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Proposal for a Cambridgeshire Decarbonisation Fund to Support the Achievement of Net-Zero Cambridgeshire by 2050

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1 Executive Summary

For Cambridgeshire to reach net-zero by 2050, targeting early investment into projects which will reduce carbon emissions most, especially in the transportation, domestic, and business sectors is needed. Government has a role to build a green economy through regulation, funding, economic incentives and other wider financial instruments, but all sectors, local authorities, businesses and communities will need to commit investment into a low carbon future to manage the climate and biodiversity emergencies. The aim of this report is to identify ways in which Cambridgeshire businesses can invest locally in community infrastructure and nature-based projects that reduce carbon emissions at their source or actively sequester carbon. This investment will support earlier reductions to carbon emissions than might otherwise occur, provide added value to the places we live, and the people that live and work here, whilst also benefiting businesses as part of their wider carbon emissions, environmental, social and governance (ESG) commitments.

Our proposal to achieve this goal is to set up a **Cambridgeshire Decarbonisation Fund** into which businesses can invest; the benefits provided to businesses and the community are carbon credits, biodiversity net gain, air quality as well as indirect benefits such as health, wellbeing and community engagement, and ultimately a greener future for Cambridgeshire. This report identifies areas in which carbon reduction projects facilitate wider "co-benefits" for businesses and the community, such as a healthier workforce, improved air quality in city centres, and business reputation boosts from investment into green technologies. By investing in this fund, businesses will improve their corporate social responsibility in a meaningful way, which extends to improving the community in which their employees work and accelerating carbon emissions reductions to prevent global temperature rises above 1.5 degrees. To ensure community support and engagement in the Fund, projects should be brought forward by the communities within Cambridgeshire, through open calls, collaborations with local organisations and charities, or facilitated by the expertise of councils as the elected representatives of local communities. This Fund follows the overall motto of "**avoid, reduce, sequester**", as we have determined that this is the order in which we need to address becoming carbon neutral. First, avoiding emissions at all, then reducing emissions when this is not possible, and finally sequestering CO_2 already in the atmosphere. A summary of the recommendations can be found below.

This report is outlined into three main sections; in the **Introduction** a global snapshot is provided for existing carbon credit systems throughout the world. Then, methodologies for Carbon Credits and Carbon Pricing are described. In the **Proposed Cambridgeshire Decarbonisation Fund Framework** we outline the necessary considerations for implementing a Cambridgeshire-wide decarbonisation plan, potential pitfalls, and several case studies to which we have applied carbon pricing. In addition, we describe what co-benefits this plan would provide to incentivise its use. Finally, we make **Recommendations and Summary** for future researchers who plan to implement this plan. Overall, the aim is to provide a comprehensive report of how a decarbonisation plan would work if applied to Cambridgeshire.

Recommendations:

1. Create a decarbonisation fund that allows businesses to invest in local carbon reduction projects
2. Identify sources of funding to initiate the decarbonisation fund
3. Have a tiered, prioritized list of projects for the fund to invest in which businesses value

4. Consider co-benefits when creating projects or choosing to pursue projects as this adds wider value to businesses
5. Support businesses to reduce their emissions at source where possible but use the fund for the hard-to-treat residual emissions
6. Reach out to businesses to identify business drivers and reasons to invest
7. Further assess the policy implications of projects
8. Encourage community involvement in project development

2 Introduction

The Climate Change Act 2008[1] has made it clear that if we are to tackle climate change, the UK must become net zero by 2050. Net zero means that the amount of carbon emitted is equal to or, ideally less than, the amount of carbon saved. On a County level, the 2019 CUSPE Net-Zero Cambridgeshire[2] report identified that Cambridgeshire and Peterborough together produce 6.1 Mt CO_2e per year according to 2017 estimates. This number does not include emissions from the 3000 hectares of peatland located in Cambridgeshire, which are estimated to contribute up to a further 5.5 Mt CO_2e per year. The peatland emissions are subject to further scrutiny and more current data is being collected to understand the true position.

Current projections show that a "business-as-usual" attitude over the next 30 years puts Cambridgeshire on track to still emit up to 3.5 Mt CO_2e in 2050 (*excluding* peatland emissions). Further policy and funding solutions and their alignment across sectors are clearly required if Cambridgeshire is to reach net-zero by the 2050 target, as well as strong collaboration between businesses, our communities and the public sector.

In order to reach net-zero as a nation, we need some communities to become "sinks" for CO_2: a community that is a **carbon sink** is one that has invested in nature-based solutions, like afforestation, and green technologies to capture more CO_2 than it emits, therefore overall actually sequestering carbon rather than emitting it. At the same time, there is no doubt that some communities will not reach this target and therefore will be **carbon sources**, continuing to emit harmful greenhouse gases in quantities that they are not able to sequester alone. At the point this document is written, in 2020, Cambridgeshire can shape its ambition of becoming either a **sink** or a **source** of CO_2.

Cambridgeshire is uniquely poised to take this path to becoming a carbon sink. It houses almost 3000ha of peatland; a strong Agritech research capability supporting innovations in farming practices and benefits from the Great Fen and Wicken Fen projects managed by the Wildlife Trust and National Trust. Together these have the opportunity to become a major carbon sink for the county. The new Environment and Agricultural Bills will look to facilitate some of this change.

With the **Cambridgeshire Decarbonisation Fund** one aim would be to invest in peatland projects to act as a carbon sink to support Cambridgeshire becoming Net Zero as a county by 2050 and attract inward investment from other areas. Admissible projects will be chosen according to our proposed "**avoid, reduce, sequester**" approach of a mixed portfolio of projects that avoid emissions at their source, reduce emissions to a lower level, or sequester existing emissions.

Of the 6.1 Mt CO_2e produced in Cambridgeshire and Peterborough, domestic buildings account for 21% of these emissions, and the commercial services and industry account for 27%, with additional business-related emissions arising from transportation. It is only in partnership between Government, local government, businesses and communities that carbon emissions will be reduced to the levels that are needed. For Cambridgeshire this means we need to plan and invest in local, clean energy for buildings and services; retrofit homes and businesses to be more energy efficient and install low carbon heating systems; bring forward new mass transport solutions and EV charging solutions;

[1] Gov.uk - "Climate Change Act", 2008: https://www.legislation.gov.uk/ukpga/2008/27/contents
[2] CUSPE Policy Challenges Team of Researchers -"Net Zero Cambridgeshire", 2019: https://data.cambridgeshireinsight.org.uk/sites/default/files/2019%20CUSPE%20Policy%20Challenge%20-%20Net%20Zero%20Cambridgeshire.pdf

support new agricultural and land management practices to reduce carbon emissions and pollutants and support increased biodiversity. Our natural assets such as peatland and trees are some of our biggest opportunities to store carbon.

The UK government has committed to funding a greener future in several ways, with decarbonisation a key feature of the new Energy White Paper, published December 2019. At the national level, the UK government is invested in providing industrial decarbonisation funds of up to £140m to make the country's largest industrial outputs carbon neutral[3]. The National Lottery has a Climate Action Fund that is committed to providing £100m over 10 years to counties throughout the UK, for their climate efforts[4]. In 2014 the Department for Transport (DfT) invested £500,000 in providing local authorities funding for green modes of transport. Since 2018 the UK has had an established "prospering from the energy revolution fund" – administered by UK Research and Innovation (UKRI), the fund enables investment into local energy systems and research on green technologies[5]. As part of the COVID-19 recovery, the Government has also created the "Green Homes Grants" scheme, part of a £3bn plan to make all homes in the UK more energy efficient[6]. In late March of this year, the DfT published a "Decarbonising transport" paper which set the scene for how different transport partnerships could work together to create a green transport network throughout the country[7]. Following consultation on that report, the full Transport Decarbonisation Plan is anticipated in Spring 2021.

On the nature-based side, Government is equally active, bringing forward policy and legislation to deliver nature-based solutions to the climate and environment crises. The England Tree Strategy, expected during 2021, will set the pace for planting trees across England incorporating biodiversity benefit as well as carbon sequestration[8]. Similarly, the England Peatland Strategy, anticipated by the end of 2021, is expected to set out how improved peatland management can aid in carbon sequestration.

Government funding will not cover the full costs for decarbonisation; significant levels of private investment must also be leveraged into the system. The Cambridgeshire Decarbonisation Fund, funded by businesses, could be the link between communities, public sector and government financing to support wider decarbonisation, faster and deeper.

Cambridgeshire is fortunate in that it is home to a wide variety of businesses which are spread across each of its five districts, which may provide support for local projects through funding. **Figure 1** shows a map of the top 100 businesses in Cambridgeshire[9] based on their annual turnover as of 2019. Many of these businesses have publicly pledged to reduce their carbon emissions or take part in the reduction of emissions in their area. For example, in South Cambridgeshire, Excell Group provides a

[3] UKRI -"Industrial decarbonisation", 2020: https://www.ukri.org/innovation/industrial-strategy-challenge-fund/industrial-decarbonisation/
[4] The National Lottery - "Climate Action Fund | The National Lottery Community Fund", 2020: https://www.tnlcommunityfund.org.uk/funding/programmes/climate-action-fund.
[5] Gov.uk. - "Prospering from the energy revolution: full programme details", 2018: https://www.gov.uk/government/news/prospering-from-the-energy-revolution-full-programme-details
[6] Green Homes Grants – "Get up to £5,000 towards improving ...." https://greenhomesgrant.campaign.gov.uk/
[7] Gov.uk - "Creating the transport decarbonisation plan," 2020: https://www.gov.uk/government/publications/creating-the-transport-decarbonisation-plan
[8] DEFRA Consultation Hub - "England Tree Strategy", 2020: https://consult.defra.gov.uk/forestry/england-tree-strategy/
[9] "Cambridgeshire's top 100 businesses in 2019 revealed: Study ....", 12 Dec. 2019, https://www.cambridgeindependent.co.uk/business/cambridgeshire-s-top-100-businesses-in-2019-revealed-growth-continues-but-there-s-a-note-of-caution-9093264/

"Cycle to Work" scheme[10] and has funded 16 community projects at the time of writing. The Raspberry Pi Foundation in Cambridge is committed to making its business carbon neutral by 2030, by creating sustainable IT projects[11]. In Huntingdonshire, farmers at Hilton Food Group have committed to reducing their cattle greenhouse gas emissions by 2025, and, since 2016, they have made their Scope 1 and 2 emissions publicly available from 2016 in their annual report[12].

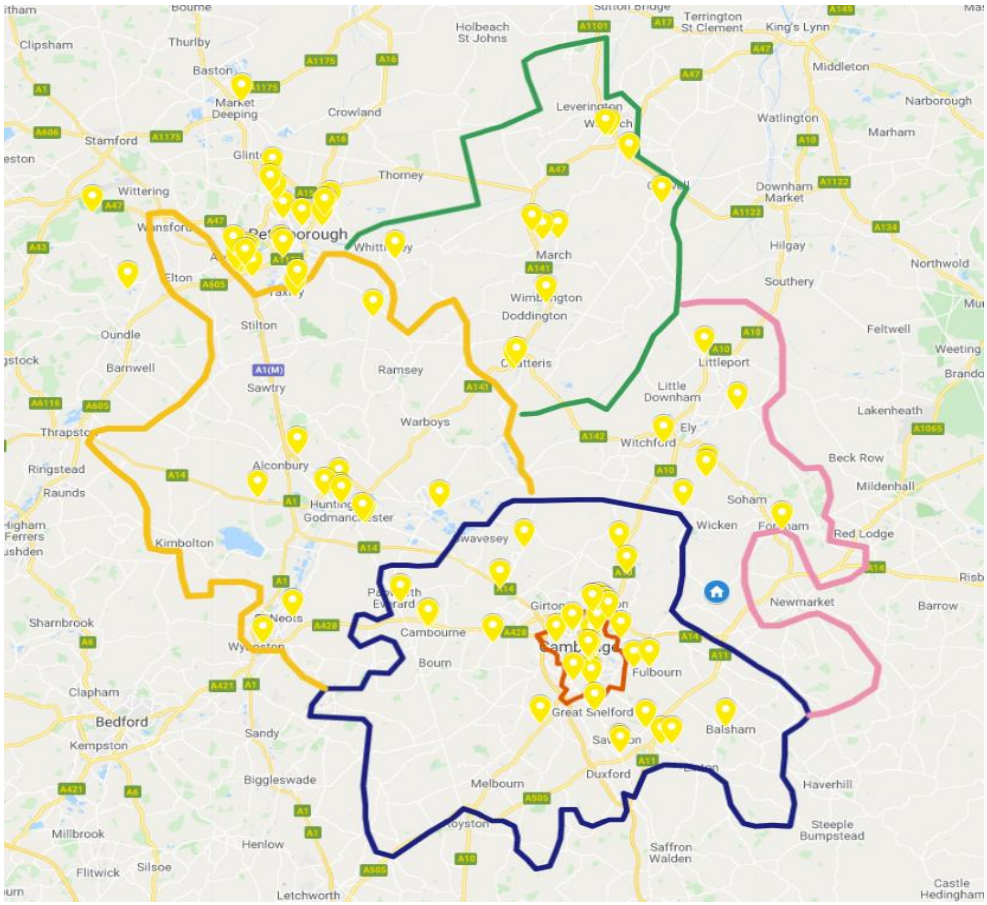

Figure 1: Map of the top 100 businesses in Cambridgeshire in 2019 based on Turnover. Districts are outlined in colour: Cambridge in red, South Cambridgeshire in blue, Huntingdonshire in orange, Fenland in green, and East Cambridgeshire in pink. The businesses are denoted by their headquarters location by yellow pins in the map. Additional businesses located in Peterborough are in the top left, and not within the district outlines.

As of April 1st, 2019, Streamlined Energy and Carbon Reporting (SECR)[13] requires that all businesses report their Scope 1 and 2 GHG emissions annually. Scope 1 emissions are "direct emissions from controlled or owned sources", including the combustion of fuel and facility operation. Scope 2 emissions are "indirect energy emissions from generation of purchased energy"[9]. With this data now being more publicly accessible than ever before, we can better understand how high individual

[10] "Social Value | Excell Group: Cloud Communications.", 2020: https://www.excellgroup.com/about-excell-group/social-value/.
[11] "University of Cambridge delivers business continuity with ....", 2020: https://www.publictechnology.net/articles/partner_article/citrix/university-cambridge-delivers-business-continuity-sustainable-it.
[12] Hilton Food Group plc. - "2016 HFG plc Annual Report ", 2016 : http://www.hiltonfoodgroupplc.com/2016/doc_download/151-2016-hfg-plc-annual-report.

13 GOV.UK - "Streamlined Energy and Carbon Reporting (SECR)", 2020: https://www.gov.uk/government/publications/academy-trust-financial-management-good-practice-guides/streamlined-energy-and-carbon-reporting.

medium and large businesses' emissions are throughout Cambridgeshire and identify which businesses will need to cut back on emissions more heavily.

CUSPE researchers in 2019 identified a CO_2e baseline for Cambridgeshire and Peterborough and the range of measures that would be needed to deliver net-zero carbon emissions by 2050. The report suggested that all existing buildings, both homes and commercial, would need low carbon heating solutions (e.g., heat pumps) and transport emissions would need to be reduced through mass transport solutions, more walking and cycling and electric vehicle (EV) charging to support electric vehicle uptake. There are many Cambridgeshire businesses that have set or are setting carbon neutral targets. Supporting businesses to decarbonise will be as important as the role of businesses to support the communities in which they operate and where staff live. On this basis, the question this research is looking to answer is:

"How can Cambridgeshire businesses that have set, or are interested in setting, carbon neutral and carbon negative targets invest to reduce carbon emissions and also reduce fuel poverty both for oil dependent communities and the wider public?"

For Cambridgeshire to strive towards becoming a **carbon sink**, by 2050, all businesses, communities and the public sector will need to work together. Businesses based in Cambridgeshire, whether a local or global business by nature, emit carbon emissions locally through their buildings, transport and products. The aim of this research is to offer businesses that emit emissions locally to consider investing in local carbon reduction schemes in existing housing or transport and nature-based solutions to prevent or sequester carbon emissions in Cambridgeshire rather than going elsewhere. The idea of a local carbon credit scheme is being explored as part of this research which supports businesses to deliver their carbon targets, reduces Cambridgeshire's overall emissions and brings other health and environmental "co-benefits" to people and nature through improvements such as air quality and local wellbeing. Businesses benefit from not only the carbon-credits in this scheme, but also from the longer-term societal benefits, and ultimately by making Cambridgeshire a desirable community in which their employees enjoy living.

A Cambridgeshire carbon credit, for the purposes of this report, is a non-tradable certificate through the voluntary market bought at a price that allows for offsetting 1 tCO_2e. The voluntary market offers carbon offsetting to businesses which are not legally obliged to fulfil an e.g., national emissions reduction goal but are offsetting their generated emissions voluntarily. Carbon credits are produced through decarbonisation projects (e.g., Swaffham Prior Community Heat Network) and purchased by Cambridgeshire businesses as a sign of their commitment to reducing carbon emissions in Cambridgeshire. By creating a system through which businesses, communities, and Cambridgeshire (and Peterborough) Local Authorities can work together to reduce emissions, this will ultimately support cohesion throughout the community and accelerate the pace at which Cambridgeshire is able to become carbon neutral.

2.1 Cost of Decarbonisation

In this section, we forecast the cost of delivering Cambridgeshire and Peterborough to net zero by 2050, and the projected cost on the local economy if nothing is done to reduce carbon emissions.

The 2019 CUPSE report[2] found that Cambridgeshire and Peterborough currently produce 6.1 Mt CO_2e per year, excluding estimates of up to 5.5 Mt CO_2e for peatland emissions. In June 2020, following the UK's departure from the EU Emissions Trading Scheme – in which carbon prices were established - the UK Government published its decision on the future of UK carbon pricing. This confirms that a **UK Emissions Trading Scheme** will be established, with phase 1 running from January 2021 to 2030 for traded emissions e.g., electricity. The intention is for the UK scheme to be complementary to the previous EU Scheme but with more stringent targets and pricing intended to accelerate the UK towards net-zero.[14]

The Department for Business, Energy and Industrial Strategy (BEIS) publish forecasts of carbon values from emissions in the traded and **non-traded** sectors. Based on the marginal abatement cost (MAC) required to meet UK emissions reduction targets. Forecast carbon values increase over time, reflecting that the costs of measures required to meet the 2050 net zero target will be higher if left to a later date – since those emissions that are easier (and less costly) to abate are generally reduced first.

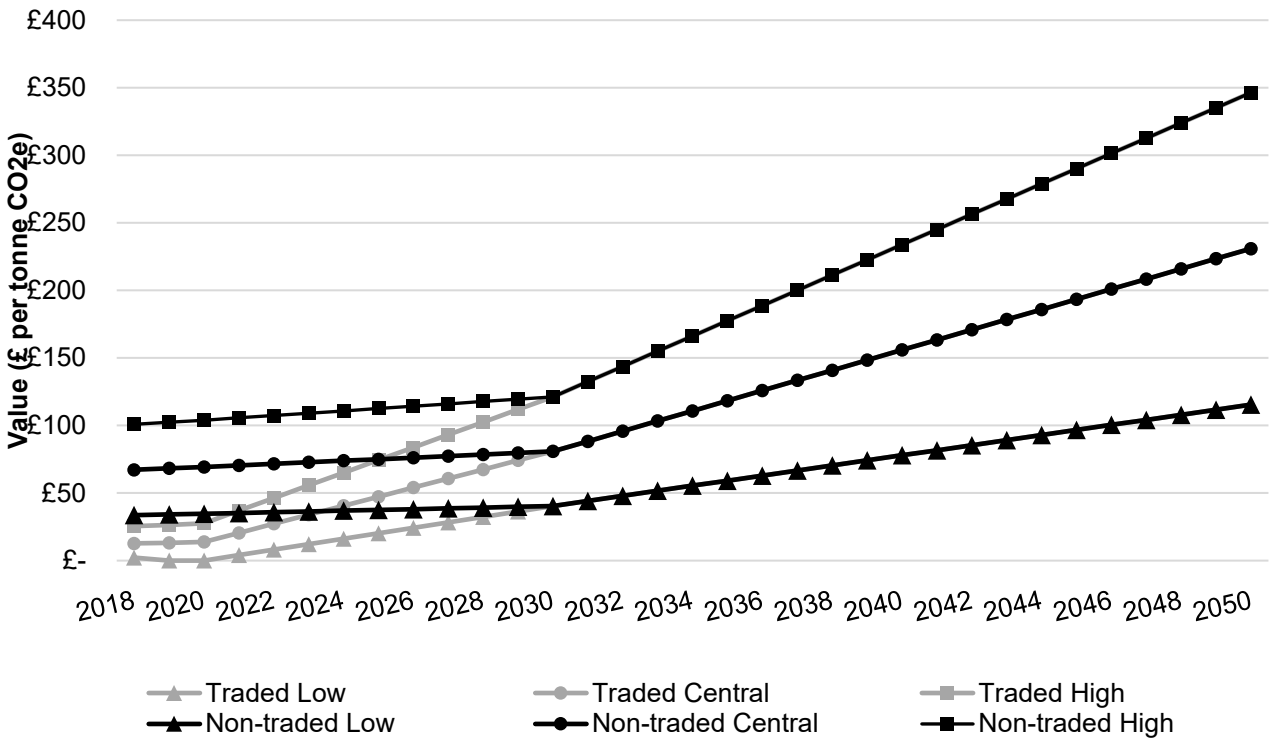

Figure 2: Carbon prices and sensitivities 2018-2050, 2018 £/tCO_2e, forecast for the traded and non-traded sectors to 2050. Values shown are for the three modelled price scenarios: high, central and low, for the traded and non-traded sectors.

This figure can be broken down into their respective sectors, as shown in Table 1: Breakdown carbon emissions and decarbonisation costs **Table 1**.

[14] HM GOV - "Powering our Net Zero Future", 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf. Accessed on 04/01/2021

Table 1: Breakdown carbon emissions and decarbonisation costs

Sector	Proportion of emissions arising from each sector [2]	Cambridgeshire and Peterborough based on case studies Decarbonisation cost per year (2020) £117/tCO_2e	Estimated carbon total carbon costs for each sector, based upon the central traded/non-traded carbon costs by 2030 using £81 per tonne
Peatland emissions	47%	£643 million	£445 million
Transport	21%	£278 million	£193 million
Commercial Services and Industry	14%	£193 million	£165 million
Domestic homes	11%	£150 million	£104million
Agriculture	4%	£50 million	£43million
Waste management	1%	£14 million	£12 million
Other	2%	£28 million	£24 million

Although an approximation, it is helpful to calculate an order of magnitude figure to plan future investment. By applying the average carbon price (£117/tCO_2/year) calculated in our case studies (see **Project Portfolio Approach**), a total of up to £1435 million per year (£792 excluding peatland emissions) is required to decarbonise Cambridgeshire and Peterborough at the time of writing this report. Applying central traded/non-traded carbon costs of £81/tCO_2, the decarbonisation cost would still amount to £1036 million per year (£591 excluding peatland emissions).

From this initial pricing of the cost of decarbonisation, we can conclude that, given the scale of investment required, it will not be enough to decarbonise Cambridgeshire through only government grants, external carbon credit schemes, or measures in place already. To fund the types of local projects necessary to decarbonise the county, we will require an additional scheme to be implemented as we describe in this report. Indeed, other Local Authorities, including the City of London and Milton Keynes, have devised their own local solutions, and we propose herein a unique solution suited to Cambridgeshire: the **Cambridgeshire Decarbonisation Fund**.

Financially speaking, early decarbonisation is key. As GHGs accumulate in the atmosphere their detrimental effects grow. Concurrently, social costs increase and cheaper abatement opportunities, especially sequestration, decrease. These will vastly outpace anticipated cost reductions of implementing green technologies to reduce emissions. This concept is described in detail Chapter 13 in the Stern Review[15]. Early decarbonisation is therefore essential to mitigate the impact of climate change in Cambridgeshire at least cost to its communities.

2.2 A Global Snapshot

Carbon pricing is increasingly acknowledged as a key methodology to cost-efficiently enable the transition to a low carbon future. The voluntary carbon offsetting market offers opportunities for individuals and businesses to offset some of their emissions through certain projects voluntarily, often allowing for greater regionality and variance than on the compliance market because of a slightly lower competitive pressure.

[15] Nicholas H. Stern et al. ”Stern Review: The economics of climate change.“ Vol. 30. Cambridge: Cambridge University Press, 2006.

One overarching scheme, which has 1800 carbon-offset projects in 80 countries across the world and defines a lot of the standards for the voluntary carbon market is The Gold Standard[16]. This standard is recognised by the Kyoto Protocol and supported by various countries across the world for voluntary offsetting through a broad range of verified interventions. These interventions include forestry, wind farms, biogas installations, and other carbon capture or carbon reduction measures. Investing in these projects costs between \$10-20/tCO_2. The pricing is based upon several factors including the Fairtrade price per project (discussed in the section on **Project Pricing**), social cost of carbon, and ultimately supply and demand for carbon credits[17].

Globally, the price of carbon credits ranges from £1-95[18]. The price of carbon credits can have a major impact on the financial viability of decarbonisation projects, the willingness of businesses to invest in these projects, and the overall total reduction in emissions. It is critical to price carbon credits appropriately to achieve buy-in from Cambridgeshire businesses, recoup costs associated with the decarbonisation projects, and bring rise to meaningful carbon reductions in Cambridgeshire.

2.2.1 Europe

Throughout Europe, the importance of including local and regional authorities (LRAs) for achieving national climate goals and addressing climate change is widely acknowledged. Most of the recommendations of the European Commission for national energy and climate plans rely on support from LRAs due to the strong local and regional dimension of the individual interventions[19] implemented. Recommendations include the need to improve energy efficiency; increase the share of renewable energy; enable the existence of local energy communities; tackle energy poverty; and ensure a just transition to a low-carbon economy.

Funding for these local initiatives cannot be provided by LRAs alone, so partnership with businesses that are looking to offset their emissions has been sought in many different formats. It has been found that nationally oriented, locally based businesses, preferred investing in carbon offsetting projects in the country where they are operating, while international companies preferred projects located in the countries, they work with[20]. Domestic carbon offsetting has the potential to be a crucial component in national climate strategies[21] additional to and alongside the EU-ETS (and the forthcoming UK-ETS) as most of the projects excluded from the EU-ETS are of the size and scale that is feasible on a local community level (see the section on **Project Tiers** for admissible projects).

One example of a carbon credit scheme on the voluntary market offering domestic offsetting within Europe is “Climate Austria”[22]. Climate Austria provides a framework for individuals or businesses to

[16] "The Gold Standard." 2020: https://www.goldstandard.org/.
[17] "CARBON PRICING: What is a carbon credit worth? | The Gold ....", 2020: https://www.goldstandard.org/blog-item/carbon-pricing-what-carbon-credit-worth.
[18] "The Future of Carbon Pricing in the UK - Committee on .Climate Change”, 2020: https://www.theccc.org.uk/wp-content/uploads/2019/08/Vivid-Economics-The-Future-of-Carbon-Pricing-in-the-UK.pdf
[19] Commission for the Environment, Climate Change and Energy, European Committee for the Regions - “The role of local and regional authorities in National Energy and Climate Plans taking into account the recommendations by the European Commission”, 2020: 2020https://cor.europa.eu/en/engage/studies/Documents/CoR%20LRAs%20in%20NECPs.pdf
[20] Joanneum Research - “Status quo des freiwilligen Emissionshandelsmarktes in Österreich”, 2020: https://www.ifz.at/sites/default/files/2019-12/Status%20quo%20des%20freiwilligen%20Emissionshandelsmarktes%20in%20Oesterreich.pdf
[21] Adelphi - “Documentation of the Workshop: Domestic Carbon Initiatives in Europe, Experiences and Opportunities”, 2020: https://www.adelphi.de/en/system/files/mediathek/bilder/Domestic%20Carbon%20Initiatives%20in%20Europe-Experiences%20and%20Opportunities_Workshop%20Documentation.pdf
[22] Climate Austria Homepage 2020: https://www.climateaustria.at/eng.html

offset emissions at a price of 25€ (c.£23)/tCO_2 by funding Austrian projects in the fields of e-mobility and efficient logistics, residential energy efficiency improvement and local renewable energy supply. The scheme is run by a public consulting company in close collaboration with national offices (Federal Ministry for Climate Action and Federal Ministry of Agriculture, Regions and Tourism), independent verification of the pricing method is provided by an external assessor (Lloyd's Register).

Within the UK, several local authorities have implemented carbon offset schemes for new developments, namely Ashford, Islington, Milton-Keynes, Tower Hamlets and Southampton[23]. In these areas, under an S106 agreements, new developers must offset emissions for new major developments[24] (except for Islington, where minor developments are also included) via mandatory payment into a fund, usually on commencement of the development. The price of carbon varies strongly from £200/t in Milton Keynes to up to £1800/t in Tower Hamlets. Individual funds are then used for domestic, mostly residential emission reduction projects (improved energy efficiency through refitting appliances or insulation, investments into small-scale renewables), focussing on existing building stock. There is no unanimous approach to the carbon pricing strategy of funded projects. Only Milton Keynes implemented an upper limit for the cost of carbon saving measures, which must be delivered at a lower carbon price than £176.50, which represents the initial offsetting price (£200/t) minus management costs. This maximum was based upon developers having to pay a fee of £200/t into the carbon offset fund for each tonne of carbon that their project would emit over a 20-year timescale. Eventually this limit had to be lifted, as the price of carbon offset projects rose above the £200/t maximum, and the developer fee also rose equivalently.

2.2.2 Africa

There have been rapid developments in Southern and Eastern African countries such as South Africa, Kenya, Ethiopia. Most of the projects are voluntary schemes registered under the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS), Gold Standard (GS) and Climate, Community and Biodiversity Standard (CCBS).

South Africa is the epicentre of many carbon offsetting projects in Africa. Although not part of Annex 1 countries (industrialized countries) and under no obligation to reduce its carbon emissions, South Africa ratified the Kyoto Protocol and vowed to reduce its GHG emissions below its business as usual by 34% in 2020 and 42% in 2025[25]. South Africa has a unique carbon pricing system which combines a mandatory carbon emission reporting regime for businesses forming the basis of a carbon tax and carbon offsets. Companies are liable to pay taxes on any additional carbon emissions after they have used up their specified emissions threshold. The implications of the carbon tax have been carefully and rigorously reviewed since 2010 and recently a carbon tax act was signed with effect in June 2019[26]. Furthermore, a relief mechanism was put in place to aid in fully transitioning to a low carbon economy such that 5-10 % of the taxable emissions can be offset through carbon projects at a price

[23] NEF - "Review of Carbon Offsetting Approaches in London", 2020: https://www.london.gov.uk/sites/default/files/gla_cof_approaches_study_final_report_july_2016.pdf
[24] The definitions of major development vary between councils. Usually this includes all development with 5 (10 in London, Southampton and Ashford Growth area) or more dwellings, more than 500 sq m of floorspace or building on a site larger than 0.5 hectares. In London, Southampton and the Ashford Growth area the thresholds are increased to 10 dwellings and to 1000 sq m floor space.
[25] National Treasury - "Carbon Offsets Paper of the National Treasury of the Republic of South Africa", 2014: https://www.gov.za/sites/default/files/gcis_document/201409/2014042901-carbon-offsets-paper.pdf
[26] South African Government - "Carbon Tax Act 15 of 2019", 2019: https://www.gov.za/documents/carbon-tax-act-15-2019-english-afrikaans-23-may-2019-0000

lower than the carbon tax rate of ZAR 120/t ($17/t) of CO2/e[27]. These carbon offset projects are primarily in the renewable energy, energy efficiency, waste management and forestry sectors. South Africa also has well documented administration of the carbon offsetting schemes, accreditation, verification, independent auditing system and offset registry which is accessible to the general public.

Other countries like Kenya[28], Uganda[29], Ethiopia, Tanzania and Zimbabwe have continued to put in efforts to reduce their carbon emissions through voluntary carbon offset schemes mostly channelled at energy efficient infrastructure and tree-planting tailored to the context of the needs of developing countries[30]. However, a number of the projects in Africa are still being funded by the World Bank[31] and carbon offsetting organizations in developed countries[32].

2.2.3 North America

In the Americas, Canada and the United States of America (USA) there are well-established carbon offset schemes, albeit enforced only in the province of Quebec, and ten states respectively.

The Quebec Carbon Offset Credit Scheme is a voluntary scheme for individuals or organisations wishing to reduce or sequester GHG emissions. The scheme focuses on sectors of activity or sources other than those subject to compliance obligations in the province of Quebec. The scheme is established under existing legislation[33] and carbon reduction targets in the province[34] as an additional pathway for businesses to increase their impact whilst complying with established carbon emissions regulations. It is not necessarily a regulatory compliance measure and so that has been an incentive for businesses to want to use the scheme to maximise their emissions reduction strategies. Projects admissible under this scheme are for methane destruction[35] or reduction and the destruction of ozone depleting substances. Projects admissible under this scheme are required to help meet the objectives under any or a combination of the categories. These, however, do not include (re/af)forestation, transport fuel changes, and organic/biomethane project options. The eligibility to apply for the scheme and steps leading to the issuance of offset credit is underpinned by clearly established regulations. The scheme operates on a straightforward 4-stage project registration, implementation and monitoring, verification and issuance, and project renewal (if applicable) processes. This makes the operation of the scheme a relatively simple one.

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[27] National Treasury - ”Carbon Offsets Paper of the National Treasury of the Republic of South Africa,“ 2014:
[28] Carbon Footprint - ”Kenya Reforestation: sequestering carbon, providing wildlife habitats and helping a local community“ n.d.: https://www.carbonfootprint.com/plantingtreesinkenya.html
[29] Uganda Carbon Bureau - ”Carbon offsetting – going neutral.“ n.d.: https://www.ugandacarbon.org/services/going-neutral
[30] Climate Neutral group – “Offset Projects”, 2020: https://climateneutralgroup.co.za/offset-projects/
[31] The World Bank - ”Expanding Kenya’s Renewable Energy Capacity“, 2015: https://www.worldbank.org/en/results/2015/08/18/expanding-kenya-renewable-energy-capacity
[32] United Nations - ”United Nations Carbon Offset Platform,“ (n.d.): https://offset.climateneutralnow.org/allprojects?specs=260
[33] Légis Québec - ”Regulation respecting a cap-and-trade system for greenhouse gas emission allowances“, 2020: http://legisquebec.gouv.qc.ca/en/showdoc/cr/Q-2,%20r.%2046.1?langCont=en#ga:l_iii-gb:l_iv-h1
[34] Ministry of Environment - ”Québec in action against climate change“, 2015: http://www.environnement.gouv.qc.ca/changements/carbone/reportage-ng2015.pdf
[35] Methane destruction is the combustion or flaring of methane gas

The Regional Greenhouse Gas Initiative (RGGI), a multi-state CO_2 cap-and-trade framework[36], and the California Cap-and-Trade scheme[37] are the most widely applied in the USA[38]. A cap-and-trade scheme is a system for controlling carbon emissions and other forms of atmospheric pollution by which an upper limit is set on the amount a given business or other organization may produce but which allows further capacity to be bought from other organizations that have not used their full allowance. The RGGI is applied in the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont. The framework operates on an emissions-allowance based system which permits power plants in participating states to obtain an allowance for each ton[39] of CO_2 emitted annually. Under the RGGI, allowances are auctioned, rather than allocated freely. The scheme is limited to businesses running fossil fuel-fed power plants with capacities of 25MW or more. Such businesses in the nine states may comply by purchasing allowances at quarterly auctions or purchasing allowances from other generators within the region that have excess allowances or supporting offset projects.

The California Cap-and-Trade scheme applies to businesses with CO_2 emissions at 25,000 tons/year or more, operating in the following sectors only in the state of California: Electricity generation (including imports), industrial sources of energy, and distributors of petroleum and natural gas. Under this scheme, emissions allowances purchases are permitted, with specific limitations on borrowing from those with emissions 'credits'. In terms of projects permissible under this scheme, protocols currently exist for: forestry (including urban forestry), dairy digesters, ozone depleting substances projects, mine methane capture, and rice cultivation. The operation of the scheme is relatively complex, requiring application and approval involving multiple regulators.

In Latin America, Mexico is the only country making notable efforts to develop a carbon-related scheme[40, 41]. This is in the form of a pricing tool under a cap-and-trade framework that follows after that of the state of California in the US. Still under development, it aims to allow for carbon credits trading[42].

2.2.4 Australasia

In Asia, the largest carbon offsetting projects run to counterbalance emissions from overseas by international charities, large businesses and governments. Examples of projects can be found on the

[36] The Regional Greenhouse Gas Initiative - "The Regional Greenhouse Gas Initiative – Elements of RGGI." n.d.: https://www.rggi.org/program-overview-and-design/elements
[37] Centre for Climate and Energy Solutions - "California Cap and Trade", 2019: https://www.c2es.org/content/california-cap-and-trade/
[38] White & Case LLP - "United States: Greenhouse gas emissions trading schemes", 2017: https://www.lexology.com/library/detail.aspx?g=0f6bf054-27dd-4cc0-b856-107b1ad0854e
[39] Note here that this refers to a US ton, or 2000 lbs as these schemes are US based
[40] Ecosystem Marketplace - "Latin America", 2015: https://www.ecosystemmarketplace.com/marketwatch/carbon/latin-america/
[41] Business News Americas - "Carbon credit opportunities and perspectives in Latin America", 2005: https://wikileaks.org/gifiles/attach/176/176960_carbon%20credits%20opps.pdf
[42] Diàlogo Chino - "Mexico launches its updated carbon market", 2018: https://dialogochino.net/en/climate-energy/10471-mexico-launches-its-updated-carbon-market/

Gold Standard website[43]. These include the Wind Energy Project in Gujarat, India[44] and the Changbin and Taichung Wind Power Project in Taiwan[45]. However, there are some interesting examples of local authorities taking ownership of their own emissions.

In Japan, cities and prefectures[46] are joining forces with energy providers and local businesses to invest and provide green energy to locals[47]. The most successful of these is the Yamanashi Power Alliance created by Yamanashi Prefecture and Tokyo Electric Power Co. Together they supply power generated by a prefectural hydroelectric and solar power plant to companies at an inexpensive price, preferentially selecting companies that match its renewable energy goals. The Alliance is also investing in the development of more efficient energy storage systems.[48]

In China, a number of cities have come up with their own schemes to deal with pollution. In Shenzhen, the local government has created a special development tax to ensure public transportation receives enough funding and space in a rapidly growing city[49]. Several cities are also building constructed wetlands to deal with their wastewater in an energy and cost-effective way[50]. The wetlands also boost biodiversity and provide a recreational area for locals.

In Australia, Sydney, Melbourne, Moreland and Yara have been certified Carbon Neutral Cities[51] through various schemes such as Melbourne's '1200 Building' retrofitting program[52].

2.2.5 Global Ideas to Apply in Cambridgeshire

Each of the different carbon-offset schemes across the globe contains several commonalities which the proposed Cambridgeshire Decarbonisation Fund needs to consider. These include transparency, verification, and local authority approval. Many of the projects in Asia have been accredited by the Gold Standard (GS) scheme, and it will be important to ensure that Cambridgeshire projects have a clear methodology to demonstrate carbon reduction which is accepted by businesses locally and consider whether a project looks for external accreditation The GS projects have defined timescales (e.g. 20 years for domestic homes in Milton Keynes), clear terms of the agreement as defined by the local organization, and transparent pricing.

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[43] Gold Standard - "Impact registry for certified projects", 2020: https://registry.goldstandard.org/projects?q=&page=1&is_certified_project=true

[44] Gold Standard - "Wind Energy Project in Gujarat India", 2020: https://www.goldstandard.org/projects/wind-energy-project-gujarat-india

[45] Gold Standard - "Changbin and Taichung Wind Power, Taiwan", 2020: https://www.goldstandard.org/projects/changbin-and-taichung-wind-power-taiwan

[46] A prefecture is the first level of jurisdiction and administrative division in Japan. They are headed by a directly elected governor.

[47] Japan for Sustainability - "Local Governments in Japan are Entering Power Retail Business as Country Shifts to Locally Produced Renewable Energy", 2016: https://www.jlgc.org.uk/en/news_letter/local-governments-in-japan-are-entering-power-retail-business-as-country-shifts-to-locally-produced-renewable-energy/

[48] The Japan Times - "Yamanashi vies for energy storage investment", 2016: https://www.japantimes.co.jp/news/2016/12/26/business/yamanashi-vies-energy-storage- investment/

[49] Guido di Pasquale *et al.* "Innovative public transport in Europe, Asia and Latin America: a survey of recent implementations", *Transport Research Proceedings 14*. 2016: https://doi.org/10.1016/j.trpro.2016.05.276

[50] Dongqing Zhang *et al.* - "Constructed Wetlands in China. Ecological Engineering", 2009: https://doi.org/10.1016/j.ecoleng.2009.07.007

[51] C40 - "Melbourne certified as Carbon Neutral C40 Blog", 2013: https://www.c40.org/blog_posts/melbourne-certified-as-carbon-neutral-city

[52] City of Melbourne - "1200 Buildings", n.d.: https://www.melbourne.vic.gov.au/business/sustainable-business/1200-buildings/Pages/1200-buildings.aspx

The GS scheme offers guidance on verifying and validating projects. Should an external validation process be a prerequisite for businesses, the Cambridgeshire Decarbonisation Fund could consider an independent third party (Validator/Validation Team[53]) that could assess:

- that the project design of a clean development mechanism project fulfils the requirements set out by the Fund
- whether the project has been implemented as planned
- that the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described
- that the project provides benefits in Cambridgeshire in accordance with its project design

Finally, as in “Climate Austria” the aim is for local projects to not only reduce carbon emissions at the local level, but also identify the other co-benefits for communities which will in turn bring greater local community support for projects. In Austria especially, the projects included in this scheme were of the scale that would not be viable for the EU-ETS scheme but would be locally oriented and therefore feasible. This locality is especially important to the Cambridgeshire Decarbonisation Fund. In the details of the fund outlined in the next section, we have attempted to address each of these requirements in detail.

[53] More suitable to reduce risks of collusion or corrupt practices for validation of CDM projects

3 Proposed Cambridgeshire Decarbonisation Fund Framework

3.1 Benefits of the Cambridgeshire Decarbonisation Fund

The Cambridgeshire Decarbonisation Fund ("The Fund") represents a new approach to a 'green new deal' that will set Cambridgeshire on the path of raising locally generated investment from its businesses to tackle decarbonisation in a win-win approach.

We have identified three parties in Cambridgeshire which will benefit from the establishment of The Fund: businesses, communities, and benefits to nature and biodiversity.

Firstly, businesses that invest into The Fund benefit through being able to offset a portion of their own carbon emissions through a carbon credit scheme, which will put them one step closer to achieving their own carbon neutral pledges and support the community to achieve their emissions reductions quicker than they might otherwise.

Additional benefits are realised through the fact that this fund will invest into local projects that directly benefit local communities. For example, by reducing fuel poverty through energy efficiency retrofits; or improving air quality by investing in renewables for oil dependent communities; or by improving access to nature by investing in carbon sequestration or tree planting. This is also a direct benefit for the businesses' employees. Current and prospective employees will be able to see that the business that they work in is investing directly into their local area, thereby providing social responsibility at a direct level. Given that the projects offered by this fund are on a local level, businesses and employees will see a tangible contribution to their community.

Secondly, Cambridgeshire will benefit as projects are rolled out to reduce carbon emissions across the county thus helping to achieve the county council's target of net zero emissions by 2050. The Fund will offer carbon credit benefits to businesses and generate a small return to fund development costs for future projects i.e., reforestation and cycle ways.

Finally, local communities will benefit as their county becomes greener. For residents currently dependent on oil, projects such as the Swaffham Prior Community Heat Network (discussed further in **Case Study: Swaffham Prior Community Heat Project**), will reduce the impacts of fuel poverty and retain the health benefits of a warm home with less air pollution. Improving air quality by reducing sources of air pollutants is anticipated to reduce hospital trips for air pollution-related pathologies. Installing renewable heating projects will improve community and alleviate burden and cost on the NHS.

As the decarbonisation fund is aiming to establish a "green new deal" between communities and businesses, the projects should be **brought forward by Cambridgeshire communities** (Think Communities approach), in close collaboration with Local Authorities and existing organisations working in this field (e.g., Cambridge Zero, nature conservation organisations etc.).

3.2 Project Pricing

The proposed Cambridgeshire Decarbonisation Fund is an investment opportunity for businesses. For a business investing in the fund their return on investment is carbon reduction certificates/credits and demonstrable local benefits to staff living and working locally The model proposed serves as the basis for the Cambridgeshire Decarbonisation Fun, which, while aimed at local business, may also attract investment from outside Cambridgeshire too, as the ambition is to create Cambridgeshire as a 'positive sink' rather than paying others for carbon abatement as it is a 'source' of carbon emissions.

A Fairtrade pricing model is proposed (see **Case Study: Swaffham Prior Community Heat Project** below for approach comparison). This model is based on the cost of implementing and managing a pipeline of carbon projects across a range of sectors, combined with a margin that covers the management and governance of the fund and supports seed funding for project development. This business margin secures the viability of the fund over the longer term.

The Fairtrade model, also used in part by the Gold Standard Scheme, is considered to be a "fair trade" as it ensures that the total cost of a project will be covered by the carbon offset pricing, and that businesses or investors are receiving a fair price for their investment. This approach facilitates a variety of projects to be developed across sectors where some sectors cost more and some less for carbon abatement so allows the more difficult projects to proceed which might bring bigger societal benefits such as tackling fuel poverty alongside the readily deliverable projects such as tree planting. To calculate the overall price of one tonne of CO_2 the initial project costs, running costs, and business margin are factored in.

Adopting the Fairtrade pricing model is helpful in making businesses see themselves as partners with the communities within which they operate in the collective fight against climate change. Adapting the widely used Fairtrade pricing model to be used locally in our Cambridgeshire projects means that investors can obtain a better quality of carbon offset credits and co-benefits than going elsewhere: rather than placing their investment into projects which have little relevance to their employees, businesses in Cambridgeshire are provided the opportunity to engage in meaningful work for their employees in this community.

The successful implementation of this model is contingent on a clear operational framework that has transparent and representative governance and administration, robust methodologies for verification agreed by the Fund and the business investors and is well-aligned with the national legal/regulatory framework related to decarbonisation and local ambitions of Cambridgeshire. To demonstrate the pricing frameworks explored, the real-world example of the Swaffham Prior Community Heat Project has been used.

3.2.1 Case Study: Swaffham Prior Community Heat Project

Swaffham Prior is a village in Cambridgeshire currently dependent on oil and is the focus of a heat project designed to remove oil as the fuel source. In 2018, the Swaffham Prior Community Land Trust approached Cambridgeshire County Council to collaborate on a renewable energy project using County Council owned land in Swaffham Prior to build an energy centre. The project will use boreholes in a ground source heat pump and air source heat pumps to use residual heat from the environment to provide heat to homes in the village, thus reducing carbon emissions for hot water and heat. The important point about this project is that the community has no gas infrastructure, has low density

housing as it's a rural village. In general, rural villages have high proportions of older homes which are more expensive to successfully retrofit with individual air source heat pumps unless significant levels of energy efficiency measures are invested.

a. Fair Trade Pricing

A new business model is being developed for Swaffham Prior that looks to offer the carbon emission reductions from the scheme into the Fund to attract investment into the project. The project is keen to offer all homes the opportunity to connect to the heat project at no upfront cost. This will provide the strategic benefit of a faster route to decarbonisation for the village and for Cambridgeshire carbon emissions. To offer this opportunity to everyone, the business case for the project is dependent on the ability for it to sell the carbon reductions generated by the project. With this goal in mind, the Fairtrade carbon pricing model[54] has been used as a framework, as it guarantees income into the business model. It is clear that in order to fund carbon neutral projects and deliver the changes at the pace required to meet national objectives and offers equity to local people. The challenge with current government incentives is that the homeowner needs to make substantial upfront capital investment into their property to access grants/incentives and this is not a route open to many households especially those on lower incomes. This type of scheme will make a difference. A Carbon Fund can provide climate equity and improve the speed of carbon reductions – two very important value adds needed right now.

The Fairtrade carbon pricing model, shown in **Equation 1,** subtracts the project revenues from the total project costs which include investment, carbon cost and business margin. The cost of 1 tonne of CO_2 saved is calculated by dividing the net cost of the project by the number of tonnes of CO_2 saved by the project.

Equation 1: The Fairtrade Pricing Model

$$Fairtrade\ pricing\ = \frac{(investment\ cost + project\ cost + carbon\ cost + business\ margin) - revenues}{Number\ of\ credits}$$

By using the Fairtrade pricing model as a framework, we have devised a potential Cambridgeshire pricing strategy, the Cambridgeshire Pricing Model, shown in Equation 2, which sums project costs, ongoing costs along with a business margin before calculating the price of each carbon credit per tonne of CO_2 saved.

Equation 2: Proposed Cambridgeshire Pricing Model

$$Cambridgeshire\ Pricing\ Model\ = \frac{(project\ costs\ +\ ongoing\ costs\ +\ business\ margin)}{Number\ of\ credits}$$

Inflation will be accounted for by linking this model to an index such as Retail Price Index (RPI). Calculations have been conducted (**Table 2**) excluding potential revenues as these are currently unknown. Furthermore, there will be indirect revenues such as improved air quality reducing cases of both cardiovascular and respiratory diseases which will provide benefit to the NHS which will be monitored and monetised to demonstrate additionality.

[54] Fairtrade International - "Fairtrade carbon credits price methodology", 2015: https://files.fairtrade.net/standards/FCC_price_methodology.pdf

Table 2: Fairtrade pricing model applied to the Swaffham Prior projected carbon costing data over 25, 30, and 40 years. Carbon credits are calculated both with and without ongoing costs, and with and without a 10% business margin added. Total project costs are c.£ 5.2m

Duration	Scenario	Carbon dioxide saved (tonnes)	Ongoing costs (£)	Price/CC/yr - *ongoing costs*	Price/CC/yr + *ongoing costs*	Price/CC/yr - *Ongoing costs* + 10% business margin	Price/CC/yr + *Ongoing costs* + 10% business margin
25 years	Worst	20,845	1,239,500	£249	£309	£274	£340
25 years	Expected	26,769	1,437,500	£194	£248	£214	£273
25 years	Best	36,679	1,552,340	£142	£184	£156	£203
30 years	Worst	25,815	1,495,320	£201	£259	£222	£285
30 years	Expected	33,158	1,732,920	£157	£209	£173	£230
30 years	Best	45,185	1,867,560	£115	£156	£127	£172
40 years	Worst	35,804	2,006,960	£145	£201	£160	£221
40 years	Expected	46,005	2,323,760	£113	£164	£124	£180
40 years	Best	62,281	2,498,000	£83	£124	£92	£136

b. BEIS Pricing

The 2008 EU Legislation on Climate Change determined the EU's climate change package which divided carbon pricing into "traded" and "non-traded" sectors, and set a predicted price for these two types of carbon up to 2050[55]. The traded carbon pricing applies to any carbon emissions which are covered by the EU Emissions Trading System (power and heat generation, commercial aviation, and energy-intensive industry), and non-traded pricing applies to those which are not covered under this system. By 2030, these two prices are predicted to have converged as a result of the establishment of a global carbon market. approach. The High, Low, and Central scenarios are based on a 2012 marketing valuation on EU Allowance futures contracts and different states of the carbon market[56].

Although the implementation of a UK ETS scheme has been announced[57], as a response to UK withdrawal from the EU, we will – due to the time of writing being early January 2021 - operate under the assumption that the UK government will impose carbon pricing at or higher than the current EU predicted prices. With the knowledge that a UK based trading scheme may appear in the next 2-5 years, it could be wise to set the carbon pricing in this Cambridgeshire scheme at a target level which mirrors the likely UK predicted prices. This means that should a trading scheme be put in place

[55] Department for Business, Energy & Industrial Strategy - "Valuation of energy use and greenhouse gas: Supplementary guidance to the HM Treasury Green Book on Appraisal and Evaluation in Central Government", 2018: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794737/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal-2018.pdf. Accessed 15 Jul 2020.
[56] Department of Energy & Climate Change - "Updated short-term traded carbon values used for UK, public policy appraisal", 2012: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/245385/6667-update-short-term-traded-carbon-values-for-uk-publ.pdf.
[57] Department for Business, Energy & Industrial Strategy - "New Emissions Trading System proposal would see UK go further inn tackling climate change. New UK system to replace EU system for trading carbon emissions", 1 Jun. 2020, https://www.gov.uk/government/news/new-emissions-trading-system-proposal-would-see-uk-go-further-in-tackling-climate-change.

nationwide, it will be easy to match our prices with those of the UK government.

The Greater London Authority (GLA) has already set up a Carbon Offset Fund, based on charging new developers a price per tonne of carbon emitted for every new build in the GLA[58]. Their pricing schemes in 2018 were set at £60/tCO_2 which is the BEIS, non-traded price of carbon as of 2018, as well as the suggested Zero Carbon Hub price per tonne of carbon[59].

Using the BEIS carbon price projections, the 2020 price of carbon would be £69/tCO_2 at a central price of non-traded carbon as shown in **Table 3** below. This is the price of carbon for one tonne of carbon per year, and therefore, to buy one tonne of carbon in 2020 at a central BEIS price guaranteed for 5 years would be:

$$£60/tCO_2 \times 1tCO_2 \times 5\ yr\ = £300.$$

Using the non-traded carbon prices in 2020, we have calculated the estimated revenue assuming all the projected carbon emissions for the Swaffham Prior project are purchased in 2020, and presented those results in

[58] Mayor of London - "Carbon Offset Funds - Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds", 2018: https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf

[59] Department for Communities and Local Government - "Next steps to zero carbon homes – Allowable Solutions Government response and summary of responses to the consultation.", 2014: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/327842/140626_Government_Response_to_Consultation_-_Next_Steps_to_Zero_Carbon_H__FINAL.pdf.

Table 4.

Table 3: BEIS Traded and Non-Traded prices per tonne CO2 (given in £/tCO2) projected for the years 2020-2025. Adapted from data table 3 of the BEIS 2019b Valuation of Energy Use and Greenhouse Gas.

Year	Traded price: Low estimate	Traded price: Central estimate	Traded price: High estimate	Non-Traded price: Low estimate	Non-Traded price: Central estimate	Non-Traded price: High estimate
2020	0	14	28	35	69	104
2021	4	21	37	35	70	106
2022	8	27	46	36	72	107
2023	12	34	56	36	73	109
2024	16	41	65	37	74	111
2025	20	47	74	38	75	113

Table 4: Projected possible savings from selling all CO_2 savings from Swaffham Prior project over a 30 year guarantee. The BEIS pricings are from 2020 as shown in Table 3.

Pricing Level	2020 BEIS Price £	Tonnes of carbon dioxide saved over 30 years			Max. possible revenue from selling all carbon dioxide in 2020 for 30 years		
		Worst	Expected	Best	Worst	Expected	Best
Low	35	25,815	33,158	45,185	£77,550	£1,160,530	£1,581,475
Central	69	25,815	33,158	45,185	£1,781,235	£2,287,902	£3,117,765
High	104	25,815	33,158	45,185	£2,684,760	£3,448,432	£4,699,240

The results presented in

Table 4 show only one type of scenario for a business or businesses purchasing carbon credits, and is in particular, highly reliant on a business being willing to make a significant up-front investment for the project and would be required to offset their credits for a total of 30 years.

In reality, especially given that the price of non-traded carbon is projected to rise over time, the Fund may want to look into selling carbon over periods of 5 or fewer years at a time. This would allow smaller businesses to be able to buy into the plan, offer the Fund a constant stream of revenue with the possibility of businesses getting an "automatic renewal" into the Fund, and could potentially offer higher revenue over 30 years as the price of carbon rises.

Comparing the Fairtrade and BEIS models above, it is clear that with the BEIS model, the total cost of a project such as the Swaffham Prior Heat network will not be covered. Therefore, it is suggested that the Fairtrade model be used to price each tonne of $CO_{2\,f}$, as this will ensure that the overall cost of the project is covered, while maintaining flexibility across the projects.

3.2.2 Project Portfolio Approach

Initially, fund development centred on the concept of pricing individual projects, with businesses investing directly into individual specific projects (or a designated share of the costs), as described above. However, it became apparent that the more challenging projects, such as taking communities off oil and cutting emissions at source, would be more expensive per tonne of carbon when compared to tree planting for example and may therefore not be funded by businesses.

Opting for a fund rather than a matching scheme between businesses and projects, allows for much greater security of delivering a wider range of projects and offers the businesses with a portfolio of funded projects, which they can gain greater promotional benefits according to their individual needs. It also enables averaging the carbon price over a variety of projects and thereby provides greater financial stability for the fund and the assigned carbon price against unexpected additional costs in individual projects. Funds are the option of choice for all UK-based and many other offsetting schemes worldwide and thus offer great potential for Cambridgeshire as well.

In this section, we create a theoretical "Project portfolio" of different projects throughout Cambridgeshire, which utilizes the Fairtrade pricing model to calculate each tonne of carbon, and then averages over the projects included to create a "Cambridgeshire Carbon Cost". The projects are ranged over the tiers mentioned in the following section on **Project** Tiers, and the costs and projected carbon savings are based on a single year. We have grouped each project into the "**avoid, reduce, sequester**" sections, which are further discussed in detail below, based on whether projects avoid carbon emission, reduce carbon emission, or sequester carbon.

From **Table 5**, if we were to combine the total carbon credits and project prices, the average cost of carbon in Cambridgeshire for a given year is £203/tCO_2. By combining the total projects in the portfolio, while still using the Fairtrade pricing scheme to cost out each carbon credit, we can utilize projects such as tree-planting which are low cost, high reward, to reach a lower median carbon cost for the fund.

Table 5: Example project prices which could make up a Cambridgeshire Project Portfolio for a given year

Project Type	Total tCO_2 saved	Price of Projects	Fairtrade Price

Avoid	1,500	£427,500	£285
Reduce	715	£100,000	£140
Sequester	2,750	£55,000	£20
Total	4,965	£582,500	£117

3.3 Project Tiers

Projects that could be admissible for funding through the proposed decarbonisation plan will likely differ greatly in their approach to contributing to a net zero Cambridgeshire. To facilitate assessment of this variety of projects we suggest a tier system for interventions that can be summarised as "**avoid, reduce, sequester**". All projects, regardless of their tier according to their CO2e reduction approach, should present co-benefits associated with the project and disclose relevant quantitative data or estimated outcomes to include these co-benefits in the carbon price.

Tier 1 comprises all projects that avoid emissions at the source, i.e., by providing clean energy. This tier primarily includes small-scale, off-grid renewable energy generation for local communities e.g., installing PV systems, solar water heaters, small scale hydropower, heat pumps, wood-fuelled ovens, biogas or biomass plants etc. These projects are of particular interest for voluntary offsetting because they are exempt from the EU-ETS. Projects in Tier 1 will likely have to prove robustness and sustainability over the longest timescales and against different scenarios for developments in the national and international energy sector but have the highest potential to be a driver towards a net zero Cambridgeshire.

Tier 2 projects will target emissions reduction and are split into two types. Tier 2a encompasses projects concerned with the reduction of existing emissions from residential and industrial energy use and the energy use for transportation by increasing the efficiency of that energy usage or making necessary changes to the framework where the emissions occur. Most interventions that are proposed will fall into this tier as these are much more accessible financially e.g., by retrofitting electrical appliances or better insulation of domestic buildings. Capital investment should target funding further projects which are improvements (i.e., fall into Tier 1) and provide better energy usage to ensure actual emissions reduction by these interventions and avoid rebound effects. Another sector with very high potential for emissions reduction is transportation. Interventions that focus on switching from cars to public transport or bikes, or technological changes like the transition towards e-mobility would also be included in this tier. E-mobility projects coupled with a renewable energy supply could potentially also fall into Tier 1.

Tier 2b projects focus on the reduction of emissions from natural sources, usually driven through detrimental human interactions with the environment. In the UK, this mostly concerns the use of peatlands and wetlands. The approach towards reducing emissions from peatlands and wetlands differs a lot from the treatment of the emissions targeted in Tier 2a projects and is much more intertwined with new and developing agricultural land use practices. When in good condition, peatlands not only stop emitting further CO_2 but can also become carbon sinks again; projects focussing on new farming methodologies with peatland and the creation of carbon sinks will be important and have the potential to move from Tier 2 to Tier 3 dependent on their role.

Emissions that can neither be avoided nor reduced may be tackled by "capturing" or "sequestering" some of the carbon produced by non-natural sources from the air. These projects are categorised as

Tier 3 and could include both bio-sequestration through tree planting or algae bioreactors and technological carbon capture and storage solutions. Even though tree planting is and will be an important measure in mitigating anthropogenic climate change, tree planting is restricted by the area that can be allocated for afforestation and its effect is delayed substantially compared to Tier 1 and 2 interventions. Therefore, we strongly recommend using a mix of all three projects in the decarbonisation fund, potentially including an option to prioritise Tier 1 and 2 projects over Tier 3.

Identifying this list of projects and grouping them into categories will need to be a process which includes input from both the community, the business investors and the Fund governance structure. It will be beneficial to get insight from the community as to which type of projects are the most important to them. Additionally, in order to undertake many projects in Tier 2, this will require local community approval, as it mainly involves installing new technology in villages or local communities. The levels of community engagement and project development support will need to be discussed as to develop credible projects takes time and commitment from everyone

Tier 1: Clean Energy Supply – supporting off-gas communities to decarbonise their heat e.g., Swaffham Prior Community Heat Network

In March 2017, Cambridgeshire County Council approved its Corporate Energy Strategy which contains a vision to help "build energy resilient communities through aligning the Council's assets and the potential for energy generation with local needs". It is estimated that 10,000 households and businesses are oil-dependent for heating and hot water across Cambridgeshire. The council's Climate Change and Environment Strategy of May 2020 details a commitment to help oil-dependent communities make the transition to low carbon and renewable energy generation. A pilot Community Heat Project is underway in Swaffham Prior using ground source heat pumps as a renewable energy solution. There is also a project started involving three villages in Huntingdonshire, Great Staughton, Perry and Grafham that have accessed funding from the rural energy grant fund to scope the feasibility of taking the three villages off oil. The national clean growth strategy projects that heat networks will need to provide 17-24% of the UK's heat by 2050 to meet UK carbon reduction targets effectively. Rural areas really struggle to access grants for off-gas decarbonisation projects as the housing densities are low and homes can be older and more spread out.

Tier 2: Transportation Emissions Reduction - Electric Vehicle Charging Infrastructure

Investing in new technologies, e-mobility for future developments in the county will help towards the net zero carbon goal. For example, sustainable cement uses an alternative production method which results in a reduction in CO_2 emissions of between 50-80%. This has been used for the new stretches of the A14 and should be encouraged for all new building projects. If sustainable cement proves to be significantly more expensive in the early years, the Fund could invest into this technology for a major new community scheme and bring the carbon benefit into the Fund.

Transportation emissions contributed 45% of all emissions in Cambridgeshire in 2017 (CUSPE, 2019). Accelerating the adoption of sustainable transport methods is an important part of creating a sustainable Cambridgeshire. Sustainable transport methods, such as electric vehicles (EV), have greater energy efficiency relative to traditional automobiles and contribute up to 60% less carbon

emissions[60]. EV use is rapidly rising and projected to increase significantly by 2025[61]. However, a barrier to widespread EV use is the accessibility of EV charge points. Increasing EV use across Cambridgeshire, and an associated reduction in carbon emissions, may be facilitated by increasing the number of EV charge points[62].

There are currently 12 EV charge points positioned at Park and Ride locations across Cambridgeshire. Two EV chargers were installed respectively at Babraham, Longstanton, Madingley, Milton, St Ives, and Trumpington and have supplied a total of 3402 charges since (to add year installed). These 12 Cambridgeshire EV charge points were estimated to have saved between 70 and 105 tonnes of Carbon in 2019 alone. Assuming the average internal combustion engine vehicle emits 404g of carbon per mile; this carbon saving is equivalent to a traditional automobile travelling between 170,000-259,000 miles. An additional benefit of EV charge points is the scalability. By installing more EV charge points, Cambridgeshire residents can be better supported to use electric rather than traditional automobiles.

The choice of location for new EV chargepoints will have a large impact on the amount of carbon emissions reduced by the project. We found that, in 2019, Trumpington Park and Ride contributed 46% of total EV charges compared to a total of 1 charge (0.02%) from the two EV chargers at St Ives Park and Ride. However, it is worth nothing that the EV chargers installed at Trumpington Park and Ride are owned and operated by BP Chargemaster as loss leaders. The current charge of 12p/kWh does not cover the cost of electricity. Mechanisms to introduce price-parity across Park and Ride locations are required. It may be beneficial to research EV use across Cambridgeshire to select locations which maximise their use and subsequent carbon reductions and find out those areas where commercial operators will not invest as the patronage is too low to provide the financial return on their investment. However, it is important that charge points are available ahead of need and Cambridgeshire residents have equitable access to charge points. An additional benefit of EV chargepoints is the flexibility with where they can be installed. The Fund could invest in greater levels of EV charging infrastructure to deliver wider connectivity across Cambridgeshire and in particular in the more rural areas.

Tier 3: Carbon Sequestration

As previously mentioned, Cambridgeshire is positioned uniquely well in terms of its available natural resources (peatland and unused land) to become a region for sequestration. In particular, the Great Fen Peatland Project is a 50-year restoration project to create a “living landscape” for both wildlife and people to enjoy[63]. Lowland peats are considered by the Department for Environment, Food and Rural Affairs to be among the most significant sources of CO_2 in the UK, but with appropriate conservation and restoration, could become effective sinks for CO_2 over the next few decades. In

[60] Moro, Alberto, and Laura Lonza - “Electricity carbon intensity in European Member States: Impacts on GHG emissions of electric vehicles.” *Transportation research. Part D, Transport and environment* vol. 64, 2018: https://doi.org/10.1016/j.trd.2017.07.012

[61] XIangyu Luo *et al.* - " Electric Vehicle Charging Station Location towards Sustainable Cities,” 2020: https://www.mdpi.com/1660-4601/17/8/2785

[62] Ghazale Haddadian *et al*. - “Accelerating the Global Adoption of Electric Vehicles: Barriers and Drivers,“ *The Electricity Journal.* 2015: https://doi.org/10.1016/j.tej.2015.11.011

[63] Chris Evans *et al.* - "Final report on project SP1210: Lowland peatland systems in England and Wales – evaluating greenhouse gas fluxes and carbon balances,” 2017: .http://randd.defra.gov.uk/Document.aspx?Document=14106_Report_FINAL.pdf

total the Great Fen Peatland Project aims to restore up to 3700 ha of land in Cambridgeshire, which if properly maintained could become a carbon sink of -3.56 tCO_2/ha/yr saved[64].

Additionally, the 2019 CUSPE Carbon Zero Cambridgeshire report[65] provides a detailed scenario for afforestation projects throughout Cambridgeshire. Assuming that 3,000ha of land is used in 2020 for afforestation of a biodiverse set of trees, they predict it is possible to sequester between 5-13 tCO_2/ha/year; this equates to between 15,000 and 195,000 tCO_2 sequestered per year. Using the Fairtrade pricing scheme, this puts the price per tCO_2 at less than £30/tCO_2. Clearly, this is a lucrative and necessary method to include within the project tiers, however it cannot be the only method; as the 2019 CUSPE report points out, overplanting is a biodiversity risk as not all areas benefit from tree planting, and therefore 3,000 ha of land is likely to be the largest amount of land possible to use for tree-planting. For that reason, sequestration is considered to be the bottom tier of projects, as it is limited in its possibilities and therefore cannot be our only method to reaching carbon neutrality.

3.4 Potential additions to scheme

The Fund is just one mechanism which can encourage businesses to invest in local community infrastructure projects to offset their carbon emissions that are hard to reduce e.g., from aviation.

More strategically, Cambridgeshire may need to consider how to raise capital for the Cambridgeshire decarbonisation fund or whether it needs a much larger Fund for strategic infrastructure. Although currently local government does not have the powers to raise money locally for low carbon infrastructure this could be a future opportunity. Some areas in the UK are discussing whether, a 1 penny per litre fuel tax (oil, gas, petrol and diesel) could be introduced to fund strategic electricity upgrades to facilitate local smart energy grids or mass transit solutions. Scaling the Fund or setting up a separate fund for inward investment is something to explore further.

To extend the reach of the Fund, which is currently modelled on voluntary engagement by businesses, there are examples in the UK where carbon offset funds (see **A Global Snapshot - Europe**) have been set up related to the planning system and bringing forward new developments. These have been based on where a development cannot deliver the required levels of carbon emissions reduction onsite for a very good reason, that a commuted sum is put into a fund to invest in carbon reductions in local projects. This is an option that the Cambridgeshire Local Authorities have already discussed as an option and offers the potential of a steady source of additional income drawing substantially from the experience of other UK councils.

3.5 Governance and Administration

To oversee the set up and management of the decarbonisation fund it is advised that an independent board is established with representation from the following stakeholders:

1. Cambridgeshire County Council Chair and secretariat for the Fund
2. Local Authority Partner representation

[64] IUCN UK Peatland Programme - "The Great Fen | IUCN UK Peatland Programme," 2001: https://www.iucn-uk-peatlandprogramme.org/projects/great-fen-0?destination=/projects-map
[65] CUSPE Policy Challenges Team of Researchers -"Net Zero Cambridgeshire", 2019: https://data.cambridgeshireinsight.org.uk/sites/default/files/2019%20CUSPE%20Policy%20Challenge%20-%20Net%20Zero%20Cambridgeshire.pdf

3. Businesses operating in the County
4. Community representatives
5. Voluntary appointments of Decarbonisation expert researchers (to offer informed advice on ways to improve the operation and management of the fund)
6. Auditing firm (to play a supervisory role in the operation and management of the fund)
7. Validation team

A proposed schema summarising the process for administering the Cambridgeshire decarbonisation fund, with focus on projects, is summarised in **Figure 3** below.

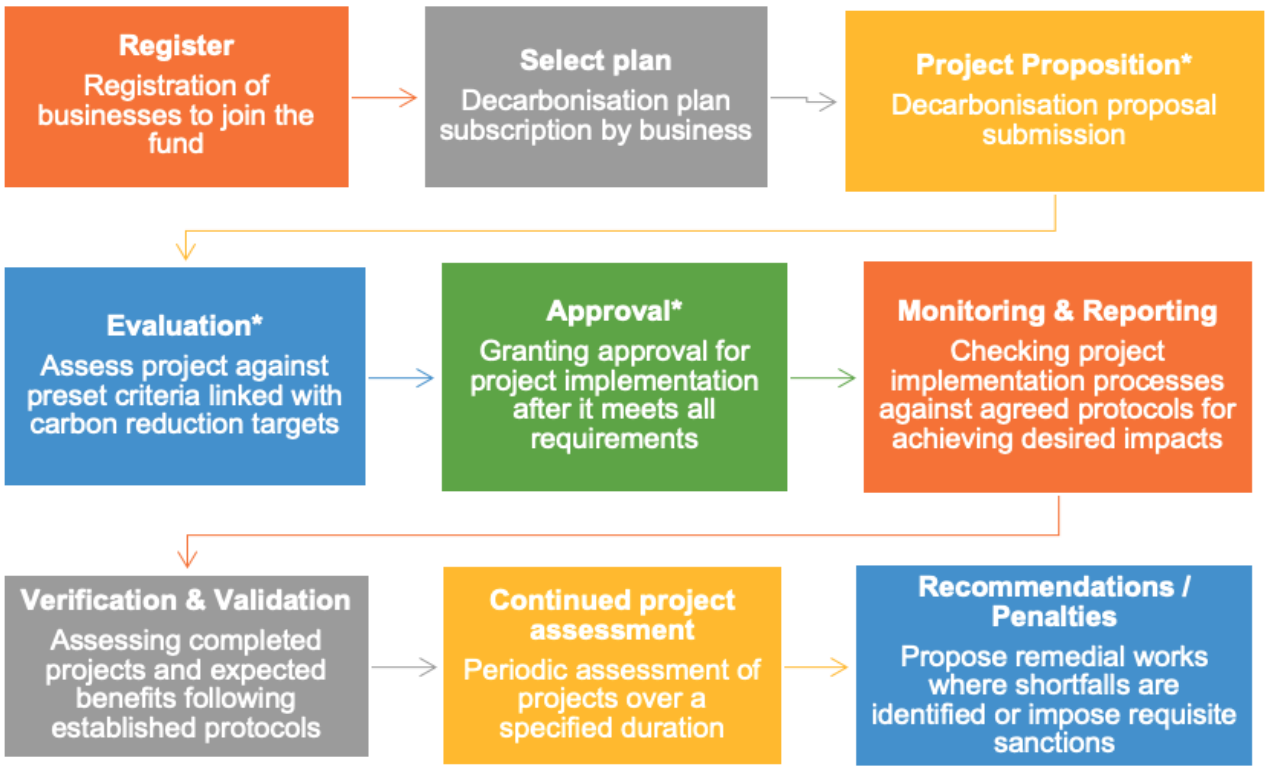

Figure 3: Proposed framework of stages for administering and operating the fund

The flowchart presented in **Figure 3** is designed for the initial stages of the fund and can be revised over time to be shorter. For instance, after a number of projects have been undertaken using the fund, a review will be useful to inform the creation of an initial set of pre-validated, ready to implement projects by the administering body. Such a list would have to be updated periodically. Approaching the implementation of the flowchart this way will facilitate innovation in the administration processes, by modifying the three stages of 'Project proposition', 'Evaluation' and 'Approval' (see **Figure 3**) into one. A business may get choice on investment scale, carbon benefits, preferred areas/sectors for investment for example which will form their plan. The preceding holds implications for the breakdown of stakeholders listed below.

A breakdown of stakeholders to be involved at each stage:

1. Register: Business; Administering body
2. Select plan: Business; Administering body
3. Project proposition: Business, Community, Local Authorities
4. Evaluation: Administering body

5. Approval: Administering body; Audit entity
6. Monitoring and reporting: Administering body; Business
7. Verification and validation: Administering body; Validation entity/team
8. Continued project assessment: Administering body; Validation entity/team; Audit entity
9. Recommendations / penalties: Administering body; Validation entity/team; Audit entity

In terms of the day-to-day operation of the fund including the performance of functions such as registering, evaluating, verifying, validating and reporting on projects and businesses that are applying for them, two alternatives are available. On the grounds of possible lack of internal capacity in the local authorities to effectively operate such a fund - an independent entity could be useful. The appointment of an organisation experienced in the operation and management of decarbonisation funds through appropriate procurement methods could help minimise overheads for the Council Alternatively, local authorities have the option to administer the fund using an internal unit. This, however, is likely to be attended by the need to hire additional individuals who already have the requisite knowledge and capabilities or hiring and training them. The choices will rest on with the decision-making body - to outsource this service within the appropriate procurement vehicles, or to use internal resources and capabilities depending on which option leads to the most effective use of resources and optimisation of operations and reporting.

3.6 Project Verification

All carbon projects within the Cambridgeshire Decarbonisation Fund need to demonstrate some key characteristics to prove their legitimacy, integrity and credibility. According to the Carbon Trust[66], these requirements are

1. **Additionality:** Additionality is a key defining characteristic of carbon offset projects. Administered carbon projects under the fund needs to demonstrate that would have not been implemented except for the revenue of the fund. This means that the establishment of the decarbonization fund is the main motivation for considering the carbon projects[67]. Project additionality is oftentimes misunderstood for carbon offset projects that would have been pursued without the sales and certification of carbon offset credits[68]. This includes projects that are mandatory by law or investments in renewable energy or energy-saving equipment mainly for their profitability. Such projects cannot be said to be additional because they would have been considered or have happened anyways. A project can only demonstrate additionality if and only if the decarbonization fund plays a pivotal role in its implementation[69]. Usually, certifying bodies like the Gold Standard[70] and CDM[71] and many others have specific protocols for demonstrating and assessing the additionality of a project.

2. **Permanence:** Reductions in carbon emissions through the execution of the projects should not be susceptible to reversibility, thus ensuring their permanence. However, some projects

[66] Parliament Office of Science and Technology - ”Voluntary Carbon Offsets,” 2007: https://www.parliament.uk/globalassets/documents/post/postpn290.pdf
[67] GHG Management Institute - ”Additionality”, 2019: https://www.offsetguide.org/high-quality-offsets/additionality/
[68] GHG Management Institute - ”Additionality”, 2019: https://www.offsetguide.org/high-quality-offsets/additionality/
[69] GHG Management Institute - ”Additionality”, 2019: https://www.offsetguide.org/high-quality-offsets/additionality/
[70] Ecofys, TÜV-SÜD and FIELD -” The Gold Standard - Premium quality carbon credits requirements,” 2008: https://www.goldstandard.org/sites/default/files/gsv2.1_requirements-11.pdf
[71] Clean Development Mechanism - “Tool for the demonstration and assessment of additionality in A/R CDM project activities,” 2005: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v1.pdf

are intrinsically susceptible to reversibility. A typical example is forestry projects aimed at increasing green spaces and sequestering carbon in trees within the community. Cutting down the planted trees, eliminating green spaces or the emergence of natural disasters like forest fires and pest outbreaks can cause reversibility in the carbon initially stored, thus creating risk. It is important that non-permanence risks such as those mentioned above are considered in the administration of carbon projects and it may necessitate a clear legal ownership and delineation of the long-term liability of the carbon credits generated by the fund[72]. To mitigate the non-permanence risks arising from forestry projects, the fund can either allow temporary credits to be issued if it foresees reversibility, buy insurance to compensate reversal, hold back a certain percentage of credits in a reverse pool or take up the liability itself[73]. Therefore, in the administration of the fund, there needs to be a clear construct of how the fund intends to manage these risks.

3. **Avoidance of leakages:** Leakages occur when the carbon offset projects carried out within a region causes emissions outside the boundaries of that region or in neighbouring cities. A carbon offset project should ensure no leakages most especially from activity shifting. A good example of this scenario is an ecological leakage where the process of restoring and rewetting peatlands leads to the death of trees and forest especially in hydrologically connected regions. An extension of this effect will be the reduction in cultivation of food within Cambridgeshire due to the unavailability of lowland peatland, giving rise to increased cultivation activities in nearby regions.

4. **Not double-counted:** By ensuring that a carbon registry is established as a part of the Fund, credits sold should be recorded and retired so that they are not double-counted.

5. **Verifiable:** Projects should also have methodologies agreed by the businesses investing in the fund. This can require an independent body to monitor and ensure that all suggested CO_2 savings from the projects are true and real if needed. In cases where the carbon savings are not realized, the Fund would need to bring forward additional projects to realise the carbon reduction. Transparency will be important. It is important that the administrative body for the projects factors this risk of not realising the carbon savings for some projects to the forecast levels and takes proper steps to mitigating them. Verification and validation procedures are discussed below.

6. **Co-beneficial:** Apart from the guaranteed emission reduction, it is important that the Fund provides health co-benefits e.g., air pollution reductions or health improvements. This is discussed in later chapters of this report.

Verification and validation

To ensure that the framework for the fund gains the needed trust among stakeholders, establishing an agreed methodology or structure for verifying and validating projects is needed. Having a good structure in place will maintain transparency among stakeholders about how the scheme is operated, which is important in building trust and legitimacy of the scheme.

[72] Scott A. Smith *et al.* -" Forest offset credits: a cornerstone of sustainable development on aboriginal lands," *Lexology.* 2009: https://www.lexology.com/library/detail.aspx?g=0d0b8a3e-a871-4e3f-8507-e628c719441a
[73] Scott A. Smith *et al.* -" Forest offset credits: a cornerstone of sustainable development on aboriginal lands," *Lexology.* 2009: https://www.lexology.com/library/detail.aspx?g=0d0b8a3e-a871-4e3f-8507-e628c719441a

To have a robust structure, the following principles are indispensable:

1. There must be clarity of requirements to be met for each clean development mechanism (CDM) project (e.g., transparent demands)
2. Evaluation methodology must be coherent across set criteria (e.g., consistent methodologies/calculations)
3. Businesses must be assured that enforcement and monitoring will be undertaken (e.g., fair compliance protocols)
4. Guarantee of measurable or impact-led benefits to local stakeholders (e.g., real benefits)

It is important to highlight that validation will be seen as a 'stamp of approval' for businesses that are seeking to make a statement with their decarbonisation efforts. Recognising this potential to act on self-serving interest that is characteristic of businesses it is important to ensure transparent auditing that align with relevant global (e.g., UNFCCC), national (UK Climate Change Act 2008) criteria, as well as local host (Regional) carbon targets.

Proposed validation process and validation protocol

To undertake a rigorous validation process, having a clearly laid out protocol is essential. A validation protocol provides guidance for the process of validation and reporting on projects by outlining requirements projects are to meet (e.g., volume of carbon to be sequestered). Structuring a validation protocol for the Cambridgeshire decarbonisation fund should follow the outline of mandatory criteria that will be established for the kinds of projects admissible, a list of the targets they are expected to meet, based on which any corrective measures may be proposed.

Figure 4 shows a flowchart of the process of validating a project under the Gold Standard scheme that can inform the establishment of a local one for the decarbonisation fund for Cambridgeshire.

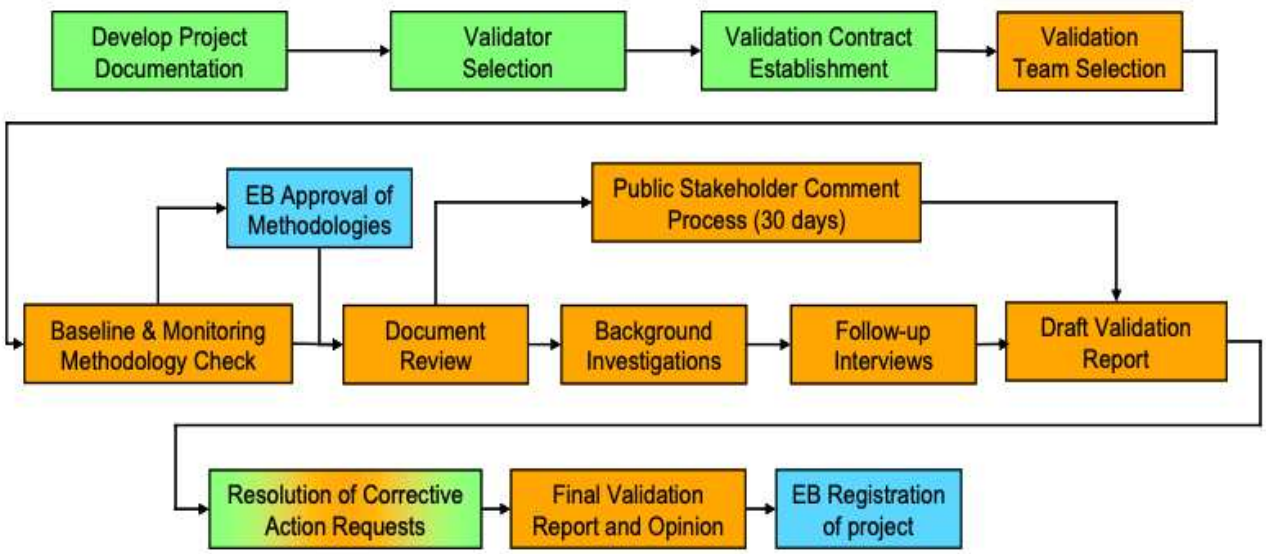

Figure 4: Validation process for projects under the Gold Standard scheme. Project Proponent(s) [Green]; Validator [Orange]; Scheme Administrators (GS in this case) [Blue]

In adopting the structure used by the Gold Standard, it is proposed that the following 4 key elements are maintained in order to assure stakeholders of a robust process:

1. A critical assessment of the requirements projects are expected to meet
2. Evaluation of project documentation
3. On-site visit for evaluation of project
4. Public stakeholder commentary

An example of a validation protocol template, based on the GS scheme, is shown below in **Figure 5** and **Figure 6**.

Table 1: Mandatory Requirements for Clean Development Mechanism (CDM) Activities

REQUIREMENT	Ref	CONCLUSION	Cross Reference to Checklist (Table 2)
The requirements the project must meet.	Reference to the legislation or agreement where the requirement is found.	This is either acceptable based on evidence provided (OK), or a Corrective Action Request (CAR) of risk or non-compliance with stated requirements.	To ensure a transparent process, this refers to the relevant checklist questions in Table 2 to show how the specific requirement is validated.

Table 2: Requirements Checklist

CHECKLIST QUESTION	Ref	MoV	COMMENTS	Draft Conclusions	Final Conclusions
The various requirements in Table 1 are linked to specific checklist questions the project shall meet. The checklist is organized in different sections, following the CDM-PDD structure. Each section is then further sub-divided. The lowest level constitutes a checklist question	Reference to documents where the source to the checklist question or item is found.	The means of verification explains how conformance with the checklist question is investigated, i.e., through document review (DR) or interview (I).	The section is used to elaborate and discuss the checklist question and/or the conformance to the question. and to explain the conclusions reached.	This is either acceptable based on evidence provided (OK), or a Corrective Action Request (CAR) or a Clarification Request (CL) Whenever a CAR or CL is issued, table 3 shall be used to describe how the findings have been resolved and concluded.	The final conclusion of the validation shall be documented as either OK, CAR or CL. This is based on the resolution of outstanding issues as elaborated in Table 3.

Figure 5: An example of a validation protocol structure. Adapted from the Gold Standard Validation and Verification manual for CDM Projects (2006, p.4)

Table 3: Resolution of Corrective Action and Clarification Requests

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
If the conclusions from the draft validation are either a Corrective Action Request or a Clarification Request, these shall be listed in this section.	Reference to the checklist question number in Table 2 where the CAR or CL is explained.	The responses given from the project proponent or other project participants during the communications with the validation team shall be summarized in this section.	This section shall summarize the Validation Team responses and final conclusions. The conclusions shall also be included in Table 2, in the section called "Conclusions Final".

Figure 6: An example of a validation protocol structure. Adapted from the Gold Standard Validation and Verification manual for CDM Projects (2006, p.4)

Transparency of scheme

To ensure transparency with businesses and to track progress towards both county and national goals of net zero carbon, the emissions intensity ratio (EIR) could be utilised. Used on a national scale, the emissions intensity ratio is an indicator of clean growth performance measured in tonnes of CO_2 per £1 million GDP. The EIR is currently 270 tCO_2/£1 million GDP and must decline to ~100 tCO_2/£1 million GDP by 2032 to align with carbon emission targets which require emission intensity to reduce by 5% per annum[74]. Tracking Cambridgeshire and Peterborough's EIR annually will measure progress toward net zero goals. In 2017, the Cambridgeshire and Peterborough region produced £27,101 million in GDP[75] and 6.1 Mt of CO_2. The Cambridgeshire and Peterborough EIR was 225tCO_2/£1 million GDP in 2017 which was 17% lower than the national average. In order to reach national targets, the Cambridgeshire and Peterborough EIR would need to reduce by 125tCO_2/£1 million GDP by 2032 equating to a 55% reduction over the next 12 years.

Businesses participating in the Cambridgeshire Decarbonisation Fund will need to demonstrate their commitment to reducing their carbon footprint. With both businesses and the Council publishing their carbon footprint on an annual basis, this collaboration can help to drive decarbonisation through teamwork and perseverance. It is important to note that the future of the Cambridgeshire Decarbonisation Fund will be dictated by the actual performance of existing projects, i.e., projects must deliver their expected carbon pay-out, as well as provide the further mentioned co-benefits.

[74] Department for Business, Energy and Industrial Strategy - "The Clean Growth Strategy - Leading the way to a low carbon future." 2017:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf
[75] Trevor Fenton - "Regional gross domestic product all NUTS level regions" 2019:
https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossdomesticproductallnutslevelregions

3.7 Cambridgeshire Decarbonisation Fund Benefits

Decarbonisation is not just a measure to mitigate climate change but is closely intertwined with a multitude of social and economic issues we face as a society. As community members, we should make sure that our actions not only advance our personal interest but benefit the people at large. This notion is formalised by the Social Value Act (2013) for British governments and Corporate Social Responsibility (CSR) for businesses. CSR stipulates that businesses are required to be socially accountable to themselves, their stakeholders, and the public. Whilst not a legal requirement, CSR has both societal impacts, and bottom-line benefits for businesses (see Department for Business Innovation and Skills 2014 report). In this section, we explore how the Cambridgeshire Decarbonisation Fund participants can meaningfully contribute secure societal benefits in addition to their carbon credit advantages.

3.7.1 Social Benefits

- **Democratic oversight of Cambridgeshire carbon emissions**. The Fund's secretariat and finances will be managed by Cambridgeshire County Council. This administration will be overseen by a Board, with elected councillors and Board members, including community representatives. This means residents will have a say on how the Fund is run and what future projects it will invest in.

- **Fair energy transition**. The local government's management of the Fund will also confer a high degree of transparency to the energy transition in Cambridgeshire. This transparency means the project can be held to higher standards of fairness, receive and adapt to feedback, and thus gain more public approval than corporate initiatives alone.

- **Tailored solutions**. The local aspect of the scheme means that the parties involved can create solutions and opportunities that bring greater economic and environmental outcomes to the County as opposed to national broad stroke policies.

- **Fuel poverty reduction**. Although the upfront costs of renewable energy are higher than traditional fuel sources, they provide cheaper energy in the long term and contribute to reducing fuel poverty which affects 9.5% of Cambridgeshire's population

3.7.2 Economic Benefits

- **Ownership of local emissions**. The local nature of these decarbonisation projects helps to raise awareness of the climate challenge Cambridgeshire faces while demonstrating an accessible solution. The scheme enables businesses and communities to be less reliant on international and national projects to reduce and offset their carbon emissions.

- **Jobs and local expertise**. Developing local projects will generate new jobs but also create local expertise in sustainable transitioning. This will enable the County to move quicker and be more ambitious on climate issues in the future, while developing a market for Cambridgeshire residents to export their skills nationally.

- **Future tax mitigation.** It is very likely that new taxes[76] will be introduced by the Government to offset the UK's carbon emissions. While dependent on the terms surrounding any future taxation scheme, the fund offers businesses the potential opportunity to reduce this tax contribution in the future, instead investing directly into carbon reduction projects. Similarly, the scheme could be amended to enable complementarity with any taxation scheme, should this come forward.

- **Proof of social responsibility**. Businesses that invest in the Fund will provide evidence that they take on social and ecological responsibility for the communities most of their employees live and work in. They might also become more attractive for prospective applicants as the awareness of climate change continues to rise in the general population and particularly the young generation.

3.7.3 Health Benefits

- **Reduction of power sector and transport pollutant emissions.** The power and transport sectors are major sources of air pollutant emissions. In 2010, the power sector accounted for around 40% for global sulphur dioxide emissions, and 20% of NO_x[77,78]. These substances are important precursors for particulate matter formation (PM-10). NO_x, along with methane and other volatile organic compounds (NMVOCs) can also lead to increased ozone formation. PM-10 and ozone are particularly important health threats[79].

- **Reduced burden on the NHS.** Each year between 28,000 and 36,000 deaths are attributable to air pollution in the UK. The societal cost of air pollution as a public health risk is estimated to surpass £20 billion annually. In Cambridgeshire, 5.2% of population mortality is directly attributed to air pollution[80] (c.f. national average of 5.1%). Additionally, there are strong links between high levels of air pollution and cardiovascular and respiratory diseases resulting in reduced life expectancy[56],[81]. Public Health England (PHE) estimates that in England for every 1ug/m^3 $PM_{2.5}$ reduced, 50900 coronary heart diseases cases, 16500 stroke cases, 9300 asthma cases and 4200 lung cancer cases could be averted over 18 years. This strongly demonstrates the importance of reducing air pollution in Cambridgeshire and the benefit this will bring to society as well as the NHS.

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[76] Chris. Giles and Leslie Hook. "Zero emissions goal: the mess of Britain's carbon taxes," *The Financial Times.* 2020: https://www.ft.com/content/c4e7cf36-61f5-11ea-a6cd-df28cc3c6a68

[77] Rachel Hoesly *et al.* - "Historical (1750–2014) anthropogenic emissions of reactive gases and aerosols from the Community Emission Data System (CEDS)," *Geosci. Model Dev. Discuss.* 2017: https://gmd.copernicus.org/articles/11/369/2018/

[78] Gunnar Luderer *et al.* - "Environmental co-benefits and adverse side-effects of alternative power sector decarbonization strategies," *Nature.* 2019: https://www.nature.com/articles/s41467-019-13067-8

[79] Jos Lelieveld *et al. "The* contribution of outdoor air pollution sources to premature mortality on a global scale," *Nature.* 2015: https://www.nature.com/articles/nature15371

[80] Transport and Health JSNA - "Air Pollution: Key Findings," 2015: https://cambridgeshireinsight.org.uk/wp-content/uploads/2017/08/Transport-and-Health-JSNA-2015-Air-Pollution.pdf

[81] James Stewart-Evans *et al.* - "Review of interventions to improve outdoor air quality and public health," 2019: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938623/Review_of_interventions_to_improve_air_quality_March-2019-2018572.pdf

3.7.4 Case Study Benefits

- **Swaffham Prior Community Heat Network**. A household is classified as being in fuel poverty if they have fuel costs above average and their disposable income post-fuel costs is below the poverty line. Fuel poverty status depends on energy efficiency, energy prices and income. By providing the residents of Swaffham Prior with the ground source heat pump, fuel poverty will be alleviated with both lower and with steady fuel prices, i.e., not influenced by the fluctuation of crude oil prices from foreign policy and conflict. Additionally, this project aligns with the governmental Clean Growth Strategy which states that all fuel poor homes must be upgraded to EPC Band C by 2035 where practical, cost-effective and affordable. There is a strong association between cold houses and ill-health such as respiratory illnesses, costing the NHS approximately £760 million per year[82].

- **EV Charge Point Installations[83]** These projects firstly stand to generate several important health benefits. EVs produce much lower fuel-pipe emissions compared to traditional vehicles and possess almost silent motors. With a proper deployment of EV, these attributes would lead to significant reductions in air and noise pollution (see Health Benefits). Switching to an EV also allows drivers to make financial savings on fuel due to the reduced cost of electricity compared with petrol or diesel. Over the course of 10 years and 120,000 miles, this represents an estimated saving of $4130 (£3889). There are also associated savings that can be made through the simplified operations and maintenance of EVs ($1488 or £1149). The use of EVs has also been shown to boost the economy through the creation of indirect jobs from the installation and maintenance of electric vehicle charging equipment. Spending less on transportation may also mean this money can go into the local economy through consumer spending. Finally, although cars serve an important transportation function, they are typically in use for mobility less than 5% of the time. This limited use, coupled with the storage capability of EV batteries means the EV can provide flexibility services to the national grid via Vehicle to Grid arrangements - storing energy in their batteries when there is excess electricity and releasing back to the grid when power demand is high.

- **Green Deal Communities project.** This was a Government funded project to improve energy efficiency of domestic properties. The Project helped move 1900 residents out of fuel poverty by increasing household energy efficiency, decreasing energy demand whilst also improving the county's housing stock. While the Swaffham Prior project focuses solely on homeowners, this scheme aimed to deliver better heating for rental properties where fuel poverty is particularly high. The process involved several partners creating a supply chain for energy efficiency measures and supporting the local economy.

- **The Great Fen Peatland Project.** Led by the Wildlife Trust BCN this project seeks to restore 14 square miles of agricultural land to wild fen, promoting habitat connectivity, biodiversity and sustainable peatland agriculture. The project has the potential to turn the area into a net carbon sink. Besides reducing carbon emissions and providing carbon sequestration in the long term, The Great Fen Project seeks to increase and protect Cambridgeshire's biodiversity.

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[82] Department for Business, Energy and Industrial Strategy - "The Clean Growth Strategy - Leading the way to a low carbon future," 2017:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf

[83] Ingrid Malmgren - "Quantifying the societal benefits of electric vehicles," *World Electric Vehicle Journal.* 2016

The peatland also provides new sources of revenue through ‘wetland farming’, where crops able to tolerate higher water table levels are cultivated in place of “traditional” crops. Wetland farming helps preserve and enhance the wet peat beneath the water’s surface, thereby minimising carbon emissions associated with traditional agriculture in drained or reclaimed peatland. Crops include forms of grass/grain crop, historical herbs and medicinal plants such as sphagnum moss. This economic stimulus intends to make Cambridgeshire a hub for wetland conservation, farming and carbon monitoring expertise by bringing together several partner organisations such as Cambridge Acre, University of East London (wet farming) and Centre for Ecology and Hydrology (emission monitoring).

Together these three case studies develop a legacy to support the long-term delivery of energy efficiency and offsetting measures. They mobilise the market and supply chain, develop local authority capacity, raise awareness, strengthen community partnerships, and develop relationships with landlords and businesses.

4 Recommendations and Summary

For the Cambridgeshire Decarbonisation Fund to work, it needs to be very well advertised and businesses need to know why it is better to support carbon reduction in Cambridgeshire rather than abroad. It needs to be understood by all parties as a “green deal” between local businesses and local communities with the Local Authorities as facilitators. By encouraging project development ideas to come from community leaders, the fund will be actioning projects which are relevant to community well-being. The Cambridgeshire Decarbonisation Fund should be a collaborative initiative between the Local Authorities, communities and local businesses. Therefore, businesses should be consulted as to what aspects of their carbon footprint will be challenging to reduce and would benefit from the help of this Fund. For the fund to have a quick and robust impact on Cambridgeshire emissions levels we recommend a mixture of projects from all tiers, especially having active projects from Tiers 1 or 2 at all times. If a fund like this is to be rolled-out in the next year, we recommend following the recommendations in the list below, in order to create a successful fund, which will be well used by businesses and also generate revenue for the projects in question.

1. **Create a Cambridgeshire decarbonisation fund that allows businesses to invest in local carbon reduction projects**

2. **Identify a source of funding to initiate the decarbonisation fund**

    2.1. Work with UK Green finance institute to identify initial seed funding and discuss seed funding with Local Authority partners
    2.2. Identify individuals or businesses who may be willing to donate to this fund
    2.3. Create Local Plan policies that allow Section 106 agreement that allows new builders to add to the fund

3. **Have a tiered, prioritized list of projects which businesses can invest in. This list will come from both community members, Local Authorities and third sector organisations to create a diverse list.**

    3.1. We have identified three tiers of projects around the idea of “avoid, reduce, sequester”
    3.2. Tiers 1 and 2 focus on all or some removal of carbon, and include projects such as installing a heat network, and retrofitting respectively, Tier 3 describes carbon sequestration projects
    3.3. At the local level, it will be especially important to focus on Tier 2 projects as these can be most effective, while Tier 1 projects have to go hand in hand with national strategies and Tier 3 projects are limited in scale

4. **Consider co-benefits when creating projects or choosing to pursue projects which are additional to the benefit of carbon credits and beyond corporate social responsibility**

    4.1. Put businesses investing in Tier 2 projects on a priority list for retrofitting
    4.2. Ensure carbon credit methodology accepted by businesses and can be scrutinised at the national level
    4.3. Allow marketing benefits for business advertisement either through providing a list of sponsors or benefactors
    4.4. Reinforce the idea that buying in now is cheaper than waiting until 2030, 2040, or later

5. **Encourage/enforce transparency in businesses emissions reduction**

    5.1. All large businesses will be required to report their Scope 1 and 2 emissions starting this year, and we should support smaller businesses with carbon footprinting to help them to invest and receive carbon credits.
    5.2. Implementing the scheme should start off with a clear definition of requirements and approval processes for projects. This clarity is critical from the onset since a mix of perception of usefulness of the scheme, and actual usefulness will be impacted if transparency is not well managed from the onset.
    5.3. Create a contract with businesses which supports them to actively take steps to reduce their emissions as and be part of this Fund

6. **Reach out to businesses to gain insight into their incentives**

    6.1. Assess the potential uptake of this scheme
    6.2. Allow businesses and community members to provide feedback on the setup of this fund, and gauge their interest
    6.3. Understand the scale of investment and benefits that businesses would be willing to buy from this fund. Would a business such as AstraZeneca contribute in the millions, would a local business like a coffee van contribute as well? And what co-benefits are important to each?

7. **Further assess the policy implications of projects**

    7.1. Collect more data to assess social, health and financial benefits of projects to Cambridgeshire residents.
    7.2. Without a clear list of projects which will be included in this fund, it is difficult to assess what the full range of societal benefits are, but could include pollution reduction, alleviating fuel poverty, or improving health and wellbeing of citizens.

8. **Allow for community involvement in project development**

    8.1. There should be strong community engagement to understand the types of projects residents may support
    8.2. By including the community in the process, this makes it a real collaboration between the Local Authorities, businesses, and communities

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