realbusiness.co.uk/cop26-mean-uk-smes

As a result, there is an opportunity for Cambridgeshire County Council and its public sector partners to offer a unifying service which, through a team of trained advisors and a dedicated website, can meet these requirements. Broadly, it is proposed that the Carbon Advisory Service (CAS), centred on SMEs, would provide:

- Free tailored advice, and signposting relevant external resources and services.
- Assistance with carbon accounting.
- Conducting energy audits and business-specific recommendations.
- Assistance with the creation of action plans, including recommending the purchase of carbon credits from the Cambridgeshire Decarbonisation Fund where appropriate.
- Assistance with procurement and accessing financial support for carbon-reduction projects.
- A paid-for, tiered accreditation service to certify businesses' participation and progress.
- Training and networking opportunities and regular updates on funding, technology and environmental legislation.
- Support with publicity and follow-up on businesses progression towards set targets.

An overview of the proposed services offered by CAS is provided in Figure 2.

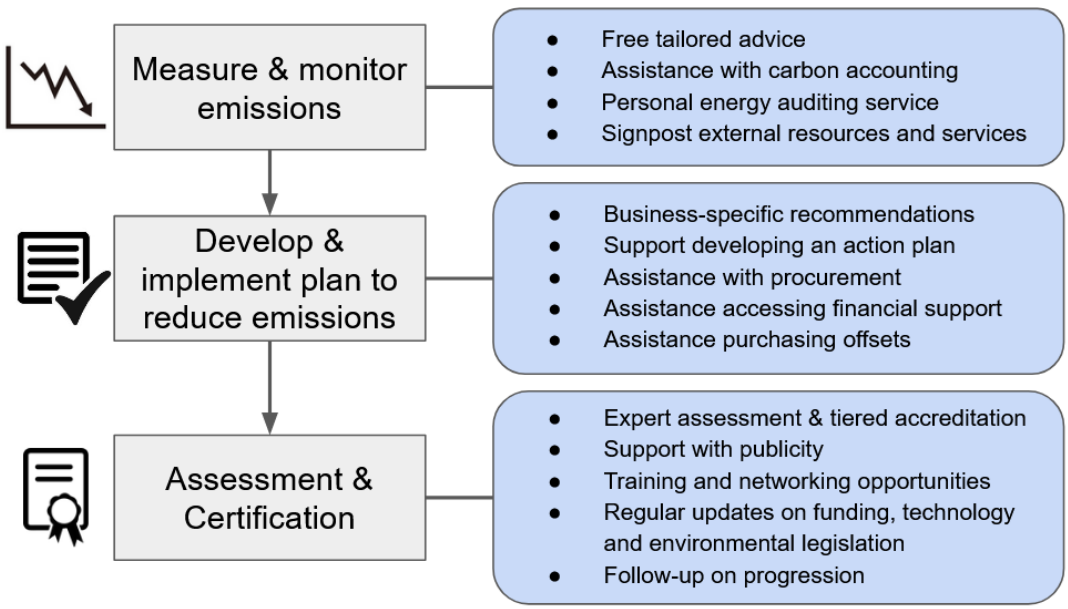

Figure 2: Outline of support offered to SMEs through the proposed Carbon Advisory Service.

We propose that these services are provided free of charge, excluding accreditation which businesses would pay for according to a sliding scale and which would provide an important funding stream to CAS (discussed below).

The CAS will also serve eligible large companies, which may wish to apply for accreditation or offset their emissions through the Cambridgeshire Decarbonisation Fund. The CAS will serve as a gateway to the Decarbonisation Fund by identifying 'hard to reduce' emissions and recommending the purchase of carbon credits where appropriate. The schematic diagram, shown in Figure 3, outlines how the CAS will serve SMEs and larger companies, and how it will link with the Decarbonisation Fund.

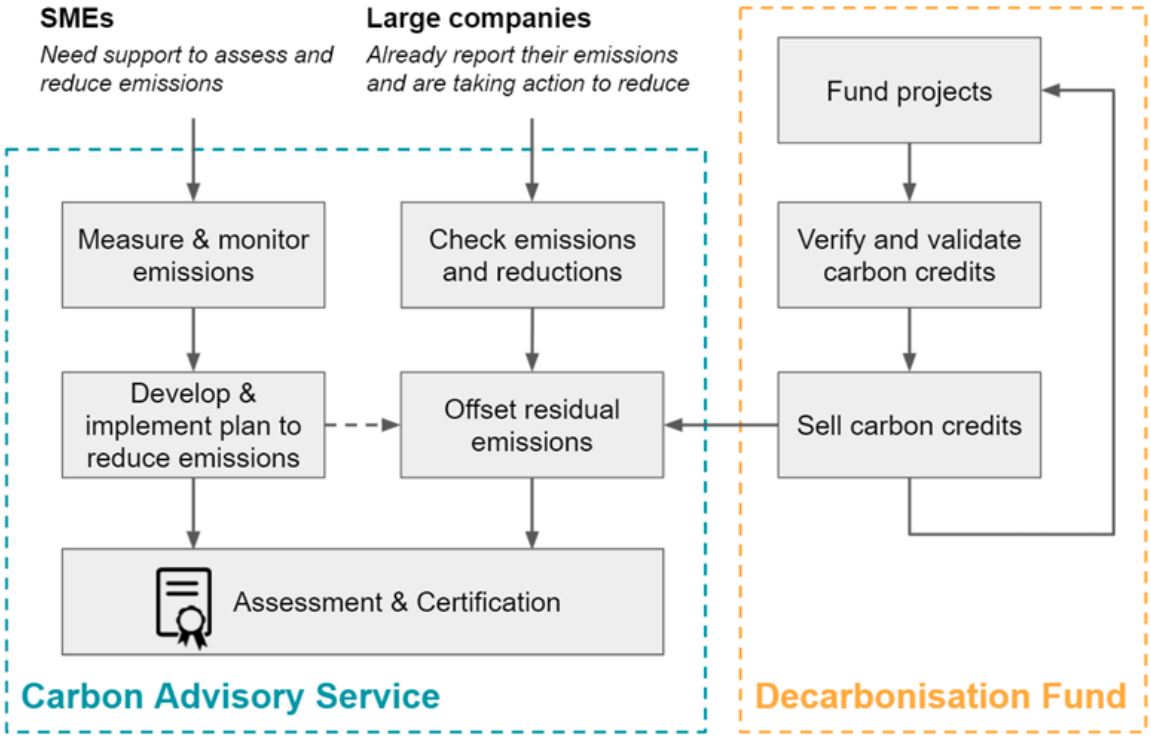

Figure 3: Proposed outline for Carbon Advisory Service and its role as a gateway to the Cambridgeshire Decarbonisation Fund

2.3.1 Links to the Cambridgeshire Decarbonisation Fund

The carbon auditing process offered by CAS will lead to an action plan for SMEs to reduce their emissions, focusing on easy wins that can achieve large reductions with minimal financial or opportunity cost. For emissions that are identified as being 'hard to reduce', such as those that form an unavoidable part of a business's operations, CAS would recommend that these emissions are offset through the purchase of carbon credits from the Decarbonisation Fund. Using CAS as a gateway to the Fund ensures that the Fund results in a genuine reduction in net emissions, rather than being used as a cover to avoid making easy reductions elsewhere. This operational model is summarised in Figure 3.

The purchase of carbon credits should be incentivised within the structure of CAS's accreditation scheme. This could be achieved through tiered certification, with the highest tier reserved for businesses which have achieved carbon neutrality. If the Carbon Charter award scheme is extended to Cambridgeshire, a fourth tier ('Platinum') could be added to recognise net-zero businesses. Moreover, there are clearly opportunities to discuss with Norfolk and Suffolk County Councils the merits of incorporating carbon offsetting into the Carbon Charter and allowing businesses across the region to offset their emission with the Decarbonisation Fund, greatly increasing market exposure.

2.3.2. Beyond SMEs

i. Links to large businesses

Large businesses are a substantial contributor to the county's emissions[32], and represent a significant opportunity to increase investment in the Decarbonisation Fund through the sale of carbon credits. It is therefore recommended that CAS includes a pathway for involving larger businesses as well as SMEs.

Large businesses are more likely to have an in-house sustainability advisor, have more capital to invest in decarbonisation measures, and are already held to standards of emissions auditing and reporting, including the Energy Savings Opportunity Scheme (ESOS)[33]. They therefore have little need of the carbon auditing and advice offered by CAS. However, evidence from the BEE Anglia case study suggests that these businesses do have an interest in engaging with local-scale sustainability initiatives, particularly to obtain locally-recognised accreditation. This can improve public perception of the business among potential employees and customers in the area.

As large businesses are likely to have already completed more stringent carbon auditing processes, it is recommended that CAS follows the example of BEE Anglia in adopting ISO14001 (or equivalent) compliance as a prerequisite for engaging with CAS and, by extension, the Decarbonisation Fund. This will avoid accreditation through the CAS becoming a 'soft option' for larger businesses, which may seek to avoid the rigours of achieving compliance with more robust and comprehensive standards.

[32] CUSPE 2019 Report

[33] https://www.gov.uk/guidance/energy-savings-opportunity-scheme-esos

Furthermore, for businesses which meet the eligibility requirements, only emissions which are 'hard to reduce' will be eligible for offsetting through the purchase of carbon credits.

ii. Social and micro enterprises

Recognition for the role of social and micro-enterprises in the region is growing, and strategic support from local government reflects this, with programmes including Care Together: Happy at Home[34] promoting opportunities for community micro-enterprises (CMEs) in the older adult care sector. These incubating or accelerating CMEs offer a unique opportunity to build a net zero strategy into operations right from the start. Existing CMEs should access CAS via the SME pathway (Fig. 3), while incubating CMEs or those looking to scale up operations could be supported with tailored advice to audit their plans prior to launch/expansion, followed up by later auditing and certification through the SME pathway.

2.3.3. Financing

Two financing questions need to be considered:

1) How will SMEs pay for the emissions reductions recommended to them by CAS?
2) How will CAS itself be funded?

i. Financing for SMEs

SMEs often lack capital to make large up-front investments in decarbonisation, so access to external financing is likely to be required. As many emissions saving measures will pay for themselves over the short-medium term, access to interest-free finance is often of equal benefit or even preferable to grant funding for helping businesses to cover upfront costs and this option is worth exploring. However, at present grants are generally more widely available.

CAS should offer assistance with accessing these grants, to remove as much of the burden from SMEs as possible in enacting recommendations. CAS should identify potential grants, provide information about these to SMEs, and possibly offer support in the grant application process. If taking a maximally in-house approach (see next section), CAS could also aim to obtain funding to provide its own grants

[34] https://www.cambridgeshire.gov.uk/residents/adults/connect-with-your-local-community/happy-at-home

or loans to participating SMEs. **A library of loans and grants offered in Suffolk and Norfolk has been collated by The Carbon Charter[35], and a similar local repository should be offered by CAS.**

ii. Financing CAS

The main costs for CAS are expected to be from developing a website and employing advisors (trained individuals who will carry out carbon auditing; provide tailored recommendations; support businesses in the creation of action plans; conduct certification; support with publicity and follow-up on progression), or contracting external organisations if an outsourcing approach is adopted (see next section). BEE Anglia operates with a skeleton staff of three advisors[36], it is envisaged that CAS will require a larger team, likely in the region of 5-10 full time staff, in order to provide the proposed support to Cambridgeshire businesses.

Payment for certification would provide a potential funding stream to cover some of these costs. However, the cost of accreditation must not become a barrier to participation for SMEs. Therefore, it is recommended that the accreditation fee should operate on a sliding scale according to business size, with larger businesses paying more to access the scheme. A similar pricing model is used by BEE Anglia.

Payment for certification is however unlikely to cover all the operational costs of CAS, therefore other funding streams should be sought. The running costs of BEE Anglia are largely covered by a European Union Regional Development Fund, which expires in mid-2022 and further funding from this fund is impossible due to Brexit. Nevertheless, Ned Harrison at BEE Anglia is hopeful that government grant funding will become available to sustain its activities, therefore this should be investigated, along with other local opportunities.

2.3.4. Options for in-house delivery, outsourcing and potential partnerships

We suggest two possible approaches to delivering proposed CAS.

1) In-house provision of all services
2) Outsourcing one or more stages of the process to contracted partner organisations

[35] https://carboncharter.org/resources-grants-and-funding/
[36] http://www.beeanglia.org/about-bee/team/

i. In-house delivery

All stages of the process could be delivered through the partnership of Cambridgeshire Local Authorities and the CPCA Business Board, with advisors employed directly. This would involve the creation of a new, Cambridgeshire and Peterborough-specific certification scheme. This has the advantage of offering complete oversight of the process, and potentially smoother integration with the Decarbonisation Fund. It also fully leverages the local appeal of the scheme and any trust local businesses may place in public bodies. However, it is also possible that, for some businesses, direct involvement will deter participation. The in-house approach would also place higher resource and operational demands on the above partnership and present higher upfront costs and financial risk.

ii. Outsourcing

Alternatively, one or more stages of the process, outlined in Figure 1, could be procured and contracted to organisations to offer an outsourced partnership-approved service. Examples include:

- **Groundwork** - charity which currently provides auditing and advice services for BEE Anglia and the Carbon Charter (see case study).
- **Carbon Charter** - accreditation scheme currently offered by Norfolk and Suffolk County Councils could be adopted and overseen by Cambridgeshire County Council, expanding the scheme across East Anglia. This would offer greater regional recognition and impact. It would also reduce setup costs.
- **University of Cambridge** - a similar scheme in Derbyshire (DE-Carbonise[37]) has successfully partnered with the University of Derby to provide expertise. Cambridge Universities offer a wealth of locally-available expertise in sustainability initiatives, including through the newly-established Cambridge Centre for Carbon Credits (4C)[38], the Cambridge Institute for Sustainability Leadership (CISL)[39], and the School of Environmental Sciences at the University of East Anglia. Within CISL, the Canopy program[40], launching in 2022, may offer opportunities to facilitate knowledge sharing among SMEs and access to further expertise and training.
- **Other charities, non-for-profit organisations and businesses** - a large number of organisations already operate in the carbon advisory sector (Figure 1), offering tools and services covering different stages of our recommendations (Appendix A). If it was felt that

[37] https://www.derby.ac.uk/business-services/funding/de-carbonise-project/
[38] https://4c.cst.cam.ac.uk/
[39] https://www.cisl.cam.ac.uk/
[40] https://www.cisl.cam.ac.uk/canopy

these organisations were best placed to offer a specific service, the relevant services could be encouraged to collaborate and work together to provide the advisory support.

2.3.5. Next steps

We recommend the following actions are taken to refine our proposals for the establishment of a Cambridgeshire Carbon Advisory Service:

- Consult with local businesses (both SMEs and large businesses) to assess local demand for CAS.
- Decide whether to adopt an in-house or outsourced approach, and identify partner organisations if necessary.
- Identify potential funding sources for CAS.
- Identify potential sources of grants or loans for SMEs.
- Design a bespoke accreditation scheme (liaising with Norfolk and Suffolk county councils on the merits of collaboration).
- Determine pricing structure for businesses applying for certification.
- Choose a methodology for identifying hard-to-reduce emissions which will be eligible for offsetting through the Decarbonisation Fund.

3. Establishment of a Cambridgeshire Decarbonisation Fund

3.1. Overview

The justification for the establishment of a Cambridgeshire Decarbonisation Fund is covered in detail in the CUSPE 2020 report[41]. This previous report highlights the scale of decarbonisation required within Cambridgeshire, which would not be achievable without support from all sectors. A Decarbonisation Fund is a potential solution to this: in which carbon credits are sold to local businesses to pay for decarbonisation projects. This is considered a mutually beneficial arrangement; by attracting organisations to offset their hard-to-reduce carbon as early as possible, their financial contribution into the scheme enables the Cambridgeshire public sector to place this investment into local projects.

Whilst the main focus of the Fund may be on the reduction of greenhouse gas emissions, decarbonisation projects also provide other co-benefits to the local communities. These can include a reduction of pollution-related health problems,[42] increased flood resilience[43] and lifting people out of fuel poverty. Large-scale investments in green infrastructure can also stimulate the local economy, making Cambridgeshire a leader in the execution of nature-based solutions for decarbonisation projects. This expertise could be exported to other local authorities, allowing the further growth of local companies.

Following on from the CUSPE 2020 report, two key areas of the Fund have been investigated: the validation and verification of carbon credits, and the financial management of the Fund. The validation of carbon credits is a key component, as this will be required by businesses wanting to buy credits and contribute to this fund to offset their own emissions. This section discusses how carbon reductions are calculated and monitored, and how these reductions can be used to make sellable carbon credits. The Woodland Carbon Code (WCC) is used as a case study of a validation body. The Swaffham Prior

[41] https://data.cambridgeshireinsight.org.uk/dataset/cambridgeshire-policy-challenges-cambridge-university-science-and-policy-exchange-cuspe-20

[42] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution#call-to-action-reducing-air-pollution

[43] https://www.forestresearch.gov.uk/tools-and-resources/fthr/urban-regeneration-and-greenspace-partnership/greenspace-in-practice/benefits-of-greenspace/flood-risk-alleviation/

Community Heat Network project[44] has been taken as a case study to investigate the best way to verify and validate carbon credits for this type of project, as retrofits of domestic housing are a key sector for carbon reductions. Based upon this research, it is concluded that:

- Projects within the Cambridgeshire Decarbonisation Fund should have their carbon credits verified and validated through approved bodies.
- If this is not possible, publicly available methodologies for carbon calculations should be used to determine carbon savings.
- In both cases, a third-party organisation will be required to confirm the number of carbon credits produced by a project.

The main aim of the financial research was to estimate how large a Fund would need to be to create a significant difference to the Cambridgeshire area. This culminated in a financial model, which simulates the financial and environmental impacts of a Fund over 40 years. With the largest Fund size modelled, this model predicts 19% of Cambridgeshire's annual emissions could be addressed by this Fund within 25 years, and would give a 125% return on investments above inflation over the 40 years.

The key assumption of the model is the availability of initial finance to start the Fund. Potential sources of initial capital were identified, these will need to be investigated further to assess a feasible size of Fund available to Cambridgeshire. From this research, it is concluded that:

- The size of the Fund should be maximised, to increase community benefits, environment impact and financial returns
- Initial funding should be sought from multiple sources, to increase the initial size of the Fund and increase resilience within the Fund.

3.2. Validation and verification

3.2.1. Outline

The proposal for a Cambridgeshire Decarbonisation Fund assumes that businesses will contribute to this fund to offset their hard-to-reduce emissions in the short to medium term by purchasing carbon credits. These credits will be generated by decarbonisation projects in the portfolio and will fund the maintenance of current projects and new projects. For businesses to want to buy the carbon credits,

[44] https://heatingswaffhamprior.co.uk/

they need to trust that the corresponding amount of carbon has actually been saved. Otherwise, businesses could decide to buy potentially cheaper carbon credits elsewhere to offset their emissions or not offset early enough to help meet net zero targets.

Validating and verifying decarbonisation projects enables businesses to trust that the projects have been carried out to the appropriate standards and that the stated carbon savings are correct. The Government's Environmental Reporting Guidelines set out DEFRA's good quality criteria for external decarbonisation projects that businesses can use to offset their emissions:[45]

- The carbon savings of a project must be additional to those that would have occurred otherwise.
- The project must not cause leakage by increasing emissions elsewhere.
- The carbon savings should be permanent, with a minimal risk of losing carbon.
- Validation and verification must be carried out by an accredited and recognised independent third party.
- Carbon credits can only be sold after the corresponding carbon savings have occurred.
- A registry must be used to prevent double counting of carbon credits and to make the information on the projects publicly available.

Based on these guidelines and the research performed, this report proposes the following recommendations for the validation and verification of projects within the Cambridgeshire Decarbonisation Fund:

- Organise and perform the necessary assessments, measurements and predictions required for validation and verification of the decarbonisation projects in the decarbonisation fund portfolio.
- Determine whether it would be cost-effective and practical to register decarbonisation projects with certification organisations.
- As an alternative, develop a standard for the validation and verification of the decarbonisation fund projects and employ suitable third-party bodies.
- Adapt relevant publicly available methodologies to develop ones that are specific to decarbonisation projects in the Fund for which no suitable methodologies currently exist.
- Use the Woodland Carbon Code for the validation and verification of afforestation and reforestation projects.

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

3.2.2. Important Considerations Prior to the Start of Projects

The process of validation and verification involves checking different aspects of decarbonisation projects. This requires project developers to have made certain assessments, measurements, and calculations in advance of the validation/verification dates and these often cannot be done retroactively. When looking to develop a new carbon reduction or removal project for which carbon credits can be issued, it is important to make sure that credits that will be produced will be of high "quality". However, to develop a high-quality carbon credit, many criteria need to be considered, with the prioritisation of differing criteria depending both on the aims of the project developer and the predicted buyer of the credits. In general, six 'quality objectives' have been defined in recent literature and will be explored within this section[46]. These include:

1. Robust determination of the greenhouse gas emissions impact of the mitigation activity
2. Avoiding double counting of emission reductions of removals
3. Addressing the risk of non-permanent removal
4. Facilitating the transition towards net zero emissions
5. Transparency and oversight of the crediting process and project methodologies
6. Social and environmental co-benefits and an absence of a negative impacts

1. Robust determination of greenhouse gas emissions impact of the mitigation activity:

(a) Additionality:

A project developer needs to confirm that their decarbonisation projects display additionality.[47] This means that the projects could not have proceeded without the money gained from selling carbon credits[48]. It is not enough simply for a project to save carbon if the project would have been funded without selling carbon credits. In other words, a project lacking additionality is not able to sell any carbon credits, even if it has saved the corresponding amount of carbon. To understand whether a project is additional, the project developer must consider all financial, economic, legal, political or technological drivers of the project. For example, a political driver would be future introduction of

46 https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/54su0gjupo_What_Makes_a_High_quality_Carbon_Credit.pdf?_ga=2.133621070.1362238229.1637849475-1929427670.1586291417

47 https://openknowledge.worldbank.org/bitstream/handle/10986/24295/K8835.pdf?sequence=2&isAllowed=y

48 https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf?utm_source=Securing%20Climate%20Benefit:%20A%20Guide%20to%20Using%20Carbon%20Offsets&utm_medium=tools-library&utm_campaign=SMECH

legislation in proposition of a specific emission-mitigating technology: if an offset project is developed around the use of this specific technology, the project would cease to be politically additional upon the enactment of such legislation, as the project activity *would have occurred anyway.* Similarly, if a project does not need to source funding from selling carbon credits in order to be financially viable then it would not be considered financially additional. Finally, if the project involves using an emission abatement technology that is also used within a similar, but not exactly the same, context in the surrounding area or in the same country, then it is probable that the project activity would likely have been adopted anyway in the near future: in this context technological additionality could not be ensured. A useful way to determine whether a specific project activity is likely to remain additional over the next 10-20 years is to look at the country's nationally determined contributions (NDCs): for example, emissions from flights and aviation are not covered within the UK's NDCs and, therefore, project activities that focussed on mitigating aviation emissions are likely to remain additional for the foreseeable future, as the government will not be putting in place legislation or financial incentives to promote the reductions of these emissions. However, the UKs NDCs do cover restoration and preservation of peatlands. Therefore, project activities related to peatland stewardship would likely not remain additional as the government may introduce incentives for the private sector to maintain and invest in peatland preservation.

(b) Robust quantification of emission reductions and removals:

One of the most important criteria for developing quality carbon offset credits is the use of robust quantifications outlining the emission reductions and removals of the project activity, over time. This is paramount, as over-estimation of emissions reductions or removals will lead to double emissions overall given the fact the credit buyer is purchasing a credit to 'offset' their own emissions. There are five key components of a project activity's emission calculations that need to be guaranteed:

- No ex-ante crediting is permitted: credits must only be given for emissions that have already been reduced or removed. Credits cannot be given for emission reductions or removals that have not happened yet.
- All emission sinks and sources are identified within a project activity and a way to robustly quantify them is identified.

- A conservative 'baseline' is set. The baseline scenario of a project is the level of emissions/sequestration that would occur in the absence of the project.[49,50] The carbon savings of a project are measured relative to the baseline scenario. As such, it is important that baseline emissions are not overestimated, as this will lead to an overestimation of the amount of carbon saved. Similarly, any baseline carbon sequestration needs to be accounted for; this is most relevant for forestry projects where a significant amount of existing vegetation could sequester carbon.[51]
- The emission reductions or sequestration is robustly monitored.
- Leakage is robustly incorporated into emission quantifications. Leakage describes any emissions that may be caused by the project but occur outside of the project boundary. For example, if a specific area of forest is protected from logging within a project activity. Logging activity may simply move to another area as a result of the project being implemented. The resulting 'leaked' emissions would need to be quantified for the logging in the alternate area and incorporated into emission reduction claims for the project.

2. Avoiding double counting of emission reductions or removals

(a) Avoiding double issuance:

Double issuance occurs when the sample carbon credit is issued to multiple buyers. To avoid double issuance, every carbon credit that is issued must be traceable and transparently 'retired', meaning that the credit is no longer available to be purchased. This is ensured by many mainstream credit issuers by applying a traceable reference code to every carbon credit that is produced under their scheme, with an open database of all past and present credits.

(b) Avoiding double claiming:

Double claiming occurs when multiple entities count the same carbon credit towards different climate targets or goals. This can occur within the same country or at the international level. At the international level, for example, an offset project's activity could involve the establishment of a renewable energy-based mini-grid system for a community. The emission reductions achieved through this project will be sold as a carbon credit to an overseas buyer, therefore contributing to an

[49]https://openknowledge.worldbank.org/bitstream/handle/10986/24295/K8835.pdf?sequence=2&isAllowed=y

[50]https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf?utm_source=Securing%20Climate%20Benefit:%20A%20Guide%20to%20Using%20Carbon%20Offsets&utm_medium=tools-library&utm_campaign=SMECH

[51]https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_CarbonCalculation_Guidance_V2.4_March2021.pdf

offsetting of the overseas country's emissions calculations. However, the presence of the mini-grid within the domestic country means that the electricity usage of the main grid reduces, because the community is using their new renewable mini-grid instead. However, the power and energy planning ministry will observe the reduced electricity supply and incorporate it into its own emission reduction calculations. This means that two countries are claiming the same emissions reductions. To avoid this, it has been suggested that "(i) carbon crediting programs have procedures in place to identify and earmark in which calendar year and in which country the emission reductions occurred; (ii) procedures for host country authorizations are in place; and (iii) procedures for the application, reporting and reconciliation of corresponding adjustments are in place". [52]

3. Addressing the risk of non-permanent removal

(a) Degree of permanence of emission removal or reduction:

Many project activities, mostly those centred on emission sequestration, offer impermanent emission abatement. The permanence of emission removal depends on longevity of the emission storage process. For example, emission sequestration from tree planting only lasts as long as the integrity of the tree and surrounding soil is maintained. If a forest that has been planted within a carbon offset project is burnt down in a forest fire, or later chopped down owing to a change in government agenda, then all of the emission sequestration will be reversed. This will result in double emissions in the long run. Therefore, diligence should be taken when deciding on project types and activities in terms of whether a project that only ensures short-term emission sequestration should even be pursued in the first place. Contrastingly, some project activities will ensure long term or irreversible emission reductions, such as landfill methane destruction.

(b) Approaches to addressing non-permanence risks:

A level of impermanence of emission sequestration may be acceptable if the project addresses the associated risks sufficiently. For example, under many verification standards, projects are required to set aside a number of credits that cannot be sold as collateral in the event of a reversal of some of the emissions reductions. Similarly, there should be a robust way in which reversals are monitored and accounted for over time by, for example, reducing the number of credits sold in future.

[52]https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/54su0gjupo_What_Makes_a_High_quality_Carbon_Credit.pdf?_ga=2.133621070.1362238229.1637849475-1929427670.1586291417

4. Facilitating transition towards net zero emissions:

(a) Enhancing adoption of low, zero or negative emissions technologies:

Carbon offset project development and financing should not be a permanent fixture within the net zero transition and they act as a deterrent for long term public policy implementation and financial investment. Instead, carbon financing should act as an enabler, to set in motion sustainable and endogenous future financing of net zero technologies. Projects should promote and facilitate the adoption of innovative technologies that go further than *common practises* within the project host country. Common practises are defined both with a temporal aspect (which methods are common at the time of the project implantation) and a spatial aspect (which methods are common in the host country specifically, not in another more developed country for example). With these in mind, project developers determine whether similar technology is already being used in the host country and, therefore, whether carbon financing is truly promoting innovation.

5. Transparency and oversight of the crediting process and project methodologies

(a) Third-party auditing:

As is covered in more detail later in this section, most certification organisations require that all calculations, assumptions and methodologies be first 'validated' to ensure that they are robust, and also that long-term monitoring of the process be carried out and 'verified' in order to ensure that everything outlined during the validation process has turned out to be demonstrably true. It is important that an unbiased, third-party auditor carry out auditing on all relevant documents at both of these stages to ensure that aspects of the project stand up to scrutiny.

(b) Transparency and stakeholder consultation:

Project developers should ensure that sufficiently detailed information on all aspects of their projects are publicly available at all times. Procedures should also be in place to ensure transparent decision-making processes, often with minutes from meetings being publicly available. Project developers should also carry out thorough stakeholder consultation prior and during project implementation and the findings from these consultations also made publicly available. Transparency and stakeholder consultation contribute to good governance which in turn contribute to buyer trust.

6. Social and environmental co-benefits and an absence of a negative impacts

(a) Assessment of environmental and social impacts:

The impact of a project will likely go beyond just the emissions that are reduced or removed. This means that all potential benefits and risks associated with a project should be comprehensively reported on within all project development documents (which should be publicly available). This will involve stakeholder consultations as stated above. This is particularly important within projects where land use changes. Land use changes can have far reaching effects: displacement of biodiversity should be assessed and the effect on both the livelihoods and living conditions of the surrounding communities should be taken into account. Any negative impacts will need to either be compensated for, or be recognised as reasons for the project to not go ahead if the negative impacts outweigh the benefits. This is important not only from an ethical standpoint but also to reduce future liability of the project developers. It is also important for ensuring economic 'value-for-money' of projects. Similarly, some projects may have positive co-benefits, such as reducing emissions, green job creation, and habitat creation. These co-benefits can potentially be quantified and monetised.

(b) Projects that support resilience and adaptation:

Given that the effects of global heating are already being felt within the UK in the form of floods and extreme weather, there is a need for climate resilience and adaptation. For example, projects relating to land management may also have co-benefits of managing the effect of flooding. Some buyers may prioritise projects that either directly or indirectly support climate resilience.

3.2.3. Performing Validation and Verification

After the project has begun, accredited and independent third-parties provide validation and verification at certain intervals. This involves checking relevant documents, as well as potential site visits.[53] Alongside the project design, the predicted carbon savings are assessed during validation, which normally must occur within 2-3 years of the start of the project.[54,55] If necessary, this validation body will outline the corrective action responses that are needed to address any issues.[56] Following successful validation, verification bodies perform validation 5 years after the start of the project, then typically every 5 years after that (or 10 years in the case of forestry projects[57]). These third-parties usually need to be contacted approximately 6 months in advance. Verification checks the progress of

[53] https://www.goldstandard.org/take-action/certify-project

[54] http://globalgoals.goldstandard.org/101-par-principles-requirements

[55] https://www.woodlandcarboncode.org.uk/landowners-apply/3-validation-initial-project-check

[56] https://www.planvivo.org/validation-verification

[57] https://www.woodlandcarboncode.org.uk/landowners-apply/4-verification-ongoing-check-of-project-sequestration

the project and confirms the amount of carbon saved. After any corrective action responses are completed, the project developer will receive verified carbon credits that are recorded and made publicly visible on a registry to provide transparency.[58] Double counting can occur if multiple entities claim the same carbon savings generated by a project; to avoid this, each carbon credit is assigned a unique serial number on the registry and is retired when sold.

Project developers can have their projects validated and verified using a certification organisation. These are well recognised organisations that provide a framework for carrying out decarbonisation projects.[59] This includes providing methodologies for different types of projects, reviewing specified documents, accrediting validation/verification bodies and issuing carbon credits via a registry that is either owned by the organisation[60] or is managed by an external company, such as IHS Markit. Projects certified using these organisations need to renew their crediting period (usually 7-10 years) to confirm that their project is still eligible to receive carbon credits.[61] Three certification organisations are Gold Standard,[62] Plan Vivo,[63] and Verified Carbon Standard.[64] As an example, the framework for Gold Standard is as follows:[65]

1. Project plan and stakeholder consultation
2. Review of preliminary design
3. Validation by accredited validation and verification body
4. Review of project design
5. Cycle of project monitoring, third party verification and performance review

The benefit of these certification organisations is that they are trusted as good standards for decarbonisation.[66] However, there are some disadvantages to projects from the Cambridgeshire Decarbonisation Fund being certified with these organisations. One of the main issues is cost, since these organisations charge fees for reviewing documentation and issuing credits, in addition to the fees from the validation and verification bodies themselves (see Appendix C). In the case of Plan Vivo,[67] the fees are typically larger and less dependent on the number of credits issued than those of Gold

[58] https://www.planvivo.org/markit-registry
[59] https://www.goldstandard.org/our-story/gold-standard-global-goals
[60] https://verra.org/project/vcs-program/registry-system/
[61] https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf?utm_source=Securing%20Climate%20Benefit:%20A%20Guide%20to%20Using%20Carbon%20Offsets&utm_medium=tools-library&utm_campaign=SMECH
[62] https://www.goldstandard.org/
[63] https://www.planvivo.org/
[64] https://verra.org/project/vcs-program/
[65] https://www.goldstandard.org/take-action/certify-project
[66] https://www.goldstandard.org/our-story/gold-standard-global-goals
[67] https://www.planvivo.org/costs-fees

Standard,[68] and Verified Carbon Standard,[69] making them less effective for small projects. For example, for a project that sequestered 15,000 tonnes of CO_2 annually, the costs up to validation would be $4500-$7550 with Plan Vivo, compared to $1750 with Gold Standard and $2000 with Verified Carbon Standard. Furthermore, the costs of issuance would be $6000 for Plan Vivo, compared to $1500 with Gold Standard and $2100 with Verified Carbon Standard. (Note, these costs do not include the fees for the validation and verification bodies themselves.) For Gold Standard and Verified Carbon Standard, the greater influence of the number of credits issued on the fees means that their cost-effectiveness for use with the Decarbonisation Fund will depend on the size of the decarbonisation projects to be certified, as well the number to be certified together. Another issue with these certification organisations is that Plan Vivo and Verified Carbon Standard do not have any accredited validation and verification bodies in the UK;[70,71] while there is one such body accredited by Gold Standard in the UK, it cannot validate or verify certain types of decarbonisation projects.[72] As such, suitable third-parties would need to travel from outside the UK to perform site visits. Therefore, the sizes of the decarbonisation projects in the Fund may influence the benefit of being certified with one of these organisations versus the costs involved.

To illustrate the details involved in following a validation and verification framework from a certification organisation, the Woodland Carbon Code (WCC)[73] is described in Appendix D. The WCC is relatively cost-effective and provides detailed guidance on calculating carbon sequestration and performing validation and verification of woodland projects. It is therefore recommended that the WCC is used to validate and verify forestry projects within the Decarbonisation Fund.

One alternative strategy would be for the Decarbonisation Fund to develop its own standard for validation and verification and/or possibly linking with the Cambridge Centre for Carbon Credits to undertake this process. This is possible because methodologies for validation and verification, such as those from Verified Carbon Standard,[74] are publicly available, so relevant methodologies could be used for projects in the Decarbonisation Fund. Suitable independent third-party bodies could then be employed to perform the validations and verifications. Therefore, the same framework for validation and verification would still be followed as if the projects were certified with one of the aforementioned

[68] https://globalgoals.goldstandard.org/fees/
[69] https://verra.org/wp-content/uploads/2020/04/Program-Fee-Schedule_v4.1.pdf
[70] https://www.planvivo.org/validation-verification
[71] https://verra.org/project/vcs-program/validation-verification/
[72] https://globalgoals.goldstandard.org/approved-auditors
[73] https://www.woodlandcarboncode.org.uk/
[74] https://verra.org/methodologies/

organisations. For businesses to trust this approach, the methodologies used and the reviews involved will need to be made publicly available to provide the necessary transparency.

3.3. Financial structure of the Fund

In this section, three separate questions are addressed. In the first part, a financial model of the Fund is presented. This model estimates revenues and costs of the Fund over a 40-year timeline, as well as estimating the amount of carbon saved through projects. The model shows that significant financial and environmental gains can be made, and this scales well with the amount of initial investment acquired. It is therefore recommended that the Fund should acquire as much initial funding as possible, to maximise the financial return and environmental impact over the next 40 years.

The second part covers the different sources of funding available to start the Fund. Four main funding sources are highlighted: council borrowing, public loans/grants, issuing green bonds, and private investment. A portfolio of these funding sources is recommended, to increase the resilience and size of the Fund.

The final part investigates other revenue sources beyond the revenue from selling carbon credits. For example, through local plan policy a carbon levy could be applied to new developments. Where emissions cannot be mitigated cost effectively on-site, a contribution to the Fund is calculated. This incentivised low-carbon building practises and provides a revenue stream for the Fund if emissions aren't fully removed. In addition, for Local Authorities that have already invested in some low-carbon projects, the carbon savings from these could be sold as credits to provide an initial revenue stream.

Based on the research presented here the following recommendations are made:

- A diverse portfolio of initial funding should be sought, combining both public and private sources to ensure the Fund is resilient.
- The amount of initial funding should be maximised, as this will create the biggest environmental impact and largest financial returns in the long-term.
- Projects in the Fund should be those which require the selling of carbon credits to be financially viable. Projects which are financially viable without selling carbon credits should be performed in addition to the running of this Fund.
- Setting up a separate company might be useful, as this can detach any initial revenue costs associated with the Fund from the Council's finances. This may allow a larger Fund to be viable than what would be possible from within the Council.

3.3.1. Financial models

To determine the financial viability and climate impact of this Fund, a financial model was constructed to estimate the financial and environmental return over a 40-year period. A range of parameters were estimated (for full information see Appendix E), and created a worst-case, best-case, and expected scenario for three different Fund sizes. This model demonstrates the feasibility and scalability of the Fund and shows that the size of the Fund should be maximised. A larger fund will provide ever more benefits to the environment, the local communities, and the council's finances.

The initial funding is assumed to mainly come from project-specific funding (30-50%) and project-independent funding (30-60%), with a smaller amount provided through green bonds (10-15%). Projects are assumed to produce carbon credits for sale for 20 years, after which they may still remove CO_2 but would not produce credits to sell. This distinction is important, as this provides actual carbon reductions from projects which last longer than 20 years, rather than solely providing carbon credits to offset other emissions. Projects were modelled to start in 6 waves over a 20-year period,[75] with each wave incorporating a blend of "avoid", "reduce" and "sequester" projects to create a portfolio with an averaged carbon credit price. Fund sizes have been described by the size of local authority borrowing required at the start of the Fund (either through PWLB, other local authority or private sources), and key figures for the expected scenario of the Fund sizes are shown below (Table 1).[76]

Expected scenario	Max carbon saved/year ($MtCO_2$)	Max carbon saved/year, % of current emissions	% Financial return on investments	Net financial gain after 40 years (£m)
£50m fund	0.538	4.6%	125%	100
£100m fund	0.930	8.0%	125%	174
£250m fund	2.183	18.8%	123%	382

Table 1: Predicted figures for the three modelled Fund sizes, taken from the "expected" scenario. Current emissions are taken to be 11.6 $MtCO_2$ (incl. peatland emissions). % Financial return is calculated as 100% + (end balance/total loans taken) after all loans are repaid. Net financial gain values are after all outstanding loans are paid, and do not account for inflation.

As seen in the first two columns of Table 1, annual emissions can be reduced significantly with this Fund, with the carbon saved per year increasing with the size of the Fund. The maximum carbon saved value is reached 25 years after starting the Fund (2048 if the Cambridgeshire Decarbonisation Fund

[75] Whilst projects were modelled to begin in 6 waves, this was predominately to simplify the model. A more realistic scenario would be for a continuous stream of projects starting when they are ready. However, this should not detract from this model giving a rough insight into the scale of the benefits from a Fund.

[76] See Appendix E for values of the worst and best case scenarios

begins in 2023). With the largest Fund modelled, about 19% of Cambridgeshire's annual emissions could be removed per year, with that reduction delivered by 2050.[77]

The Fund would also be financially viable, with positive returns projected over the course of 40 years (Table 1, columns 3 and 4). The return on investments is 105-125% for each fund size, meaning larger funds (which take out more loans) give larger financial yields. The Fund's net balance (when the Fund's balance is greater than outstanding loans) becomes positive within 30 years (Figure 4). In the first 20 years, the revenue produced by projects is reinvested into future projects (as well as covering annual running costs), which enables the Fund to support projects worth 1.8-2.3 times more than the total loans received. The Fund's balance decreases in the final five years, as the model assumes a constant level of indirect staffing costs, however in practice this is unlikely to be necessary once no new projects are being developed.

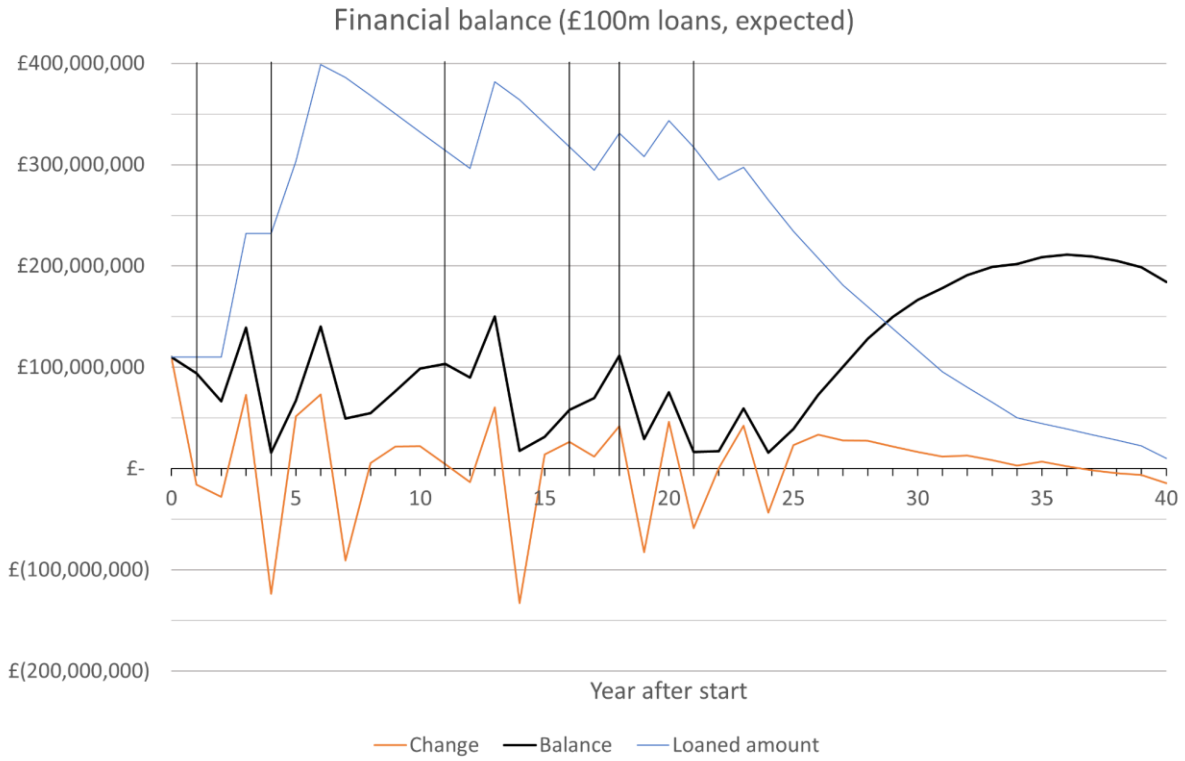

Figure 4: Graph of finances for the fund, showing end of year balance (black), annual change (orange) and outstanding debts (blue). This chart was taken for the £100 million fund under the expected scenario. Vertical lines indicate years in which project waves are started.

[77] Annual emissions taken to be 11.6 $MtCO_2$ (including peat emissions), as presented in the CUSPE 2019 report (https://data.cambridgeshireinsight.org.uk/dataset/cambridgeshire-policy-challenges-cambridge-university-science-and-policy-exchange-cuspe-8)

While successive waves of projects allow the recycling of funds to multiply the impact of initial loans, each portfolio of projects in a wave will be independently financially viable. This is illustrated in Figure 5, showing a 104% return on investment of a single project portfolio over its 20-year life.

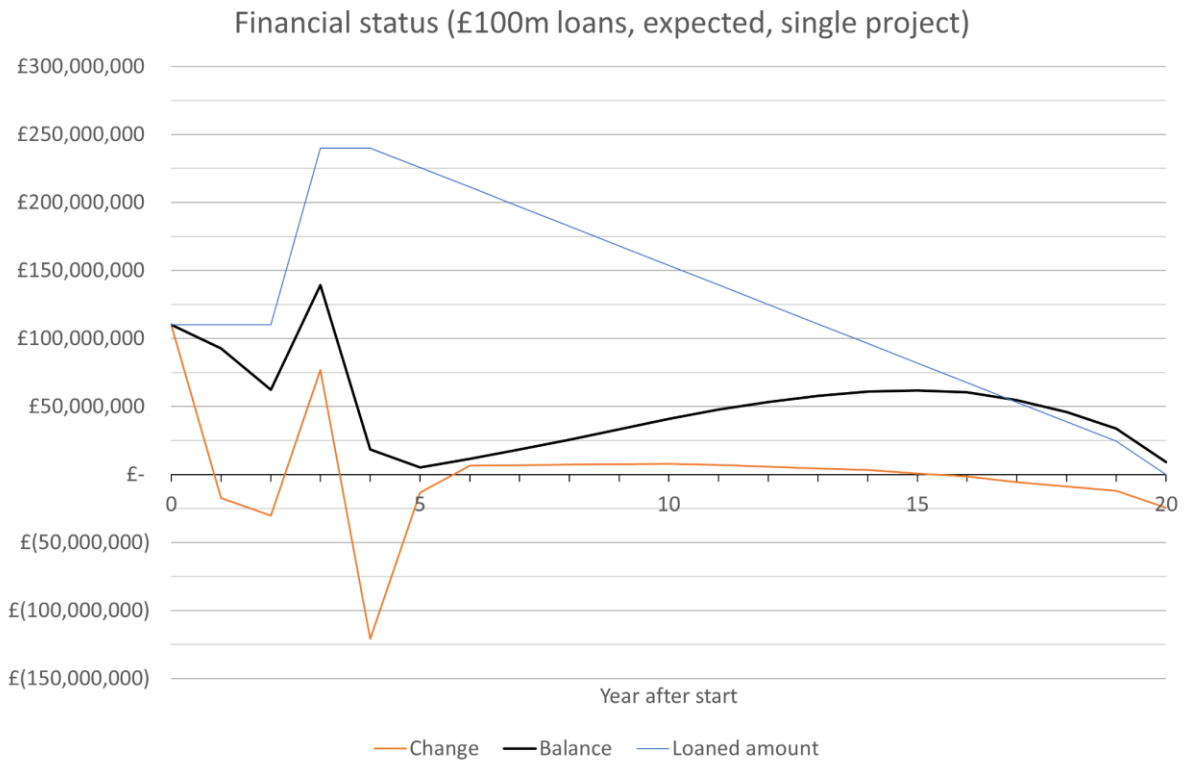

Figure 5: Financial status of a single wave of projects. £240m in loans taken out to fund £325m worth of decarbonisation, giving a return of £9.1m after 20 years.

The number of carbon credits produced and sold per year is shown in Figure 6. The number of carbon credits produced increases as more projects become functional, peaking between years 15 and 25, then decreasing as projects are retired. These values are important, as it has been assumed that all the carbon credits created will get sold. If there is insufficient demand locally, these could potentially be sold in other markets at a national level. The potential local demand for carbon credits should be investigated further, to ensure that a large Fund will be viable. Global modelling of carbon credit markets and companies' net-zero commitments suggests demand could be up to 15 times higher than 2020 levels in 2030, and up to 100 times higher in 2050.[78] [79]

[78]https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge

[79]https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf

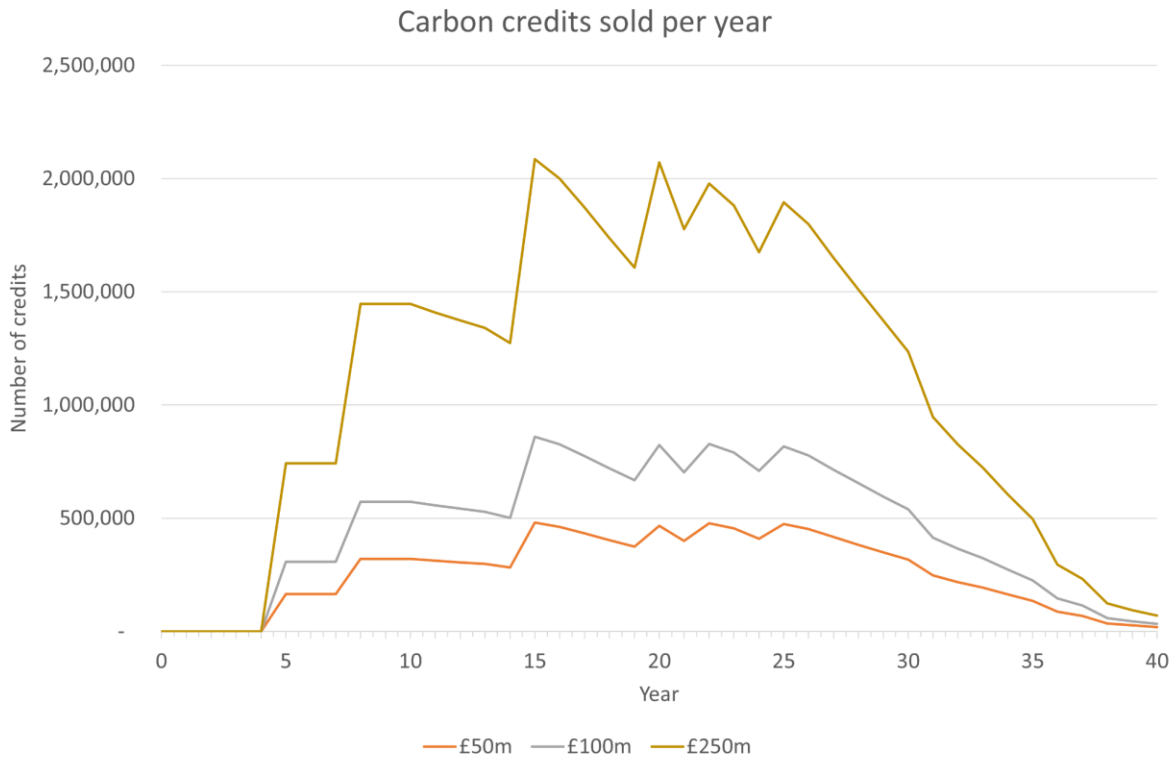

Figure 6: Number of carbon credits produced and sold each year, given for the three sizes of fund modelled. These figures are taken from the "expected scenario" for each.

The model presented here provides a simplified outline of what the Fund may look like, however, it clearly demonstrates two takeaways for the Fund. First, the Fund should be financially viable regardless of size and length of duration. Second, the financial and environmental returns from the Fund scale roughly linearly with size. Combined, these two features imply that the size of the Fund should be maximised, and only limited by current capabilities. A larger Fund will provide ever more benefits to the environment, the local communities, and the council's finances.

3.3.2. Initial funding

Projects undertaken as part of this Fund will incur most of their costs before any revenue is produced through carbon credits. Most projects will either require significant infrastructure construction before any credits are produced (e.g., renewable energy production, renewable heat networks), or require multiple years to achieve their full carbon reducing potential (e.g., afforestation or peatland projects). This necessitates sourcing finance through means other than selling carbon credits at the outset. Potential sources of funding have been identified, which have been separated into three categories: project-specific funding (e.g., government loans and business collaboration), project-independent funding (e.g., council borrowing and private investment), and issuing green bonds.

We found that project-independent loans were only required in the first 10 years, after which project revenue and project-specific funding was sufficient to sustain project development over the next 10 years and beyond. Further details on these three funding categories are provided below.

Project-specific funding

Project-specific funding encompasses any loans or funding which is linked to a specific project. Financing is separated into three sources: government loans, collaboration with local businesses, and private investment. In the financial models presented above, between 30% (worst scenario) and 50% (best scenario) of project costs are assumed to be provided by project-specific loans, through a combination of the above sources. It was found that the availability of the funding was *the* key differentiator between the worst-case and best-case scenarios: better access to project-specific funding allows for a significantly larger Fund, leading to greatly increased financial and environmental benefits.

The largest source of project-specific funds are government grants or loans to incentivise particular categories of projects.[80] A wide range of funding sources is available from the government for individual projects; in particular projects which focus on energy or heat decarbonisation. The scope of projects funded through these loans may increase over time, so should be monitored regularly in order to maximise the level of funding received through these incentives.

Another funding option may be to collaborate with local businesses who would benefit from particular projects. This could be a direct benefit (e.g., the provision of reliable renewable power to the business), or an indirect benefit (e.g., upgrading the energy efficiency of local housing, encouraging employees to the area). All projects proposed should be assessed for benefits to local businesses, and if one is identified, the Council should investigate whether the financing of the project could be shared by the Fund and the relevant businesses.

Private investment may also be an option for flagship projects, as demonstrated by the company Abundance Investments.[81] This company provides a platform for individuals to invest in a variety of environmental projects. Their ability to support large infrastructure projects is highlighted by the financing of two solar farms in collaboration with Swindon Council. In total, £4.2m was raised through Abundance Investment within 5 months, allowing the building of these solar farms providing up to 10 MW of renewable power.[82]

[80] See "Greater South East Energy Hub" for financing options for energy-based projects: https://www.energyhub.org.uk

[81] Abundance Investments: https://www.abundanceinvestment.com

[82] https://issuers.abundanceinvestment.com/case-studies/swindon-common-farm-chapel-farm

Project-independent funding

Project-independent funding encompasses all loans and funding which the Fund could attract which are not linked to specific projects within the Fund. The main options for this funding are council borrowing and private investment.

Council borrowing is likely to be the most reliable and largest project-independent funding source available to the fund at the start. Preferably, borrowing would come from the Public Works Loan Board (PWLB), who are able to issue large, long-term loans to local authorities for infrastructural projects.[83] In the financial models described above, it is projected that an initial loan of 30-60% of the first project portfolio would be required, followed by a smaller 20-year loan taken out in year 5 to coincide with the development of the second wave of projects. No further local authority borrowing would be required after this once revenue from the selling of carbon credits of previous projects starts.

Private investment may also be possible as a project-independent source of funding. If the Fund can be seen as a reliable long-term investment, this may attract green/ethical pension funds.[84] This may become an option as the Fund develops and proves its viability.

Green bonds

Green bonds (or community municipal investments, CMIs) are a method for local businesses and residents to invest in local decarbonisation projects, allowing local projects to be performed and providing a financial return to investors. In the financial models, it is assumed that 20-year bonds totalling £10 m will be issued in year 0, reissued in year 20, and repaid in full year 40.

The management of green bonds has been pioneered by Abundance Investment, who have recently overseen the issuance of green bonds by two local councils (West Berkshire and Warrington Borough) for a total of £2m.[85] They are in the process of issuing further green bonds for Islington Council worth £1m. Given the ambition of the Cambridgeshire Decarbonisation Fund compared to these previous schemes, issuing a larger amount of green bonds should be investigated.

3.3.3. Alternate revenue sources

While most of the income for the Fund will come from the selling of carbon credits, there are some opportunities to supplement this cash flow. To ensure the consistency with the Fund's objectives, these alternative revenue sources should be climate positive.

Working with the Local Planning Authorities, two options could be considered:

[83] https://www.dmo.gov.uk/responsibilities/local-authority-lending/about-pwlb-lending

[84] For an example of a green pension fund, see "Path Financial": https://thepath.co.uk/our-services/pensions

[85] https://issuers.abundanceinvestment.com/council-climate-bonds

- Developers contribute to the fund to offset operational emissions which are difficult to remove through on-site measures.
- Emissions associated with the construction of new building developments are subjected to a carbon levy within Cambridgeshire.

A developer carbon levy has been successfully implemented by Milton Keynes County Council, as well as a selection of London Boroughs. In Milton Keynes, developers are required to reduce the emissions from construction and running of the building (minimum 45%) and offset the remaining emissions by paying £200/tCO_2 into a fund to finance local decarbonisation projects.[86] Not only does this levy encourage developers to adopt low carbon construction methods and increase the energy efficiency of the buildings, but it also allows decarbonisation projects to be performed at no direct costs to the council or residents. This scheme could be incorporated into the Cambridgeshire Decarbonisation Fund by obliging developers to buy carbon credits from the Fund, ensuring that future developments within Cambridgeshire are carbon neutral. Alternatively, a carbon levy could be set at the price of the more expensive "avoid" projects (£200-250/tonne) to encourage further emissions reductions during construction and supply additional income for the Fund.

Previous council decarbonisation projects external to the Fund could provide another source of revenue.[87] These previous projects are mostly renewable energy generation and will be fully paid through the electricity they provide. Since these projects will also reduce carbon emissions, part of this reduction could be sold as carbon credits and provide an initial revenue for the Fund before the first projects are functional. However, there may be issues with the validity of these carbon credits, as they will not satisfy the additionality requirement described above (Section 3.2.2).

[86] https://www.milton-keynes.gov.uk/planning-policy/documents/Sustainable_Construction_SPD.pdf

[87] Of interest are Triangle and North Angle solar farms and renewable energy at park & ride sites: https://www.cambridgeshire.gov.uk/residents/climate-change-energy-and-environment/climate-change-action/low-carbon-energy/large-scale-renewable-energy-and-storage

4. Summary and Recommendations

In order to maximise the effectiveness of the Cambridgeshire Decarbonisation Fund, the establishment of a separate Carbon Advisory Service (CAS) is recommended. This Service will complement the Fund by assisting businesses in the estimation and reduction of their carbon footprints, as well as recommending offsetting through the Fund, if applicable. The primary target for CAS is expected to be SMEs, but pathways both for larger businesses and for social- and micro-enterprises are also recommended. Establishing this service will ensure that offsetting through the Fund is limited to genuinely hard-to-reduce emissions and that the Fund operates alongside, rather than instead of, other decarbonisation measures essential to meeting net zero targets. Furthermore, the CAS will enable a holistic approach to emissions reduction within participating businesses. It will also offer key co-benefits for both businesses and communities, including improved efficiency, increased attractiveness to consumers and supply chain partners, readiness for future regulatory change, and improved environmental quality.

Following on from the CUSPE 2020 report on the establishment of a Cambridgeshire Decarbonisation Fund, two aspects of this Fund were investigated in detail: validation and verification of carbon credits, and the financial viability of the Fund. The importance of validating and verifying decarbonisation projects within the Decarbonisation Fund has been investigated. This will be a significant part of the management of the Fund and will require substantial organisation to ensure that the relevant information is gathered for each project for the different stages of the validation and verification process. There is an additional benefit for the Fund in terms of credibility by registering projects with a certification organisation; however, the cost-effectiveness of this may vary by project and by the certification organisation used. A possible alternative is to create a standard for the Decarbonisation Fund based on publicly available methodologies and that employs suitable third-party validation and verification bodies. How such methodologies could be adapted to validate and verify the Swaffham Prior Heat Network project has been explored, as an example of how this approach could be applied to future projects. Finally, the report has considered how the UK-based Woodland Carbon Code can be used to generate carbon units from forestry projects and the level of detail and preparation that is required.

With the largest Fund size modelled, 25% of Cambridgeshire's annual emissions could be mitigated within 25 years. This means that a Cambridgeshire Decarbonisation Fund will be an important tool for phasing out the county's 'hard to remove' emissions. In order to achieve this reduction in emissions, the Council should maximise the amount of initial funding acquired to increase the size and efficacy

of the Fund. This initial funding should be sought from a variety of sources, with Local Authority borrowing and government loans likely to be the most significant sources.

Beyond a Cambridge Decarbonisation Fund, much more will need to be done across the county to achieve net-zero. The council can facilitate this by encouraging local businesses to decarbonise through the proposed Carbon Advisory Service, and by exerting pressure upon their supply chain to encourage action across the board. There are also many projects that can be performed that are economically viable (e.g., renewable energy, increasing energy efficiency), which should be undertaken in addition to this Fund, either directly by the Council or through partnerships with local businesses.

The report's recommendations for the Carbon Advisory Service and Decarbonisation Fund are summarised below:

1. The establishment of a local Carbon Advisory Service to support small and medium sized businesses in Cambridgeshire to decarbonise, through the provision of the following services:
    a. Free tailored advice, and signposting relevant external resources and services.
    b. Assistance with carbon accounting and the creation of action plans.
    c. Energy audits and business-specific recommendations.
    d. Assistance with the purchase of carbon credits from the Cambridgeshire Decarbonisation Fund, where appropriate.
    e. Assistance with procurement and accessing financial support for carbon-reduction projects.
    f. An accreditation service with tiered certification.
    g. Training and networking opportunities and regular updates on funding, technology and environmental legislation.
    h. Support with publicity and follow-up on businesses progression towards set targets.
2. The Carbon Advisory Service should act as a gateway to the Decarbonisation Fund, ensuring that businesses reduce their emissions as far as possible before offsetting any residual 'hard to reduce' emissions through the purchase of carbon credits.
3. The Decarbonisation Fund should support emissions-reduction projects that would otherwise not be financially viable (i.e. would not produce revenue or financial savings which outweigh the cost of the project). Projects which do not require the sale of carbon credits to be financially viable should be performed separately to the running of this Fund.

4. The Decarbonisation Fund should set a single carbon price through a portfolio approach, where more carbon expensive projects (with high social / environmental value) are supported by projects with a lower project cost per tonne of CO2.
5. The Decarbonisation Fund should organise and perform the necessary assessments, measurements and predictions required for validation and verification of the decarbonisation projects in the decarbonisation fund portfolio.
6. The Decarbonisation Fund should register projects with established certification organisations where relevant and cost-effective, and otherwise use/adapt relevant publicly available methodologies from such organisations for validation and verification.
7. The initial funding provided for the establishment of the Decarbonisation Fund should be maximised, as this will enable the biggest environmental impact and largest financial returns in the long-term.
8. A diverse portfolio of initial funding should be sought for the establishment of the Decarbonisation Fund, combining both public and private sources to ensure that the Fund is resilient.

Appendix A - Services offered by existing carbon advisory organisations

The table below provides a summary of the tools/services offered by existing carbon advisory organisations. Columns on the left represent the most generic tools/services, becoming progressively more specific and tailored moving across columns to the right. Organisations in black offer that specific tool/service free of charge. Organisations in grey charge for that specific tool/service.

Calculating emissions		
Auditing advice and literature	**Online calculator**	**Personal auditing service**
SME Climate Hub Greenhouse Gas Protocol B Corp Climate Collective Avieco	SME Climate Hub Greenhouse Gas Protocol Carbon Footprint	Carbon Footprint Ricardo PLC Greenstone Ecometrica Anthesis Loreus xtonnes

Making recommendations			
General literature	**Sector-specific literature**	**Training/e-learning**	**Tailored business-specific recommendations**
The Carbon Charter NetRegs SME Climate Hub B Corp Climate Collective Green Growth	The Carbon Charter Carbon Literacy Project NetRegs Wrap B Corp Climate Collective	Carbon Literacy Project NetRegs START2ACT Greenhouse Gas Protocol Ricardo PLC CDP Loreus IMEA Carbon Footprint	BEE Anglia The Science Based Targets Initiative Green Growth Eastern New Energy Energy Saving Trust Carbon Trust START2ACT Carbon Footprint Avieco Ricardo PLC Ecometrica Anthesis Verco Loreus xtonnes

Assistance with funding/procurement			
Information on available funding	Funding application support	Procurement assistance	Funding provision
The Carbon Charter Energy Saving Trust Eastern New Energy B Corp Climate Collective	BEE Anglia Eastern New Energy Wrap	BEE Anglia Energy Saving Trust	BEE Anglia Wrap

Taking sustained action		
Support creating action plans		Follow-up and progression
BEE Anglia NUS Green Impact Eastern New Energy SME Climate Hub B Corp Climate Collective Energy Saving Trust Carbon Trust	Carbon Footprint Avieco Ricardo PLC Anthesis Verco Loreus xtonnes	BEE Anglia SME Climate Hub Energy Saving Trust Ricardo PLC Greenstone

Certification		
Badge/logo	(Tiered) certification	Publicity support
NUS Green Impact **SME Climate Hub**	NUS Green Impact The Carbon Charter Carbon Literacy Project The Science Based Targets Initiative Carbon Trust Carbon Footprint CDP	BEE Anglia The Science Based Targets Initiative Eastern New Energy SME Climate Hub Green Growth Energy Saving Trust

Table 2: Summary of the tools/services offered by existing carbon advisory organisations. Columns on the left represent the most generic tools/services, becoming progressively more specific and tailored moving across columns to the right. Organisations in black offer that specific tool/service free of charge. Organisations in grey charge for that specific tool/service.

Appendix B - Case Study of BEE Anglia and the Carbon Charter

i. Introduction

Suffolk County Council has been helping businesses to implement environmental measures for over 15 years. An energy efficiency advisory service was originally set up in response to pressure from district councils to help local businesses save energy and protect the environment. The council currently provides business advice and grant funding for SMEs through Business Energy Efficiency (BEE) Anglia,[88] which is co-financed by Suffolk County Council and the European Regional Development Fund (ERDF). Local businesses can also receive advice and recognition for taking steps to reduce their carbon emissions through the Carbon Charter award scheme,[89] which is supported by The Suffolk Climate Change Partnership between Suffolk's local authorities and the Environment Agency.[90] Both BEE Anglia and the Carbon Charter services are now also available to businesses in Norfolk, where the programmes are overseen by Norfolk County Council. This case study will provide an overview of the services available to businesses in Suffolk and Norfolk, how these programmes are structured and funded, and outline the environmental outcomes and how local businesses have benefited. Insights into the implementation of the programmes were also obtained from an interview with the BEE Anglia Project Manager at Suffolk County Council, Ned Harrison.

ii. Services to Businesses

Through the complementary services provided by BEE Anglia and the Carbon Charter, local small SMEs are able to access: expert energy saving and emissions reduction advice, grant funding for emissions reduction initiatives and locally-recognised accreditation for implementing emissions saving measures. The programmes work closely with the Chambers of Commerce and local business organisations to link with local businesses. They also promote their services through regular press releases, providing details of successful projects undertaken with local businesses.

"After working with a local printing business and putting out a press release, we had a flurry of interest from other print firms, the same thing happened when we worked with our first law firm" - Ned Harrison, BEE Anglia Project Manager

Advice

Both BEE Anglia and Carbon Charter provide access to trained expert advisors who can help businesses identify energy and emissions savings. The advisory services are delivered by the charity Groundwork

[88] http://www.beeanglia.org/
[89] https://carboncharter.org/
[90] https://www.greensuffolk.org/about/suffolk-climate-change-partnership/

East, which acts as a point of contact for businesses. Advice is provided through a hybrid approach of remote support and site visits. The advisors typically produce an energy audit in which they rank recommended measures according to upfront cost, potential energy and emissions reduction, and pay-back time. They also help businesses to find suitable local suppliers or installers of low carbon technologies.

Groundwork Carbon Management process:[91]

1. **Establishing a baseline** – by measuring your current carbon footprint our consultant will be able to identify areas for improvement for your business to focus on.
2. **Set targets** – our consultants understand SMART carbon management objectives. Their experience will help your business to understand what targets are achievable based on the resources you have available.
3. **Monitor** – record keeping is essential when managing your carbon to track progress. Our industry leading tools will ensure all the data you need is at hand.
4. **Adapt** – carbon management is a continual improvement process; recommendations can continue to be made. Our consultants can even help you go beyond net zero, looking to a climate positive future where your business seeks to remove additional carbon dioxide from the atmosphere.

Grant funding

BEE Anglia and the Carbon Charter also help businesses to access grant funding to reduce the upfront cost of emissions reduction projects. BEE Anglia provides grants of up to £20,000 at an intervention rate of between 20% to 40% of project costs.[92] The Carbon Charter does not provide any funding directly but helps businesses to apply to a range of different grant funds,[93] many of which are exclusive to Suffolk.

Accreditation

The Carbon Charter has supported approximately 600 businesses to achieve accreditation through tackling their carbon emissions. Though less robust and comprehensive than other national / international standards for measuring environmental performance, the Carbon Charter provides an effective incentive for businesses to take action.

[91] https://groundworksbs.org.uk/carbon-management/
[92] http://www.beeanglia.org/grant-funding/
[93] https://carboncharter.org/resources-grants-and-funding/

"The Carbon Charter has helped incentivise businesses to implement the recommendations of their energy audit" - Ned Harrison, BEE Anglia Project Manager

The Charter is targeted specifically at SMEs and is designed to be "attainable for companies which do not employ a full-time energy manager, and can't afford a rigorous environmental management system".[94] According to Ned Harrison, Project Manager at BEE Anglia, "SMEs are often overwhelmed by the structural and legal implications of achieving compliance with standards such as ISO14001[95] and The Carbon Trust Standard,[96] the Charter offers something which is both meaningful and attainable for them". The Carbon Charter process encourages businesses to implement quick and effective measures to put them on a path of emissions reduction. Through taking action and making tangible progress towards decarbonisation, businesses are encouraged to go further, as they start to capitalise on the benefits and begin to view themselves as part of the solution.

There are three levels of Carbon Charter Accreditation, which are outlined in Figure 7. Put simply, the Bronze level charter recognises businesses which 'take [their] carbon impact seriously', and is intended to be within reach of any business. A Silver level business has 'significantly reduced its carbon emissions', and a Gold level business is 'an exemplar of low carbon management'.

[94] http://www.beeanglia.org/about-bee/carbon-charter/carbon-charter-quick-q-and-a/
[95] https://www.iso.org/standard/60857.html
[96] https://www.carbontrust.com/what-we-do/assurance-and-certification/the-carbon-trust-standard

Bronze – has a working energy/carbon reduction policy, signed off by senior management, with clear reduction targets and planned actions in place to measure and monitor progress.

Silver – in addition to bronze requirements, is making significant and measurable progress on carbon reduction.

Gold – In addition to silver requirements, demonstrates exemplary practices, such as developing a sustainable procurement system, engaging in staff and/or community development, and/or facilitating or encouraging carbon efficiency and spreading the resource efficiency message within the business sector.

Figure 7: Logo and requirements for the three levels of accreditation awarded by the Carbon Charter in Suffolk and Norfolk.[97]

Eligibility

While historically only available to SMEs, the Carbon Charter has recently started granting accreditation to larger companies in response to increasing interest. These larger companies were often already compliant with other more comprehensive standards such as ISO14001 but wanted to have local recognition of their environmental credentials. In order to avoid larger companies using the charter as a cheap and easy alternative to more robust and demanding schemes, larger companies are required to be ISO14001 (or equivalent) compliant as a prerequisite.

Application process

Charter accreditation is awarded based on an independent assessment by a qualified auditor who carries out a site visit and submits a report to the Carbon Charter Panel. The assessment considers the major environmental aspects of the business and how it is addressing its environmental impacts. The auditor will also calculate a carbon footprint for the business. The Carbon Charter Panel, which is made up of qualified and experienced environmental professionals from a range of local organisations including the Environment Agency, Suffolk County Council, local authorities and the water companies, will then determine the level of award that the company receives. The business is then informed of the outcome, together with practical suggestions for further progress. The accreditation process typically takes 6-12 months to complete, though timescales can vary considerably. Businesses are

[97] https://carboncharter.org/about-the-carbon-charter/

encouraged to renew their Charter accreditation every two years, through a simplified renewal process.

iii. Structure and Funding

The organisational structure of BEE Anglia and the Carbon Charter is outlined in the diagram shown in Figure 8. BEE Anglia is currently co-funded by Suffolk County Council and the European Regional Development Fund (ERDF). However, grant funding from the ERDF is due to expire mid-2022 and the council is seeking future support from the UK Government. The Carbon Charter, which charges for its advice and accreditation services, does not rely on any external revenue streams, giving greater financial stability and ensuring continuity of service. Suffolk County Council is the lead partner and handles project finances and grant payments for BEE Anglia and the Carbon Charter, while Norfolk County Council oversees delivery of the programmes in Norfolk. Advice and auditing services are provided to businesses via the charity partner Groundwork East in Suffolk and Norfolk. The processing of grant applications is undertaken by Nwes, a not-for-profit enterprise agency supported by the ERDF.

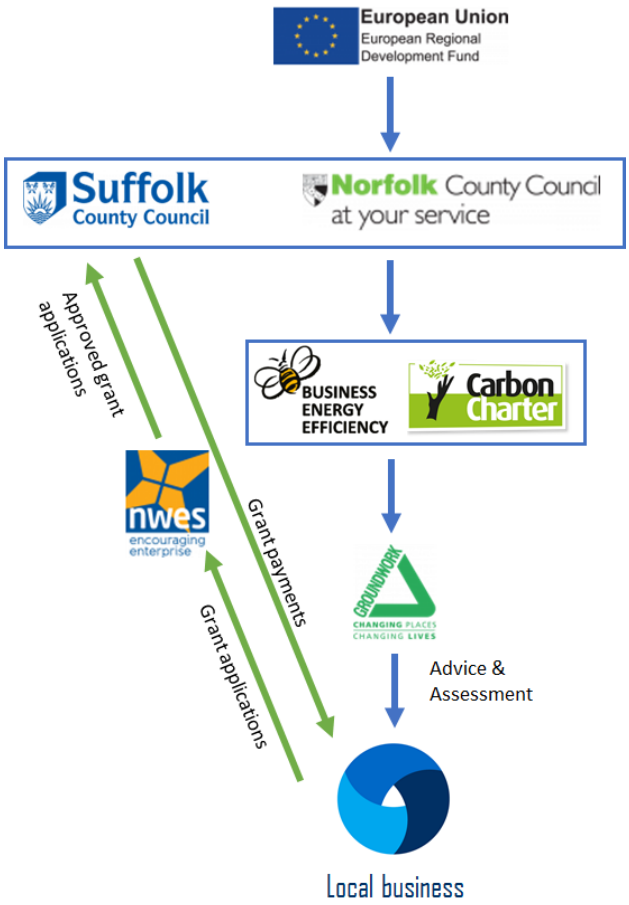

Figure 8: Schematic diagram showing the organisational structure of the services offered by BEE Anglia and the Carbon Charter on behalf of Suffolk and Norfolk County Councils

The cost of Carbon Charter accreditation depends on the size of the business:

- £750 for microbusiness (0-9 employees)
- £850 for small business (10-49 employees)
- £950 for medium-sized business (50-250 employees)
- Prices start at £1,250 for organisations with over 250 employees.

The fee may be covered by BEE Anglia or paid by businesses themselves and covers the costs of an onsite audit and review and provides the business with two years of accreditation and network membership. The fee covers the Groundwork advisor's time, which is charged at £50 per hour, with a small margin included to cover other non-chargeable costs. There is also the opportunity for larger organisations to support the programme as 'Pathfinder Partners'. One such example is the East of England Co-operative, which supports local businesses and producers to apply for the award and covers the accreditation fee for its suppliers.

iv. Implementation and Outcomes

During 6 years of operation, BEE Anglia has helped 874 businesses to cut energy usage. This work has realised annual savings of 3,000 tonnes CO2e through the measures implemented with grant funding alone, with further carbon reductions from measures implemented without grants. In addition, since its establishment in 2010, the Carbon Charter has accredited 600 businesses and carried out over 800 energy audits across businesses as varied as cleaning services, groceries delivery, food and beverage producers & suppliers, financial & legal services, engineering, construction materials, schools, printing services and marketing services. The Carbon Charter is also now recognised in council procurement and businesses are required to meet at least some of the criteria of the charter to supply goods / services to the council.

Businesses which approach the BEE Anglia or the Carbon Charter do so for several reasons:

- Motivated owner(s) / employee(s)
- Cost reduction / efficiency savings
- Perceived pressure from peers, competitors and customers
- Competitive advantage
- Compliance with current and future environmental legislation
- Pressure from customers / meeting procurement requirements
- Pressure from staff and attracting new employees

"Businesses often say that cost is their main concern but in my experience time and confidence often present greater barriers" - Ned Harrison, BEE Anglia Project Manager, Suffolk County Council

Ned Harrison believes that good quality advice can give SMEs the confidence they need to implement energy saving measures. He explained that “businesses which get in touch often have a pretty good idea of what they want to do to reduce carbon emissions but lack the confidence to follow through on those plans”. In this sense, the advisor's role is to use their experience and relevant case studies to provide businesses with the reassurance they need that their proposed measures will deliver the expected benefits. Furthermore, Ned’s experience has taught him that, while businesses are often very keen to have an advisor visit and produce an energy audit, they often fail to implement any of the recommendations, even those which are low cost and have short pay-back times. However, the Carbon Charter accreditation programme has been highly effective at incentivising more companies to implement the recommendations of their energy audits. It has also attracted many more businesses who want local recognition of their environmental efforts.

The Carbon Charter lists the following benefits of Certification and Membership:

- Use of the Carbon Charter logo – communicate your commitment to carbon reduction to all your stakeholders
- Listing in Carbon Charter’s Member Directory
- Access to Member Login Area
- Free support from our sustainable business services team
- Priority invitations to a range of training and networking events
- Introductions to other like-minded businesses working locally
- Regular updates on funding, new technologies and environmental legislation

Appendix C - Validation and verification fees

i. Gold Standard Certified Emissions Reductions Fees

Fee Type	Cost
Annual Registry Account Fee	$1000 per account
Preliminary Review Fee	$900 per project
Project Design Review Fee	$0.05 per credit minus Preliminary Review Fee
Performance Review Fee	$1000 per project
First Year of Issuance	$0.05 per credit minus Performance Review Fee
Subsequent Issuances	$0.1 per credit minus Performance Review Fee OR $0.02 per credit minus Performance Review Fee plus 1.5% of credits given to Gold Standard

ii. Gold Standard Microscale Carbon Fees

Fee Type	Cost
Annual Registry Account Fee	$1000 per account
Preliminary Review Fee	$500 per project
Performance Review Fee	$650 per project
Standalone Project – Validation Fee	$5000 per project
Standalone Project – Annual Verification Fee	$2500 per project per year
Programme of Projects – Validation Fee	$20000 per programme
Programme of Projects – First Voluntary Project Activity Validation Fee	$2500
Programme of Projects – Inclusion/Validation Fee	$2500 per additional Voluntary Project Activity
Programme of Projects – Annual Verification Fee	$1500 per Voluntary Project Activity

iii. Plan Vivo Fees

Fee Type	Cost
Project Idea Note Review Fee	$750
Project Design Document Review Fee	$1800
Validation Coordination and Report Review Fee	$1000
Registration Fee	$1000-$4000 per project
Issuance Fees	<50000 Plan Vivo Certificates per year = $0.4 per Plan Vivo Certificate >50000 Plan Vivo Certificates per year = $0.35 per Plan Vivo Certificate

iv. Verified Carbon Standard Fees

Fee Type	Cost
Account Opening Fee	$500 per account
Registration Fee (credited towards future issuance levies)	Estimated volume of annual emissions reductions × $0.1; capped at $10000
Validation/Verification Body Annual Fee	$2500 per year
Verified Carbon Unit (VCU) Issuance Levy	1-10000 VCU = $0.05 per VCU 10001-1000000 VCU = $0.14 1000001-2000000 VCU = $0.12 2000001-4000000 VCU = $0.105 4000001-6000000 VCU = $0.085 6000001-8000000 VCU = $0.06 8000001-10000000 VCU = $0.04 >10000000 VCU = $0.025

Table 3: Adapted tables of the main costs associated with certifying a project with Gold Standard (i. and ii.), Plan Vivo (iii.) and Verified Carbon Standard (iv.). For a project to be classified as a Gold Standard Microscale Carbon project (ii.), there are certain requirements, such as the maximum number of carbon reductions per year is 10,000 tonnes CO_2 equivalents.

Appendix D - Case Study of Validation and Verification with the Woodland Carbon Code

Afforestation and reforestation projects are important for sequestering carbon, particularly from emissions that are difficult to reduce. The carbon sequestered can then be sold as carbon credits. However, it is important that these projects have been validated and verified, so that businesses that want to buy the credits can trust that they correspond to an accurate amount of sequestered carbon. As such, forestry projects involve more procedures than simply planting the required number of trees.

One standard that provides the guidelines for carrying out certified forestry projects is the Woodland Carbon Code, a UK-based Government-supported voluntary code that is managed by Scottish Forestry.[98,99] It provides a framework for the validation and verification of tree planting projects, including predicting and confirming the amount of carbon sequestered by the project, as well as checking that the projects conform to UK Forestry Standard.[100,101] Predicted Issuance Units (PIUs) are given based on predicted carbon sequestration, while Woodland Carbon Units (WCUs) are given after verification of the actual carbon sequestered.[102] Only the WCUs can be used by businesses to report against UK-based emissions. It is worth noting that WCUs are technically not carbon credits, as they do not meet all additionality requirements.[103] This is because of the UK government's policy on woodland creation as part of the United Nations Framework Convention on Climate Change (UNFCCC) agreements.[104]. In practice, this means that WCUs cannot be used by UK businesses to compensate for overseas emissions or those from international flights or shipping.

Costs involved

Aside from the validation/verification performed by third-parties, the costs involved with using the Woodland Carbon Code are based on the number of carbon units sequestered by projects.[105] There is a £0.06 charge per unit for adding the PIUs to the registry, followed by a £0.03 charge for each PIU

[98] https://www.woodlandcarboncode.org.uk/

[99] https://www.woodlandcarboncode.org.uk/about/governance

[100] https://www.woodlandcarboncode.org.uk/landowners-apply/3-validation-initial-project-check

[101] https://www.woodlandcarboncode.org.uk/landowners-apply/4-verification-ongoing-check-of-project-sequestration

[102] https://www.woodlandcarboncode.org.uk/buy-carbon/what-are-woodland-carbon-units

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

[104] https://www.woodlandcarboncode.org.uk/standard-and-guidance/1-eligibility/1-6-additionality

[105] https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_CarbonUnitRegistry_Fees_July2016.pdf

verified as a WCU. The rest of the costs are paid to the bodies that perform the validation and verification. For example, the cost of a single validation/verification with OF&G (including the application fee and VAT) is £1382.40.[106] There is no fee for reviewing documentation, unlike the other certification organisations mentioned above, and the issuance charges per unit are less than those aforementioned organisations (Appendix C, pages 60-61), making using the Woodland Carbon Code cost-effective for certifying forestry projects within the Cambridgeshire Decarbonisation Fund.

Before validation and verification

For potential projects within the portfolio of the Decarbonisation Fund, the first step is to register with the Woodland Carbon Code, which can only be done before any planting begins – projects cannot be registered retroactively.[107] This involves creating an account for each project on the UK Land Carbon Registry, which is maintained by the third-party company IHS Markit. The UK Land Carbon Registry provides a publicly available record of the predicted and verified carbon units for each project, providing transparency for potential buyers.[108] The following steps for projects involve completing the detailed methodology provided by the Woodland Carbon Code that is used for predicting the carbon sequestration of the project over its lifetime, as well as providing the information needed by third-party bodies to perform validation and verifications.[109]

Prior to the validation of projects, the predicted carbon sequestration is calculated. The Woodland Carbon Code provides spreadsheets that use various planting details to perform the calculations, including the tree species used, the seedling area and spacing, and the management type.[110] In addition, the baseline sequestration of any current vegetation needs to be measured before it is cleared prior to tree planting, as well as any leakage if emissions are caused outside of the project area, as the calculations account for any sequestration/emissions that are over 5% of that predicted for the forest. However, the UK legislation that protects semi-natural habitats and existing woodlands reduces the likelihood of leakage due to intensified land use outside of the project area.[111] Therefore,

[106] https://assets.ofgorganic.org/rd316-woodland-carbon-code-charges.59tbab.pdf
[107] https://www.woodlandcarboncode.org.uk/landowners-apply/2-register-your-project
[108] https://www.woodlandcarboncode.org.uk/standard-and-guidance/2-project-governance/2-7-carbon-statements-and-reporting
[109] https://www.woodlandcarboncode.org.uk/landowners-apply/template-documents
[110]https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_CarbonCalculation_Guidance_V2.4_March2021.pdf
[111] https://www.woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-2-carbon-leakage

the project developers need to know these details of the current land area and the design of the forest at the start of the project.

Performing validation and verification

The validation and verification of the projects are performed by bodies accredited by the UK Accreditation Service.[112,113] Currently, these are Organic Farmers and Growers (OF&G) and Soil Association. For validation, these bodies check that the carbon sequestration predictions are correct. Validation must be carried out within 3 years of the project start date and the process can take 4-6 months from contracting one of the accredited bodies to receiving PIUs after validating the predicted carbon sequestration. If any corrective actions are specified by the body, these need to be completed within 1 month. Once PIUs are received, they are recorded on the registry. 20% of these are kept as a buffer in case of reversal (such as from fires) or lower sequestration than predicted.[114] As such, not all carbon units generated will be available to sell. Another spreadsheet from the Woodland Carbon Code uses the number of PIUs, along with the carbon price and the costs involved with validation and verification, to calculate the costs and income involved with following the Code.[115] This can help demonstrate the financial additionality of the project. Forestry Commission grants and funding can be used with Woodland Carbon Code projects;[116] the requirement for financial additionality is that at least 15% of the project's planting and establishment costs up to year 10 come from selling WCUs.[117]

Verification is performed at regular intervals to assess the progress of the project and confirm the actual carbon sequestration that has occurred. This is first carried out 5 years after the start of the project, then every 10 years subsequently.[118] Progress and monitoring reports need to be submitted in advance of the verification due date – between 9 and 12 months before. Additionally, the project developers need to conduct a survey of the area, which is also sent to the verification body.[119] For the first verification, the aim of the survey is to check the stocking density and health of the saplings, while subsequent verifications confirm the amount of carbon that has been sequestered compared to that

[112] https://www.woodlandcarboncode.org.uk/landowners-apply/3-validation-initial-project-check
[113] https://www.woodlandcarboncode.org.uk/landowners-apply/4-verification-ongoing-check-of-project-sequestration
[114] https://www.woodlandcarboncode.org.uk/standard-and-guidance/2-project-governance/2-3-management-of-risks-and-permanence?highlight=WyJidWZmZXIiLCInYnVmZmVyJyIsImJ1ZmZlciciXQ==
[115]https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_Cashflow_Spreadsheet_Guidance_V2.1_March_2021.pdf
[116] https://www.gov.uk/guidance/the-woodland-carbon-code-scheme-for-buyers-and-landowners
[117] https://www.woodlandcarboncode.org.uk/standard-and-guidance/1-eligibility/1-6-additionality
[118] https://www.woodlandcarboncode.org.uk/landowners-apply/4-verification-ongoing-check-of-project-sequestration
[119] https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_SurveyProtocol_Version2.1_March2021.pdf

predicted. The surveys involve dividing the area into subsets based on planting density and then taking measurements of the trees at randomly assigned plots. Therefore, substantial planning and coordination is required prior to each verification, and is an important part of the management of the projects.

Once the carbon sequestration has been verified, the corresponding number of PIUs are converted to WCUs.[120] These are recorded on the registry and can be sold to businesses to be used to compensate for emissions in the UK. The WCUs can be grouped with the carbon credits generated by other projects in the decarbonisation fund portfolio and sold in combination to businesses. Upon being sold, the WCUs are retired on the registry, so that there can be no double counting.

Example project: Forest of Marston Vale

An example of a group of forestry projects that have been registered with the Woodland Carbon Code in a neighbouring authority is the Forest of Marston Vale.[121] It is located in 61 square miles between Bedford and Milton Keynes and the area was designated as one of 12 Community Forests by the Government in 1991.[122] The Forest of Marston Vale Trust oversees the 10 different projects involved, which total 98.24 ha planted between 2001 and 2013 and which have increased tree cover from 3.6% in 1995 to 15.4% in 2015. Over its 100-year project lifespan, it is predicted to sequester 52,987 tonnes of CO_2 equivalents.[123] Therefore, this is a large scale set of forestry projects that are successfully following the Woodland Carbon Code.

In addition to the carbon saved, the Forest of Marston Vale has produced many co-benefits. To quantify these, the Forest of Marston Vale Trust commissioned an academic study, which found that, for every £1 invested in the Forest up to 2015, there were £11 of social, economic and environmental benefits.[124] These benefits included £4.95 million of physical health benefits per year; a boost to the local economy of £22.05 million per year from local spending for goods, services and contractors; and £1.49 million per year of air quality benefits and reduced social damage costs. Therefore, the creation

[120] https://www.woodlandcarboncode.org.uk/standard-and-guidance/2-project-governance/2-6-registry-and-avoidance-of-double-counting

[121] https://www.woodlandcarboncode.org.uk/case-studies/woodland-carbon-projects/forest-of-marston-vale-group

[122] https://www.marstonvale.org/Handlers/Download.ashx?IDMF=c9d14c67-2ba3-402f-b3dd-fd124495bdd1

[123] https://www.woodlandcarboncode.org.uk/case-studies/woodland-carbon-projects/forest-of-marston-vale-group

[124] https://www.marstonvale.org/Handlers/Download.ashx?IDMF=c9d14c67-2ba3-402f-b3dd-fd124495bdd1

of the Forest of Marston Vale has provided significant benefits to the community in addition to sequestering carbon.

Other credit types

It is possible to generate other types of credits, with different co-benefits, from a forestry project registered with the Woodland Carbon Code.[125] However, the predicted income from these needs to be stated during validation, because the income from these types of credits could mean the project is no longer additional. Alternatively, instead of stacking different types of credits, different trees could be designated for different credit types. It is worth noting that there will be different market demands for different types of credits. Therefore, careful assessment is needed prior to stacking credit types on any forestry projects using the Woodland Carbon Code.

[125] https://www.woodlandcarboncode.org.uk/standard-and-guidance/1-eligibility/1-6-additionality

Appendix E - Financial structure

i. Model parameters

The model was first set up for the "50 million, expected" scenario with the following parameters:

Indirect running costs:

This cost was predominately made up from the employment of people within the council to oversee the fund, and the associated costs for these employees (such as office space etc). 10-12 employees were estimated to be required, with a total annual cost of £670,000.

Validation/verification:

This cost was estimated at £400,000 annually. This is likely to be an overestimate, and these costs can be better estimated with knowledge of the amount and types of projects performed.

Business margin:

The annual cost of running projects was averaged over the first 20 years, and compared to the annual validation, indirect costs, and loan repayments (0.6*average over the first 20 years). This suggested a minimum business margin of 26%, on top of which 3% was added to give 29% as the business margin used.

Project costs and revenue:

The majority of costs were estimated to be incurred in the first 5 years (70% of total), with a constant "running cost" of 2% of the total (Figure 9). Revenue was estimated to start in year 5 and be consistent until year 10. After year 10, revenue decreases year upon year, to account for a reduction in additionality of the projects which is likely to occur. Reductions used are 5% from previous year in years 11-14, 10% in years 15-16, 20% in years 17-18 and 25% in years 19-20.

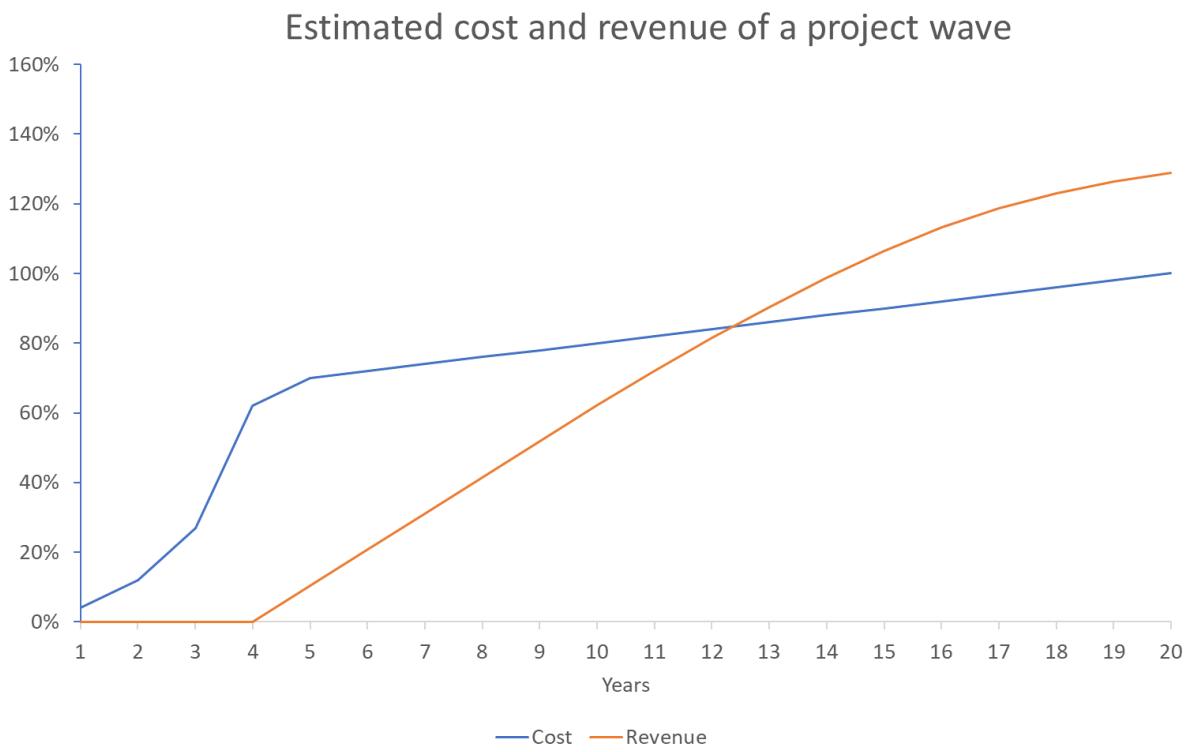

Figure 9: Estimated cost and revenue for projects over their 20-year life. This was used for the expected scenarios.

Cost of carbon

The cost of carbon was calculated from the estimated cost of decarbonisation in three types of project: "avoid", "reduce" and "sequester". "Avoid" was estimated to cost £220/tCO_2, based on the Swaffham Prior Heat Network. "Reduce" was estimated at £140/tCO_2 based on the CUSPE 2020 report. "Sequester" was estimated at £15/tCO_2, based on estimates from woodland carbon code of £7-20/tCO_2 (which includes a buffer for reversal/insurance of credits). A blend of projects from each of these categories was produced to give the desired cost of a carbon credit (Figure 10): starting around £105 and rising to £140 (Figure 11).

Portfolio size	**£164,000,000**		
Group 1			
Breakdown	**Cost/tCO2**	tCO2 offset	Project price
"Avoid"	£220.00	454,280	£ 99,941,600.00
"Reduce"	£140.00	319,800	£ 44,772,000.00
"Sequester"	£15.00	1,287,400	£ 19,311,000.00
Total		2,061,480	£ 164,024,600.00
	Average cost per tCO2		£ 79.67
	Average credit (with markup)		**£ 102.67**

Figure 10: Calculations performed for the first portfolio of projects in the "£50 million, expected" scenario.

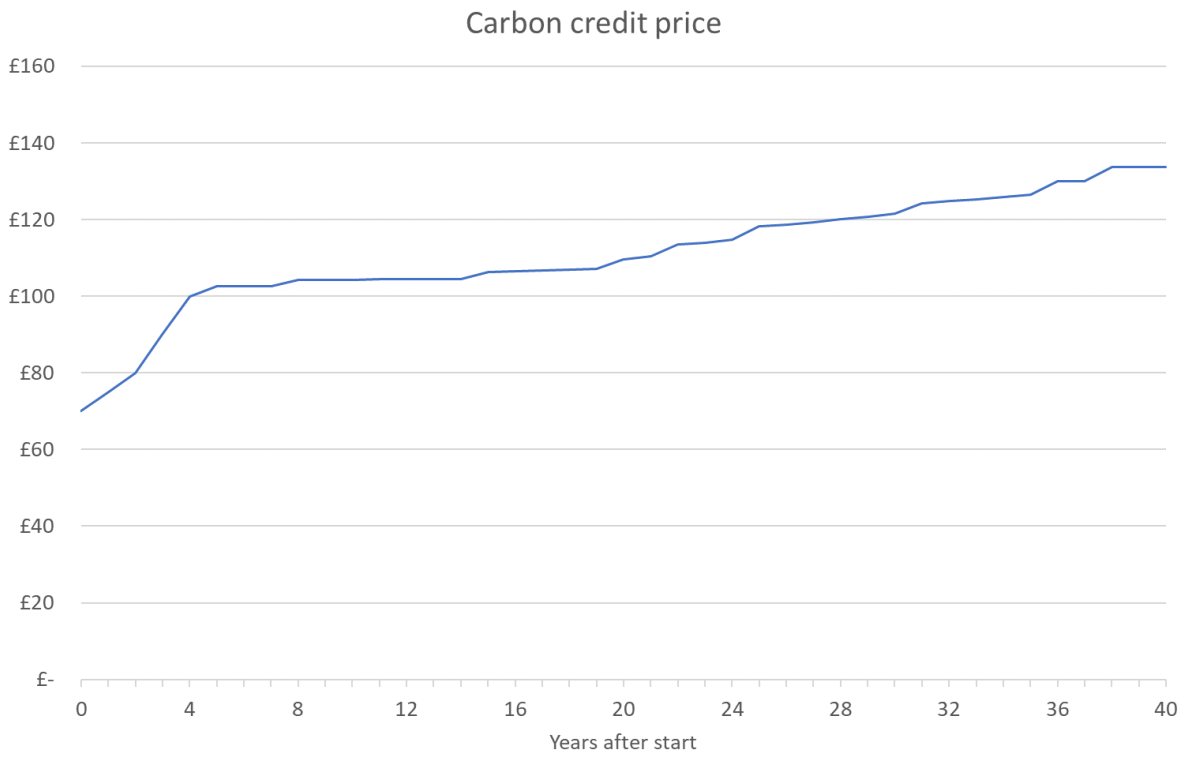

Figure 11: The price of a carbon credit sold by the decarbonisation fund over 40 years. Graph taken for the "£50 million, expected" scenario

Loans and repayments

General loans were taken out in the years 0 and 5 of the fund, allocated to council borrowing from the Public works loans board, though this may come from private sources if identified. Green bonds were also issued through Abundance Investments for 20 years in year 0 and 20. Project specific loans, from

a mix of public and private sources, were taken out in the third year of that project wave (before the major costs incurred in the fourth year). Project specific loans were estimated at 40% of the project's value, and last for 20 years. Project loans were paid off as done by the council: with the minimum revenue repayment above interest only being paid once revenue is being received. Below is a summary of the loans taken out for this scenario (Figure 6).

Number	Source	Amount	Year start	Interest rate	Years of bon	Total repaid
1	PWLB	50,000,000	0	2.10%	40	74,675,000
2	Green bonds (Abundanc	10,000,000	0	2.50%	20	15,000,000
3	Project loans 1	65,600,000	3	2.20%	20	80,753,600
4	Project loans 2	63,600,000	6	2.30%	20	78,959,400
5	PWLB	40,000,000	5	2.30%	20	48,740,000
6	Project loans 3	57,500,000	13	4.00%	20	81,650,000
7	Green bonds (Abundanc	10,000,000	20	8.00%	20	26,000,000
8	Project loans 4	35,000,000	18	5.50%	20	55,212,500
9	Project loans 5	37,500,000	20	5.50%	10	48,843,750
10	Project loans 6	26,750,000	23	6.00%	10	35,577,500
	Total	395,950,000				545,411,750

Figure 10: A summary of the loans taken out during the "50 million, expected" scenario.

Projects performed

Projects were modelled to be performed in six waves over twenty years, with different cumulative values for each wave. The values of each wave were optimised to maximise carbon savings without becoming insolvent. The value of each project for each scenario is shown below on page 67. Project waves were started in the following years: 1, 4, 11, 16, 18, 21. This system of 6 waves was adopted to simplify the modelling process, however a continuous process of project initiation may be preferable.

Other financial sources

Extra funding has been taken from the selling of carbon credits from existing Council projects (Triangle solar farm, North Angle farm and Park & Ride energy projects). These were estimated to save 11,000tCO_2/year and sold for 25 years at the price of carbon credits produced by the fund.

Fund scale-up

The larger fund sizes were based upon the £50m fund, but with some changes to simulate the effects of scaling up.

For £100 m fund:

- Indirect costs and Validation/verification costs were 75% higher

For £250 m fund:

- Indirect costs and Validation/verification costs were 300% higher

Best and worst-case scenarios

The best and worst-case scenarios portrayed were derived from the corresponding expected scenario with the following modifiers.

For the worst-case scenario:

- Projects come online a year later (year 6). The cost schedule stays the same
- Indirect costs are 25% higher
- Validation costs are 50% higher
- Interest rates start 0.2% higher, rising to 1.5% higher at year 25
- Only 50% of credits from past projects are sold (Triangle farm etc)
- Project-specific loans are 30% of project value (down from 40%)
- Cost to remove carbon is 10% higher. This reduces the amount of carbon saved per project.

For the best-case scenario:

- Indirect costs 10% lower
- Validation costs are the same (but more projects are run)
- Interest rates start 0.1 % lower, up to 0.5% at year 25
- Project-specific loans are 50% of project value (up from 40%)
- Carbon credits are 10% cheaper to produce. This increases the amount of carbon saved per project

ii. Project portfolio size

The following tables describe the value of each project wave used in these models.

Project portfolio sizes for £50 million Fund (£m)	Worst	Expected	Best
Group 1	112	164	259
Group 2	83	159	265
Group 3	123	230	450
Group 4	70	140	260
Group 5	42	125	220
Group 6	39	107	199
Total	**469**	**925**	**1653**

Project portfolio sizes for £100 million Fund (£m)	Worst	Expected	Best
Group 1	210	305	480
Group 2	155	270	480
Group 3	200	415	800
Group 4	120	240	450
Group 5	76.5	205	390
Group 6	75	180	375
Total	**836.5**	**1615**	**2975**

Project portfolio sizes for £250 million Fund (£m)	Worst	Expected	Best
Group 1	510	735	1180
Group 2	400	720	1100
Group 3	540	950	2120
Group 4	290	690	1000
Group 5	180	380	950
Group 6	170	380	850
Total	**2090**	**3855**	**7200**

iii. Other calculated values

Max carbon saved/year ($MtCO_2$) (year in brackets after)	£50m fund	£100m fund	£250m fund
Worst	0.293 (16)	0.517 (16)	1.335 (16)
Expected	0.538 (25)	0.930 (25)	2.183 (25)
Best	0.979 (25)	1.750 (25)	4.234 (25)

Max carbon saved/year as a percentage of current emissions (11.6 $MtCO_2$, incl. peatland)	£50m fund	£100m fund	£250m fund
Worst	2.5%	4.5%	11.5%
Expected	4.6%	8.0%	18.8%
Best	8.4%	15.1%	36.5%

% Financial return on investments after 40 years	£50m fund	£100m fund	£250m fund
Worst	102%	105%	106%
Expected	125%	125%	123%
Best	124%	125%	124%

Net financial gain of fund after year 40 (£m)	£50m fund	£100m fund	£250m fund
Worst	6.1	24.5	63.8
Expected	100.2	174.2	381.9
Best	176.9	325.3	768.6

Total carbon mitigated by projects over 40 years ($MtCO_2$)	£50m fund	£100m fund	£250m fund
Worst	6.6	11.8	29.5
Expected	12.1	21.2	51.0
Best	21.2	38.2	92.7

Value of projects:loans taken out	£50m fund	£100m fund	£250m fund
Worst	1.89	1.87	1.92
Expected	2.34	2.31	2.31
Best	2.25	2.25	2.26

Maximum carbon credits sold (thousands/year) (year in brackets after)	£50m fund	£100m fund	£250m fund
Worst	293 (16)	517 (16)	1335 (16)
Expected	481 (15)	860 (15)	2086 (15)

Best	877 (22)	1562 (25)	3814 (22)

Total credits sold over the 40-year period (millions)	**£50m fund**	**£100m fund**	**£250m fund**
Worst	5.7	10.1	25.3
Expected	10.6	18.6	44.6
Best	18.7	33.6	81.6

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