

Leveraging accounting practices to embed greenhouse gas emissions in decision making: A Blackpool Unitary Authority case study

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## Abstract

With current global policies putting us on track for 2.9 °C of warming by 2100, urgent and ambitious action is required to operationalise the Paris agreement and keep us 'well below 2°C'. The Intergovernmental Panel on Climate Change (IPCC) state that to close this mitigation gap sub-national entities must be leveraged, calling for sustainability reporting to be mandated and enforced. This mitigation gap is unlikely to be closed without robust sub-national targets, baselines, monitoring, and reporting, including scope 3 consumption-based emissions. At present, target ambiguity is widespread and is undermining robust emissions management. In the UK, local authorities are struggling to make sense of disparate guidance and respond to grass roots and top-down pressure to decarbonise. A strongly devolved approach to local authority net zero support has emerged which has placed English authorities at a disadvantage as 52% reductions in spending power, resulting in severe under resourcing, is exacerbated by the lack of statutory or clear guidance articulating the nature of local authorities' role in the net zero transition. By working closely with Blackpool Unitary Authority as a case study partner this research considers and interprets the wealth of authority applicable guidance and develops an iterative, applied approach to indirect emissions management using spend-data. A proof of concept, informed by discussions with key staff members and access to working and management practices, is presented. It simply demonstrates how Blackpool's spend data can be used to estimate and begin to manage indirect emissions in-house to (i) embed GHG emissions more fully organisationally (ii) build carbon literacy (iii) spread emissions accounting burdens across the organisation by utilising existing performance and accountancy practices. This is supplemented with a three-stage iterative approach to refining data quality, calculation methods and emissions governance that is grounded in public and private sector best practice net zero strategy.

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## List of acronyms and abbreviations

4CCN	4 Cost Centre Name
7CCN	7 Cost Centre Name
9AN	9 Account Name
BEIS	Department for Business Energy and Industrial Strategy
CBE	Consumption-based Emissions
CCC	Climate Change Committee
CDP	Carbon Disclosure Project
CEUK	Climate Emergency UK
CH <sub>4</sub>	Methane
CMW	Carbon Market Watch
CO <sub>2</sub> e	Carbon Dioxide
CO <sub>2</sub> e	Carbon Dioxide equivalent
COICOP	Classification of Individual Consumption by Purpose
DEFRA	Department for Environment Food and Rural Affairs
EEIO	Environmentally Extended input output
EF	Emission Factor
GGC	Greening Government Commitments
GHG	Greenhouse Gas
GHGP	Greenhouse Gas Protocol
GMCA	Greater Manchester Combined Authority
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LGA	Local Government Association
MHCLG	Ministry for Housing Communities and Local Government
N <sub>2</sub> O	Nitrous Oxide
NAO	National Audit Office
NCI	New Climate Institute
NF35	Nitrogen Trifluoride
NGO	Non-governmental Organisation
NPPF	National Planning Policy Framework
NRW	Natural Resources Wales
ONS	Office of National Statistics
PFC	Perfluorocarbon
RSD	Relative Standard Deviation
SBTi	Science-based Targets initiative
SF <sub>6</sub>	Sulphur Hexafluoride
SIC	Standard Industrial Classification
SME	Small Medium Enterprise
SR1.5	Special Report 1.5
SSN	Sustainable Scotland Network
T&D	Transport and distribution
UN	United Nations
VAT	Value Added Tax
WTT	Well to tank
WWF	World Wildlife Fund

## Clause of declaration

This thesis is all my own work and has not been submitted in any form for the award of a higher degree elsewhere.

# 1. Introduction

The UK has a net zero by 2050 target for greenhouse gas (GHG) emissions. The gases and emission sources included in the target boundary are aligned with IPCC National Greenhouse Gas Inventory reporting guidelines and refer to emissions under direct control or territorial responsibility of the UK (e.g. from energy production, industrial processes and product use, agriculture/forestry/land use and waste) (IPCC, 2006; BEIS, 2022). At sub-national scales net zero or carbon neutrality targets generally also include emissions (and removals) beyond an entity's direct control i.e. scope 3 or value chain emissions (Hans *et al.*, 2022). Widening national system boundaries to also include consumption-based emissions (CBEs) (scope 3) is recognised as important to avoid outsourcing of pollution (IPCC, 2022) and the UK monitors and publicly discloses CBEs separate to territorial emissions reporting requirements.

The global carbon budget and the physical constraints of the earth system inform the call for net zero by 2050. The IPCC SR1.5 (2018) report indicated that for a 50% chance of staying below 1.5°C of warming (deemed a 'safe' level) we need to reach zero emissions globally by 2050, meaning we have approximately ~600 Gt of CO<sub>2</sub> left to emit (with a current emissions rate of ~40 Gt CO<sub>2</sub> yr<sup>-1</sup>). This includes all CO<sub>2</sub> emissions regardless of accounting variation (i.e. consumption, production or territorial) as each tonne emitted remains in the atmosphere, consuming our remaining carbon budget and adding urgency to the task.

It is important to note that the territorial emission approach (where only emissions produced or released within a nation are included) makes sense on a global scale to avoid double counting. If we were to combine all nations' consumption-based emissions estimates the figure would be significantly larger than the true total - as emissions across global value chains would be counted multiple times. Interestingly, the level of trust we have in the territorial-based system to deliver rapid decarbonisation somewhat informs our level of action on consumption-based or 'outsourced' emissions, although however we assign responsibility is ultimately normative, meaning debate and uncertainty are hard to quell without enforced reporting and accounting requirements.

With current global policies putting us on track for closer to 3°C of warming by 2100 (Climate Action Tracker, 2022) ambitious action is required to operationalise the Paris agreement and keep us 'well below 2°C' 'preferably below 1.5°C'. To achieve urgent decarbonisation and close this 'mitigation gap', sub-national entities must be leveraged. In support of this, the IPCC (2022) calls for sustainability reporting to be mandated and enforced, stating that without robust targets, baselines, monitoring and reporting the gap is unlikely to be closed. They also note that sub-national entities such as local authorities can only realise their full decarbonisation potential when

emissions beyond administrative boundaries (i.e. scope 3 or CBEs) are also addressed (IPCC, 2022).

### 1.1 UK local authorities and net zero

In the UK, sub-national corporate entities use the Greenhouse Gas Protocol (GHGP) and HM Government's (2019) Environmental Reporting Guidelines to track emissions. Only quoted (and large) companies are required to report emissions to central government. UK local authorities have separate tracking and reporting requirements which differ across the devolved nations. In England, whilst there is no statutory requirement to track or report emissions, the GHGP and UK Environmental Reporting Guidelines are applicable, and the Department for Business, Energy and Industrial Strategy (BEIS) have funded a Local Partnerships GHG accounting tool where authorities can voluntarily track and submit emissions estimates (mainly scope 1 and 2) to aid benchmarking. The government also compiles and publishes data on local authority area-wide territorial emissions, many authorities (and consultancies) use the (two-year lagged) area-wide data to inform decarbonisation strategy and emissions accounting (BEIS, 2022b).

In contrast, Scotland and Wales are sector leaders with numerous reporting requirements. Wales' Public Sector Net Zero Carbon Reporting Guide (2022) requires all public sector bodies to estimate and report on *all scope* operational emissions annually from 2022. In Scotland, public sector bodies have a statutory duty to cut GHG emissions and have been reporting annually to government since 2016 on emissions and decarbonisation policies (including how carbon is embedded organisationally). In addition, an amendment to the 2009 Scottish Climate Change Act requires public sector bodies from 2022 to also report; their target date for net zero direct emissions, their targets for reducing indirect emissions, how their spending plans and resource use aligns with net zero ambitions and the completeness and format of disclosure (Scottish Government, 2021).

UK local authorities have a key role to play in emission reductions (Fig.1), from social housing, transport and waste to their wider influence through investment and procurement decisions as well as leading by example in their role as place makers (NAO, 2021; CCC, 2020).



**Figure 1** Local authority control and influence over decarbonisation diagram taken from *Local Authorities and the 6<sup>th</sup> Carbon Budget 2020* report.

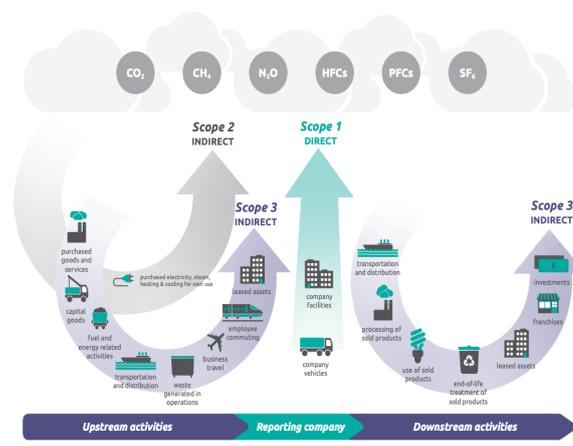
In 2021 the National Audit Office (NAO) found that 91% of English local authorities had adopted at least one net zero target but that central government is yet to define their role in achieving national net zero or set out how it will work with them to clarify this. The overall lack of clarity from central government on English local authorities' roles and responsibilities and the myriad of relevant guidance, standards and approaches mean there is little consistency in reporting and strategy on net zero. This is compounded by significant differences in authorities' powers, functions, and local circumstances (NAO, 2021).

The Climate Change Committee (CCC) (2020) set out guidance for monitoring and reporting emissions in a local authority setting and noted that the lack of an official reporting framework in England means emissions tracking is varied and hinders benchmarking despite the voluntary local partnerships reporting tool. They recommend authorities measure and report scope 1 and 2 (direct emissions and purchased energy) as a minimum and define and report scope 3 (indirect emissions) as actively as possible, *using the data that is available*. Other recommended actions include aligning all policy, spending and functions with net zero, implementing training and capacity building and ensuring staff are carbon literate.

In addition, the AR6 IPCC (2022) report notes that higher ambition in mitigation commitments sub-nationally did not always result in greater mitigation action. Constraints included the ability to; create new institutional competencies, change cultural norms and values of policy and professional actors, and cooperate between administrative departments. They highlighted that information, capacity building and disclosure were important, alongside robust performance measures. Moreover, the failure to embed climate change organisationally often leads entities such as local

authorities to continue making decisions that are inconsistent with emissions reductions targets. This contributes to lock in for *all scope emissions*, resulting in significant consumption of the carbon budget that requires more drastic action to address (IPCC, 2022). Ensuring decision making aligns with decarbonisation is an urgent task given that estimated emissions from planned energy infrastructure projects globally already jeopardise the 1.5°C target (Tong et al., 2019).

Whilst the need for action on scope 1 and 2 (direct and purchased energy [Fig.2]) emissions is pressing, many authorities and organisations have been working to track, report and reduce these emissions for over a decade and so management and mitigative pathways are relatively well developed. Efforts must now also focus on the wider/indirect emissions (scope 3) associated with activities, often comprising over 70% of an organisation’s footprint (Valls-Val & Bovea, 2021; NRW, 2019; GHGP, 2012), as well as how climate change mitigation can be embedded across organisational functioning to leverage swift emissions reductions (CCC, 2020; IPCC, 2022). Given that emissions are associated with nearly all activities in the current high carbon economy it is clear that the challenge to embed as well as track and reduce indirect emissions are interdependent. By understanding and tracking how emissions are associated with *all our activities*, we can make climate change the lens through which we make decisions and direct ourselves toward a low carbon future.



**Figure 2** GHG Protocol emissions scopes taken from the GHGP Scope 3 standard (2011)

### 1.1.1 Embedding indirect emissions into decision making

In England, authorities struggling to respond to their climate emergency and/or net zero commitments are failing to consistently measure and consider the emissions implications of decisions, resulting in spending, policy or project decisions that do not

reflect publicised decarbonisation commitments (CCC, 2020; Howarth *et al.*, 2021; Garvey *et al.*, 2022). Without robust emissions baselines, tracking and disclosure and unambiguous targets to which progress is clearly measured, both in internal and external communication, authority's risk losing trust, failing to achieve promised reductions, and locking us into a high carbon future (IPCC, 2022; CCC, 2020; Howarth *et al.*, 2021).

The failure to meaningfully embed emissions considerations in authority decision making is widespread and largely due to the absence of top-down regulation and guidance on emissions reporting, disclosure, and targets from central government (CCC, 2020; Howarth *et al.*, 2021; Garvey *et al.*, 2022). It is coupled with the overwhelming variety and volume of emissions management guidance in circulation meaning many authorities outsource carbon management to consultants - distancing officers and elected members, responsible for overseeing council functions, from emissions management and the emissions context of activities (CCC, 2020).

In England, this is compounded by significant regional disparities and endemic under-funding under the ongoing austerity regime (NAO, 2021). As a result, poorer authorities are at a disadvantage when trying to properly resource climate emergency responses, including their ability to establish sufficient in-house carbon/climate/environment teams, fund projects and educate staff (Sudmant *et al.*, 2018; Garvey *et al.*, 2022). However, even within larger or well-resourced carbon teams, siloed working practices across authority functioning and the lack of staff carbon/climate literacy outside of dedicated teams, limits the extent to which emissions can be considered in day-to-day service provision and decision making (Howarth *et al.*, 2021; CCC, 2020).

Informal discussions with a variety of authorities and organisations conducted for this research, including Hammersmith and Fulham council, Nottingham City council, Hull City council, Calderdale council, the Welsh Local Government Association, London councils umbrella group, Blackpool council and Hertfordshire County council, supported observations in the literature (CCC, 2020; IPCC, 2022) that identified siloed working regimes, limited carbon literacy and hesitation around addressing scope 3 emissions as barriers to climate action. It was noted that this results in emission calculation and management becoming isolated in teams that are not suitably located within key decision-making processes (IPCC, 2022).

Often, attempts by authorities to embed emissions considerations earlier in project and policy processes become tick box exercises that carry little weight, especially when the economic or financial status quo are perceived to be at stake or authorities are battling against restrictive budgets (CCC, 2020; Hale *et al.*, 2021; IPCC, 2022). This highlights the importance of both officer and elected member knowledge and the

need to establish working practices that consider emissions implications more fundamentally, to create new cultural norms and competencies (IPCC, 2022).

Additionally, due to widespread target ambiguity in public and private sector sub-national decarbonisation strategy, net zero commitments are widely acknowledged as insufficient to ensure a timely transition to global net zero by 2050 (Hans *et al.*, 2022; IPCC, 2022; Hale *et al.*, 2021). Focus must be on improving targets and identifying those that are not credible, requiring clarity on emissions scopes and sources in inventory and target boundaries and robust measurement and disclosure practices to ensure transparency and integrity (Hans *et al.*, 2022; IPCC, 2022; Fankhauser *et al.*, 2022). Authorities also require support to set and measure progress toward robust targets which differentiate between own operation and area wide emissions, include scope 3 or CBEs and robustly disclose annual emissions data.

Including scope 3 within sub-national inventory and target boundaries is now considered vital to meaningfully address the 'mitigation gap' (IPCC, 2022; NCI and CMW, 2022; SBTi, 2021). This is due to the renewed urgency of the climate problem (IPCC, 2022) and the current failure of national-level *territorial* net zero commitments to secure a 'well below 2°C' trajectory by the end of century. Furthermore, scope 3 emissions often constitute the majority of an organisation's footprint (over 70% [GHGP, 2012]), with category 1 purchased goods and services and category 2 capital expenditure scope 3 emissions sometimes accounting for 50-60% of total emissions (Ozawa-Meida *et al.*, 2013; NRW, 2018). Whilst this is partly due to the indirect nature of scope 3 emissions and the high uncertainties associated with estimates, work to report and reduce each category of these emissions sends a clear message to stakeholders and the market and ensures multiple entities along the value chain collaborate to drive emissions down (GHGP, 2013; GHGP, 2011; NRW, 2019; NRW, 2018).

Authorities experience inherent difficulties when addressing scope 3 including uncertainty, difficulty obtaining data, data granularity issues and limited control/influence over certain scope 3 categories, often causing hesitancy around inclusion in inventory and target boundaries (CCC, 2020). Although these barriers are legitimate, they should not be prohibitive to beginning to account for and reduce indirect emissions given the urgency of the climate problem (IPCC, 2022; Scottish Government, 2021). UK relevant guidance (Scottish Government, 2021; Welsh Government, 2022; UK Government, 2019) and global emissions management standards produced by the Greenhouse Gas Protocol (GHGP), set out multiple calculation methods of varying accuracy to support iterative approaches to scope 3 management that address data paucity issues over time (GHGP, 2011; GHGP, 2013).

Many progressive councils are making headway reviewing guidance and collaborating with universities and local government partners to start calculating and managing scope 3 emissions as authority specific calculation methods emerge (CCC, 2020; LGA 2022b). However, many under resourced authorities at the start of their net zero journeys lack the capacity, capability, or resource to robustly progress net zero strategy or scope 3 management (Sudmant *et al.*, 2018; Garvey *et al.*, 2022). The perceived complexity of scope 3, given that emissions are not under authorities direct control, and the variety of management approaches, can lead to expensive outsourcing or inaction. In the absence of central government guidance, support is required to interpret and communicate suitable scope 3 calculation and management methods.

GHGP (2013), UK Government (2019), Welsh Government (2022), Scottish Government (2021), academic literature (Berners-Lee *et al.*, 2011; Berners-Lee *et al.*, 2019) and consultant-based guidance generally support an iterative approach to scope 3 emissions calculation that starts 'shallow and wide', using spend data and emission factors sourced from Environmentally Extended Input Output (EEIO) analysis to estimate emissions and identify high emitting areas. As EEIO derived emission factors are based on sectoral averages they are indicative and high-level, and so literature, guidance, and consultant recommendations encourage the replacement of these high-level estimates with more resource intensive but accurate data/calculation methods over time (GHGP, 2011; GHGP, 2013). These are usually sourced from detailed life cycle analysis (LCA), a hybrid approach (EEIO and LCA) and/or supplier or product specific data (GHGP, 2011; GHGP, 2013; Berners-Lee *et al.*, 2019).

Authority specific guidance on this process is disparate and no specific methodology for English authorities exists (Garvey *et al.*, 2022; CCC, 2020). As such, to support more widespread scope 3 management this report postulates that the development of a replicable proof-of-concept establishing the spend-based method in an authority is required. This can start a process of iterative improvement, refining data quality and building in-house capacity and carbon literacy over time. Due to the simplicity and high-level nature of the spend-based method (GHGP, 2013; GHGP, 2011) it is sensitive to resource constraints, and if clearly articulated, could offer under-resourced authorities a simple route to *beginning* in-house, iterative scope 3 management.

In addition, beyond providing a starting point which can direct refinement efforts, spend-based emissions estimates situated within existing financial structures could leverage accountability, performance, and management processes already in place to tackle emissions. Offering the potential to embed high-level emissions estimates into spending decisions and foster wider collaboration between departments to address siloed working as emissions are estimated, tracked, and refined alongside financial considerations. Focussing on adapting existing structures opposed to investing

limited time and resource in creating wholly new systems to embed and account for emissions.

There is an urgent need for more resourcing, regulation, guidance, support, and clarity from central government to properly leverage local authorities in the net zero transition, and as the pace of climate change continues the frontline and potentially transformative role of authorities in enabling the transition cannot afford to be squandered (NAO, 2021; CCC, 2020; CEUK, 2021). Whilst the proliferation of climate emergency and net zero declarations is encouraging (Hohne *et al.*, 2021), the quality of subsequent emissions management and action is not (Hans *et al.*, 2022; Dawkins *et al.*, 2019; Howarth *et al.*, 2021).

Therefore, despite centrally imposed limitations, where possible, progress can and should be made toward addressing barriers to climate action which authorities have autonomy over (Howarth *et al.*, 2021). These include but are not limited to some of the critical organisational/institutional barriers identified by the IPCC (2022) and the CCC (2020) such as:

- Creating new cultural norms and competencies including improving carbon/climate literacy and embedding emissions considerations into ways of working.
- Fostering cooperation between administrative departments to address siloed working practices and leverage existing capacities and decision-making structures to tackle GHG emissions.

## 1.2 Scope of this report

This report aims to empower Blackpool Unitary Authority (BUA) and other similarly under-resourced authorities, at the start of their net zero journeys, to use existing financial and governance structures to tackle their indirect emissions. The work aims to provide clarity on the wealth of applicable emissions management guidance and standards, to support robust local authority climate action in the absence of top-down regulation and requirements from UK central government, disentangling the nature of iterative scope 3 emissions management.

Blackpool is used as a case study partner to explore opportunities for internal scope 3 emissions management that builds capability within authority-specific constraints. Blackpool's current net zero strategy is reviewed (Section 3) and local authority applicable emissions management guidance is collated and discussed (Section 4). A simple, iterative, spend-based approach (to calculate significant scope 3 emissions) is

then presented, discussed in the context of wider net zero strategy, and applied to Blackpool council's spend data and strategy (Section 5).

The collation of guidance, approach and discussion aims to support transparent disclosure, avoid misinterpretation/greenwashing, and enable more robust assessment of climate action and ambition by external observers. It endeavours to respond to a wealth of guidance and literature (CCC, 2020; GHGP 2011; UK Government, 2019; NAO, 2021; CEUK, 2021; Gillard *et al.*, 2017; Hale *et al.*, 2021; Howarth *et al.*, 2021; Garvey *et al.*, 2022; IPCC, 2022) calling for action on embedding carbon organisationally and robust action on scope 3 emissions in the public sector. The primary focus is authorities' own operation scope 3 emissions management and overarching net zero strategy, but it can also inform scope 1 and 2 decision-making and area-wide decarbonisation strategy.

## 2. Methods and research approach

This research was funded by the Centre for Global Eco-Innovation as part of their ECO-I Northwest (NW) project. The ECO-I NW funding is focussed on stimulating interdisciplinary research that supports low carbon innovation across the NW region by pairing industry partners with postgraduate researchers. The research for this report was therefore conducted in partnership with NW sustainability consultancy Carbonbit. As a result, this project was required to provide applied and practical outputs for public sector use, commercial outputs, and robust academic insights. Given the contrasting nature of these requirements they were, at times, challenging to balance. To secure their fulfilment, an applied research approach was adopted from the outset, ensuring practical outputs were complemented by academic rigor.

The research began by considering how local authorities could better embed GHG emissions into decision making. It focussed on indirect or scope 3 emissions to explore ways this vast, under-reported, area of emissions could be made visible. It first considered how UK green book informed GHG valuation or shadow pricing could support authorities to account for emissions more explicitly, before focussing solely on emissions calculation and governance. The choice to narrow the research focus to emissions calculation and governance resulted from discussions with multiple local authorities and public sector bodies, conducted as part of the applied research process. It emerged that whilst there was interest in carbon pricing, the majority of authorities did not yet have a firm understanding of their total GHG footprint, and so this became the research priority. This applied research approach was necessitated by the funding conditions, required outputs and the research problem (embedding emissions into decision making).

From the outset, it was important to interact with authorities to understand real-life constraints and competing priorities in councils across the UK who were attempting to align decision making with decarbonisation. This approach sought to ground the research in the reality of climate change and the grass roots pressure to act that authorities were facing, but also to understand the barriers and constraints experienced. This was to ensure any innovation was deeply practicable, and led the research to begin by conducting informal discussions and interviews with a range of public sector organisations and councils, including: Lancaster City Council, Hull City Council, Cambridge City Council, Hammersmith and Fulham Council, Nottingham City Council, Blackpool Unitary Authority, the Welsh Local Government Association, Calderdale Council, Carmarthenshire County Council, London Councils umbrella group, Merthyr Tydfil borough council and Hertfordshire County Council.

These discussions made clear that authorities were aspiring to address indirect emissions, and consider them more meaningfully in decision making, but were faced with multiple constraints. Namely, that they did not know what their total, scope 1+2+3 GHG footprint was. They noted how significant capacity, capability and funding constraints limited the willingness of staff outside dedicated carbon teams to address indirect emissions, and how publicly available, or in-house emission tools, seeking to support emissions consideration in decision making, were often either prohibitively complex or in practice were reduced to tick box exercises. This landscape set up the bounds of the project: to see what approaches could better estimate and manage emissions, using existing guidance, tools and expertise sensitive to the implementation barriers in practice.

To develop a practicable and applied approach to support indirect emissions management, Blackpool was chosen as a case study partner. This was due to NW funding requirements, but also because it is one of the most deprived council areas in England and was at the start of its net zero journey. It is representative of many authorities across the UK struggling to tackle the net zero challenge within austerity constraints. Choosing Blackpool also meant that the research could explore what a large council was doing to balance significant social needs with decarbonisation commitments, and better understand the existing capacity, resources and ability to address scope 3 emissions present.

Alongside discussion with councils and securing Blackpool as a case study partner a broad range of public and private guidance, standards, requirements, and accreditation for GHG emissions management was reviewed. This was collated and applied to the specific conditions facing Blackpool and underpinned the spend-based approach to indirect emissions management in Section 5 of this report.

Working closely with Blackpool to understand council functioning and priorities and existing accounting, performance and carbon management was fundamental to the research. This process occurred over six months and was mediated by Blackpool's Net Zero Strategy Manager Scott Butterfield. After the project pitch was presented to senior management and given permission to involve staff across the authority, Scott helped direct attention to key staff members and obtain document and meeting access where required. In total, 15 informal interviews were conducted with council staff over this period, these were conducted to: establish accountancy practices, understand how spend data was handled and organised, understand how performance toward targets was measured within the council, determine what barriers to embedding or accounting for emissions were faced, identify levels of carbon literacy, and better understand decision making practices. Various staff members supported this process including the Energy Manager, Head of Accounts, Finance Officers, the Performance delivery officer, the Head of Project Development and Funding and the Chief Internal Auditor.

These conversations and the documents and information provided, ultimately allowed a test case for publicly available in-house accounting of indirect emissions, using spend-data, to be created for this research. This was heavily reliant on the accounting team to provide spend data and accountancy codes and members of the carbon team and beyond to provide insight into capacity and capability, to ensure the feasibility of the approach.

Whilst adopting an applied approach was necessary for this research project, it did limit the research practically. Whilst most councils were forthcoming, it was challenging to access and identify key personnel to discuss with. This was most apparent during the work with Blackpool where various developments in the research hinged on getting access to spend data in a specific format or waiting for a key staff member to have availability to answer questions on sometimes convoluted decision making, energy management or accountancy processes. This strengthened the applicability of the work but also indicated the extent to which staff capacity is limited, how pressing competing priorities are and how, if senior and mid-level management do not champion emissions management practices they will not develop. This represents the most significant limitation of the work; in that it ultimately relies on impassioned individuals at various levels of management to commit to addressing and embedding emissions considerations across council functioning. Although, this is also a symptom of the lack of statutory and transparent requirements from central government clarifying the role of local authorities in the net zero transition.

### 3. Blackpool Unitary Authority and the net zero challenge

Blackpool authority area is only 35 km<sup>2</sup> with a population density ten times that of the English average (MHCLG, 2019). In the 2019 Indices of Multiple Deprivation, Blackpool was ranked as the most deprived local authority area in England suffering from issues such as low average earnings, high crime rates and increasingly lower than average life expectancy rates (MHCLG, 2019).

Deprivation issues have been compounded by reductions in government funded spending power of 52% across England since 2010, meaning already stretched authorities like Blackpool have had to make annual spending cuts of up to 7% for over a decade (NAO, 2021a). Widespread impacts on service delivery have resulted and the CCC (2020) report that in many areas austerity has affected local authorities' ability to use their powers to address climate change as staff are cut back, specialist staff are lost and authorities become increasingly risk averse.

This strained and uncertain landscape leaves authorities like Blackpool with a difficult and somewhat overwhelming task – to meet increasing service demand with limited resources whilst decarbonising operations and enabling area-wide emissions reductions. Moreover, centrally directed funding and policy issues further limit authorities' ability to act. Examples include the National Planning Policy Framework (NPPF) minimum requirements which prohibit authorities from raising build standards without becoming legally vulnerable, or the current short-term competitive funding for narrow decarbonisation projects with tight bidding (and delivery) timeframes, which impose difficulty on smaller authorities or those with less capacity and skills to access funds. For example the recent Salix decarbonisation fund which Blackpool was not successful at securing.

The wider structural and institutional limitations faced by authorities are detailed in full by the CCC (2020) and the NAO (2021) and it is clear authorities such as Blackpool have little capacity to change central government policy other than by lobbying for greater resource, clarity and support. This is a near ubiquitous commitment in local authority climate action plans. In the interim, all other available levers must be pulled with urgency and work to decarbonise (often mandated by local grassroots pressure to declare a climate emergency) must focus on what can be achieved despite these limitations.

As described in Section 1.1 and 1.1.1, this is particularly true of scope 3 emissions where local action has been stunted by lack of clarity, for example by the absence of an English national framework for organisational and area-wide emissions management including target setting, defined emissions boundary guidance and approaches to tracking emissions. Instead, authorities are developing net zero action plans and management based on piecemeal policies and communication from central government. This means they rely on an array of information from BEIS, the Local

Government Association (LGA), non-governmental organisations (NGOs) and universities, which in turn can lead to a costly reliance on consultants, hindering internal capacity building (CCC, 2020; NAO, 2021).

For council or operational emissions, addressing scope 1 and 2 (direct emissions and purchased energy) still requires more coordinated national support, funding, and expertise. Still, management and action are more established for scope 1 and 2 and emissions are somewhat easier to address with targeted mitigation projects than scope 3, for example by making decisions regarding energy suppliers or vehicle use to reduce direct fuel consumption. Data on scope 1 and 2 also tends to be more readily available, well bounded and can be accurately calculated from electricity or fuel consumption data (such as kwh or litres of fuel used) and BEIS conversion factors (Fig.3).

In contrast, scope 3 is limited by boundary, data and measurement uncertainty as well as inherent system complexities manifest in the varying degrees of control or influence authorities have over reductions (Fig.3). This means that robust baselines, carbon budgets and clear scope 3 net zero trajectories are not possible. Instead, well communicated and caveated action plans with expansive budgets/boundaries that follow an iterative approach are key. Local authorities are clearly not responsible for all value chain emissions associated with their operations, but they do have a responsibility to the public to understand how their activities interact with emissions and make reductions where possible.

	Council Operations	Area Wide
Easier to measure ↑	<b>Scope 1 &amp; 2 Emissions</b> <ul style="list-style-type: none"> <li>• Good data should be available to enable robust baseline analysis, carbon budgets and clear trajectory to net zero</li> <li>• Under the direct control of the local authority</li> </ul>	<b>Scope 1 &amp; 2 Emissions</b> <ul style="list-style-type: none"> <li>• Data available from BEIS should allow key priorities to be identified and actions to be developed with partners</li> <li>• Mostly not under the direct control of the local authority</li> </ul>
	<b>Scope 3 Emissions</b> <ul style="list-style-type: none"> <li>• An emerging area where measurement is not fully developed with new methodologies emerging, and there are data availability issues</li> <li>• Wide and shallow analysis to identify key priorities, commence quick wins and build plan for better data gathering</li> </ul>	<b>Scope 3 Emissions</b> <ul style="list-style-type: none"> <li>• The UK government has not yet set the protocols it wants to use for scopes and boundaries for city wide reporting.</li> <li>• Influence only. Identify priority areas for action and start work</li> </ul>

Increasingly remote →

**Figure 3** Council and area-wide emissions approaches in England taken from Local Authorities and the 6<sup>th</sup> Carbon Budget 2020 report.

### 3.1 Climate emergency declaration

Blackpool declared a climate emergency in 2019, announcing a target to reduce emissions to net zero by 2030. As with many authorities there are remaining ambiguities surrounding the GHGs covered, current emissions rates (baselines) and organisational, operational and target boundaries (Blackpool Council, 2021; Blackpool Council 2021a). They are yet to disclose which emission sources, scopes and council owned organisations are included or clearly define the level of ambition for council operational emissions versus area-wide decarbonisation. However, progress has been made by holding a climate assembly to inform strategy and an overview climate emergency action plan has been published where many actions identified have already been progressed (Blackpool Council, 2021).

Blackpool's climate emergency declaration (Blackpool Council, 2021a) commits the council to:

- "Make council activities net-zero carbon by 2030"
- "Achieve 100% clean energy across the council's full range of functions by 2030"
- "Ensure that all strategic decisions, budgets and approaches to planning decisions are in line with a shift to zero carbon by 2030"
- "Support and work with all other relevant agencies toward making the entire area zero carbon within the same timescale"

On the council website the target is described as 'making the council's carbon emissions net zero and using 100% clean energy across the council's services by 2030' (Blackpool Council, 2021), whilst the climate action plan page states that the plan 'sets out how the council and town can aim for net zero carbon emissions by 2030' (Blackpool Council, 2021b).

Clarity is needed on various aspects of the target including:

- Whether the target includes all GHGs as CO<sub>2</sub> equivalents (CO<sub>2</sub>e) or is solely carbon focussed?
- Which 'council activities' or 'council services' are included (where inventory and reporting boundaries are being drawn) e.g. wholly owned companies?
- Which GHGP emission scopes are included in the 2030 target for both the area and council?
- Where target boundaries are being drawn for the area and council operational targets?

- Which categories within scopes are included within the target i.e. scope 3 has 15 categories (Table.1)
- What is the ratio of removals to reductions, and what type and standard of removal methods will be permitted to achieve targets? (McLaren *et al.*, 2019)

Internally, progress has been made on choosing an initial scope and organisational boundary, baselining and exploring mitigation pathways for area and council emissions. Blackpool did this by commissioning the Carbon Trust (for £28k) to calculate their scope 1 and 2 footprint, from data collated by Blackpool, to prepare a corresponding mitigation project pathway for the top 10 highest emitting sites. Separate work was also completed by Atkins (2021) for each authority area in Lancashire offering territorial-based emissions baseline and mitigation pathway options.

The council's operational emissions baseline and organisational boundary is not yet publicly disclosed as Blackpool is waiting on the final Carbon Trust report. The current undisclosed boundary includes all Blackpool council's operational and wholly owned businesses scope 1 and 2 emissions and scope 3 (council only): upstream scope 1 and 2 (Well To Tank [WTT] and Transport and Distribution [T&D]) (category 3), council accommodation and travel (category 6) and water usage (partial category 5). It is unclear whether this also includes wholly owned company scope 3 categories.

Current territorial emissions for the town have been estimated to be 490 kt CO<sub>2</sub>e as published on the Blackpool council website from (Atkins, 2021) Lancashire Net Zero Pathways Options Report. In contrast, the PCAN (2017) 'town wide carbon account' estimated ~1 Mt CO<sub>2</sub>e (territorial), ~1.8 Mt CO<sub>2</sub> (consumption-based carbon only) and ~2.5 MtCO<sub>2</sub>e (consumption-based including all GHGs) for the Blackpool area. The discrepancy is telling and highlights inherent uncertainty in emissions estimates, stressing the importance of target baseline and boundary clarity for accountability. The chosen boundary for town wide emissions accounting and management appears to be production/territorial emissions based opposed to consumption, despite the IPCCs (2022) calls for emissions beyond administrative boundaries to be monitored and reduced to fully leverage sub-national decarbonisation. Although, the climate emergency declaration itself commits to executive and scrutiny functions 'reviewing both production and consumption emissions associated with council activities' (Blackpool Council, 2021a). Notably no interim targets have been set. However, this is likely due to the enormity and ambiguity of their 2030 target.

### 3.1.1 Caveats to sub-national net zero strategy

The IPCC (2022) lists 'ambiguous net zero targets' as a key continuing challenge to global decarbonisation in their latest technical mitigation summary report. Critique in this report is therefore focussed on addressing the inconsistencies with targets, disclosure and emissions management that many under-resourced authorities (and sub-national entities) struggle with. The aim is to support and inform unambiguous internal and external communication of net zero strategy.

Authorities net zero strategies must endeavour to avoid dilution of ambition and foster transparency around the magnitude and difficulty of the task faced, so they can present an honest picture of the opportunities and limitations associated with the net zero challenge. It is important to find ways to avoid the understandable tendency to prioritise 'looking good' at target progression over concrete and honest action. This is even more pertinent for corporate responsibilities on net zero.

In essence, local authorities are required to strike a delicate balance – rigorously tracking and understanding the ways in which their activities interact with emissions whilst working urgently to reduce them by taking clear responsibility for scope 1 and 2, an evolving responsibility to scope 3 and communicating caveats and the limits of their powers. However, there is a critical need to avoid being too quick to cite centrally imposed limitations as reason for inaction or maintain ambiguity around targets and disclosure which often results in intended or unintended greenwashing (IPCC, 2022).

### 3.2 Blackpool net zero strategy and indirect emissions

The iterative spend-based approach presented in Section 5 of this report is focussed on own operation emissions management and relates to various work previously identified to progress Blackpool toward its net zero targets. These include the Carbon Trust's recommendations for further work, Blackpool's climate emergency action plan points and the climate emergency declaration itself (Blackpool Council, 2021b; Blackpool Council 2021).

This section seeks to place the calculation method in the context of Blackpool's specific net zero ambitions by briefly summarising it here alongside a table of scope 3 emission categories (Table.1) including their relevance to Blackpool's emissions and their compatibility with the spend-based method.

The spend-based approach utilises a simple and established 'shallow and wide' emission calculation method (GHGP, 2011; CCC, 2020) – where each spend line is multiplied by a kgCO<sub>2</sub>e/£ sector average emission factor (from multi-regional

environmentally extended input-output [EEIO] analysis [Owen and Barrett, 2022]) to give an indication of emissions (see Equation 1).

$$\text{Activity data (e.g. tonnes of material, litres of fuel or pounds spent) x emission factor (e.g. BEIS conversion factor or proxy spend factor) = emissions}$$

#### Equation 1

The emission factors (EFs) used are publicly available and published on the HM Government 'UK Carbon Footprint' webpage. Up until June 2022 as work for this report was completed the most recent UK indirect supply chain emission factors were published by DEFRA using 2011 data (DEFRA, 2013). Accordingly, the associated uncertainty, calculated as relative standard deviation by the Welsh Net Zero Reporting method, was estimated to be +/-25%. It is well understood that all emission factors, often averaged over multiple scenarios, carry uncertainty which cannot be adequately eliminated (Welsh Government, 2022). Despite the uncertainty associated with the resulting emissions estimates the Welsh Government deemed the 2011 EFs as the most suitable option for standardised public sector accounting and reporting of category 1 and 2 (purchased goods and services and capital spend) scope 3 emissions (see Section 4.1). At the time of writing (June 2022) an updated set of 2019 indirect supply chain emission factors were published by DEFRA for the first time in nine years, replacing the 2011 set. UK and England-specific EFs were published, and so, despite work carried out for this report to improve the 2011 EFs (see Sections 4.1.1, 5.1 and appendix A), the 2019 EFs are now the most reliable source of indirect supply chain emission factors for use with England-specific and UK spend. The replacement of EFs over time is inevitable and key to ensure the relevance of the emissions estimates.

Using a spend-based approach looks to somewhat address indirect emissions and embed carbon more fully organisationally by focussing on *starting* to track indirect emissions, using spend data and existing financial structures. This can place knowledge in the hands of accountants and managers exploiting existing decision-making structures and can start broadly and build capacity as the process is refined, helping to:

- Track and embed carbon emissions more fully organisationally
- Bring forward the date at which significant scope 3 emissions (e.g. purchased goods and services, capital spend and investments) are acted on
- Build carbon literacy and awareness
- Build a robust footprint over time
- Avoid consultant outsource spend and undermining of internal capacity (empowerment)
- Spread emissions management and accounting burdens across the organisation by utilising existing practices

Previously identified actions and recommendations to enable Blackpool to progress its net zero ambitions which may be furthered by the spend-based approach presented in Section 5 of this report are detailed below.

#### *Carbon Trust recommendations*

- "Blackpool should consider expanding scope of footprint, specifically more scope 3 emissions, which typically have the largest contribution to an organisations footprint"
- "Organisational boundary should be extended in the future to include... scope 3 emissions... purchased goods and services, waste, capital goods, investment"
- "Improved management practices, better operational procedures and monitoring, measurement and targeting"
- "As Blackpool becomes increasingly familiar with the carbon foot printing process, and can instil stronger data collection process, they should begin to expand their footprint to cover all emissions sources and revisit existing sources"
- "Blackpool Council should focus on developing a variety of internal communications to raise awareness and build capabilities internally. This will be crucial when looking to develop a strategy that is effective. Engagement from the outset will help gain buy-in for Blackpool's priorities, and encourage behaviour change across the organisation." (Carbon Trust, 2022).

Using a spend approach aligned with existing practices can work toward these recommendations without the costs of outsourcing.

#### *Blackpool climate emergency plan*

- 101 Audit on council's carbon data capture for accurate monitoring reduction in emissions
- 102 Establish performance indicators and monitoring arrangements to check trajectory for accurate monitoring reduction in emissions
- 105 Identification of specific development needs across all council services via carbon literacy processes to ensure all staff are equipped to take decisions based on sustainability
- 109 Co-ordinate sustainability efforts across the council's companies to maximise potential of company resources
- 111 Review scope of emissions included in 2030 target to consider inclusion of further scope 3 upstream and downstream categories to increase awareness of sustainability

- 112 Adopt 'climate first' approach where all council strategies and initiatives must demonstrate ability to contribute to achieving net zero to ensure consideration of sustainability agenda throughout all work
- 116 Set minimum environmental social value targets for all procurement decisions
- 117 Add specific environmental measures for suppliers

The Climate Emergency plan (Blackpool Council, 2021b) also states that Blackpool will be "accounting for emissions in all of our actions". Work on using spend data to track and refine emissions estimates can work towards accounting for indirect emissions more fully in all council spending activity (Berners-Lee et al., 2011; Ozawa-Meida et al., 2013).

#### *Climate emergency declaration*

- "Ensure that all strategic decisions, budgets and approaches to planning decisions are in line with a shift to zero carbon by 2030"
- "Ensure that all council led leadership teams embed this work in all areas and take responsibility for reducing, as rapidly as possible, the carbon emissions resulting from the council's activities, ensuring that any recommendations are fully costed and that the Executive and Scrutiny functions review council activities taking account of production and consumption emissions and produce an action plan within 12 months, together with budget actions and a measured baseline"
- "Request that council scrutiny committees consider the impact of climate change and the environment when reviewing council policies and strategies"
- "Report on the level of investment in the fossil fuel industry that our pensions plan, and other investments have, and review the council's investment strategy to give due consideration to climate change impacts in the investment portfolio"
- "Ensure that all reports in preparation for the 2020/ 2021 budget cycle and investment strategy will take into account the actions the council will take to address this emergency" (Blackpool Council, 2021a).

The approach presented in this report aims to progress commitments to account for consumption emissions across council activities (Table.1). It argues that by aligning emissions tracking with well-established and embedded financial management, emissions could be further considered across council activities such as in investment decisions, budget setting and policy and strategy formation.

Furthermore, all 15 scope 3 categories, in the context of Blackpool's emission sources, have been assessed for compatibility with the spend-based method outlined above.

Given that spend-based estimates are high level in nature, methods for more accurate calculation have also been provided, such as using specific fuel consumption data and emission factors from suppliers to calculate category 4 emissions. These methods represent the next stage of iteration for emissions calculation, for use once *more specific data* becomes available, this iteration approach is explored in detail in Section 5.3. In the interim, the spend-based calculations provided in Table.1 can enable high-level estimates of emissions to be calculated to guide decision making. The relevant council department responsible for the emissions in each category at Blackpool has also been provided to target action.

As demonstrated in Table.1, local authority own-operation spend data can be used to estimate the following GHGP scope 3 categories; 1 purchased goods and services, 2 capital spend, 5 waste (in absence of weight data), 6 business travel (in absence of fuel data), 8 assets the council is leasing from elsewhere (some of this category will show up in spend - see Table.1) and 15 investments. Category 7 - employee commuting is the only significant category of emissions that spend data cannot be used to calculate emissions for.

**Table 1** Scope 3 operational GHGP (2011) emission categories and their relevance to Blackpool council own-operation emissions. Categories are assessed for compatibility with spend-based emissions calculation method (spend [activity data] x average EEIO EF = emissions), including how calculations can be improved over time to inform Blackpool's scope 3 strategy. All emission calculation methods and category information are sourced from the Scope 3 standard (GHGP, 2011) and Technical calculation guidance for scope 3 (GHGP, 2013) unless otherwise indicated.

Scope category	Content	Council relevance and coverage (council operations only, not inc. wholly owned companies)	Eligibility for spend-based method (spend x average EEIO EF = emissions)	Iteration examples	Area of council with influence
<b>Category 1</b>	Purchased goods & services	All purchased goods and services	Spend-EF method viable for high level estimate (GHGP, 2011; GHGP, 2013). All purchased goods and services included in the data set used for spend-based method proof of concept using Blackpool's Community and Environmental services 20/21 spend data.	Refining EF choices over time by using updated EFs as they are published (UK Government, 2022) and seeking product and supplier specific data (e.g. supplier scope 1 and 2 and process based EFs for specific products) GHGP, 2011; GHGP, 2013).	Each department makes decisions on spend. Elected members input on larger decisions.
<b>Category 2</b>	Capital goods	All capital goods and capital expenditure. Can include any machines or computer hardware 'extended life products used to provide a service'. Capital goods are fixed assets or plant, property, and equipment (PP&E) e.g. equipment, machinery, buildings, facilities, and vehicles. GHGP (2011) says 'organisations should not depreciate/discount emissions from capital goods over time. Instead, account for total emissions in year of acquisition the same way category 1 emissions are calculated'. Organisations are permitted to delineate capital spend based on financial accounting capital spend categorisation. (GHGP, 2011; GHGP, 2013)	Blackpool council, capital expenditure/goods are reported separately by department. Spend-EF method is viable for high level estimate (GHGP, 2011; GHGP, 2013). Property/asset purchases can be tracked via spend-EF method as long as they are included in departmental capital expenditure.	Refining EF choices over time and seeking supplier and product specific data (e.g. supplier scope 1 and 2 and process based EFs) GHGP, 2011; GHGP, 2013) – BEIS (2022) produce conversion factors for use with weight/volume of selected construction materials used (e.g. steel).	Departmental and elected member decisions.
<b>Category 3</b>	Upstream scope 1 & 2	Extraction, production, transportation, and distribution of scope 1&2; fuels, electricity, and heat/steam. (GHGP, 2011; GHGP, 2013)	Carbon Trust calculated these emissions as part of their carbon footprinting work for Blackpool (Carbon Trust, 2022). Blackpool can use Carbon Trust's calculation method for monitoring these emissions (which simply multiplies relevant BEIS [2022] conversion	Track with scope 1&2 data, using WTT and T&D BEIS conversion factors. Note that LGA class WTT and T&D as out of boundary for local authorities given limited (if any) ability to influence outside of	Service manager for energy and sustainability. Projects and procurement team for mitigation projects.

			<p>factors by scope 1 and 2 primary activity data), alongside their scope 1&amp;2 monitoring processes.</p> <p>Or Blackpool can assign electricity, gas, diesel, and petrol spend based EFs, but these include (for electricity at least) generation/transmission/distribution and so cannot separate scope 1&amp;2 from 3 in high level spend-EF approach (GHGP, 2011; GHGP, 2013).</p>	scope 1&2 reduction choices (LGA, 2022).	
<b>Category 4</b>	Upstream transportation and distribution	This includes transportation/distribution between immediate (Tier 1) suppliers to the council as well as third-party transport and distribution services including logistics and transport between buildings or facilities e.g. transportation of goods in council-controlled vehicles. (GHGP, 2011; GHGP, 2013)	Spend-EF method viable for high level estimate (GHGP, 2011; GHGP, 2013). For Blackpool this category may include portage or commissioned transport/distribution of goods. However, in EEIO derived EFs for purchased goods and services ALL emissions associated with that purchase are included so <i>upstream transport and distribution between suppliers is covered in the high level spend-EF method</i> . Therefore, if Blackpool uses the spend-based method to account for all category 1 and 2 scope 3 emissions Blackpool could class this category as in scope and accounted for, possibly choosing to report on combined category 1 and 4 emissions.	Specific fuel consumption data with EFs from suppliers where relevant GHGP, 2011; GHGP, 2013).	Projects and procurement team. Departmental and elected member decisions.
<b>Category 5</b>	Waste	Including solid waste and wastewater. Waste treatment by third parties ONLY. Waste treatment at facilities owned/controlled by the council are accounted for in scope 1 and 2 (direct and indirect electricity and fuel combustion) (GHGP, 2011; GHGP, 2013).	Emissions from third-party waste services can be accounted for with the spend-based method (GHGP, 2011; GHGP, 2013) and includes <i>waste Blackpool creates which is collected and treated by a third party</i> . The GHGP advise using the average data method (e.g. and EF for total tonnage of waste to disposal) but using the spend method to give a higher-level estimate if weight data is not	Total waste to disposal method in tonnes with average EFs assigned, seeking EFs for specific waste types then directly sourcing supplier specific scope 1&2 data for incineration/recycling etc. (GHGP, 2013) for waste <i>created</i> by Blackpool operations. Reported as category 5 emissions.	Community and Environmental Director and elected member decisions.

			<p>available is acceptable (GHGP, 2011; GHGP, 2013).</p> <p><i>Waste services controlled by the council</i> are also included in the proof of concept as scope 3 spend-based emissions, as waste management is outsourced via contracts. Technically these should be accounted for as scope 1 and 2 emissions, but Blackpool does not currently have the contract data so should refer to GHGP (2013) and GHGP (2011) for guidance calculating and reporting emissions from waste services <i>provided</i> by them.</p> <p><i>Waste created by Blackpool operations and waste services provided by Blackpool council</i> are different. In the proof of concept they are included as category 1 emissions as they have been classes as spend on 'purchased goods and services' as waste services are outsourced. Blackpool can choose to report these as category 5 or category 1 emissions at this high-level starting point.</p> <p>Water is metered and categorised in spend, the average spend-based EF for water has been assigned.</p> <p>Carbon Trust (2022) did not calculate emissions from waste for Blackpool but have done so for water, it may be more suitable to use their method/data for monitoring. Both waste and water spend-EF estimates have been included in the Blackpool proof of</p>	<p>Blackpool should refer to GHGP (2013) and GHGP (2011) for guidance calculating and reporting emissions from waste contracts (i.e. waste services <i>provided</i> by Blackpool).</p> <p>Water should be measured in primary consumption activity data (by cubic metres) and multiplied by BEIS (2022) EF. (GHGP, 2013).</p>	
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			concept data set and can be removed as desired.		
<b>Category 6</b>	Business travel and hotel stays	Air, rail, bus, ferry, car etc. travel (inc. employee-owned vehicles for council work NOT commuting) this includes hotel stays. (GHGP, 2011; GHGP, 2013).	<p>Money spent on each form of transport multiplied by the appropriate spend-based EF is GHGP compliant (GHGP, 2011; GHGP, 2013). The proof of concept 9AN breakdown provides some travel type for categorisation (e.g. bus, tram, rail), where 'travel' is the 9AN a generic land transport EF has been assigned.</p> <p>Carbon Trust have calculated business travel based on miles travelled and transport type so this spend approach may be redundant if monitoring is established using their approach/data.</p> <p>Blackpool 'car allowances' include fuel used and car maintenance/leasing and so is not possible to separate scope 1 &amp; 2 from scope 3 in this category. Business travel (minus car allowances) have been included in the Blackpool proof of concept data set.</p>	<p>Iteration could include: spend-EF method (using EEIO average EFs), progressing to distance-based method or fuel-based method (i.e. scope 1&amp;2 emissions of transport provider) with specific fuel EF applied (GHGP, 2011; GHGP, 2013).</p> <p>For hotel stays, BEIS produce 'hotel stay' conversion factors based on the number of nights (BEIS, 2022a) which could be substituted into the spend-based monitoring set if required to replace sector spend EF.</p>	Departmental and elected member decisions. Corporate leadership team to set strategy/policy on travel and hotel stays.
<b>Category 7</b>	Employee commuting	Transport between home and work site	Not possible with spend-EF method.		Corporate leadership team and elected members can influence behaviour and set strategy.
<b>Category 8</b>	Assets council is leasing off others	Leased assets such as buildings, vehicles and machinery. Likely included in scope 1&2 'controlled' vehicle/building use e.g. as direct fuel used or electricity/gas consumption. (GHGP, 2011; GHGP, 2013)	Asset use not included in scope 1&2 could be included in 'admin building expenses' and actual payment of leases may show up (with minimal emissions), most likely spend for leased assets is evident as 'electricity' 'gas' 'diesel' and 'car allowances' but also other leased assets are included within spend ledgers. This is compatible with spend-EF	<p>Scope 1&amp;2 coverage of assets.</p> <p>Screening for which leased assets are included in spend ledger is required to separate out category 8 emissions for reporting.</p>	Departmental and elected member decisions.

			approach, but most likely asset emissions are covered in scope 1&2.		
<b>Category 9</b>	Downstream transportation and distribution	Minimal (Welsh Government, 2022)	N/A	N/A	
<b>Category 10</b>	Processing of sold products	Minimal (Welsh Government, 2022)	N/A	N/A	
<b>Category 11</b>	Use of sold products	Minimal (Welsh Government, 2022)	N/A	N/A	
<b>Category 12</b>	End-of-life treatment of sold products	Minimal (Welsh Government, 2022)	N/A	N/A	
<b>Category 13</b>	Downstream leased assets.	Council assets leased out e.g. housing stock, owned buildings. (GHGP, 2011; GHGP, 2013).	Carbon Trust (2022) footprint included leased housing stock in scope 1&2 for some council owned organisations. Further downstream leased assets may be included in scope 1&2.  Not compatible with spend-EF method.	This is included in scope 1&2 coverage of assets and is not suited to spend based tracking.	Director of resources, departmental and elected member decisions.
<b>Category 14</b>	Franchises	N/A	N/A	N/A	
<b>Category 15</b>	Investments	Including financial investments and pensions. (GHGP, 2011; GHGP, 2013).	Can be calculated and tracked via 'spend'; GHGP (2013) method - sum of investee company total revenue x EF investee sectors in kgCO2e/£ revenue x share of equity of investor (%) = emissions.  Not included in the proof of concept as investment information is kept separately. Blackpool could consider estimating emissions from investments using this method.	'spend' analysis on investment portfolios and pensions using method outlined here.  Not tracked departmentally but with central accounting and SOA.	Director of resources, elected member decisions.

## 4 GHG emissions management guidance

This section collates relevant guidance and resources to inform local authority net zero strategy and an iterative approach to scope 3 emissions management. Guidance relating to:

- GHG inventorying and reporting
- Net zero/decarbonisation targets, boundaries, and disclosure

is reviewed, and how carbon considerations such as emissions tracking, and reductions can be embedded organisationally is considered throughout. This is to provide clarity on the disparate guidance relevant to English authorities, seeking to survey the policy landscape and mandated emissions management methods. Given the need for authorities to build in-house capacity/capability, embed carbon in decision making and act on scope 3 emissions, this section also seeks to ensure the scope 3 approach presented in Section 5 is appropriately situated in the literature and guidance to reassure Blackpool and others of its validity and relevance.

Target and disclosure guidance is considered additionally to GHG inventorying and reporting due to the significant target ambiguity issues in local authority net zero and climate emergency strategy (Howarth *et al.*, 2021; CEUK, 2021). It is reasoned that without placing scope 3 emissions calculation, tracking, and reporting in the context of robust overarching strategy including target setting and disclosure, authorities will struggle to achieve the level of transparency and integrity required to support scrutiny and the deep emission reductions required.

A wide range of guidance, standards, tools and resources exist to inform emissions management in sub-national UK entities (Table.2) with GHG reporting, and target requirements differing for companies and local authorities. For local authorities, guidance also differs on a devolved basis (see Fig.4).

	Local Government	Corporate
Required	<p>England: None</p> <p>Scotland: All significant public sector bodies to complete the <b>'Public bodies climate change reporting duty'</b> annually (established 2016). Reporting on profile (budget/staff), climate change governance, management, strategy, corporate emissions, projects and targets, adaptation, procurement and validation of report data. From 2022 also required to set direct and indirect net zero targets and set out how spend and resource will be aligned with those targets.</p> <p>Wales: All public sector bodies to report Scope 1 &amp; 2, some scope 3 emissions (including procurement) and land use emissions to the Welsh Assembly from 2022 using <b>Welsh Public Sector Net Zero Carbon reporting guide (2021)</b></p>	<ul style="list-style-type: none"> <li>• UK companies listed on the stock exchange (EEA market or with shares on the New York Stock Exchange or NASDAQ)</li> <li>• Unquoted large UK companies which are required to prepare Directors reports</li> <li>• Large Limited Liability Partnerships (see Companies Act)</li> </ul> <p>Required to disclose their annual energy use and GHG emissions (Scope 1, 2 and 3) using the <b>Environmental Reporting Guidelines: including Streamlined Energy and Carbon reporting and greenhouse gas reporting (2019)</b></p>
Voluntary	<p>England: <b>Local Partnerships GHG accounting tool</b> including Scope 1, 2 and selected scope 3</p> <p>Scotland: no additional voluntary reporting</p> <p>Wales: no additional voluntary reporting</p>	<p>UK Government encourages all other companies to report using <b>Environmental Reporting Guidelines: including Streamlined Energy and Carbon reporting and greenhouse gas reporting (2019)</b></p>

**Figure 4** Local government and corporate sub-national GHG statutory and voluntary reporting requirements for the UK.

As sub-national entities, UK local authorities also sit somewhat uniquely within public and private management spheres due to the corporatisation of their governance and fiscal management (and significant outsourcing of service delivery) (Wollmann, 2011). From an emissions management perspective, this means that national, devolved, and corporate guidance can apply and as noted, this can make deciphering guidance to baseline, monitor, and set emissions targets for different emission scopes complex.

#### 4.1 Scope 3: calculation, accounting and reporting

This section reviews current UK applicable scope 3 calculation, accounting and reporting guidance drawing on international, national, central government, local government, devolved and corporate sources. The spend-based method is focussed on to identify the simplest starting point for iterative scope 3 emissions management appropriate for an under-resourced authority such as Blackpool at the start of their net zero journey. It is reasoned that identifying an achievable starting point in terms of time burden, within authority relevant guidance, could make uptake more likely in a resource stretched environment and empower Blackpool to estimate and improve estimates in-house to build much needed capacity and capability. Moreover, given that the availability of financial data is high and management structures are well established in authorities, using spend data has the potential to leverage existing systems to tackle emissions opposed to creating new ones.

The most widely used emission management standard for public and private sub-national organisations is the GHGP, it is an internationally recognised standard from the World Resources Institute and World Business Council for Sustainable Development. The GHGP have published a wealth of guidance on calculating and monitoring scope 1, 2 and 3 emissions including specific city inventory and target accounting guidance (Table.2). The GHGP corporate and scope 3 standards are company focussed but can be applied to any sub-national organisation. The UK Environmental Reporting Guidelines (HM Government, 2019), LGA guidance and Welsh and Scottish guidance all adhere to the protocol (see Table.3 for guidance list).

Key GHGP guidance for calculating and managing council-based operational emissions, opposed to area-wide emissions, include the Corporate Standard (2004), Scope 3 Accounting and Reporting standard (2011) and the Technical Guidance for Calculating Scope 3 emissions (2013). These documents introduce scope 3 emission boundaries (see Section 4.2 of this report), accounting and reporting principles, the 15 scope 3 emission categories and give specific calculation and target setting guidance for a wide range of sectors and situations.

Fig.5, taken from the Welsh Public Sector Net Zero Reporting Guidance (2022) summarises the GHGP scope 3 categories deemed relevant for public sector emissions reporting and inventories. Some categories are less relevant for local authorities, and for reporting purposes Wales excludes franchises and investments, partially excluding sold products and downstream categories. The work for this report, using Blackpool specific information and data has looked at how a spend-based approach can help enable *as complete an assessment as possible* for scope 3.

Category	Description	Sources
<b>Scope 1: Direct emissions</b>	Emissions from operations that are owned or controlled by the reporting organisation	<ul style="list-style-type: none"> <li>• Generation of heat</li> <li>• Onsite generation of electricity and heat e.g. Combined Heat and Power (CHP)</li> <li>• Physical or chemical processing*</li> <li>• Transportation of employees/goods in company-controlled vehicles</li> <li>• (Fugitive emissions from company-controlled sources)</li> </ul>
<b>Scope 2: Indirect emissions from energy</b>	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling generated by a third party and consumed by the reporting organisation	<ul style="list-style-type: none"> <li>• Generation of purchased electricity</li> <li>• Generation of purchased heat or steam</li> <li>• Generation of purchased district heating</li> </ul>
<b>Scope 3: Indirect emissions</b>	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting organisations, including both upstream and downstream emissions	<ul style="list-style-type: none"> <li>• Purchased goods and services</li> <li>• Fuel and energy-related upstream activities</li> <li>• Upstream transportation and distribution*</li> <li>• Waste generated in operations</li> <li>• Business travel</li> <li>• Employee commuting</li> <li>• Upstream leased assets</li> <li>• Downstream leased assets*</li> <li>• Downstream transportation and distribution*</li> <li>• Processing of sold products*</li> <li>• End-of-life of sold products*</li> <li>• (Franchises)</li> <li>• (Investments)</li> </ul>

**Figure 5** Emissions scopes and sources/categories from the GHGP deemed relevant for public bodies in the Welsh Public Sector Net Zero Reporting Guidance (2022), brackets indicate reporting exclusion and stars indicate partial exclusion, see Welsh guidance for detail.

Using spend to calculate emissions is a high-level method often described as ‘shallow and wide’ and can be used to estimate a significant portion of scope 3 emissions (see Table.1). Namely, 1 purchased goods and services, 2 capital spend, 5 waste (in absence of weight data), 6 business travel (in absence of fuel data), 8 assets a council is leasing from elsewhere (partially) and 15 investments.

Each organisation is different but certain categories often make up a greater proportion of the carbon footprint than others. In general, scope 3 can account for over 70% of an entity’s total emissions with purchased goods and services (category 1) and capital spend (category 2) alone sometimes constituting up to 50-60% of overall emissions (Ozawa-Meida et al., 2013: NRW, 2018). This is perhaps unsurprising given that 40% of global emissions are estimated to be driven by purchased and sold goods alone (CDP, 2018). As work for this report is focussed on how Blackpool can quickly

start estimating and refining its scope 3 emissions, without outsourcing or placing an unmanageable administrative or capacity burden on the council, it is focussed exclusively on purchased goods and services and capital spend of a single directorate, to capture a large emission source area and serve as proof of concept (Section 5.1). The application of a spend-based calculation method for other scope 3 categories was also considered in Table.1. The spend-based approach (Section 5) uses Equation 1 (Section 3.2), where secondary or proxy spend data is multiplied by a sector average emission factor to give an emissions estimate (see Fig.6).

The GHGP explain in their technical scope 3 calculation guidance:

- The principles for selecting appropriate calculation methods (e.g. data availability, cost of obtaining data)
- The screening criteria for scope 3 category inclusion (e.g. proportion of total footprint)
- Which data sources are suitable for each scope 3 category of emissions
- The differences and merits of primary and secondary data (Fig.6)
- How to improve data quality over time.

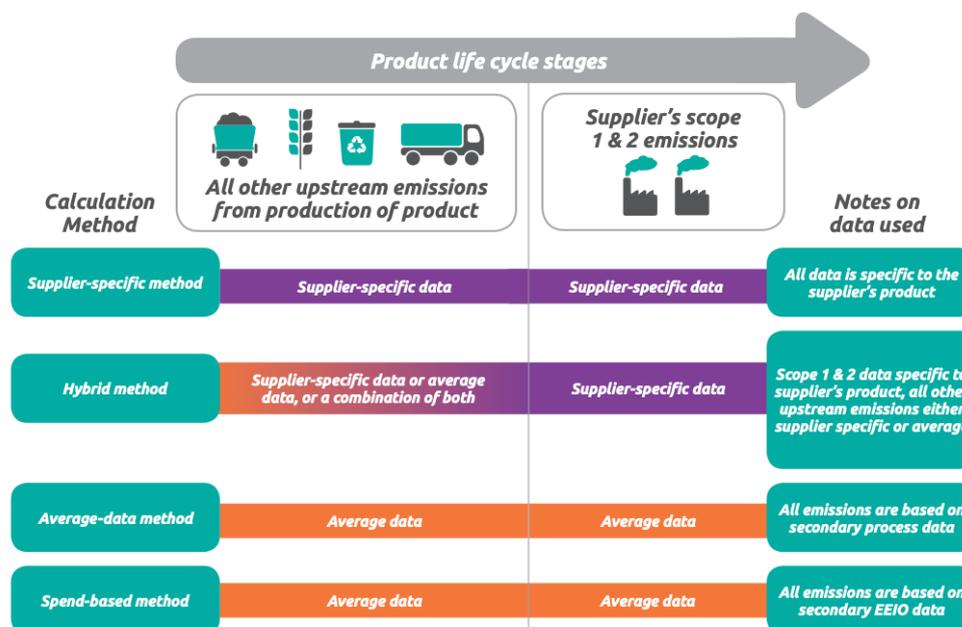


Figure 6 GHGP technical scope 3 calculation guidance (2013) diagram indicating possible category 1 (purchased goods and services) data sources and calculation methods.

In the technical scope 3 calculation guidance, four methods for category 1 are presented (outlined in Fig.6). The supplier-specific method at the top of Fig.6 is most specific and therefore considered the ideal, although in practice achieving this level of detail for all purchased goods and services is unrealistic and often unnecessary, especially from the outset. The spend-based method at the bottom of Fig.6 is the

least specific and means that all emissions are based on average secondary EEIO data, where a model has estimated GHG emissions arising in different sectors of the economy. This is known as a top-down approach and provides good coverage of all emissions associated with a product or service as boundaries are not drawn at each stage in the supply chain. This contrasts with a bottom-up or process-based approach where decisions are made along each step of the supply chain on which emissions to include, making comparability with other estimates difficult (Ozawa-Meida et al., 2013).

	<b>Primary data (e.g., supplier-specific data)</b>	<b>Secondary data (e.g., industry-average data)</b>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>• Provide better representation of the company's specific value chain activities</li> <li>• Enables performance tracking and benchmarking of individual value chain partners by allowing companies to track operational changes from actions taken to reduce emissions at individual facilities/companies and to distinguish between suppliers in the same sector based on GHG performance</li> <li>• Expands GHG awareness, transparency, and management throughout the supply chain to the companies that have direct control over emissions</li> <li>• Allows companies to better track progress toward GHG reduction targets (see chapter 9)</li> </ul>	<ul style="list-style-type: none"> <li>• Allows companies to calculate emissions when primary data is unavailable or of insufficient quality</li> <li>• Can be useful for accounting for emissions from minor activities</li> <li>• Can be more cost-effective and easier to collect</li> <li>• Allows companies to more readily understand the relative magnitude of various scope 3 activities, identify hot spots, and prioritize efforts in primary data collection, supplier engagement, and GHG reduction efforts</li> </ul>
<b>Disadvantages</b>	<ul style="list-style-type: none"> <li>• May be costly</li> <li>• May be difficult to determine or verify the source and quality of data supplied by value chain partners</li> </ul>	<ul style="list-style-type: none"> <li>• Data may not be representative of the company's specific activities</li> <li>• Does not reflect operational changes undertaken by value chain partners to reduce emissions</li> <li>• Could be difficult to quantify GHG reductions from actions taken by specific facilities or value chain partners</li> <li>• May limit the ability to track progress toward GHG reduction targets (see chapter 9)</li> </ul>

**Figure 7** A summary of advantages and disadvantages of primary and secondary data when calculating GHG emissions from the corporate value chain (scope 3) accounting and reporting standard (2011).

A summary of the advantages and disadvantages of primary or secondary data from the scope 3 standard are outlined in Fig.7. In addition, the Technical Scope 3 guidance (2013) explains that EEIO based estimates allow for time and cost savings and offer a simple method and application yet lack the specificity and accuracy of process-based approaches. Alternatively, process-based methods offer specificity, focus and analytical opportunities but suffer from significant time/cost/labour burdens and often aren't comparable with other estimates as boundaries are selected by the person calculating. A hybrid approach (combining the two) is permitted within the protocol, as is the use of proxy data to fill in gaps (e.g. using floor area for energy consumption).

The same guidance applies for category 2 capital spend, and the GHGP states that emissions should be accounted for in the year of acquisition and not subject to depreciation or discounting over time. Category 2 capital spend emissions can therefore be treated like any other purchased goods (GHGP, 2013).

#### 4.1.1 Devolved public sector guidance

For central government, HM Treasury (2021) publish Sustainability Reporting Guidance which details the statutory reporting requirements of central government bodies within the scope of the Greening Government Commitments (GGCs). Minimum GHG reporting requirements include all scope 1 and 2 emissions (alongside gross expenditure e.g. the purchase of fuels/energy etc.) and scope 3 travel emissions. Qualitative reporting is additionally required to detail how organisations have embedded sustainability into their procurement (including emissions reductions), disclose food and catering contracts/purchases and report on how sustainability was embedded into the selection process for construction work (HM Government, 2021).

For specific (all scope) GHG emissions calculation guidance, bodies are referred to the Environmental Reporting Guidelines (HM Government, 2021), summarised below (3.1.1.1). Non-financial reporting requirements (e.g. GHG emissions) are encouraged to be collected from current systems 'to regularise the collection of such information throughout the year'. It is noted that this may require additions/changes to existing systems or processes e.g. additional subjective codes in financial systems for scope 3 travel emission calculation inclusion/tracking (HM Government, 2021).

Other key GHG (scope 3) accounting and reporting guidance for English authorities specifically, includes the LGA supported Local Partnerships GHG accounting tool and FAQ document (Local Partnerships, 2022), the LGA climate change reporting guidance (LGA, 2022) and the UK Environmental reporting guidelines (2019).

Comprehensive devolved guidance is also useful for English authorities, in particular, the Welsh Public Sector Net Zero Reporting guidance (2022), the Scottish Public Sector Leadership on climate change report (2021) (Section 4.1.1) and the associated (consultant produced) scope 3 method overview (EUAC, AUDE and ARUP and 2018).

In England, LGA (2022) guidance supports the Local Partnerships GHG accounting tool which includes all scope 1 and 2 emissions and limited scope 3 on a tonnage/volume of material/service basis (i.e. tCO<sub>2</sub>e/kg), it requires 'outsourced scope 3 emissions' e.g. contracted out services such as social care, to be reported on a separate tab, again organised by quantity of material purchased.

The guidance offers a local authority specific interpretation of the GHGP criteria for identifying relevant scope 3 emissions in relation to services, citing Carbon Trust's best practice scope 3 guide (Carbon Trust, 2022). They acknowledge the spend approach to scope 3 category 1 and 2 emissions but explain that the DEFRA emission factor EEIO-based dataset for the UK (utilised by Welsh guidance and work for this report before the June 2022 update) was discontinued in 2011 and encourage authorities to use up-to-date BEIS conversion factors. These factors comprise of volume and tonnage-based emission factors for specific materials/services (process-based industry average data). Local Partnerships and LGA acknowledge the challenge this presents for authorities tasked with converting their spend data into material tonnage data for the reporting tool but offer no supporting guidance on a method/approach (LGA, 2022).

Now that a single source of updated indirect supply chain EFs are available (the first update published by DEFRA in nine years) and are expected to be updated annually with a three-year lag, it is likely that the LGA and Local Partnerships will review their position on the use of spend-based EFs to report procurement and capital expenditure emissions.

The *required* environmental reporting guidelines for UK companies (see Table.2) also currently (June 2022) recommend the use of tonnage/volume specific BEIS conversion factors. These guidelines require all scope 1 and 2 emissions within a company's operational boundary to be reported (consistent with the GHGP) with no scope 3 requirement. Voluntary reporting, however, is encouraged and chapter 3 'Voluntary greenhouse gas reporting' of the UK Environmental Reporting Guidelines (2019) presents (the previously) discontinued supply chain emission factors for UK sectors (published by DEFRA) (in 'annex E'), in accordance with the GHGP scope 3 standard (2011). The 2019 guidance condones the use of out-dated indirect supply chain EFs to gain an overview of the emissions associated with spend and enable a more complete organisational footprint to be calculated in the absence of more specific data (e.g. litres fuel, tonnes of material or supplier specific emissions). UK Government are also likely to replace the 2011 EFs in 'annex E' of the Environmental Reporting Guidelines (2019) with the updated set of 2019 EFs published in June 2022.

The UK carbon footprint webpage previously directed users to the UK consumption emissions (1990-2018) spreadsheet where spend based (tCO<sub>2</sub>e/£) conversion (or emission/supply chain) factors were included by COICOP (classification of individual consumption according to purpose) opposed to economic sector (e.g. Standard Industrial Classification [SIC] code). Up until June 2022 the most recent COICOP factors were published using 2018 data.

Due to the age of the 2011 indirect supply chain set (precipitating significant uncertainty) an updated version of the discontinued 2011 SIC-based factors using UK *direct* EFs (ONS, 2022) (see appendix A and Section 5.1 for method) alongside the 2018 COICOP conversion factors were utilised with Blackpool spend for this report, prior to the 2022 EF update. Section 5.1, 5.3 and appendix A discuss this further and introduce the updated England-specific 2019 indirect supply chain EFs by SIC code and COICOP published by DEFRA in June 2022, these EFs should now be preferentially used to calculate emissions from spend data.

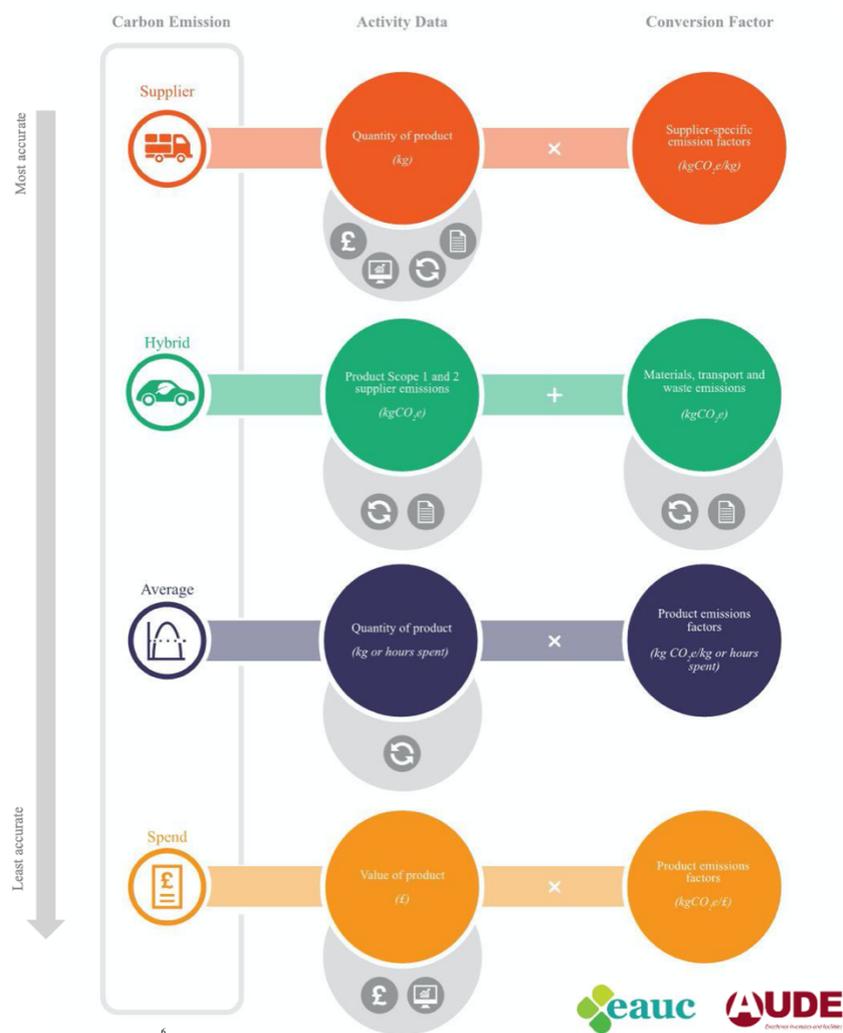
Scotland and Wales each have clear emissions reporting/inventory requirements and guidance for public sector bodies. In Scotland, the Sustainable Scottish Network (SSN) supports public bodies on their journey to net zero on behalf of the Scottish Government, overseeing the Public Bodies Climate Change Reporting process and publishing analysis and guidance.

The SSNs 'Public sector leadership in the global climate emergency' report (2021) offers detailed guidance on climate change reporting and action. They note that for category 1 and 2 scope 3 emissions (procurement/supply chain and capital) data and reporting is not as mature as other areas, acknowledging that it may take time for bodies to set up processes. Reporting emissions *estimates* opposed to accurate measurements in these areas is therefore permitted and instead of quantitative targets, potential hotspots or high emission areas and actions to address and refine estimates can be identified and submitted (SSN, 2021).

Efforts are being made by the Scottish Government to further support public body reporting on supply chain emissions (Scottish Government, 2021). Action has included a detailed ministerial letter to authority chief executives calling for action, legal requirements via amendments to the Climate Change (Duties of Public Bodies: Reporting Requirements) (Scotland) Order 2015 and specific all scope calculation guidance (to be published in the coming net zero manual [SSN, 2022a]) (Scottish Government, 2021).

Currently, Scottish authorities report using the Public Bodies Climate Change Duties reporting platform which includes certain scope 3 emission sources as specific material purchases and their (industry-average) associated emission factors (i.e. as tCO<sub>2</sub>/kg opposed to tCO<sub>2e</sub>/£). Bodies have an option to include any additional emission categories with justified calculation methods, although only six use the opportunity to report on supply chain and capital emissions at present (SSN, 2021). A separate procurement tab also asks authorities to detail how procurement activity/policies have contributed to climate change duty compliance.

The new legal requirements for supply chain emission reporting, alignment of spending plans with net zero and target setting for indirect emissions (Climate Change (Scotland) Act, 2009) means the platform will be expanded to allow all bodies to submit scope 3 emissions estimates, presumably the coming net zero manual will specify appropriate calculation methods. In the meantime, SSN signpost to a consultant produced scope 3 calculation summary document (EUAC, AUDE and ARUP, 2018) which clearly outlines the spend, industry average, hybrid and supplier specific calculation approaches (Fig.8).



**Figure 8** Scope 3 calculation methods for procurement from a consultant produced scope 3 calculation summary guide (EUAC, AUDE and ARUP, 2018) for the Sustainable Scottish Network.

The consultant produced guidance discusses emission factors, highlighting the BEIS conversion factors, which for scope 3 consist of material use factors (e.g. tCO<sub>2</sub>e/kg opposed to tCO<sub>2</sub>e/£) and water/waste/travel factors for use with volume and distance-travelled data. For procurement-related emission factors they signpost the DEFRA

2011 discontinued supply chain set or industry specific spend based factors, encouraging organisations to consider the age, source, and origins of the data to make appropriate choices on sets to use. At the time of their writing (2018), there was no single source of up-to-date emission factors for UK procurement emissions (see Section 5.1, 5.2 and appendix A Table.13 and Table.14 for DEFRA's 2022 supply chain emission factor update).

Wales's public sector reporting requirements on category 1 and 2 scope 3 emissions are more specific and have been published in the 'Welsh Public Sector Net Zero Carbon Reporting Guidance' (2022) (Section 8 - Data and Methods: Supply Chain) and accompanying spreadsheet. They require all public sector bodies from 2022 to categorise spend (for purchased goods and services and capital expenditure) by Standard Industrial Classification (SIC) code so that 2011 DEFRA indirect supply chain emission factors can be applied to estimate emissions (Fig.9).

The reporting spreadsheet (Fig.10) includes emission factors in kgCO<sub>2</sub>e/£ and authorities simply input total spend (in purchasers prices including VAT) by SIC code. The input sheet then calculates emissions by multiplying total spend in each category by the corresponding emission factor. For all emission categories, the Welsh approach requires the Relative Standard Deviation (RSD) to be included when reporting to indicate the level of uncertainty associated with the emission figure. For spend-based estimates they recommend an RSD of +/- 25%. This uncertainty level is high in comparison to material or fuel use data (~2.5% to 15%) but deemed acceptable by the Welsh method (2022) as they endeavour to standardise emissions reporting for all public sector bodies, recognising the importance of a complete (if uncertain) footprint when monitoring progress toward an emissions reduction target. Their decision was also informed by the proportional significance of category 1 and 2 (purchased goods and services and capital expenditure) scope 3 emissions *within* complete footprints and so, regardless of uncertainty, recognise its priority for inclusion and action (NRW, 2019).

The welcome June 2022 update to DEFRA's 2011 EFs means they will now likely be replaced with 2019 indirect supply chain EFs in future Welsh reporting, and, as the EF data has been more recently modelled to account for any changes in tax, inflation and trade flows in the intervening years, the RSD uncertainty estimate will be revisited and reduce, as emissions estimates will be more representative.

Methodology level accuracy	Activity data	Methodology	Recommended RSD
<b>Tier 1</b>	£ spent by the organisation	Allocate expenditure against SIC codes Multiply £ by the SIC code EF	+/-25%

**Figure 9** Reporting calculation method for scope 3 GHG emissions associated with goods and services and capital expenditure from the Welsh Public Sector Net Zero Carbon Reporting Guidance (2022).

**Instructions for users:**

- 1) Identify the amount spent on different product groups (in actual prices in £, including VAT).
- 2) Multiply the amount of spending by the conversion factor to get total emissions in kilograms of carbon dioxide equivalent (kg CO<sub>2</sub>e). This excel spreadsheet does this automatically following your entry of the amount of spending into the appropriate box.

*Table 13 Indirect emissions from the supply chain*

SIC code (SIC 2007)	Product category	Amount spent by product category (£)	Emission factor (kgCO <sub>2</sub> e per £ spent)	Total kg CO <sub>2</sub> e	RSD estimate (+/-%)	Notes on data source and exclusions
01	Agriculture products <sup>2</sup>		3.10			
02	Forestry products		0.75			
03	Fish products <sup>2</sup>		0.93			
05	Coal, lignite, peat <sup>3</sup>		2.97			
06 & 07	Crude petroleum and natural gas & Metal ores		0.66			
08	Other mining and quarrying products		0.81			
09	Mining support services		0.24			
10.1	Preserved meat and meat products		1.40			
10.2-3	Processed and preserved fish, crustaceans, molluscs, fruit and vegetables		0.97			
10.4	Vegetable and animal oils and fats		0.99			
10.5	Dairy products		1.02			

**Figure 10** Example section of the 2011 DEFRA indirect supply chain emission factors (categorised by SIC code) reporting input sheet taken from the Welsh public sector reporting spreadsheet (Welsh Government, 2022).

On a national scale, both Wales and Scotland have also been assessing the carbon impact of their spend (Cardiff University, 2021; Scottish Government, 2021a). As part of the Climate Change (Scotland) Act 2009 the Scottish Government has been estimating the consumption-based emissions associated with planned budget expenditure (since 2016) to fulfil the Act’s statutory requirement (Scottish Government, 2021a). Data from the Scottish Government Environmentally Extended Input-Output model (EEIO) (2015) is used, and spend areas are categorised into economic sectors (Scottish Government, 2021a). In practice, due to the vast nature of the national budget many spend lines will be assigned to one sector/category, often ‘public sector and defence’. This limits the accuracy and representativeness of the estimates but, as ever with indirect emissions and the inherent uncertainties associated with emission factors, an indicative number still offers a useful and informative starting place, allowing for a more complete view of a footprint.

Assessing the carbon impact of spend has had a limited effect on altering emissions associated with spending decisions in Scotland (Cardiff University, 2021), likely due (in part) to the carbon estimate being completed *after* the planned budget decisions have been made. At present, Strategic Environmental Assessments are predominantly used to quantify emissions impacts over a policy/project lifetime *during* the decision-making process (instead of a spend-based estimate) at a national level. Major decisions are still often incompatible with decarbonisation targets and so research is underway at Strathclyde University to better understand how climate impacts of Scottish Government policies may be assessed and carbon more directly considered during the development of Scottish budgets and spend decisions (University of Strathclyde, 2021).

The Welsh government have also started exploring the carbon associated with spend, publishing illustrative results for the 2021-2022 draft budget in the document: 'Towards a GHG Assessment of the Welsh Government Budget' (Cardiff University, 2021). They follow established Scottish concepts (using Welsh Input-Output data) and aim for comparability.

Key differences in the Welsh approach, which may heighten the impact of the budget carbon assessment, include the ambition to allow for 'what if' scenarios in the tools design, where decision makers can look at the illustrative consequences of different spending choices in real time - inserting the emissions information into the decision-making process. The Well-being of Future Generations (Wales) Act 2015 is also influential, and the future generations commissioner Sophie Howe (supported by the act) has been vocal about the importance of assessing the carbon impacts of Welsh government decisions. The commissioner, alongside others, pushed for the recent decision to halt all new road building in Wales, due to the urgency of the net zero task (Welsh Government, 2021a). This landmark decision by Welsh Government indicates a strong commitment to achieving net zero and suggests that carbon impact of spend assessments, as were conducted on the road spending and in conjunction with clear decarbonisation strategy across government, may hold enough sway to sufficiently challenge high carbon decisions.

## 4.2 Net zero: targets and disclosure

GHG accounting and reporting fundamentally informs organisational net zero target setting/strategy, including baselining, monitoring, and disclosure. Although interdependency between accounting/inventorying and targets makes it difficult to discuss them in isolation the current ambiguity of net zero targets, widely documented as a significant barrier to ambitious climate action (IPCC, 2022), calls for target specific guidance/literature to be examined. Principles for robust target setting, management and disclosure require disentanglement. As such, this section aims to provide an

overview of net zero/GHG emissions target guidance, with necessary accounting practice overlap, relevant to English/UK authorities' operational scope 3 emissions.

#### 4.2.1 Emissions inventory boundaries

Determining which emissions to include within the emissions inventory i.e. setting the *inventory boundary*, is a critical task for any organisation and can be challenging for scope 3 emissions. It is fundamentally an accounting/reporting action but included in this section as accounting boundaries determine the type and extent of targets and target boundaries.

The GHGP details multiple ways an entity can define its inventory boundaries in the GHG Protocol Corporate Standard (2004) distinguishing between:

- Organisational boundaries
- Operational boundaries

Organisational boundaries are concerned with how an entity's emissions are consolidated. For authorities, the 'control approach' applies, and within this category a financial or operational approach can be used. A financial approach means that boundaries are drawn where an entity receives economic benefit or has ownership/control (opposed to legal ownership), whereas an operational approach delineates based on whether an entity has full authority to decide how something is run. For Blackpool, determining the organisational boundary would relate to decisions around which, if any, of its wholly owned companies to include in the accounting/reporting boundary.

Operational boundaries involve identifying emissions (within the organisational boundary), associated with operations, categorising them into scope 1, 2 and 3 and choosing the extent of accounting categories and reporting for indirect/scope 3 emissions.

In accordance with the Kyoto protocol, emissions reporting in all scopes usually covers the seven main GHGs: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF<sub>3</sub>) and sulphur hexafluoride (SF<sub>6</sub>). Emissions estimates covering all seven Kyoto gases are reported using CO<sub>2</sub>e (CO<sub>2</sub> equivalents). Each GHG has a specific global warming potential (GWP), which is calculated relative to CO<sub>2</sub> to allow emissions to be expressed in tCO<sub>2</sub>e.

Ambiguity over which gases are included in emissions inventories and targets is still widespread, and clear disclosure and consistent reporting is required to address this

(Hans *et al.*, 2022; IPCC, 2022). To limit temperature increase to 1.5°C globally, the IPCC SR1.5 states that CO<sub>2</sub> emissions must reach net zero by 2050 with non-CO<sub>2</sub> GHG emissions reaching net zero by around ~2070 (IPCC, 2018). As such, most statutory and voluntary emissions reporting, and best practice emissions management, requires all GHGs under the Kyoto protocol to be estimated and included in inventory and target boundaries.

The accounting/inventory and reporting boundary for English authorities own/operational emissions has not been nationally set, other than the evolving categories included in the voluntary Local Partnerships GHG accounting tool which offers basic scope 3 reporting on a tonnage-of-material purchased/consumed basis. Guidance wise, the GHGP have published specific scope 3 requirements on boundaries in the Scope 3 Standard (2011) which the LGA (2022) interprets within a local authority context to help inform English authorities' decisions on scope 3 boundaries.

The LGA (2022) guidance provides an overview of local authority specific risks and opportunities associated with scope 3 reporting/target setting and outline a prioritisation (or mapping/screening) activity for authorities to undertake to understand; the possible emission sources in each scope 3 category, where meaningful data can be reported and where there is an opportunity to manage/reduce emissions. The steps include:

- Identify sources 'longlist': List all potential emission sources and map value chain (all purchased and sold goods and services including suppliers and value chain partners)
- Control v. Influence: Establish if the authority has control (i.e. can make different low carbon decisions/drive emissions reductions) or influence (i.e. incentives/opportunity) over emission sources
- Refine sources 'shortlist': using GHGP criteria for inclusion (see Fig.11) decide which emissions from the 'longlist' are relevant/appropriate for boundary inclusion
- Review 'shortlist' for data availability and accuracy: Identify how data will be accessed and appropriate emission calculation methods. Due to issues with scope 3 accuracy/availability they note that estimates can be used to report if methods are transparent/disclosed, and any exclusions justified.

Criteria	Description
<b>Size</b>	They contribute significantly to the company's total anticipated scope 3 emissions (see section 7.1 for guidance on using initial estimation methods)
<b>Influence</b>	There are potential emissions reductions that could be undertaken or influenced by the company (see box 6.2)
<b>Risk</b>	They contribute to the company's risk exposure (e.g., climate change related risks such as financial, regulatory, supply chain, product and customer, litigation, and reputational risks) (see table 2.2)
<b>Stakeholders</b>	They are deemed critical by key stakeholders (e.g., customers, suppliers, investors, or civil society)
<b>Outsourcing</b>	They are outsourced activities previously performed in-house or activities outsourced by the reporting company that are typically performed in-house by other companies in the reporting company's sector
<b>Sector guidance</b>	They have been identified as significant by sector-specific guidance
<b>Other</b>	They meet any additional criteria for determining relevance developed by the company or industry sector

**Figure 11** GHGP criteria for identifying relevant scope 3 activities for inclusion within the inventory boundary taken from the Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011).

From a devolved perspective, Scottish and Welsh governments are more explicit than the UK Government on clarifying scope 3 inventory and reporting boundaries for local authorities. In Wales, the government has set a target to achieve a 'carbon neutral public sector by 2030' (Welsh Government, 2022) and the reporting guidance published in 2022 details the operational boundary for *all* public sector bodies (see Fig.12).

Section	Category	Sources
<b>Included in reporting</b>		
<b>Estate</b>	Buildings	<ul style="list-style-type: none"> <li>• Generation of electricity, heat or steam</li> <li>• Generation and Transmission &amp; Distribution (T&amp;D) of purchased electricity</li> <li>• Generation and T&amp;D of purchased heat or steam</li> <li>• Fuel and energy-related upstream activities (<i>also known as “well to tank” emissions</i>)</li> <li>• Upstream leased assets (<i>only where not included elsewhere in public sector</i>)</li> <li>• Downstream leased assets</li> <li>• Short cycle carbon emissions from biofuels</li> <li>• Water supply and treatment</li> </ul>
	Fleet and other mobile equipment	<ul style="list-style-type: none"> <li>• Transportation of employees/goods in company-controlled vehicles</li> <li>• Fuel and energy-related upstream activities (<i>also known as “well to tank” emissions</i>)</li> <li>• Sequestration from owned estate</li> </ul>
	Land based emissions and sequestration	<ul style="list-style-type: none"> <li>• Sequestration from owned estate</li> </ul>
	Waste generated in operations	<ul style="list-style-type: none"> <li>• Waste generated in operations</li> </ul>
<b>Supply Chain</b>	Procurement	<ul style="list-style-type: none"> <li>• Purchased services</li> <li>• Purchased goods</li> </ul>
	Business Travel	<ul style="list-style-type: none"> <li>• Employee commuting</li> <li>• Grey fleet</li> <li>• Public Transport</li> <li>• Service Travel</li> </ul>
<b>Excluded from reporting</b>		
<b>Exclusions</b>	Not relevant	<ul style="list-style-type: none"> <li>• Physical or chemical processing</li> <li>• Franchises</li> <li>• Downstream transportation and distribution*</li> <li>• Processing of sold products*</li> <li>• End-of-life of sold products*</li> </ul>
	Other	<ul style="list-style-type: none"> <li>• Fugitive emissions from company-controlled sources</li> <li>• Upstream transportation and distribution</li> <li>• Investments</li> </ul>

**Figure 12** Operational inventory/reporting boundary for public sector bodies in Wales from the Welsh Public Sector Net Zero Reporting guide (2022). Asterisks indicate Natural Resources Wales may include these emission sources.

In Scotland, there is no overarching public sector target, but public bodies have a statutory duty to contribute to the delivery of Scotland’s national net zero by 2045 target. Under the Duties of Public Bodies: Reporting Requirements Order (2015) they have been consistently reporting scope 1 and 2 emissions and new guidance requires *where applicable* targets to be reported for reducing indirect (scope 3) emissions. In the supporting ‘Public Sector Leadership on the Global Climate Emergency’ (2021) guidance they state that over time public bodies will be expected to report on their

scope 3 emissions as fully as possible. Explaining that high uncertainty regarding scope 3 emissions is expected but should not be a barrier to inclusion as poor data maturity can still support reporting for transparency.

In addition, although scope 3 emissions are often not under direct control of a body, influence over emissions can be exercised via behaviour, supply chain engagement and decision making. Scottish Government (2021) present GHGP scope 3 categories and highlight the expected data maturity, noting that not all categories will be relevant for all public sector organisations (or authorities) and so require bodies to review their reporting boundary to understand which categories are relevant for them. They require all reporting to meet the GHGP principles of relevance, completeness, consistency, transparency and accuracy (Fig.13).

**GHG accounting and reporting of a scope 3 inventory shall be based on the following principles: relevance, completeness, consistency, transparency, and accuracy.**

GHG accounting and reporting of a scope 3 inventory shall be based on the following principles:

**Relevance:** Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.

**Completeness:** Account for and report on all GHG emission sources and activities within the inventory boundary. Disclose and justify any specific exclusions.

**Consistency:** Use consistent methodologies to allow for meaningful performance tracking of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

**Transparency:** Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.

**Accuracy:** Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information.

**Figure 13** GHGP principles for GHG accounting and reporting of a scope 3 inventory taken from the Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011).

## 4.2.2 Targets

Targets to manage emissions can clearly only be set for sources that are included in the GHG inventory boundary. Therefore, aiming to include and estimate as many (relevant) scope 3 emission categories/sources as possible is vital to stimulate decarbonisation and close the 'mitigation gap'. Guidance explored in this section on scope 3 target setting covers UK and devolved sources as well as the GHGP and independent corporate and public sector accountability standards i.e. the Science Based Targets initiative (SBTi), Corporate Climate Responsibility monitor and Council Climate Scorecards from Climate Emergency UK.

Independent corporate guidance is generally focussed on ensuring targets are Paris compliant (on a 1.5°C trajectory i.e. global net zero 2050 see Section 4.2.2) and target ambiguity/greenwashing is addressed. Crucially aiming to ensure the vast number of voluntary and therefore *unregulated* corporate emissions pledges are robust. To distinguish real climate leadership from greenwashing and unlock greater ambition to close the 'mitigation gap' efforts are being made to set standards, verify, and publicly monitor targets and disclosure.

The corporate wave of pledges has been mirrored by regional and local government declarations, both suffering from the same target ambiguities as they endeavour to respond to bottom-up pressure (from citizens, shareholders etc.) in the absence of top-down statutory requirements/guidance (IPCC, 2022). In the UK, the flurry of climate emergency target declarations (since 2018), has resulted in many authorities setting unclear and sometimes overambitious if well-meaning targets that they are struggling to act on. This highlights the reality that if nations do not respond to the (welcome) bottom-up pressure that has precipitated pledges with clear and robust emissions target (and inventory/reporting) regulation, the opportunity to leverage ambition may be lost.

Local authorities clearly have a duty to their citizens to understand and disclose how their activities interact with emissions and work to reduce their impact, but many are under-resourced, stretched and have limits to their powers. So, whilst sub-national public and private similarities exist, robust corporate level guidance on decarbonisation and scope 3 can only *inform* authority action. When aware of the authority-specific limitations that exist, it is evident that holding them to the most stringent corporate standards may not be appropriate and fully disclosed clear efforts to estimate/reduce scope 3 over time may be more suitable. Companies do, in contrast, profit from the climate externality and have full autonomy over their operations.

As mentioned, scope 3 emissions often do not lend themselves to accurate measurement and can be difficult to draw inventory and target boundaries for. This means that establishing robust baselines, carbon budgets/targets and net zero trajectories in the first instance, as is possible for scope 1 and 2 emissions, can be difficult and a more iterative approach is required. As such, indicative emissions estimates using more uncertain calculation methods such as industry or sector average data are acceptable, and targets may initially need to be set to improve:

- Supplier engagement
- Emission source coverage
- Data availability

- Data accuracy

These refinement-based targets may need to be set *before* a baseline is established and an appropriate reduction target identified. It may also make sense to set category or source specific scope 3 reduction targets as data within categories may resolve at varying rates. When taking this approach, it is important that the nature of action on scope 3 and any associated targets are *well communicated and disclosed* to avoid ambiguity and misinterpretation.

Often ambiguity stems from a misunderstanding of target terminology. Net zero or carbon neutrality targets, useful to set overarching organisational ambition, mean that offsetting or emission sequestration/removal is permitted to reach the *balance* of zero emissions by a certain date. In contrast, absolute reduction targets specify a reduction amount (in tCO<sub>2</sub> or tCO<sub>2</sub>e) to be achieved via specific abatement measures. Finally, intensity targets are expressed as a reduction in the ratio of GHG emissions relative to a metric e.g. output/production (GHGP, 2011), although to be GHGP compliant absolute emissions must also be reported.

### **Public sector standard setting and accreditation**

Independent assessment of UK councils' climate action plans has been conducted by Climate Emergency UK (CEUK). The assessment utilises a scoring system based on their Climate Action Plan Checklist (CEUK, 2021), and was developed with partners including Ashden and The Centre for Alternative Technology. Assessment considered both area-wide and own operation plans but most of the guidance and scoring questions were whole area focussed. Target, inventory/target boundary and scope 3 related requirements/guidance have been identified in the scoring methodology (CEUK, 2021a) and included in Table.2 alongside observed ambiguities. Listed ambiguities are not exhaustive but aim to highlight where language and requirements are unclear, creating opportunity for misinterpretation or uncertainty which may undermine ambition. Comments focus on ambiguities around target language, inventory and target boundaries, and emission scopes, categories, and sources (as defined by the GHGP [GHGP, 2004; GHGP 2011]) to help inform robust future action.

**Table 2** Climate Emergency UK's Council Climate Plan Scorecard (CEUK, 2021a) criteria related to target, inventory/target boundary and scope 3 requirements is included in 'council scorecard requirements'. Each criterion is assessed for observed ambiguities in term definition, target language and target/inventory boundary requirements in relation to emission scope/category/source coverage.

Council scorecard requirements	Ambiguity in scoring methodology
<i>Include science backed targets where the scope is considered</i>	<ul style="list-style-type: none"> <li>• No clear definition of 'science backed' – but they reference Tyndall centre for whole area scope 1 and 2 emissions and carbon budget, referencing a 'Paris aligned' decarbonisation trajectory without definition</li> <li>• No requirement to clarify GHGs</li> <li>• No definition of 'scope' in this context</li> <li>• No clear requirements of council own operation emissions calculation, monitoring, or targets</li> <li>• No clear differentiation for area-wide and own operation emissions and targets</li> </ul>
<i>Include interim targets for carbon reduction in whole district up until net zero date - more points given for 2030 or earlier net zero target</i>	<ul style="list-style-type: none"> <li>• No clear definition of 'carbon reduction' or 'net zero' used here</li> <li>• No requirement to clarify GHG inclusion in interim targets</li> <li>• No context for 2030 date given e.g. a definition of a science backed target, why an earlier date is important in the methodology</li> <li>• No consideration of the feasibility of a 2030 net zero target date</li> <li>• No requirement to state which emission scopes and categories are included</li> </ul>
<i>State a net zero target for whole district - more points given for 2030 or earlier net zero target</i>	<ul style="list-style-type: none"> <li>• No requirement to define target terminology e.g. net zero</li> <li>• No requirement to identify target boundary i.e. no requirement to state which emission scopes and categories are included</li> <li>• No context for 2030 date given e.g. a definition of a science backed target, why an earlier date is deemed important in the methodology</li> </ul>
<i>Council has a target of reaching net zero for own emissions by 2030</i>	<ul style="list-style-type: none"> <li>• No requirement to define target terminology e.g. carbon neutral</li> <li>• No requirement to clarify GHGs included</li> <li>• No requirement to identify target or inventory boundary i.e. no requirement to state which emission scopes and categories are included</li> <li>• No context for 2030 date given e.g. a definition of a science backed target</li> </ul>
<i>Terms, scope and fairness are defined including; net zero terminology, what gases are included, percentage reductions relative to carbon budget, burden sharing recognised</i>	<ul style="list-style-type: none"> <li>• No requirement to identify target or inventory boundary i.e. no requirement to state which emission scopes and categories are included</li> <li>• No clear differentiation for area-wide and own operation emissions and targets</li> <li>• No clear requirements of council own operation emissions calculation, monitoring, or targets</li> </ul>

<i>Committed to a target monitoring system to evaluate, review and update targets</i>	<ul style="list-style-type: none"> <li>• No specific monitoring method requirements e.g. quantitative/qualitative</li> </ul>
<i>Plan must measure and set emissions targets for whole district</i>	<ul style="list-style-type: none"> <li>• No clear requirements of council own operation emissions calculation, monitoring, or targets</li> <li>• No clear differentiation for area-wide and own operation emissions and targets</li> <li>• No requirement to identify target or inventory boundary i.e. no requirement to state which emission scopes and categories are included</li> </ul>
<i>Plan must include baseline emission inventory for whole district</i>	<ul style="list-style-type: none"> <li>• No clear requirements of council own operation emissions calculation, monitoring, or targets</li> <li>• No requirement to identify target or inventory boundary i.e. no requirement to state which emission scopes and categories are included</li> </ul>
<i>Plan must quantify current emissions for whole district</i>	<ul style="list-style-type: none"> <li>• No requirement to identify target or inventory boundary i.e. no requirement to state which emission scopes and categories are included</li> <li>• No clear requirements of council own operation emissions calculation, monitoring, or targets</li> </ul>
<i>Breakdown of scope 1, 2 and 3 emissions for whole district; must be for whole area not council own operations, must set out scope 1 and 2 fully, must 'mention' scope 3</i>	<ul style="list-style-type: none"> <li>• No clear GHGP aligned requirement/guidance to disclose specific emission scopes and categories</li> <li>• No requirement to estimate include any scope 3 emission sources or categories</li> <li>• No requirement for council own operation emissions breakdown</li> </ul>

The scoring methodology (CEUK, 2021a) is accompanied by a glossary which defines some of the target terminology and language used. Ambiguities persist in these definitions, and certain key definitions e.g. 'absolute reduction targets' are absent. Scope 3 emission sources for council own operation and whole area targets/plans are defined in accordance with the GHGP but the definition is not utilised in the scoring criteria. The Climate Action Plan Checklist (CEUK, 2021) provides further guidance for councils which helps to clarify:

- Which GHGs are included within net zero targets
- That emissions breakdowns by scope 1, 2 and 3 should be for both whole area and council own operations
- That council own operation emissions can be calculated using the LGA and Local Partnerships accounting tool (Local Partnerships, 2022) – *but this includes limited scope 3 emissions only*

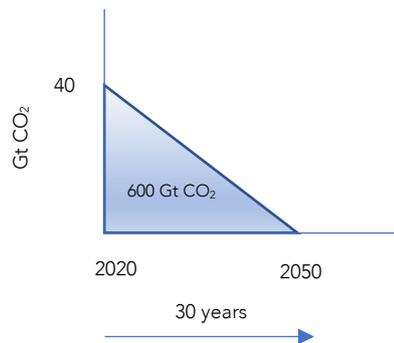
Key recurring ambiguities in Table.2 include:

- The lack of focus on own operation emissions footprints and targets
- The lack of clarity around 'science backed' targets
- The lack of clarity on GHGP emissions scope and category coverage in inventory and target boundaries

These are briefly discussed below to explore their importance in robust emissions management.

The role of robust sub-national *own operation* emissions management has been identified by the IPCC as crucial to help close the 'mitigation gap' (IPCC, 2022; Hans *et al.*, 2022). Relatedly, the need for clearly defined 'science backed' emissions targets for different sectors is also widely understood (IPCC, 2022) and independent corporate standards/methodologies, based on the latest academic literature, are making headway (further explored in Section 4.2.2).

When referring to a 'science backed' ('science-based' or 'Paris aligned') target, most guidance is primarily concerned with the target date i.e. when emissions will reach zero. The term/s are usually referring to the scientific consensus communicated by the IPCC, specifically, the science that informed the global Paris Agreement. Most recently communicated in the IPCC's SR1.5 (IPCC, 2018), which states that to limit warming to 1.5°C (deemed a 'safe' level), global CO<sub>2</sub> emissions need to reach net zero by 2050 (with non-CO<sub>2</sub> emissions reaching net zero by ~2070). This date is informed by the observed (approximately) linear relationship between cumulative CO<sub>2</sub> emissions and planetary warming and allows us to calculate the remaining carbon budget for a specific temperature threshold. For 1.5°C, the remaining carbon budget is approximately ~600 Gt CO<sub>2</sub> (estimated via modelling) and, together with our current rate of global emissions (~40 Gt CO<sub>2</sub> yr<sup>-1</sup>) it can be used to estimate our remaining 'years to zero' for a 1.5°C temperature threshold (see Equation 2) (data is approximate and based on the year 2020). This understanding, is fully articulated by the IPCC in the SR15 and AR6 (IPCC, 2022) and forms the basis of 'science backed' emissions reduction target terminology.



$$\frac{2 \times \text{remaining carbon budget}}{\text{total emissions rate}} = \text{years to zero}$$

$$\frac{2 \times 600}{40} = 30$$

$$\frac{\text{Gt CO}_2}{\text{Gt CO}_2\text{-yr}^{-1}} = \text{yr}$$

#### Equation 2

The IPCC also assert that CO<sub>2</sub> emissions must globally reduce by ~45% by 2030 (compared to 2010 levels) to keep warming below 1.5°C, so ‘science backed’ targets are also often assessed for scientific alignment based on their 2030 reduction commitment. There are currently numerous interpretations of ‘Paris compliant’ ‘science backed’ or ‘science-based’ emissions reduction targets (the science-based targets initiative [SBTi] are the most widely used independent accreditation body for science-based targets [Hans *et al.*, 2022], their pathways are summarised in Section 4.2.2), and the academic literature is extensive with pathways varying by sector and underlying model assumptions (used to calculate carbon budgets) (IPCC, 2022). National or global regulatory standards are needed to strengthen commitments and resolve confusion, and guidance expected to be published in late 2022 by the UN Secretary-General’s High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities (launched in March 2022) (UN Secretary-General, 2022) is much awaited. In the interim, effort should be made by assessors (and sub-national organisations) such as CEUK to clearly communicate their methodologies/assessment criteria when using such terms to inform local authority action.

Ambiguity around the scopes, categories, and sources of GHG emissions included in inventory and target boundaries leaves room for misinterpretation and greenwashing and can lead to uncertainty around the scale of the problem (i.e. the total emissions an entity is responsible for). Without consistently drawn boundaries or a complete picture of the total (all scope) emissions associated with activities it is hard for external observers to properly assess progress/ambition. For example, scope 3 emissions often comprise over 70% of an organisation's total footprint (NRW, 2019; GHGP, 2012) (with category 1 and 2 emissions sometimes comprising 50-60% of the total [Ozawa-Meida et al., 2013; NRW, 2018]) but are not required to be calculated as part of CEUK scoring and are minimally included in voluntary LGA emissions reporting (Local Partnerships, 2022). Considering that the IPCC is calling for a 45% reduction in *total global emissions* (i.e. all scope emissions) by 2030 (compared to 2010 levels) authority own operation 2030 targets covering scope 1 and 2 emissions alone (perhaps comprising only ~10-20% of total emissions) may be considered inadequate, misrepresenting an organisation's true level of climate ambition.

Scope 3 emissions are often excluded due to their indirect nature and the difficulty organisations experience trying to obtain accurate, granular emissions estimates. These concerns can be addressed with appropriate understanding of the nature of scope 3 emissions, scope 3 target setting, and scope 3 calculation methods as set out by the GHGP (GHGP, 2011, GHGP, 2013), and (uncertain) high-level top-down estimates can be quickly and easily calculated (Section 5.1; Fig 6). Meaning scope 3 emissions can be included in the GHG inventory boundary in the first instance, and high-level estimates can inform the prioritisation/direction of efforts to improve data collection/accuracy over time.

As discussed in Section 4.2.1, the inclusion of scope 3 emissions estimates in GHG inventories can also enable performance targets focussed on supplier engagement, and improvements in data collection and calculation methods, to be established. These performance targets can remain in place until emissions estimates are sufficiently resolved for category/source specific reduction targets to be set and progress monitored. The high-level emissions-based impact of any decision/action/activity can be quickly estimated (with high uncertainty), relative to total emissions, to indicatively inform decision-making (see Wales' carbon impact of spend approach in Section 4.1.1). If these efforts are clearly disclosed, it can allow the robustness of emission reduction efforts (and the true level of climate ambition), in relation to an organisations whole/total emissions impact to be assessed by onlookers.

The review in this section has used the CEUK Council Climate Scorecards methodology to disentangle and highlight inconsistencies and ambiguities in local authority climate ambition, to inform more robust action and assessment. CEUK is a

small, independent organisation with limited resources and has assumed the role of independent assessor in the absence of top-down regulation for local authority climate action. In doing so, it has highlighted the pressing need for UK government to address widespread ambiguities around net zero targets, and fully leverage sub-national local authority climate action by setting out clear regulation/requirements. The extent of target and boundary guidance/requirements for England, Wales and Scotland are explored further below.

LGA (2022) guidance for English authorities is sparse on target setting but says that as GHGP scope 3 guidance continues to develop their guidance will be updated. They do assert that reporting on scope 3 can commence ahead of setting a baseline and reduction target and that reporting can be used to establish emission sources and data collection requirements, with baselines set when category inventories are sufficiently complete and reliable. They give a case study example of Dacorum Borough Council who have a net zero for 2030 target for scope 1 and 2, and as part of their wider climate emergency commitment have set a specific target for their housing stock to reach net zero by 2050 (LGA, 2022). Demonstrating the use of source specific reduction target setting.

Wales have set a 'carbon neutral by 2030' public sector target. This means that individual public sector organisations in Wales are not required to set their own external emissions management or reduction targets as the national public sector target is expected to be prioritised (Welsh Government, 2022). Whilst the national target is ambitious and supported by clear inventory boundaries, calculation guidance and reporting requirements, it remains unclear as to whether the target aims for carbon neutrality by 2030 for all scopes and categories e.g. including procured goods and services (inc. capital spend).

Guidance on category 1 and 2 emissions (purchased goods and services and capital expenditure) in chapter 8 of the Welsh approach (2022) details appropriate supply chain data and introduces the spend-based calculation method (tCO<sub>2</sub>e/£) using DEFRA 2011 indirect emission factors. They caveat the guidance, noting that the factors can only be used to produce *indicative estimates*, concluding that the method does not lend itself to setting targets or measuring emission reduction efforts. This suggests that for scope 3 category 1 and 2 emissions the Welsh Government expects bodies to categorise and estimate emissions based on spend and disclose plans to refine estimates and reduce emissions as knowledge develops (presumably in the narrative report submitted alongside the reporting spreadsheet annually).

Whilst no specific guidance is given around setting management or reduction targets for scope 3 categories within the reporting constraints, internal target setting is permitted, and bodies are reminded of their role in progressing national public sector

carbon neutrality ambitions wherever possible. Additionally, the premise of the Welsh guidance appears to be a collective refinement/iteration process (Welsh Government, 2022) as initial reporting requirements and guidance aims to:

- Establish a consistently drawn boundary to start quantifying the emissions gap to carbon neutral public sector operations by 2030
- Identify mitigation potential, so organisations and the Welsh Public Sector collectively can prioritise the appropriate action needed to move to carbon neutral operations by 2030
- Monitor, to determine how emissions are changing and if organisations are on track for neutrality

Suggesting further scope 3 target/reduction support will be published once these aims are satisfied and mitigation opportunities/areas for concern identified.

In Scotland, bodies have a statutory requirement to contribute to the delivery of Scotland's national net zero by 2045 target and are required to set and report on individual operational/organisational targets including:

- Reducing direct emissions (scope 1 and 2), where possible, to absolute zero
- Reducing indirect emissions in advance of the 2045 target

They make it clear that they wish 'public bodies to drive down emissions as close to zero as possible as quickly as possible...including supply chain emissions'. As such, net zero targets (e.g. involving carbon removal or offsets where emissions cannot be reduced to zero) for indirect emissions are permissible but *absolute reduction targets* must be specified as well, which may be for a range of specific scope 3 categories.

Indirect emission reduction targets are required to:

- Have a clearly defined baseline year
- Be a reduction from the baseline
- Be clear on scope of which indirect emissions are included in the target (i.e. defining the target boundary)
- Cover any significant areas of indirect emissions that can be appropriately measured

They suggest that net zero targets may be useful for overarching organisational ambition but absolute zero direct emissions and pathways for reducing indirect emissions must fall within the wider net zero target. Which itself must be clear on what is in scope, cover all scope 1 and 2 and appropriate scope 3 emissions, have interim

targets and ensure residual emissions (suitable for offsetting/sequestration) are as small as possible.

In section 7 of the Scottish Public Sector Reporting guidance (2021), scope 3 data for category 1 and 2 emissions is classed as having low data maturity with a large margin of error (e.g. based on industry norms/estimated factors). They advise therefore that it is not appropriate to set reduction targets for reported emissions with such high-level estimates but state that *action to reduce such emissions is still expected*. Indicating interim targets/KPIs (Key Performance Indicators) to improve data and knowledge are welcome as bodies work toward category specific reduction targets.

An important component of any emissions management target or net zero strategy is disclosure. Complete and transparent disclosure of an organisation's full emissions footprint and clear communication of targets, including, if a net zero target, the quantity of emissions removals and reductions permitted, which scopes and categories are included and if in line with a 1.5°C pathway (broadly this can mean net zero by 2050 but corporate standards have been developed by SBTi for 1.5°C pathway compliance see Section 4.2.2).

As discussed, Wales and Scotland both have mandatory local authority applicable public sector GHG emissions reporting and target disclosure in place. For English authorities there is only a voluntary option for emissions footprint reporting nationally, results of which are not clearly disclosed to the public (e.g. in the form of an analysis report like the SSNs annual disclosure of public sector emission trajectories, targets, and action) and no guidance or regulation on target setting. As such, the Scottish guidance can be a useful reference for English authorities on disclosing the extent and coverage of their emissions management targets, publicly and clearly.

Many authorities beginning to account for scope 3 emissions may also be concerned that as their inventory boundaries increase so do their emissions. For accountability/robustness and to avoid any misinterpretation it is important that this doesn't hinder scope 3 inclusion or disclosure. Instead, all targets and their boundaries should be clearly communicated, and expected and realised increases in total emissions, as scope 3 coverage increases, explained. The SSN Public Bodies Climate Change Reporting (2021) analysis report includes an example of appropriate scope 3 boundary extension communication in Fig.14, highlighting that emissions are expected to grow substantially as further indirect emissions are measured and reported and inventory boundaries expand.

- Direct emissions, mainly heating and fuel use for fleet vehicles, show little change (-2% over 5 years) and a very marginal increase since 2019/20, potentially due to 2020/21 being a colder year and also emissions reported from additional bodies.
- Indirect emissions have dropped by a third since 2015/16 and by 8% in the last year. Although there is substantive room for improvement on indirect emissions reporting there is a progressive increase in the range of emission sources being reported year-on-year and this is expected to continue, especially as the new reporting duties take effect.

**NB:** The scale of data has grown over the last 5 years, e.g. more bodies are now reporting and individual bodies are trying to capture more data, so the trends above underestimate real progress made e.g. on energy efficiency. As governance and data management matures over time the scope and volume of emissions data is expected to grow; i.e. the public sector collective reporting boundary will effectively expand, generating a substantive increase in e.g. indirect emissions from the procurement of goods and services.

*Figure 14* Extract from the Scottish Sustainability Network Public Bodies Climate Change Reporting (2021) analysis report demonstrating robust communication of scope 3 boundary expansion and emissions increase.

Robust, transparent disclosure is also important due to the increasing legal vulnerability of councils. There is potential for GHG-related lawsuits to be directed at local authorities for not introducing plans to address climate change or appropriately act on climate plans (LGA, 2022). In 2019, Client Earth wrote to 100 local authorities in England warning them that they will violate their legal obligations and risk legal challenge if proper climate action plans are not introduced (LGA, 2022).

GHGP guidance is understood to be the authority on private and public sub-national emissions management standards. As such, all UK public sector target and disclosure and reporting guidance is somewhat informed by GHGP publications (Table.3).

The GHGP set requirements and guidance on 'setting a GHG reduction target' and tracking emissions over time in chapter 9 of the Scope 3 Standard (2011). For scope 3 reduction targets the protocol requires a base year to be set and justified (the scope 3 base year may be different to the scope 1 and 2 target base year) and a recalculation policy articulated. They permit a range of scope 3 reduction *target boundaries* with Fig.15 offering an overview of advantages and disadvantages of each. Boundary options include:

- One target for total scope 1, 2 and 3 emissions
- One target for total scope 3 emissions
- Separate targets for individual scope 3 categories
- A combination of targets e.g. total target for all scopes as well as individual scope 3 category targets

The target type (absolute or intensity), completion date (i.e. short term <10 years or long term >10 years), target level (numerical value of reduction) and use of offsets must be also determined and reported at the outset.

Target boundary	Advantages	Disadvantages
<p><b>A single target for total scope 1 + scope 2 + scope 3 emissions</b></p>	<ul style="list-style-type: none"> <li>• Ensures more comprehensive management of emissions across the entire value chain (i.e., all three scopes)</li> <li>• Offers greater flexibility on where and how to achieve the most cost-effective GHG reductions</li> <li>• Simple to communicate to stakeholders</li> <li>• Does not require base year recalculation for shifting activities between scopes (e.g., outsourcing)</li> </ul>	<ul style="list-style-type: none"> <li>• May provide less transparency for each scope 3 category (if detail is not provided at the scope 3 category level)</li> <li>• Requires the same base year for scope 1, scope 2, and scope 3 emissions, which may be difficult if scope 1 and scope 2 base years have already been established</li> </ul>
<p><b>A single target for total scope 3 emissions</b></p>	<ul style="list-style-type: none"> <li>• Ensures more comprehensive GHG management and greater flexibility on how to achieve GHG reductions across all scope 3 categories (compared to separate targets for selected scope 3 categories)</li> <li>• Relatively simple to communicate to stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• May provide less transparency for each scope 3 category (if detail is not provided at the scope 3 category level)</li> <li>• May require base year recalculation for shifting activities between scopes (e.g., outsourcing)</li> </ul>
<p><b>Separate targets for individual scope 3 categories</b></p>	<ul style="list-style-type: none"> <li>• Allows customization of targets for different scope 3 categories based on different circumstances</li> <li>• Provides more transparency for each scope 3 category</li> <li>• Provides additional metrics to track progress</li> <li>• Does not require base year recalculations for adding additional scope 3 categories to the inventory</li> <li>• Easier to track performance of specific activities</li> </ul>	<ul style="list-style-type: none"> <li>• May result in less comprehensive GHG management across the value chain (if multiple scope 3 targets are not set)</li> <li>• May result in “cherry picking” (or the perception thereof) by setting targets only for categories that are easier to achieve</li> <li>• More complicated to communicate to stakeholders</li> <li>• May require base year recalculation for outsourcing or insourcing</li> </ul>

**Figure 15** GHGP scope 3 target boundary options advantages and disadvantages taken from the GHGP Scope 3 Standard (2011).

Base years for scope 3 targets may be set more recently than scope 1 and 2, and for scope 3, reporting can commence before setting a base year (whilst inventories work toward sufficient completeness and reliability) as long as organisations report that they *have not* set a scope 3 base year at present. Base year recalculation policies are integral to manage uncertain (both in estimation and influence) indirect emissions and must be reported and published. Organisations are required to recalculate base year emissions when:

- Structural changes in the organisation occur (e.g. mergers)

- Changes in calculation methods occur, data accuracy improvements are made, or errors are discovered
- The categories or activities included in the scope 3 inventory change

Organisations must develop significance thresholds to accompany recalculation policies and instruct when a recalculation is triggered (e.g. if an organisational/methodological change alters emissions by ten percent) (GHGP, 2011). Chapter 9 of the Scope 3 Standard (2011) gives further guidance on developing significance thresholds for different types of changes, as well as how to account for scope 3 emissions reductions over time (Fig.16) and accounting for avoided emissions (e.g. from specific mitigation projects).

$$\text{Change in emissions from a scope 3 category} = \text{Current year emissions from the scope 3 category} - \text{Base year emissions from the scope 3 category}$$

**Figure 16** Method for quantifying changes in scope 3 emissions over time to support GHGP compliant reporting and monitoring taken from the GHGP Scope 3 Standard (2011).

The protocol also addresses the inevitable double counting of scope 3 reductions among multiple entities in a value chain. Clarifying that as scope 3 emissions are, by definition, the direct emissions of another entity, multiple entities influence emissions and reductions. This means no single organisation can be assigned sole responsibility, and is an inherent part of scope 3 accounting, where each entity in a value chain has some degree of influence over emissions and reductions (GHGP, 2011). Scope 3 accounting therefore facilitates the simultaneous action of multiple entities to reduce emissions throughout society (GHGP, 2011). Once scope 3 accounting is more developed, companies wishing to use scope 3 emissions reductions for credits may take contractual responsibility for specific emissions in a value chain (GHGP, 2011).

### Independent corporate standard setting and accreditation

To support GHGP uptake and align voluntary pledges and action with the Paris agreement, independent corporate guidance, assessment methodologies and standards have been established. Currently SBTi and CDP are the largest independent accreditation and standard setting organisations for sub-national entities seeking to manage their GHG emissions. CDP offers guidance and a reporting/disclosure platform and SBTi, via their Net Zero Standard (2021) aim to support GHGP and Paris Agreement complaint target setting and emissions reduction management. Both bodies work collaboratively, with CDP contributing to and supporting the SBTi standard development, referring to the science-based approach as the most ambitious and robust way to set scope 3 targets (CDP, 2018). CDP supports both

companies, governments and cities to disclose their environmental impacts and mitigation strategies whereas SBTi guidance is more corporate focused. The science-based approach is still relevant for a range of sub-national groups.

The SBTi Net Zero Standard is aimed specifically at corporations with over 500 employees but SMEs can also use the guidance to help them understand science-based net zero target setting. A simplified SME route for SBTi accreditation is offered. For context, Blackpool has over 2000 employees. The summary of the guidance here aims to extract local authority relevant information.

The overarching SBTi framework requires near-term interim science-based targets (5–10-year reduction targets in line with their defined 1.5°C pathways) and long-term science-based targets (10+ years reducing emissions to residual levels in line with 1.5°C pathways no later than 2050). The science-based component relates to the reduction amount, pathway, and timeframe and SBTi specifies cross-sector and sector specific pathways. These pathways are based on the IPCC's SR15 (2018) which states that future scenarios able to limit warming to 1.5°C, with minimal overshoot, reach net zero CO<sub>2</sub> emissions by 2050. This includes rapid reductions in non-CO<sub>2</sub> GHGs and a 50% reduction in global CO<sub>2</sub> emissions by 2030. The SBTi framework highlights the criticality of near-term reductions by requiring ambitious interim or near-term targets. In their words, near-term targets are critical to stay within the global emissions budget (SBTi, 2021). The pathways used by the SBTi aim to steer voluntary climate action to achieving the 1.5°C objective of the Paris Agreement by limiting emissions to our collective ~500 Gt remaining carbon budget.

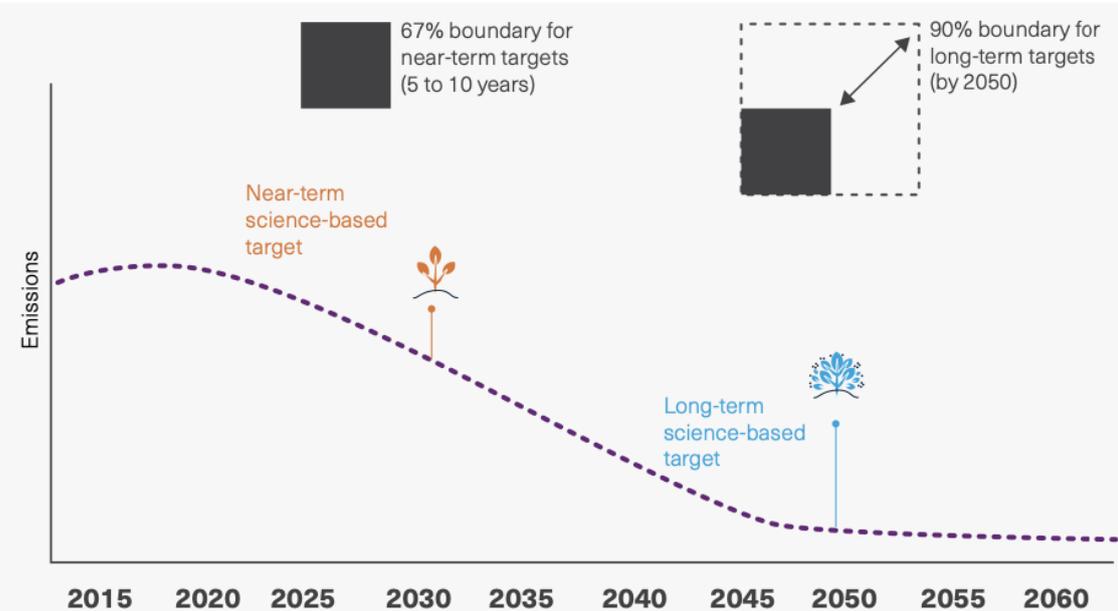
For authorities, the cross-sector pathway (recommended for setting absolute reduction targets) is relevant. For this pathway companies must set near term targets that reduce emissions at a linear annual rate of 4.2%, with long-term emissions (by 2050 at the latest) reduced by at least 90% compared to 2020 levels. Initially, companies are required to develop a GHG inventory using the GHGP Corporate Standard (2004) covering 95% scope 1 and 2 emissions and a *complete scope 3 screening* (of all *relevant* categories). If scope 3 emissions are at least 40% of total (all scope) emissions, near-term target boundaries must include at least 67% of scope 3 emissions with long-term target boundaries including 90% of scope 3 emissions. This increase in ambition from 67% to 90% (scope 3 coverage) is referred to as an expansive boundary (see Fig.17) where SBTi aims to acknowledge the challenges associated with scope 3 by enabling a gradual increase in ambition. Target boundaries must align with GHGP inventory boundaries.

### Box 2. The "expansive boundary" approach for scope 3

A comprehensive target boundary is necessary for companies to make credible net-zero claims at the end of their decarbonization journey. However, acknowledging the challenges that companies encounter with scope 3, the SBTi Net-Zero Standard is following an expansive boundary approach and a gradual increase in ambition.

In the near-term (5 to 10 years), a scope 3 target is needed whenever scope 3 represents more than 40% of a company's total emissions. Near-term scope 3 targets need to cover 2/3 of scope emissions and align to well-below 2°C ambition. In the long-term (by 2050 at the latest), the boundary of the target will increase to cover all material sources of emissions in the value chain (materiality threshold of 90%) aiming to achieve decarbonization in line with 1.5°C scenarios.

Figure 7 A visual explanation of the "expansive boundary" approach the Net-Zero Standard takes to scope 3 target boundaries.



Increasing the scope 3 boundary requirements from 67% for near-term SBTs to 90% for long-term SBTs will be challenging, but it will also drive major opportunities to collaborate across the value chain to support suppliers and customers to decarbonize. Through the expansive boundary scope 3 approach from the near to long-term, companies have time to work through the complexity of scope 3 and long-term scope 3 reductions, focusing now on fast reductions at scale across all scopes to tackle their most material emission sources.

The SBTi is developing plans to provide further support to companies through a specific follow-on project, as well as through a Supplier Engagement Toolkit which will be released in late 2021.

Figure 17 SBTi expansive boundary approach to setting scope 3 near- and long-term emissions reduction targets taken from the SBTi Net Zero Standard (2021).

SBTi also permits the use of *engagement targets* where companies set a target for suppliers or customers representing a certain percentage of emissions to set *their own* science-based reduction targets. These are eligible as near-term scope 3 targets only.

They also differentiate between ‘well below 2°C’ and 1.5°C pathways (Fig.18). Requiring all scope long-term and scope 1 and 2 near-term targets to align with 1.5°C, allowing near-term scope 3 targets to set a minimum ambition of well below 2°C i.e. between 2.5% and 4.2% linear annual reductions in emissions. Further guidance specifying target wording is provided e.g. for a cross-sector pathway absolute target they suggest:

- ‘Company X commits to reduce scope 1, 2 and 3 emissions 90% by 2035 from a 2018 base year’

For a company with multiple targets, it is necessary to express the scope 1 and 2 reduction and base year and the scope 3 reduction target/s separately.

LONG-TERM TEMPERATURE GOAL	ANNUAL LINEAR REDUCTION RATE OVER TARGET PERIOD
<b>Well-below 2°C</b> Approx. 66% chance of limiting peak warming between present and 2100 to below 2°C.	$2.5\% \leq X < 4.2\%$
<b>1.5°C</b> Approx. 50% chance of limiting warming in 2100 to 1.5°C.	$X \geq 4.2\%$

**Figure 18** SBTi ranges of emission reduction ambition suitable for near-term science-based targets taken from the SBTi Net Zero Standard (2021).

Whilst SBTi guidance is extensive, providing much needed structure to sub-national net zero approaches, they and other standard-setting bodies like CDP have been criticised for lending credibility to low quality and misleading targets. The Corporate Climate Responsibility Monitor 2022 (produced by the New Climate Institute [NCI] and Carbon Market Watch [CMW]) state that for the majority of the 18 companies assessed in their report with an SBTi approved 1.5°C or 2°C target, they would consider the rating as either ‘contentious or inaccurate, due to various subtle details and loopholes that significantly undermine the company’s plans’.

The Climate Responsibility Monitor assesses the climate strategies of 25 major global companies to analyse the extent to which they demonstrate corporate climate

leadership. They evaluate pledges against their 'good practice criteria' to identify examples for replication and highlight where improvement is needed. Supporting guidance is also published detailing the 'Guidance and assessment criteria for good practice corporate emission reduction and net-zero targets' (2022) where they focus on drawing insights on *transparency* and *integrity* within:

- Tracking and disclosure of emissions
- Setting emission reduction targets
- Reducing own emissions
- Climate contributions and offsetting claims

They explain that transparency, in this context, refers to the extent to which a company publicly discloses the information necessary to understand the integrity of a company's approaches to climate action. Integrity is defined as a measure of the quality, credibility, and comprehensiveness of their approaches.

For authorities, and the purposes of this report, good practice guidance on targets and disclosure will be summarised.

Disclosure is a key tenet of comprehensive and robust climate strategy, allowing external observers to understand an organisations scope of influence, the relevance of its climate-related targets and whether emissions reduction measures are appropriate (NCI and CMW, 2022). Annual GHG emissions disclosure which covers all direct (scope1), indirect energy-use (scope 2) and other indirect emissions (scope 3) *including* assumptions and methodologies used to calculate emissions is fundamental. All scope 3 emission categories must be reported on (if scope 3 is included), even if minor or irrelevant as required by the GHGP (GHGP, 2011). Differences in interpretation of what constitutes 'minor' or 'relevant' emissions can easily lead to inconsistency and so each category must be reported on with, at least, explanatory information on the emission source provided (NCI and CMW, 2022). It is recommended that organisations stick to the GHGP scope 3 categories as reporting other sources of emissions may not be constructive (NCI and CMW, 2022).

Complete and transparent disclosure is defined as including:

- A breakdown of emission sources/categories
- Activity data
- Emission intensities

With subsidiary companies included in disclosure and GHG inventories (NCI and CMW, 2022) e.g. Blackpool's wholly owned companies.

When setting emission reduction targets (absolute or net zero) the most comprehensive approaches cover the full spectrum of emission sources and GHGs. This means a company's total footprint across its entire value chain including all scope 3 emissions are included in the target boundary (NCI and CMW, 2022). NCI and CMW (2022) note that partial scope coverage often misleads, so clear communication on source coverage must be explicit within headline pledges. To provide a clear incentive for all with the potential to influence emissions to act, including all scope 3 emissions and categories in the target is highly relevant. It must happen despite uncertainties and indirect influence, to fully leverage climate action across the value chain (NCI and CMW, 2022).

The headline pledge is an important communicative tool and to protect against misinterpretation NCI and CMW (2022) call for the pledge to state explicit, deep emission reduction commitments which are independent of removals or offsets. This is vital if net zero or carbon neutrality targets (i.e. targets dependent on the *balance* of emissions reducing to zero) are set, failure to do so contributes to much of the current ambiguity and greenwashing around climate ambition.

The IPCC SR15 requires global net-zero to be reached by 2050 to limit temperature increase to 1.5°C which means a 98% reduction in total CO<sub>2</sub> emissions (compared to 2010 levels) with only a *limited* role for offsetting or removals (with emissions from other GHGs reaching zero by approximately 2060-2070). 1.5°C compliant pathways are outlined in the SBTi Net Zero Standard (2021) but as NCI and CMW (2022) observe whilst clear reduction pledges are useful (e.g. 90% below 2019 levels across all emission scopes) to avoid mis-leading net zero language, alone, they do not sufficiently ensure 1.5°C alignment. NCI and CMW (2022) state that wider literature is necessary to assess compliance and list further literature resources to assess this. They acknowledge it is beyond the scope of their work and highlight it as an important area for future research.

Moreover, long-term 2050 visions of decarbonisation can clearly indicate the direction of travel, but near-term or interim targets are necessary to substantiate them. For credible corporate commitments on climate change, NCI and CMW (2022) emphasise the primary importance of interim targets that require immediate action alongside explicit accountability mechanisms. Earth system constraints require immediate emissions reductions as *cumulative* emissions determine ultimate levels of warming. Any further delays to emissions reductions lead to a greater atmospheric burden and require even steeper emissions cuts. Relying on GHG offsets or removals is highly uncertain (IPCC, 2022) and near-term abatement must be the primary focus of corporate target setting (NCI and CMW, 2022).

Further to SBTi and Corporate Responsibility Monitor, other analyses and methodologies are published to assess or verify corporate decarbonisation targets. These include Climate Action 100+ Net Zero Company Benchmarks 2021 status report (Climate Action 100+, 2022), Transition Pathway Initiative sectoral overview for corporate 2050 targets (TPI, 2022) and WWF’s review of FTSE100 net zero commitments (WWF, 2021). A more comprehensive review of all current methodologies is beyond the scope of this report. The widespread use of the SBTi Net Zero Standard combined with the critical angle in the Corporate Responsibility Monitor report was deemed sufficient to further inform robust local authority scope 3 management and net zero target strategy. The Net Zero Stocktake (2022) (Table.3) provides comprehensive analysis of national, sub-national and corporate targets and reviews all independent standards and assessments seeking to verify voluntary net zero targets.

**Table 3** Selected UK local authority relevant GHG accounting and net zero target guidance, literature, and resources.

	Guidance/resources
GHG Protocol	<ul style="list-style-type: none"> <li>• <a href="#">Corporate Value Chain (Scope 3) Accounting and Reporting standard (2011)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Project protocol for accounting for GHG emissions in climate mitigation projects (2005)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Technical guidance for calculating Scope 3 Emissions (2013)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Mitigation goal standard (2014)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Policy and action standard (2014)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Corporate standard</a> (2004) updated in 2015 with scope 2 guidance update.</li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Product life cycle accounting reporting standard (2011)</a></li> <li>• <a href="#">Global protocol for community-scale GHG inventories</a> (2014) updated in 2019 with IPCC guidelines update.</li> </ul>
Public sector	<ul style="list-style-type: none"> <li>• <a href="#">Climate Emergency UK, Climate Action Plan Checklist (2021)</a></li> <li>• <a href="#">2006 IPCC Guidelines for National Greenhouse Gas Inventories</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Welsh Public Sector Net Zero Carbon Reporting Guidance (2022)</a></li> <li>• <a href="#">Advice on emissions accounting and reporting methods to inform Welsh public sector decarbonisation policy delivery (2019)</a></li> <li>• <a href="#">Welsh Net Zero Carbon Reporting spreadsheet (2022)</a></li> <li>• <a href="#">Towards a Greenhouse Gas Assessment of the Welsh Government Budget (2021)</a></li> <li>• <a href="#">Carbon Positive Project Technical Report: Calculating Natural Resources Wales’ Net Carbon Status (2018)</a></li> </ul>
Scotland	<ul style="list-style-type: none"> <li>• <a href="#">Public Sector Leadership on the Global Climate Emergency (2021)</a></li> <li>• <a href="#">Public bodies climate change duties: Putting them into practice (2011)</a></li> </ul>

	<ul style="list-style-type: none"> <li>• <a href="#">Carbon assessment of the 21-22 Scottish budget (2021)</a></li> <li>• <a href="#">Public bodies climate change reporting 2020/21 Analysis Report</a></li> <li>• <a href="#">Policy note: Taking account of climate and circular economy considerations in public procurement (2021)</a></li> <li>• <a href="#">Scope 3 Methodology (2018)</a></li> <li>• <a href="#">(Net Zero Manual for calculation/inventory and Net Zero Procurement and Construction guides will be published soon)</a></li> </ul>
England	<ul style="list-style-type: none"> <li>• <a href="#">Local Partnerships GHG accounting tool (updated 2022) (CDP city reporting aligned)</a></li> <li>• <a href="#">Sustainable procurement tools (2014)</a></li> <li>• <a href="#">Central Government Sustainability Reporting Guidance (2021)</a></li> <li>• <a href="#">Local Partnerships GHG accounting tool FAQ guidance (updated 2022)</a></li> <li>• <a href="#">LGA Climate Change: Reporting guidance for local authorities (2022)</a></li> <li>• <a href="#">DEFRA UK carbon footprint</a> including consumption emissions 1990-2019 and 2019 Indirect supply chain emission factors by SIC (standard industrial classification) code and COICOP (classification of individual consumption according to purpose) for the UK and England.</li> <li>• <a href="#">ONS Atmospheric emissions: greenhouse gas emissions intensity by industry (1990-2022)</a></li> <li>• <a href="#">Environmental reporting guidelines (2019)</a></li> <li>• <a href="#">Procurement Policy Note – Taking Account of Carbon Reduction Plans in the procurement of major government contracts (2021)</a></li> <li>• <a href="#">BEIS conversion factors for primary data (2022)</a></li> <li>• <a href="#">Standard Industrial Code support guidance</a></li> </ul>
Private sector	<ul style="list-style-type: none"> <li>• <a href="#">Science based targets (SBTi) Corporate Net Zero Standard (2021)</a></li> <li>• <a href="#">Corporate climate responsibility: Guidance and assessment criteria for good practice corporate emission reduction and net-zero targets (2022)</a></li> <li>• <a href="#">Navigating the nuances of net zero targets (2020)</a></li> <li>• <a href="#">2022 Net Zero Stocktake Report (covering countries, sub-national governments, and companies)</a></li> </ul>
Net zero target literature	<ul style="list-style-type: none"> <li>• <a href="#">Net zero emissions targets are vague: three ways to fix (Rogeli et al., 2021)</a></li> <li>• <a href="#">The meaning of net zero and how to get it right (Fankhauser et al., 2022)</a></li> <li>• <a href="#">Wave of net zero emission targets opens window to meeting the Paris Agreement (Hohne et al., 2021)</a></li> <li>• <a href="#">An actionable climate target (Geden, 2016)</a></li> <li>• <a href="#">A case for transparent net zero carbon targets (Smith, 2021)</a></li> </ul>
	<ul style="list-style-type: none"> <li>• <a href="#">Cambridgeshire County Council: Annual carbon footprint report 20/21</a></li> <li>• <a href="#">Blackpool climate emergency documents (2021)</a></li> </ul>

Local authority examples in main text	<ul style="list-style-type: none"> <li>● <a href="#">Nottingham carbon neutral action plan (2020)</a></li> </ul>
	<ul style="list-style-type: none"> <li>● <a href="#">Cornwall Council Carbon Inventory (2019)</a></li> </ul>
	<ul style="list-style-type: none"> <li>● <a href="#">Enfield climate action plan (2020)</a></li> </ul>
	<ul style="list-style-type: none"> <li>● <a href="#">Newcastle climate action plan (2020)</a></li> </ul>
GHG footprinting literature	<ul style="list-style-type: none"> <li>● Measuring carbon performance in a UK university through a consumption-based carbon footprint (Ozawa-Meida et al., 2013)</li> </ul>
	<ul style="list-style-type: none"> <li>● Carbon footprint in Higher Education Institutions: a literature review and prospects for future research (Valls-Val &amp; Bovea, 2021)</li> </ul>
	<ul style="list-style-type: none"> <li>● Advancing sustainable consumption at the local government level: A literature review (Dawkins et al., 2019)</li> </ul>
	<ul style="list-style-type: none"> <li>● Greenhouse gas footprinting for small businesses – The use of input-output data (Berners-Lee et al., 2011)</li> </ul>
	<ul style="list-style-type: none"> <li>● Hybrid life-cycle assessment for robust, best-practice carbon accounting (Berners-Lee et al., 2019)</li> </ul>
<ul style="list-style-type: none"> <li>● Carbon management accounting and reporting in practice: A case study on converging emergent approaches (Gibassier &amp; Schaltegger, 2015)</li> </ul>	
GHG accounting and calculation tool resources	<ul style="list-style-type: none"> <li>● <a href="#">Oxford net zero tool library</a></li> </ul>
	<ul style="list-style-type: none"> <li>● <a href="#">GHG Protocol calculation tools</a></li> </ul>

## 5 Spend-based, iterative emissions management: an approach

To support the discussion, spend-based emissions calculations, iterative scope 3 management, and net zero target/disclosure observations presented below (4.1, 4.2 and 4.3), previous sections of this report (Section 1.1, 3 and 3.2) outlined the need for robust sub-national climate action to help close the current 'mitigation gap' (Dawkins *et al.*, 2019; IPCC, 2022; Fankhauser *et al.*, 2022; Rogeli *et al.*, 2021; Hans *et al.*, 2022; NCI and CMW, 2022; NCI, 2020) the importance of addressing scope 3 emissions (NCI and CMW, 2022; CCC, 2020; Berners-Lee *et al.*, 2019; Berners-Lee *et al.*, 2011; Valls-Val & Bovea, 2021; Ozawa-Meida *et al.*, 2013; IPCC, 2022; Hans *et al.*, 2022) and some of the barriers to robust climate action within UK local authorities (CCC, 2020; NAO, 2021; Dawkins *et al.*, 2019; IPCC, 2022) including:

- Siloed environmental teams ("your environment team alone cannot tackle climate change" CCC, 2020)
- Big spending, policy and project decisions not reflecting decarbonisation ambitions
- Lack of staff carbon/climate literacy outside of carbon/climate teams
- Lack of sufficient embedding of strategic climate ambitions
- Limited resources (both financial and staff) and capacity
- Expensive consultant reliance which can undermine internal capacity building
- Net zero/decarbonisation target ambiguity

These barriers are compounded by the abundance of guidance and approaches supporting emissions management in circulation, a selection of which is reviewed in Section 4 above. For many English authorities the resulting opacity is felt acutely as no centralised reporting requirement or clear guidance on their role in the national net zero transition currently exists (CCC, 2020). When austerity cuts, which have caused spending power to plummet 52% since 2010 (NAO, 2021a) are added to this confusion, it somewhat explains why many under-resourced and smaller local authorities are struggling to respond to pressure from communities and NGOs, and act meaningfully on climate change to uphold their climate emergency and/or net zero commitments (Gillard *et al.*, 2017; Howarth *et al.*, 2021; Hale *et al.*, 2021).

The challenge of tackling scope 3 emissions is well understood and primarily due to the inherent complexity in value chains and the resulting uncertainty organisations encounter in both the measurement of and their influence over these emissions (CCC, 2020; GHGP, 2011; GHGP, 2013). Nonetheless, responding to calls for action with efforts that include scope 3 emission reduction and management are vital to meaningfully address the 'mitigation gap' (IPCC, 2022; NCI and CMW, 2022; SBTi,

2021). Scope 3 emissions often constitute the majority of an organisation's footprint (over 70% [GHGP, 2012]) with category 1 and 2 scope 3 emissions sometimes accounting for 50-60% of total emissions (Ozawa-Meida et al., 2013; NRW, 2018). Whilst local authority own-operation footprints are only up to 1-3% of an area's total emissions (CCC, 2020) work to decarbonise value chains and reduce each category of scope 3 emission sends a clear message, working in concert with multiple entities along the value chain to drive down emissions. Action on authorities' own-operation footprints also allows them to demonstrate and share good practice and develop low-carbon partnerships across their areas (CCC, 2020), as well as enact the internal cultural and institutional change called for by the IPCC (2022) to enable urgent widespread and transformative decarbonisation. Supporting robust authority action on net zero strategy and scope 3 is therefore a priority.

In the absence of top-down regulation/requirements from central government, work is needed to; collate and interpret the wealth of guidance on net zero strategy, targets, disclosure and scope 3 emissions management (which Section 4 of this report contributes to and guidance is discussed/interpreted for local authority relevance in Sections 5.2 and 5.3 below), and, due to the limited capacity, resource (both financial and staff), and expertise within many authorities, articulate a *simple* starting point which can be built on to monitor, manage and drive down some of the largest sources of scope 3 emissions.

This understanding has led the work for this report to focus on using financial structures and spend-based emissions estimates more broadly, not only as a simple starting point for estimating emissions, but also to help iteratively increase knowledge and embed emissions estimates into local authority functioning and decision-making. Due to the existing accountability, performance, and management processes already in place, finance lends itself well to incorporating spend-based emissions estimates and refinement processes into council functioning. Providing stepwise support toward the goal of robust data and actionable scope 3 reduction targets, placed in the context of transparent and unambiguous overarching net zero targets (IPCC, 2022; Hans et al., 2022; NCI and CMW, 2022).

Overview:

- Section 5.1 uses local authority relevant guidance and Blackpool's existing financial and governance structures to present a simple method for estimating scope 3 category 1 and 2 emissions.
- Sections 5.2 and 5.3 build on the calculation method and discuss routes to refine estimates and processes and build carbon management knowledge across Blackpool.

- Section 6.1 further informs overarching net zero and scope 3 emissions strategy by interpreting and summarising guidance in the context of Blackpool.

## 5.1 Calculating spend-based indirect emissions

This work is presented as a method authorities can follow with steps supported by guidance summarised in Section 4 and additional literature (Table.3) in the context of Blackpool council.

### 5.1.1 Method

The following method details a starting point for category 1 and 2 scope 3 emissions calculation commensurate with administrative capacity, leaving room for Blackpool to make appropriate decisions on implementing and aligning emissions management more fully with existing practices.

To provide a departmentally replicable proof of concept, the annual total spend, including capital expenditure (accounted for on separate ledger), for a single Blackpool directorate - Communities and Environment, has been categorised and used to estimate emissions. Work was completed to review best practice scope 3 guidance (Section 4) to inform the method, including research into the most appropriate, publicly available spend-based emission factors (referred to interchangeably as EFs or emission factors).

#### **Step 1:**

*Access annual accounts for department spend.* This example uses Blackpool's Community and Environment directorate spend for the financial year 2020/2021. Using the financial year for annual emissions reporting can make sense for authority operational emissions and is GHGP (2004) compliant.

*Start with the most granular spend available.* Blackpool organises spend by cost centre and account name (Table.4) and so annual spend including Level 4 Cost Centre Name (4CCN), Level 7 Cost Centre Name (7CCN) and Level 9 Account Name (9AN) offers the most informative and granular spend ledger.

**Table 4** Blackpool council internal financial accounting code structure split by account name and cost centre.

Cost centre structure		
Level code	Name	Description
1CCC	1CCN	Total for Council and subsidiaries
2CCC	2CCN	Splits Council and subsidiaries
3CCC	3CCN	Splits between revenue, capital, Housing Revenue Account, Collection Fund, and balance sheet
4CCC	4CCN	Splits level 3 by department
5CCC	5CCN	Splits level 4 by section
6CCC	6CCN	Splits level 5 by section
7CCC	7CCN	Splits level 6 by section
8CCC	8CCN	Splits level 7 by section
9CCC	9CCN	Posting level

Account code structure		
Level code	Name	Description
1AC	1AN	Total Net Expenditure
2AC	2AN	Splits level 1 between gross expenditure and gross income
3AC	3AN	Splits level 2 into CIPFA's subjective analysis e.g. employees, transport, premises etc
4AC	4AN	Splits level 3 into more detail e.g. salary, national insurance, pension etc
5AC	5AN	Splits level 4 into more detail e.g. basic pay, pay allowances etc
6AC	6AN	Same as level 9 below
7AC	7AN	Same as level 9 below
8AC	8AN	Same as level 9 below
9AC	9AN	Posting level

Of course, numerous other financial accounting codes/structures are in place at Blackpool and as accountants learn to incorporate emissions, other options for understanding the data will become apparent and more effective methods may arise. In discussions with accountants at Blackpool concerning this research, ideas were immediately stimulated and multiple other breakdowns of spend and associated emissions were identified to aid analysis, decision-making, refinement and understanding e.g. to breakdown spend based on specific job-codes.

## Step 2

*Identify spend for exclusion.* Spend data must be cleansed for outgoings (and income) which are *not* purchased goods and services (i.e. not category 1 scope 3 emissions). Spend lines were simply colour coded for exclusion in Fig.19. For Blackpool data this

meant wages (including payments made directly to people as benefits), depreciation, income and future spend/savings (i.e. spend contributing to other funds or not spent this year). As well as scope 1 and 2 emissions i.e. direct emissions and indirect energy-use emissions including fuels/diesel/petrol, gas, electricity, heating and ventilation (see Table.1 in Section 3.2 for further clarification on scope 3 categories and spend-based calculation method applicability).

Further spend lines may be excluded to allow for alignment with other emission calculation methods and avoid double counting. For example, if water or waste emissions are already being monitored. The Welsh Net Zero Reporting method (2022) (pg. 60) highlights certain SIC categories to avoid reporting on using spend data, as emissions are likely already being calculated elsewhere.

In this example (Fig.19), travel and water were highlighted (but not excluded from the calculation) as the Carbon Trust had completed work on estimating those emissions. If other emission source monitoring methods are not established or sufficiently embedded into decision-making it may prove useful to establish a system which tracks all possible emissions using spend (see Table.1), and then to later replace emissions estimates from sources which have more accurate emissions figures, once the spend-based monitoring/management method is established within a department for example.

Exclusions	
Wages	Wages
Depreciation	Depreciation
Income	Income
Scope 1	Scope 1
Scope 2	Scope 2
Future spend	Future spend
CT footprint	
Water	Water
Travel spend	Travel spend

**Figure 19** Extract from spend-based emissions calculation spreadsheet indicating the spend lines highlighted for exclusion from scope 3 category 1 (purchased good and services) calculations for Blackpool council.

Identifying spend for removal was completed using the account name (9AN) and cost centres in conjunction with clarifications from the council’s accountants. Departmental accountants and staff will be able to exclude and categorise spend more effectively with better understanding of the content of individual spend lines.

### Step 3

Assign an appropriate spend-based emission factor ( $\text{kgCO}_2\text{e}/\text{£}$ ) to each spend line. The remaining spend lines (after exclusions) were then assigned a suitable emission factor. The emission factor sets deemed most suitable, due to their public availability and government mandate, prior to the June 2022 update, were a combination of the UK indirect supply chain emission factors from 2011 (DEFRA, 2013) (used in the Welsh Net Zero Reporting method [2022]), the UK 2019 direct emission factors (UK sectoral territorial emissions) (ONS, 2022) and UK consumption emissions 2018 (see appendix A Table.12). Due to the age and uncertainty of the 2011 emission factors, they were marginally updated, using UK direct emission factors as a proxy for changes in tax/inflation/trade flows by dividing 2011 indirect EFs by the 2011 direct EFs and using the quotient as a multiplier for the 2019 direct emission factors (EF) (Equation 3).

$$\frac{2011 \text{ indirect EF}}{2011 \text{ direct EF}} \times 2019 \text{ direct EF} = \text{updated EF}$$

Equation 3

This produced a set of somewhat updated 2011 indirect emission factors organised by 106 SIC code categories (see Table.11 in appendix A). Small SIC code category differences between the 2011 and 2019 sets were also aligned (see appendix A for detail). Whilst this improved the 2011 EFs to some extent, the level of uncertainty was still difficult to estimate and so the more recent 2018 UK carbon footprint data set which includes emission intensities (in  $\text{kgCO}_2\text{e}/\text{£}$ ) categorised by 310 COICOP categories (of individual consumption according to purpose) (see appendix A Table.12), were also assigned to spend to estimate emissions. Using multiple sets of EFs i.e. COICOP individual consumption based EFs and SIC code EFs is not considered ideal (Scottish Government, 2022) but given the age of the 2011 supply chain set, the importance of enabling as complete a footprint as possible to manage and drive down emissions and the prominence of procurement emissions in a footprint (up to 50-60% of total emissions [Ozawa-Meida et al., 2013: NRW, 2018]), it was deemed appropriate. In addition, if, as this approach suggests in Section 5.2 (based on GHGP category 1 and 2 scope 3 calculation method hierarchy in Fig.6), spend-based emissions estimates will be progressively improved by seeking average product, service or supplier specific emission factors or data, organisational footprint reporting/disclosure will consist of emissions calculated using a variety of methods. As such, using a combination of COICOP and SIC-based datasets would not undermine the estimates any more than seeking product specific average EFs would.

Prior to June 2022 the COICOP consumption EF set was signposted for use on the UK carbon footprint website. As the COICOP categories are more granular (e.g. milk, garments etc.) and directed at individual consumption opposed to the SIC code categories it was not possible to assign all spend using these more recent 2018 consumption factors. Instead, a combination of updated 2011 indirect emission factors by SIC code and the 2018 consumption emission factors were used. Both sets of emission factors (Table.11 and Table.12), as well as detail on the full method used to update the 2011 indirect emission factors, are supplied in appendix A.

It should be noted that Blackpool has not explicitly stated which GHGs are included in its 2030 net zero target or clearly defined the target boundary (see Section 6.1 Table.10). Clarity is needed as carbon is often used implicitly in climate strategy communication to indicate full GHG coverage. DEFRA publish both CO<sub>2</sub>e (covering all GHGs as CO<sub>2</sub> equivalents) and CO<sub>2</sub> based emission factors for use with spend data. The method in this report has used CO<sub>2</sub>e EFs to support full emissions coverage but if boundaries and gas inclusion clarifications state otherwise CO<sub>2</sub> only EFs can be used. A key advantage of using modelled sectoral averages to estimate emissions is the full (top-down) emissions coverage it provides (GHGP, 2013), and, given the methodological ease of including a GHG estimate in such a high-level approach, it makes little sense to choose CO<sub>2</sub> only EFs.

As specific areas of spend are explored and emissions estimates refined e.g. replaced with product or supplier specific EFs or data (see Section 5.3 for refinement opportunities), further clarity on which gases are included in emissions estimates and covered in category specific reduction targets will be required. It is best practice to track and report emissions in CO<sub>2</sub>e ensuring monitoring and targets cover all seven GHGs as stipulated by the Kyoto Protocol (GHGP, 2011).

To aid with appropriate EF assignment, clarification on the emissions covered by each SIC category was sought using explanatory notes from ONS (2007), compiled for easy access at siccodesupport.co.uk (Environment Ltd, 2007). Each spend line was assigned an EF and labelled with an excel cell note to indicate the EF source and category (for replication/assessment of appropriateness) (see Fig.20). There is opportunity for immediate refinement/improvement of estimates regarding clarification on the content of 9AN spend lines, most of which (alongside the cost centre) were explanatory enough to assign an EF, others such as 'general materials' will benefit from staff knowledge to further clarify the spend profile, allowing more accurate EF assignment – see Section 5.3 for further discussion of refinement/improvement opportunities.

The emission factors are for use with purchasers' prices e.g. including VAT. Blackpool couldn't easily provide purchasers prices within the timeframe and so spend without VAT was used and judged to be acceptable given the already high uncertainty ~25% (Welsh Government, 2022) of indirect supply chain EFs and their use in this instance as an indicative starting estimate. It should be noted that all indirect supply chain EFs are modelled and calculated using purchasers' prices so using spend data in purchasers' prices is preferable (Welsh Government, 2022; UK Government, 2019).

As mentioned in Section 4 of this report, the first update in 9 years to the UK (and now also England-specific) indirect supply chain emission factors by SIC code was published by DEFRA in June 2022 (as this work neared completion). These factors allow more accurate emissions estimates to be calculated and offer a single source of recent, government mandated supply chain EFs for public and private sector use (subject to a three-year lag). Guidance for Blackpool and other authorities seeking to estimate and manage their own category 1 and 2 scope 3 emissions is now to use the updated 2019 emission factor set (appendix A Table.13) to assign EFs to spend data. Seeking updates as they are published (with a three-year lag) annually on the UK carbon footprint webpage. The UK statistics release website gives notice of upcoming updates and their publication dates. The relative standard deviation (RSD) or uncertainty of the updated factors is likely to be estimated by the Welsh approach when they replace the 2011 EFs. They currently estimate an RSD of +/- 25% for the 2011 set, which will reduce for the 2019 EFs as changes in tax, inflation and trade flows have been modelled and accounted for.

In the method originally developed for this report prior to DEFRA's 2022 update, a combination of COICOP and SIC code based EFs were used to assign to spend lines. Updated 2019 SIC EFs are now recommended for use in the first instance. As COICOP factors still offer greater category granularity (although this is somewhat reduced in the 2019 update see Table.14) for some specific items and services, which are grouped more broadly in SIC code data, this method still recognises the use of COICOP 2019 factors.

#### **Step 4**

*Multiply spend line by emission factor to give tCO<sub>2</sub>e estimate.* Each 9AN spend line was then multiplied by the assigned kg CO<sub>2</sub>e/£ EF and divided by 1000 to give the tCO<sub>2</sub>e estimate (Equation 1) (Fig.20). 9AN categories offer the most granular spend description but EFs were also assigned to the data based on the cost centre (7CCN) for comparison. The time burden for sorting, categorising, and calculating a ~1400 spend line account, following the steps laid out in this section for the first iteration of monitoring, is approximately 3-5 days for someone unfamiliar with SIC code categories.

COMMUNITY AND ENVIRONMENTAL SERVICES 2020/2021											
4CCC - Level 4 Centre Code	4CCN - Level 4 Centre Name	7CCC - Level 7 Cost Centre Code	7CCN - Level 7 Cost Centre Name	9AC - Level 9 Account Code	9AN - Level 9 Account Name	Actuals	Accounting Year	9AN kgCO2e/£ emission factor	7CCN kgCO2e/£ emission factor	9AN tCO2e	7CCN tCO2e
BPLSER	Community &	BLCLEA	Building Clean	0011	Salaries-Overtime	9,624.90	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	0061	Salaries-National Insurance	26,771.22	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	0071	Salaries-Superannuation	33,535.17	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	0993	Police Fees (Employee)	334.05	2021	0.22	0.25	0.073	0.084
BPLSER	Community &	BLCLEA	Building Clean	1608	Other Cleaning Works	15.00	2021	0.25	0.25	0.004	0.004
BPLSER	Community &	BLCLEA	Building Clean	2002	Repairs And Maintenance	11,519.36	2021	0.49	0.25	5.644	2.880
BPLSER	Community &	BLCLEA	Building Clean	2004	Running Costs-Diesel	3,539.16	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	3010	Safety Equipment	95.14	2021	0.45	0.25	0.043	0.024
BPLSER	Community &	BLCLEA	Building Clean	3040	Handicraft Materials	281.96	2021	0.49	0.25	0.138	0.070
BPLSER	Community &	BLCLEA	Building Clean	3041	Other Materials	13,061.79	2021	0.091	0.25	1.189	3.265
BPLSER	Community &	BLCLEA	Building Clean	3201	Clothing & Uniforms	5,146.98	2021	0.278	0.25	1.431	1.287
BPLSER	Community &	BLCLEA	Building Clean	3301	Printing	186.50	2021	0.47	0.25	0.088	0.047
BPLSER	Community &	BLCLEA	Building Clean	3302	Stationery	1.23	2021	0.91	0.25	0.001	0.000
BPLSER	Community &	BLCLEA	Building Clean	3305	Photocopying Charges	393.46	2021	0.76	0.25	0.299	0.098
BPLSER	Community &	BLCLEA	Building Clean	3313	General Expenses	16.00	2021	0.25	0.25	0.004	0.004
BPLSER	Community &	BLCLEA	Building Clean	3521	Landline - Line Rental	960.00	2021	0.174		0.167	0.240
BPLSER	Community &	BLCLEA	Building Clean	3523	Mobile Phones - Line Rental	882.00	2021	0.174		0.153	0.221
BPLSER	Community &	BLCLEA	Building Clean	3524	Mobile Phones - Call Charges	11.19	2021	0.174		0.002	0.003
BPLSER	Community &	BLCLEA	Building Clean	3531	Computer-H'Ware Purchase	25.15	2021	0.49		0.012	0.006
BPLSER	Community &	BLCLEA	Building Clean	3801	Other Expenses	75.00	2021	0.25	0.25	0.019	0.019
BPLSER	Community &	BLCLEA	Building Clean	3901	Contributions To Funds	36,800.00	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	6231	Accountancy	7,700.00	2021	0.12	0.25	0.924	1.925
BPLSER	Community &	BLCLEA	Building Clean	6232	Audit & Insurance	4,000.00	2021	0.12	0.25	0.480	1.000
BPLSER	Community &	BLCLEA	Building Clean	6234	Corporate Procurement	6,100.00	2021	0.13	0.25	0.793	1.525
BPLSER	Community &	BLCLEA	Building Clean	6241	Ict Services	10,800.00	2021	0.18	0.25	1.944	2.700
BPLSER	Community &	BLCLEA	Building Clean	6261	Corporate Policy	2,000.00	2021	0.13	0.25	0.260	0.500
BPLSER	Community &	BLCLEA	Building Clean	6275	Property & Estate Mgt	17,900.00	2021	0.13	0.25	2.327	4.475
BPLSER	Community &	BLCLEA	Building Clean	6282	Hr & Admin	16,200.00	2021	0.13	0.25	2.106	4.050
BPLSER	Community &	BLCLEA	Building Clean	6283	Policy, Trans & Comms	9,100.00	2021	0.13	0.25	1.183	2.275
BPLSER	Community &	BLCLEA	Building Clean	6288	Public Relations	4,000.00	2021	0.13	0.25	0.520	1.000
BPLSER	Community &	BLCLEA	Building Clean	6289	Information Governance	1,800.00	2021	0.13	0.25	0.234	0.450
BPLSER	Community &	BLCLEA	Building Clean	6290	Payroll Services	2,700.00	2021	0.13	0.25	0.351	0.675
BPLSER	Community &	BLCLEA	Building Clean	7189	Other Misc Income - No Orders	-4,645.54	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	7301	General Fees & Charges	-6,142.07	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	7971	Recharges To Other A/Cs	-345,947.00	2021			0.000	0.000
BPLSER	Community &	BLCLEA	Building Clean	7972	Sia Income	-165,125.61	2021			0.000	0.000

Figure 20 Extract from spend-based emissions calculation spreadsheet for scope 3 category 1 (purchased good and services) calculations for Blackpool council's Environment and Community directorate annual spend 2020/2022. 9AN account name and 7CCN cost centre spend lines were multiplied by indirect supply chain emission factors to calculate emissions. Cell note example demonstrates emission factor source and category labelling for each cell.

### Step 5

Calculate emissions breakdown by cost centre (7CCN). Once spend is categorised and emissions are estimated for each spend line (step 4), total annual category 1 and 2 scope 3 emissions can be calculated or Blackpool's Community and Environment directorate the total 20/21 emissions estimate is 110.6 ± 27.6 kt CO<sub>2</sub>e. In this example (Table.5), emissions and spend (minus exclusions from step 2) have been categorised by cost centre for analysis and management. Data in Table.5 is sorted by total 9AN emissions from smallest to largest so the highest emitting cost centres can be easily identified.

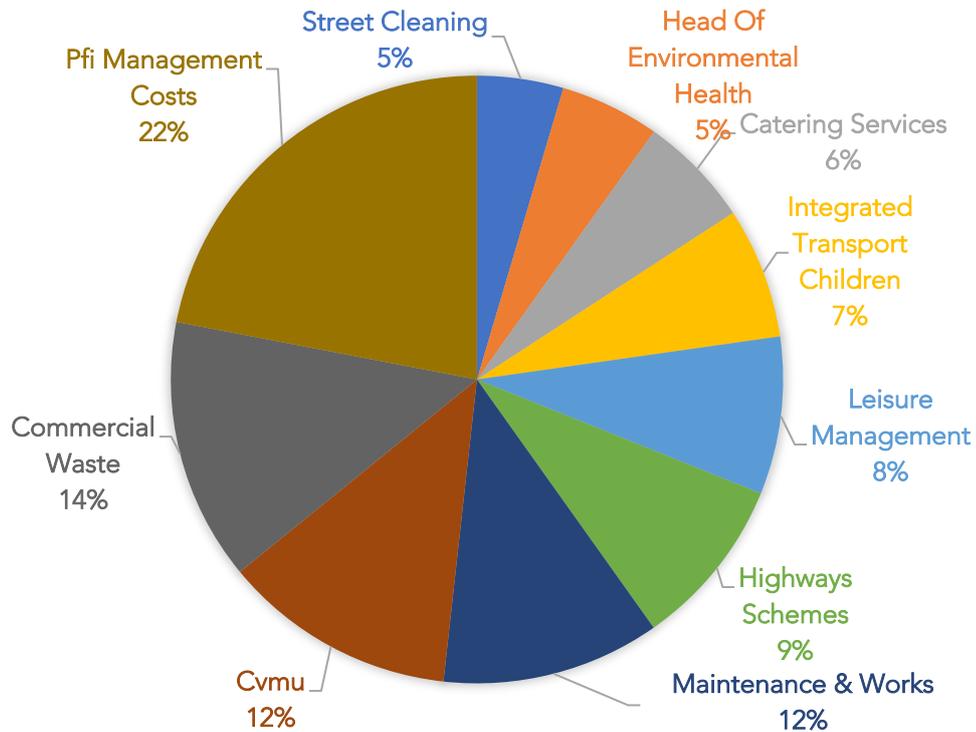
Fig.21 is a proportional breakdown of the top ten highest emitting cost centres (domestic waste is the highest emitting [see Table.5] but was not included in Fig.21 as the emission value is an order of magnitude greater than any other cost centre). With this method, emissions will vary based on the EF or spend value and so calculating the carbon intensity and total spend of a cost centre gives further insight on where to

focus efforts and refinements. Carbon intensive categories may offer good returns on decarbonisation investment as each pound diverted toward a lower carbon alternative saves comparatively more emissions.

**Table 5** Blackpool council Environment and Community 2020/2021 department spend and estimated emissions by cost centre. Data sorted by Total 9AN tCO<sub>2e</sub> emissions smallest to largest.

Level 7 Cost Centre Name (7CCN)	Total 9AN (tCO <sub>2e</sub> )	Total spend (£)	9AN carbon intensity of spend (kgCO <sub>2e</sub> /£)
Street Crossing Patrols	1.0	4797.4	0.2
Office Portage	1.2	2316.8	0.5
Central Administration	1.3	1788.4	0.7
Parking Enforcement	1.4	521.4	2.6
Street Lighting & Signals	1.8	7282.4	0.3
Sports & Physical Activity	1.9	4029.3	0.5
Pest Control	2.2	13307.0	0.2
Community Safety	2.4	9262.5	0.3
Planning Enforcement	3.1	11316.0	0.3
Local Env Action Force	3.7	14725.8	0.3
Selective Licensing	4.1	21139.1	0.2
Alleygates	4.2	25214.7	0.2
Weo Management	4.8	17485.1	0.3
Tree Gang	6.0	9917.6	0.6
Community Safety	6.4	14245.5	0.4
Pe And Sport Team	9.1	23893.2	0.4
Housing Enforcement	10.3	21377.8	0.5
Integrated Transp Rideability	10.9	22259.7	0.5
Public Protection - Food	14.8	10089.7	1.5
Trading Standards	15.4	18242.4	0.8
Integrated Transport Admin	15.5	55596.3	0.3
Public Transport Contracts	16.2	20000.0	0.8
Core Playground Maintenance	18.0	36991.5	0.5
Environmental Protection	18.3	68694.6	0.3
Building Cleaning	20.4	115304.8	0.2
Coastal & Envrnmntl Pship Invs	22.6	135675.6	0.2
Winter Maintenance	27.5	56099.1	0.5
Parks Staffing	45.5	112585.7	0.4
Integrated Transport Adults	45.8	68717.1	0.7
Licensing	61.0	162090.7	0.4
Security Services	69.5	408099.2	0.2
Traffic Management	75.4	92165.6	0.8
Parks Development	95.0	146763.6	0.6
Parades & Seawall	99.4	202965.9	0.5
Parks Green Open Space	115.5	277551.5	0.4
Public Conveniences	130.4	526861.4	0.2
Cctv	220.6	356784.8	0.6
Directorate	250.3	1277104.3	0.2
Free School Breakfasts	338.0	490800.1	0.7

Engineering	347.6	1385655.3	0.3
Transportation Services	361.0	395993.3	0.9
Street Cleaning	397.1	1384985.7	0.3
Head Of Environmental Health	458.7	844064.1	0.5
Catering Services	518.4	1400468.3	0.4
Integrated Transport Children	607.3	772696.5	0.8
Leisure Management	731.0	2982991.4	0.2
Highways Schemes	792.5	1659562.4	0.5
Maintenance & Works	1005.8	2074705.5	0.5
Cvmu	1075.9	2361435.5	0.5
Commercial Waste	1215.8	1631455.9	0.7
Pfi Management Costs	1914.3	4676233.2	0.4
Domestic Waste & Waste Pfi	96866.3	14268415.7	6.8



**Figure 21** Top ten highest emitting cost centre categories (by tCO<sub>2e</sub>) of Blackpool council's Community and Environment directorate 'purchased goods and services'.

## Step 6

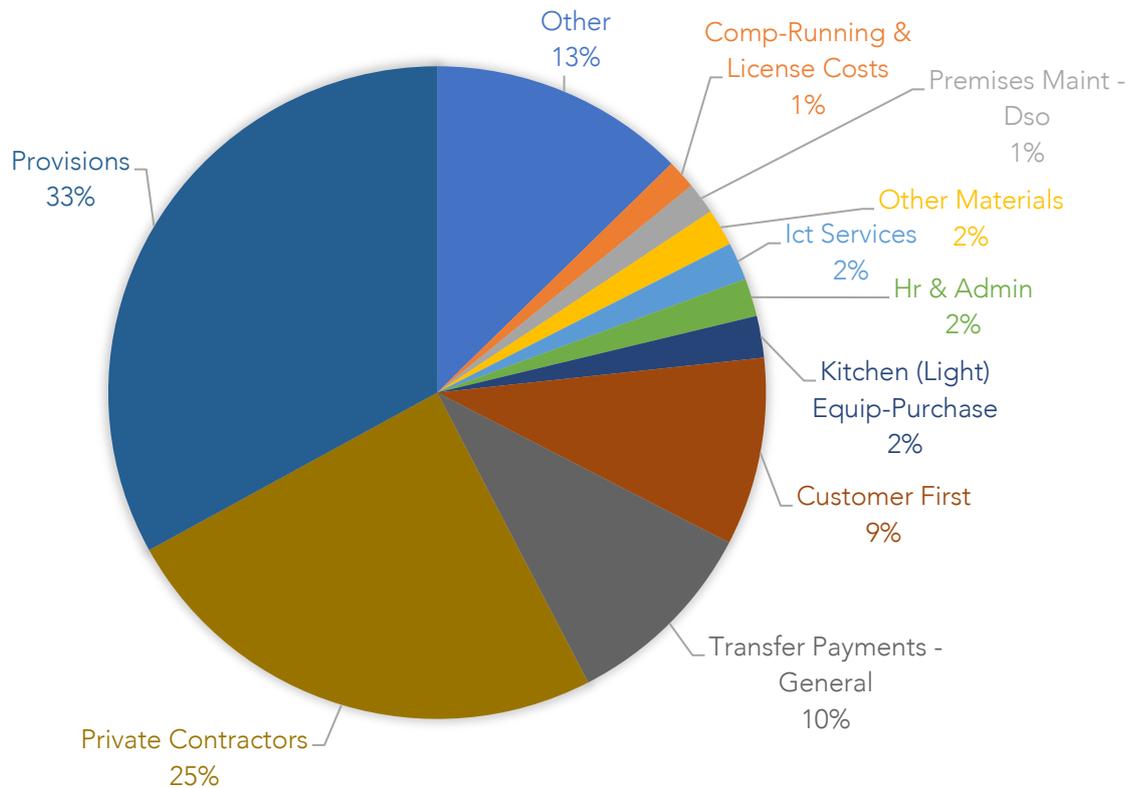
Calculate emissions breakdown by account name (9AN) within each high emitting cost centre (7CCN). Further breakdowns of spend and emissions can again be calculated to inform analysis and refinement. For this example, Catering Services, one of the top ten highest emitting cost centres (Fig.22) was chosen, with spend and emissions broken down to the most granular level - spend line/account name (9AN) (Table.6). Fig.22 visualises the proportion of emissions associated with the top ten highest emitting spend lines within Catering Services, the remaining spend lines are categorised as other.

In terms of application, a catering services manager with little carbon literacy could get an immediate idea of the profile of emissions associated with activities from Fig.22 as well as an indication of where to start improving estimates for a more accurate picture e.g. delving into the spend profile of provisions or possibly removing the emissions associated with 'transfer payments' if little about them can be influenced. Crucially, it provides a previously unavailable overview of emissions from which uncertainty can be resolved over time.

**Table 6** Blackpool council catering services emissions, spend and assigned emission factor (in kgCO<sub>2</sub>e/£) by individual spend line (level 9 account name). From 2020/2021 Environment and Community department spend ledger.

Catering Services level 9 account name (9AN)	tCO <sub>2</sub> e	Total spend (£)	Emission factor (kgCO <sub>2</sub> e/£)
Mobile Phones - Call Charges	0.000	1.74	0.174
Computer Consumables	0.005	58.00	0.083
Fixtures & Fittings Maint	0.015	179.00	0.083
Postages	0.021	75.95	0.283
Other Cleaning Works	0.046	184.38	0.25
Kitchen (Light) Equip-Repair	0.056	478.50	0.116
Chemicals	0.069	755.24	0.091
Fixtures & Fittings	0.132	1,595.00	0.083
Transactional Services	0.163	16,300.00	0.01
Office Equipment Purchase	0.173	190.10	0.91
General Services	0.202	470.62	0.43
Stationery	0.204	224.66	0.91
Rechg Cleaning Dso	0.259	1,037.26	0.25
Subscriptions	0.311	2,395.00	0.13
Photocopying Charges	0.403	530.58	0.76
Police Fees (Employee)	0.457	2,079.10	0.22
Landline - Line Rental	0.471	2,707.56	0.174
Mobile Phones - Line Rental	0.512	2,940.00	0.174
Information Governance	0.611	4,700.00	0.13

Computer-H'Ware Purchase	0.765	1,562.00	0.49
Corporate Procurement	0.793	6,100.00	0.13
Catering Services	0.810	1,883.75	0.43
Clothing & Uniforms	0.952	3,423.70	0.278
Policy, Trans & Comms	1.183	9,100.00	0.13
Corporate Policy	1.196	9,200.00	0.13
Public Relations	1.352	10,400.00	0.13
Payroll Services	1.599	12,300.00	0.13
Furniture - Purchase	2.390	13,060.52	0.183
Accountancy	2.424	20,200.00	0.12
Audit & Insurance	2.448	20,400.00	0.12
Premises Maint-Priv.Contractors	4.689	9,570.08	0.49
Other Expenses	4.852	11,284.43	0.43
Kitchen (Heavy) Equip-Purchase	5.074	5,576.25	0.91
Printing	5.397	11,482.42	0.47
Waste Collection Chgs	5.691	816.94	6.966
Property & Estate Mgt	6.123	47,100.00	0.13
Repairs And Maintenance	6.335	12,928.85	0.49
Legal Services	7.259	2,600.00	2.792
Comp-Running & License Costs	7.497	41,650.91	0.18
Premises Maint - Dso	8.085	16,500.00	0.49
Other Materials	9.556	22,223.70	0.43
Ict Services	9.684	53,800.00	0.18
Hr & Admin	9.750	75,000.00	0.13
Kitchen (Light) Equip-Purchase	10.714	8,646.91	1.239
Customer First	48.321	123,900.00	0.39
Transfer Payments - General	50.761	118,048.00	0.43
Private Contractors	127.430	296,348.75	0.43
Provisions	171.148	398,019.69	0.43



**Figure 22** Proportion of GHG emissions associated Catering Services at Blackpool council categorised by spend line.

## Step 7

Access department capital spend, assign emission factors to spend lines and multiply spend by emission factors to calculate estimates. Capital spend is often accounted for in a separate ledger to purchases. The GHGP (2013) advises capital spend be accounted for in the year of acquisition and not subject to depreciation and allow category 1 (purchased goods and services) and category 2 (capital spend) emissions to be delineated based on an organisation's internal financial accounting practices. In this example (Fig.23), the capital spend account provided by Blackpool council for the Community and Environment directorate was high level, so most capital spend lines were assigned a generic construction emission factor.

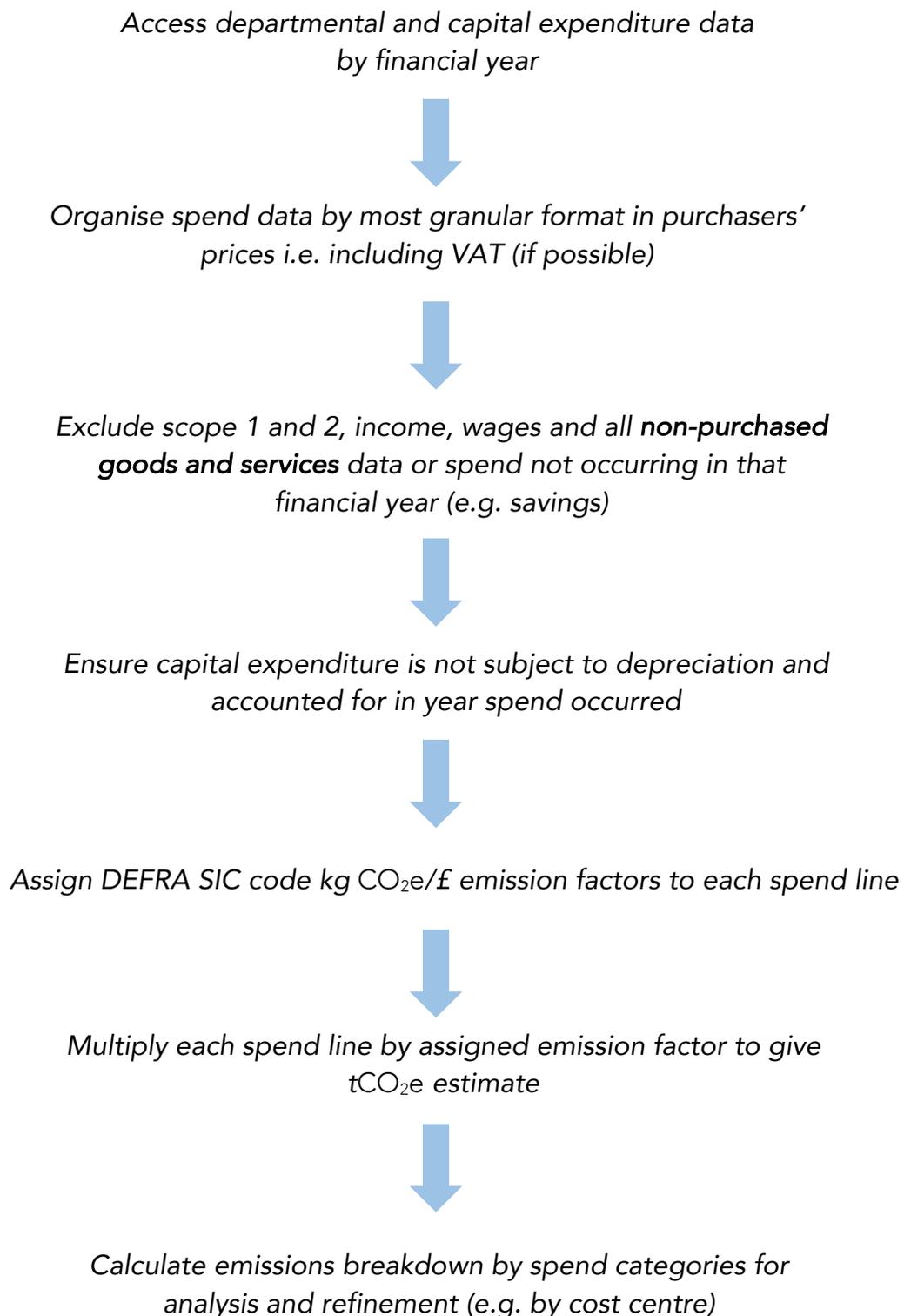
A construction EF is included in the SIC code based updated indirect EF list (appendix A). However, Leeds University have published an up-to-date emission factor for embodied emissions associated with UK construction in 2021 (0.98 kgCO<sub>2</sub>e/£) (Scott et al., 2015), spend was therefore assigned this more recent (and therefore more representative) EF instead. Using the Leeds published EF is an example of immediate

refinement or improvement of the emissions estimate, by using an up-to-date EF from the literature opposed to the generic UK indirect factors. As Section 5.2 will discuss, options for improving estimates can involve literature-sourced emissions factors for use with spend, with awareness that these may be more accurate/up to date but are not government mandated. Emission factor sources and SIC code categories are indicated in the cell notes in Fig.23.

<b>Expenditure for Capital Purposes</b>			<b>PAYMENTS</b>	<b>CAPITAL</b>	<b>GOVERNMENT</b>	<b>OTHER</b>	<b>PRUDENTIAL</b>	<b>TOTAL</b>	<b>EMISSION FACTOR</b>	<b>EMISSIONS</b>	
<b>2020/21</b>			<b>IN 2020/21</b>	<b>RECEIPTS</b>	<b>AND OTHER GRANTS</b>	<b>SOURCES</b>	<b>BORROWING</b>				
<b>Director Responsible for</b>		Code	£	£	£	£	£	£	kgCO2e/£	tCO2e	
	<b>Community and Environmental Services</b>										
	<b>Other Schemes</b>										
		Vehicle/Plant/Equipment Renewals	CB31 Total	1,448,032	Prosser, Millie: C 28 Machinery and equipment	-	1,448,032	-	1,448,032	0.91	1,318
		Anchorsholme Seawall Scheme	CP05 Total	21,685		21,685	-	-	21,685	0.98	21
		Sand Dunes	CP71 Total		Leeds univeristy methodology - Prof. John whitelegg (embodied GHG infrastructure 2015 paper)	99,855	-	-	99,855	0.98	98
		Bispham Coast Protection	CP7005 Total			124	-	-	124	0.98	0
		Bispham Drainage	CP7007 Total			31,200	-	-	31,200	0.98	31
		Stanley Park All Weather Pitch	CL6503 Total	-	Prosser, Millie: C 29 Motor vehicles	79,325	-	(79,325)	0	0.98	0
		Anchorsholme Park Playground	CL6504 Total	2,368		2,368	-	-	2,368	0.98	2
		Refuse Vehicles	CL9815 Total	1,315		1,315	-	-	1,315	0.47	1
		Layton Depot Refuse Works	CL9816 Total	1,773	Prosser, Millie: C 25 Computer electronic and communication/optical products	1,773	-	-	1,773	0.98	2
		Leisure Centre Refurbishment	CL9996 Total	432,906		34,702	398,204	-	432,906	0.98	424
		Illuminations Robotic Arm	CG6701 Total	155,598		-	-	-	155,598	0.49	76
		<b>Total Other schemes</b>		<b>2,194,856</b>		<b>155,598</b>	<b>272,347</b>	<b>1,846,236</b>	<b>(79,325)</b>		<b>1,973</b>
	<b>Transport</b>										
		Bridges	CT13 Total	172,130		172,130	-	-	172,130	0.98	169
		Blackpool/Fleetwood Tramway Extension	CT71 Total	2,272,650		1,855,303	-	417,347	2,272,650	0.98	2,227
		Yeadon Way	CT1341 Total	993,427		993,427	-	-	993,427	0.98	974
		<b>Total Transport</b>		<b>3,438,207</b>		<b>3,020,860</b>	<b>-</b>	<b>417,347</b>	<b>3,438,207</b>		<b>3,369</b>
		<b>Total Community and Environmental Services</b>		<b>5,633,063</b>		<b>155,598</b>	<b>3,293,207</b>	<b>1,846,236</b>	<b>338,022</b>		<b>5,342</b>
									<b>Total KtCO2e</b>	<b>5.3</b>	

Figure 23 Capital expenditure for Community and Environment directorate including emission factors (kgCO<sub>2e</sub>/£) and calculated emissions in tCO<sub>2e</sub> by spend line. Cell notes indicate emission factor source or SIC code categories.

'Getting started' spend-based method summary steps:



**Figure 24** 'Getting started' spend-based emissions calculation method summary. For use calculating UK local authorities departmental category 1 and 2 scope 3 emissions in tCO<sub>2</sub>e

## 5.2 Discussion

### 5.2.1 Embedding indirect emissions into decision making

The scope 3 category 1 and 2 spend-based calculation method described above (Section 5.1), effectively gives Blackpool (if replicated for all directorates or departments) a 'carbon impact of spend' analogous to the Welsh and Scottish national approaches (Scottish Government, 2021a; Cardiff University, 2021). It is also comparable to Natural Resources Wales' 'Carbon Positive' category 1 and 2 emissions calculation conducted as part of their full GHG inventory estimation (NRW, 2018). Both the NRW and national examples estimate the high-level emissions impact associated with spend using EEIO based sectoral EFs, with NRW (2018) using the 2013 DEFRA emission factors used in this report (prior to June 2022 EF update). Scotland and Wales use country specific input-output data to calculate sectoral EFs by SIC code for better regional representation, although only Scotland's EFs are consumption based i.e. including emissions occurring in the supply chain outside of Scotland (and the UK). Wales' assessment is based on direct or territorial emissions only.

In contrast to the vast budgets categorised by sector in the national approaches, the authority sized assessment enables more granular resolution i.e. each individual spend line can be manageably categorised, as demonstrated in the spend line category assignment process in (Step 4) Fig.20. The Welsh and Scottish national approaches handle budgets by 'major expenditure area' disaggregated into high-level spend lines, Scotland's 'Governance, Elections and Reform' category for example is only disaggregated into two categories with large associated spend of £0.5M and £3.1M (Scottish Government, 2021). Inevitably the combination of such high-level spend disaggregation and the SIC category format (see appendix A Table.13) results in numerous spend lines simply being assigned to the 'Public administration and defence services, compulsory security services' SIC category, offering limited comparative detail between spend groups. In contrast, at the authority level, it is feasible to assign EFs by individual account name (Fig.20). Whilst this is comparatively more resolved than the national scale, it is clear from step 7 and Fig.20 above, that greater detail on the content of certain spend lines is still needed to more appropriately assign EFs (e.g. to clarify 'other materials' within a cost centre) in some cases. Nonetheless the spend-based method is more suited in terms of granularity to sub-national accounts.

The need for greater detail on spend line content was identified as a limitation of the spend-based method in NRW's (2018) scope 3 category 1 and 2 footprint calculation, which revealed difficulty finding a finance contact with sufficient overview of all internal codes to effectively map spend to DEFRA's SIC code categories. This could be

addressed by situating the EF assignation and monitoring/reporting, *departmentally* (with the support of carbon/environment teams), to leverage staff knowledge on departmental accounting codes for optimal EF categorisation. In addition, placing high-level emissions assessment processes in the hands of those external to carbon/estates teams, tasked with day-to-day management and decision-making, has the potential to *begin* a process of organisational carbon literacy building and carbon/climate awareness raising, as EFs are assigned and emissions are reported to management, or day-to-day monitoring feeds into refinement-related performance targets (i.e. to seek product or supplier specific EFs/data for high emission areas) for example.

Leveraging management and carbon accounting practices to facilitate cultural change in an organisation in regard to its carbon management, is acknowledged in the literature (Ozawa-Meida et al., 2013; Dawkins et al., 2019) and cited by the UK Treasury (2021) in their Sustainable Reporting Guidelines for central government. The Treasury (2021) suggest central government departments adapt existing systems or processes to monitor and collate emissions e.g. establishing additional subjective codes in financial systems for scope 3 travel emission calculation, inclusion, and tracking (HM Government, 2021). They also choose to *only* include scope 3 category 6 (business travel) emissions in their GHG inventory boundary, despite the emissions being minimal in a whole footprint context, citing their 'significant role [...] in changing the culture of an organisation in terms of its carbon management' (and ease of calculation as transport specific EFs are readily available from BEIS). Presumably this refers to the visibility of emissions in travel decision-making and the real-time ability of staff to assess multiple travel options' carbon impact to justify a travel decision, induced by the reporting requirement itself and the context of a specific travel emission reduction target.

The importance of leveraging and developing staff knowledge and capabilities outside of carbon/estates teams to achieve decarbonisation targets in authorities is also acknowledged and argued for extensively (NRW, 2019; NRW 2018; CCC, 2020; Scottish Government, 2021; Scottish Government, 2011; Welsh Government, 2022; Gibassier & Schaltegger, 2015). A report commissioned by Welsh Government to inform its public sector decarbonisation strategy (NRW, 2019) notes the concentration of emissions management activity in sustainability/carbon/energy/estates roles, and explains that if Welsh public bodies will be required to report on a wider boundary of emissions in the future (i.e. extensive scope 3 categories) organisations will need to develop teams that cut across different departments, and investment in professional development will be needed to increase carbon management skills and knowledge in staff. The CCC (2020) also highlight authorities current siloed emissions management activity as a barrier to action, calling for skills/knowledge development and

investment; summed up in a recent webinar by a local authority officer who stated that 'your whole organisation must become your carbon team'.

Scotland currently shows the most commitment to broadening carbon management responsibility and calls for public sector bodies to adopt a capability framework in its 'Public Sector Leadership on the Global Climate Emergency' report (Scottish Government, 2021). It is funding and collaborating with SSN to create a framework to 'mainstream climate change' including enabling; multi-level climate visibility, strong leadership responsibility at all levels to increase accountability, commitment and action on emissions that is visible and transparent both internally and externally to increase scrutiny levels and integration of climate change within business planning to build a process where the 'climate question' is asked routinely as part of the decision-making process.

Given the current resource limitations English authorities are experiencing (MHCLG, 2019; NAO, 2021a), broadening staff roles to incorporate emissions calculation/monitoring, as proposed in this report, *can't* have a prohibitive administrative burden (i.e. it needs to start simple and high-level), happen in isolation (without cross departmental support) or replace proper skills investment. However, with clear strategic embedding of climate ambitions at all levels e.g. in the form of EF assignment, monitoring and reporting within departments and associated performance and emissions reduction targets it *can* help staff with limited knowledge better understand how council activities interact with emissions, eventually informing organisation-wide low carbon decision-making.

The spend-based approach is undoubtedly broad-brush - supplying uncertain and indicative emissions estimates (NRW, 2018; GHGP, 2013). This broadness is beneficial in terms of simplicity of application, and releases some of the stringency from the calculation process, for example, agonising over the minute detail of EF category assignment where accountancy codes combine groups of products that should be mapped to separate SIC codes is not likely to impact the overall accuracy of the results (NRW, 2018), supporting quicker application – and allows a starting point appropriate to authorities stretched capacities to be chosen. Despite uncertainties, an organisation at the start of their net zero or scope 3 journey such as Blackpool will still gain substantially more emissions information than they started with. High-level results can immediately indicate areas of high emissions (or hotspots) (step's 5,6,7 above), direct data collection and emission calculation refinement efforts and inform a more complete picture of the total emissions associated with activity.

The broad nature and high uncertainty do limit the use of the emissions data. Spend-based estimates based on sectoral average EFs do not allow for comparison of products, suppliers, or contracts *within* SIC categories and so do not offer the

granularity necessary to base comparative spend choice decisions on or measure internal progress to emission reduction targets (if only SIC based EFs are being used and reported on). Additional steps/strategy are therefore required to support low carbon decision-making, emissions reductions and effective (internal and external) scrutiny, including:

- Transparent method and estimate disclosure with caveats (i.e. methodological and the nature of scope 3) (Section 5.1)
- A well-articulated plan to refine estimates via improved data collection and calculation methods (e.g. product/supplier specific EFs or data) (Section 5.3)
- Robust overarching net zero strategy including inventory and target boundaries, disclosure, and targets (Section 6.1).

### 5.2.2 The nature of scope 3 emissions

A discussion examining the nature of scope 3 emissions is needed to further contextualise the spend-based approach and support authority emissions management strategy.

Scope 3 is often overlooked and intentionally excluded in public and private sector guidance. Entities often receive ambiguous encouragement to *consider* scope 3 management without clear calculation, inventory and target boundary or target setting guidance (e.g. CEUK, 2021; LGA 2022; Carbon Trust 2022; Hale *et al.*, 2021; Gillard *et al.*, 2017). This is because scope 3 inclusion in GHG inventories (i.e. within the operational boundary) and target boundaries is optional in a GHGP compliant corporate GHG inventory and can be difficult to calculate accurate emissions estimates for.

Additionally, Scope 3 ambiguity, exclusion and perceived difficulty can be exacerbated by commercial carbon consultants' i.e. by charging for footprinting services the perception that carbon management/footprinting requires experts (consultant or scientific) as opposed to in house staff is perpetuated (Smith, 2016). In Blackpool's case, the Carbon Trust were commissioned for £28k for multiple services (initial scoping, pathway modelling using scope 1 and 2 emissions and project identification for top 10 highest emitting scope 1 and 2 sites) including a baseline emissions calculation. The emissions calculation process involved GHG inventory boundary establishment (where the majority of scope 3 emissions were excluded by Blackpool due to the perceived complexity and optionality) and required Blackpool to access and collate the required activity data (recall equation 1) to be input into Carbon Trust's excel form organised by scope and source. Accessing and collating the data was completed by the estates team and took over eight months, once activity data were input they were submitted to the Carbon Trust. The Carbon Trust then decided

on the appropriate calculation methods (e.g. for some buildings no utility gas data was available, so they used benchmarked proxy data) and assigned appropriate EFs (e.g. either BEIS or average/proxy) to mostly primary activity data, multiplying the two to calculate emissions. The bulk of the footprinting work resided in collating wide ranging activity data across multiple sites and wholly owned companies and was completed by Blackpool.

The final step of assigning EFs could have, with appropriate guidance (e.g. Welsh Government [2022])/consultation of the GHGP documents [Table.3]), been completed by Blackpool with relatively little increased investment. Furthermore, this step could not only be feasibly achieved in house by Blackpool (possessing both an estates and carbon strategy team) but, if completed in house would also have built much needed internal carbon expertise/knowledge (NRW, 2019; CCC, 2020; Scottish Government, 2011).

Work is needed to understand and address the question of why authorities seek consultant support for footprinting, outside of the 'limited capacity' argument, given that the bulk of the footprinting work in Blackpool's case was conducted by Blackpool in activity data collation. The CCC (2020) have acknowledged the problem, stating that consultant reliance is a barrier to robust local authority action undermining internal capacity/capability building, further broadening the array of net zero strategy pursued by authorities. They assign blame to central government for not clearly articulating the role of local authorities in the net zero transition or publishing calculation guidance/requirements to empower authorities and offer clarity (CCC,2020; NAO, 2021). In addition, there is evidence to suggest that scientists (Gieryn, 1983) and consultants (Smith, 2016) perpetuate the idea that 'science must be completed by scientists' (or experts), and so commercial carbon consultants and gated academic communities may be directly contributing to authorities' perceptions that they require external expertise to estimate and manage their full GHG inventories.

The concept of leveraging emission reporting to accelerate public sector action on the climate emergency is well established in Scotland and was the topic of a recent SSN conference (SSN, 2022) and Wales' recent public sector net zero guidance was also designed to support in house emissions management and build expertise and capability (NRW, 2019). As such, part of the role of robust authority net zero and GHG inventory guidance (alongside standardisation, benchmarking, scrutiny etc.) could be considered to liberate authorities from the perception that they require external expertise to estimate and manage their full GHG inventories.

The minimum GHGP compliant accounting and reporting boundary consists of scope 1 (direct emissions) and 2 (indirect energy-use emissions) emissions, but together the three (scope 3: other upstream and downstream indirect emissions) emission scopes

represent an organisation's *total* GHG inventory. Despite scope 3 optionality, GHGP scope 3 guidance is extensive, including the Scope 3 standard (GHGP, 2011) and the technical scope 3 calculation guidance (GHGP, 2013) (summarised in Section 4). These set out the nature of scope 3 emissions, namely that scope 3 emissions are by definition, the direct emissions of another entity. As a result, multiple entities influence both emissions and reductions and *no single entity is solely responsible*. Instead, each entity in a value chain has *some degree* of influence over emissions and reductions and scope 3 accounting facilitates the *simultaneous action of multiple entities to reduce emissions throughout society* (GHGP, 2011).

This reality can make accurate footprinting/calculation of scope 3 emissions difficult, due to complex global supply/value chains (i.e. tracking and boundary difficulties) and their external/indirect nature (e.g. accessing data from suppliers along the value chain). This means an organisation's scope 3 emissions are often the largest part of their footprint – often over 70% (as multiple indirect steps contribute to the emissions associated with a material, product, service or activity) (GHGP, 2012).

The optionality of scope 3, compounded by the regulatory/statutory vacuum, is being grappled with in many authorities and organisations (Cambridgeshire County Council, 2022; Enfield Council, 2021; Newcastle City Council, 2020; Nottingham City Council, 2020). Many, have well developed scope 1 and 2 inventories for which they have been reporting emissions reduction progress on (sometimes for decades) and so may be reluctant to widen their GHG inventory boundaries, drastically increasing their footprints and 'undermining' their emissions reduction performance to date. Whilst understandable, this hesitation is at odds with our emerging understanding of robust emissions management/net zero strategy (Hans et al., 2022; NCI and CMW, 2022) and at best, results in a misrepresentation of an entities emissions management progress/ambition (confounding scrutiny), at worst, it is greenwashing.

Clearly the more emission categories an entity includes in its inventory the greater its GHG footprint, with scope 3 likely comprising the bulk of this (GHGP, 2012), but well communicated emissions disclosure acknowledging the 'simultaneous action of multiple entities across the value chain' required to reduce these indirect emissions, can put the increase in context. This is demonstrated by SSN in Fig.14 where well-caveated disclosure explains expanding inventory and target boundaries and their impact on total emissions.

High uncertainty in scope 3 calculation methods also contributes to high (and low) emission figures (e.g.  $\pm 25\%$  estimated by the Welsh government for the spend-based method). However, as discussed in Section 3.1.1 the tension between rigorous emissions tracking and management that *doesn't blame* inaction on central limitations or the complex/indirect nature of scope 3 must be handled (and action disclosed) with

integrity (NCI and CMW, 2022; Hans *et al.*, 2022). Fundamentally, transparency, honesty and clarity are key in fostering emissions management and net zero strategy (Hans *et al.*, 2022; NCI and CMW, 2022; Smith, 2021; Rogeli *et al.*, 2021; Fankhauser *et al.*, 2022) that is fit for the scale and urgency of the decarbonisation task (IPCC, 2022; IPCC, 2018). Guidance expected to be published by the UN Secretary-General's High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities (launched in March 2022) in late 2022 will hopefully provide much-needed clarity on robust sub-national net zero strategy (UN Secretary-General, 2022).

There is a growing consensus calling for complete sub-national GHG inventories i.e. scope 1, 2 and 3 emissions including all scope 3 categories with clear explanation for exclusion of categories which may not apply (e.g. franchises for authorities) and estimates of 'minimal' scope 3 categories to avoid misinterpretation of 'minimal' or 'relevant' (NCI and CMW, 2022; NRW, 2019; SBTi, 2021; Dawkins *et al.*, 2019; Valls-Val & Bovea, 2021). Complete inventories may also be less challenging to initially calculate than currently perceived. Estimates and the use of proxy data can be used to fill in gaps where higher quality data is not available. This is permitted by the GHGP (see GHGP Scope 3 standard guidance on 'using proxy data to fill in gaps' [GHGP, 2011]).

Recommendations to Welsh Government from NRW (2019) analysis highlighted that when an emission source is included in an inventory and is universal (e.g. waste or water) there should not be gaps representing a lack of data. They observe that if no actual activity data is available for an organisation, methodologies to establish benchmarks or other estimation methodologies should be used to fill in gaps. Noting that 'starting with a complete footprint, even when parts are estimated, make[s] it much easier to maintain a consistent boundary'.

In summary, to encourage and enable scope 3 reporting/calculation in authorities (and other sub-national entities) key clarifications are needed, including:

- Inventory, reporting and target boundaries can be different. Often inventory and reporting boundaries are the same, but an authority may have a full (scope 1, 2 and 3) GHG inventory which they disclose on their website but 'officially' report emissions via the LGA's GHG accounting tool (with contrastingly minimal scope 3 categories).
- Target boundaries can be variable covering all scopes (a full GHG inventory) by 2050 for an overarching target for example, or scope 1 and 2 only for 2030 with category specific scope 3 targets. The target boundary refers to the emission categories/sources included within a reduction target.

- Calculating and disclosing a complete, uncertain GHG inventory (i.e., all scopes and categories) is legitimate and supports robust and transparent net zero/emissions management strategy.
- Using proxy data such as spend data to fill in gaps and support a complete GHG inventory is acceptable as long as efforts to improve and refine data collection governance and calculation methods are made and disclosed – with progress reported on.
- Emissions can be disclosed/reported before an organisation knows how it's going to set or measure progress to reduction targets (inventory, reporting and target boundaries can be *different*). Transparency and honesty are key principles.
- Widening inventory boundaries increases an organisations emissions liability significantly, most often because of the nature of scope 3 emissions, but this should *not* stymie efforts to estimate a complete GHG inventory. This is because disclosure on the *total* estimated effect of activities on emissions alongside iterative improvement is more robust than *only* disclosing the inventory and reductions being delivered on scope 1 and 2 - considering the urgency with which emissions need to be addressed,
- Fears of 'looking bad' as emissions increase with boundaries must be dispelled and hesitation around wider disclosure should be perceived as misrepresentation or greenwashing.

### Iteration and the limitations of accurate data

In general, GHG emissions are calculated using equation 1 and many robust (and regularly updated) EFs are published for use with primary (e.g. supplier-specific or weight/volume consumed) or secondary (e.g. industry-average or spend-based) *activity data*. As mentioned, primary data estimated via assumptions or benchmarking can also be used to estimate emissions (GHGP, 2011; GHGP, 2013). Calculation methods ranging in specificity and accuracy are listed for each of the 15 scope 3 categories in the GHGP (2013) guidance, employing a range of methods, and often in a hierarchy of specificity (see Fig.6) so organisations can choose an appropriate method for their data availability/capability.

Unlike scope 1 and 2, it is well understood that because scope 3 emissions are indirect and hard to track/get accurate estimates for but are *significant* (i.e. comprising over 70% of an organisation's total footprint [GHGP, 2012]) - using benchmarking and secondary data is legitimate when starting to account for them (GHGP, 2011; GHGP,

2013). Much of scope 1 and 2 activity data is under the direct control of an organisation (i.e. litres of fuel burnt) and so specific primary activity data multiplied by robust (up to date) EFs such as BEIS conversion factors (BEIS, 2022a) is expected (GHGP, 2003; GHGP, 2013). Still, when primary activity data is not easily accessible for scope 1 or 2 emissions, benchmarked or proxy data is used (and disclosed for transparency with caveats) legitimately. For example, the Carbon Trust’s calculation of Blackpool’s carbon footprint, estimated scope 1 gas consumption for some sites based on gas bill spend, where primary consumption data was not available (Carbon Trust, 2022).

Whilst robust net zero/emissions strategy including accurate emissions data is paramount, carbon footprinting or emissions calculation methods operate on a sliding scale of accuracy, with varying assumptions and uncertainty dependent on a multitude of factors. Choosing the most robust/accurate primary or secondary data and the most up to date and suitable EFs are guiding principles of GHGP compliant footprinting (GHGP, 2003; GHGP, 2013). Legitimate data and EF choices i.e. calculation methods, for each emissions scope and category (GHGP, 2003; GHGP, 2015; GHGP, 2013) are detailed by the GHGP and organisations can choose which is appropriate for their inventory/data capacity as long as the method is clearly justified and transparently disclosed (the GHGP refer to this as disclosing data quality and have specific guidance for companies to disclose scope 3 data quality to ensure transparency and avoid misinterpretation). A tiered approach to emissions calculation and reporting, where organisations can choose the appropriate calculation method for their data availability, is utilised in the Welsh public sector net zero reporting guidance (Welsh Government, 2022).

Moreover, there is an expectation (from the GHGP) that footprints/inventory calculations will evolve over time and efforts will be made to ‘build out’ areas of the footprint by improving data collection and calculation methods (GHGP, 2011). This is fundamental to scope 3 reporting and companies are expected to use low quality data in initial years (due to limited data availability) that improves over time as higher quality data is sought and becomes available. The GHGP provides data quality guidance and organisations are encouraged to address low data quality areas with relatively high emissions first, for iterative improvement (Fig.25).



**Figure 25** GHGP iterative process for collecting and evaluating data taken from the Scope 3 standard (GHGP, 2011).

The iterative nature of scope 3 management is also accounted for in scope 3 target setting guidance. As detailed in Section 4.2.1 a range of target boundaries can be set, including separate targets for individual scope 3 categories or a combination of targets with an overarching scope 1 + 2 + 3 target as well as category specific targets. It should be noted that interim targets which set near-term goals are of priority importance to focus efforts on achieving 50% reductions in global emissions by 2030. Regardless of the target type, a base year must be set alongside a *recalculation* policy articulating the basis for recalculation (e.g. when a new data collection/calculation practice/method alters emissions by 10% or more), recalculations are required to be carried out when any significant changes in the organisation's structure or inventory methodology occur (e.g. if more accurate data becomes available). The recalculation provision acknowledges the resolving picture of scope 3 experienced by organisations, and demonstrates that even for emission reduction target setting, data can still be improving i.e. it does not have to be perfect or the 'most accurate' to start.

Furthermore, even the 'most accurate' options for scope 3 footprinting such as product specific EFs calculated via Life Cycle Analysis (LCA) (e.g. GHGP, 2011a) are also subject to significant uncertainty (Berners-Lee *et al.*, 2019; Bebbington *et al.*, 2021). LCA estimates can vary wildly based on the practitioner, with significant uncertainty arising from boundary delineation and the resulting truncation error (Bebbington *et al.*, 2021; Ozawa-Meida *et al.*, 2013; Berners-Lee *et al.*, 2019).

The diversity of approaches to emissions management strategy in England is significant and well documented (CCC, 2020), and is unlikely to be resolved without convincing coordination/guidance from the LGA or central government guidance and statutory requirements (CCC, 2020; NAO, 2021). Both Wales and Scotland have recognised this and have provided detailed statutory requirements and guidance for their public sector organisations to support robust emissions management and decarbonisation (Welsh Government, 2022; Scottish government, 2021). Still, in England, the diversity of GHG inventories, targets and calculation methods, means benchmarking and assessment of overall climate ambition is challenging (CEUK, 2021; CCC, 2020). Additionally, UK authorities also struggle with significant regional inequalities (MHCLG, 2019; NAO, 2021a) which impact authorities' associated emissions liabilities (Sudmant *et al.*, 2018) and their management capacity/capability, further exacerbating emissions management diversity (Garvey *et al.*, 2022).

Cambridgeshire County Council for example include some scope 3 category 1 (purchased goods and services) emissions in their GHG inventory, which is comparatively progressive in terms of local authority emissions management (CEUK, 2021b). They focus on major capital building/construction projects and have used an inventory of the quantity (tonnes) of material's used from their contractors to assign

BEIS material specific EFs to and calculate emissions. They accessed the material specific data for construction works from project spend data and note that the accuracy level of these calculations is high.

They state that all 'activities under the operational control of Cambridgeshire County Council are within the boundary of reporting, including those outsourced to third parties in cases where the overall responsibility still lies within the council' but go on to exclude multiple emissions sources based on the lack of data and explicitly exclude 'all other goods and services purchased and used by the council' as 'only spend data are available' and no 'accurate method is available to convert spend to emissions' (Cambridgeshire County Council, 2022). As discussed, the uncertainty associated with the DEFRA 2013 spend-based sectoral EFs is high at  $\pm 25\%$  (pre-June 2022 update) but still is a legitimate emissions calculation method cited in both the Welsh approach (Welsh Government, 2022) and the UK Government's Environmental Reporting Guidelines (2019).

The growing support for clear, complete/wider and consistent inventory and target boundaries for sub-national entities suggests that drawing a boundary around all emissions within operational control including third party activities, but then partially and fully excluding significant relevant GHGP emission categories, can be confusing (both internally and externally) in terms of emissions management/net zero strategy, misrepresent the total impact of activities on emissions and confound scrutiny (NCI and CMW, 2022; NRW, 2018; NRW 2019; Welsh Government, 2022; Scottish Government, 2021; SBTi, 2021; Berners-Lee *et al.*, 2011). GHGP guidance (discussed above in Section 4.2.2.3) supports the use of uncertain emissions estimates within a full scope-3-inclusive footprint that resolves over time, where methods of varying accuracy suited to situational data availability can be chosen legitimately to support full GHG inventory reporting/disclosure (GHGP, 2011; GHGP, 2013).

Garvey *et al.*, (2022) also highlight that carbon accounting focused on territorial or scope 1 and 2 emissions misses the spatial diversity of regional emissions, noting that CBEs or scope 3 emissions are consistently larger in more affluent areas (such as Cambridgeshire [MHCLG, 2019]) and territorial or scope 1 and 2 focussed inventories/targets/management may unfairly penalise regions more dependent on their emissions for socioeconomic stability e.g. post-industrial regions. Whilst this is more pertinent for area-wide emissions management there are implications for own-operation emissions strategy given the strong leadership opportunity robust and complete own-operation emissions management can provide, and lessons learned managing operational emissions that may be applied to area-wide strategy. It is also useful to note that estimating CBEs regionally is robustly completed on an EEIO/expenditure basis (Small World Consulting, 2020), with modelling based on the same UK supply and use tables and GHG emissions data (altered to represent specific-

regional consumption patterns) used to produce the UK's national CBEs and the DEFRA sectoral EFs used to estimate emissions from spend (the DEFRA indirect EFs additionally account for emissions and trade flows occurring outside of the UK) (Owen and Barrett, 2022).

In consequence, it may be argued that local authorities' desire for accuracy in GHG inventory calculation may be stunting consistent boundary and full GHG inventory reporting/disclosure, misrepresenting the full emissions impact of activities and further confusing scrutiny attempts of (already diverse) emissions management. Whilst Cambridgeshire County Council's scope 3 action is commendable, it is inconsistent, given that a full estimated picture of overall emissions or consistently reported GHG inventory and target boundaries are missing, seemingly held back by a hesitation to use high-level estimates to characterise emissions more fully (Cambridgeshire County Council, 2022). Other examples of selective footprinting and accuracy-based emission source/category exclusion can be found in similarly progressive or well-resourced council's emissions management strategy's (Enfield Council, 2021; Newcastle City Council, 2020; Nottingham City Council, 2020; Cornwall Council, 2019).

Not waiting for the 'most accurate' data before acting on scope 3 emissions has been discussed both by the LGA (2022) and the CCC (2020) to encourage action in local authorities, but the corresponding guidance or voluntary reporting mechanisms to support broader high-level scope 3 category reporting are absent in England. The LGA and Local Partnerships (BEIS funded) GHG accounting tool offers only limited scope 3 reporting on a specific (high accuracy) tonnage of material consumed basis, for materials such as plastics, paper, steel (Local Partnerships, 2022). It is likely that without more high-level scope 3 emissions estimates or a broader GHG inventory, many under-resourced authorities simply will not be able to extract and report this detailed information from their operations at present. The material based EFs supplied by BEIS and included in the LGA GHG reporting tool represent a level of detail likely to resolve in coming years, if, authorities are supported to start estimating and tracking their high-level scope 3 emissions more broadly now, in an iterative manner consistent with the GHGP.

Sustainable procurement efforts focussed on estimating high level emissions associated with contracts (similar to the spend-based method above), that are refined over time as supplier engagement increases and emission reduction decisions and arrangements can be made, are set out in the UK Government's Flexible Framework tool, Prioritisation tool (UK Government, 2014) and the LGA's Sustainable Procurement toolkit (LGA, 2021a). Effort's authorities make to progress these tools will go some way to providing the material consumption primary activity data the LGA GHG accounting tool requires, but data will be partial as different contracts and areas resolve at varying rates. Additionally, materials are spread across a wide range of

procurement contracts/categories, many of which may not be a current priority, and so collating consumption by weight for specific materials across contracts and the complete organisational or operational boundary, for consistent annual emissions reporting is unlikely to be achieved.

Ultimately the GHG accounting tool (Local Partnerships, 2022), existing LGA scope 3 (LGA, 2022) and sustainable procurement guidance (LGA, 2021a) are unlikely to support wider emissions management and disclosure, especially in under-resourced authorities. Given the confusing guidance/reporting landscape for English authorities' further authority specific GHG inventory and target guidance is urgently needed to provide clarity. Despite the LGA's current lack of full GHG inventory guidance and limited scope 3 guidance they are still well placed to offer and coordinate uptake in the absence of central government intervention.

### 5.3 Managing indirect emissions iteratively

This section seeks to discuss ways Blackpool and other similarly under-resourced authorities can improve category 1 and 2 scope 3 emissions data collection, calculation methods and governance/processes over time to:

- Estimate and disclose an accurate, honest and complete (scope 3 inclusive) GHG footprint
- Obtain emissions data which is granular enough to inform GHG reduction targets, measure progress toward GHG reduction targets and inform low carbon decision making
- Improve organisational understanding/awareness of the emissions associated with activities to inform reduction action and help enable the cultural/institutional change necessary for robust carbon management and decarbonisation (IPCC, 2022).

Literature, guidance and case study examples are used to support suggestions and discussion. Full articulation of the iterative progression of emissions management is beyond the scope of this report and unnecessary, as strategy and innovations will evolve/occur organically as Blackpool builds expertise. Instead, Blackpool is used to outline and discuss potential refinements which can support the aims listed above. Example iteration actions and possible mitigation levers are summarised for each stage and are meant to be illustrative to support Blackpool's own interpretation of a suitable iterative trajectory.

### 5.3.1 Stage one

As with each of the stages and suggestions in this section the order is not meant to be prescriptive but simply offer examples of the direction of travel.

For illustrative purposes stage one can be considered as the output from the spend-based method detailed in Section 5.1. For Blackpool, this comprises VAT excluded annual category 1 and 2 scope 3 emissions for the Community and Environment directorate, for the financial year 20/21. This is a reportable estimate of emissions which Blackpool could start disclosing annually alongside explanatory information regarding the method and caveats, including the estimated uncertainty and high-level nature of the emissions estimates. EFs will need to be updated annually as released by DEFRA (with a three-year lag) on the UK Government's carbon footprint webpage (UK Government, 2022).

Next steps could include replicating the proof of concept to enable a whole council category 1 and 2 spend-based emissions to be calculated. If the proof of concept is replicated emissions estimates will be collated and calculated *after* the spend/emissions have occurred, so at this stage do not provide real time information on the emissions associated with decisions for tracking, reporting to management or elected members, or for use within options assessment to inform purchase/procurement decisions. They also do not offer the granularity to compare emissions of products/services within a SIC category, but a full VAT excluded estimate of cradle-to-grave emissions for total category 1 and 2 scope 3 emissions could be calculated and disclosed annually.

Whilst the data is high-level, Blackpool still may choose to include these emissions in an overarching net zero target boundary (such as net zero 2050 for scope 1, 2 and 3 emissions), with the ambition to set individual category/source specific reduction targets when more accurate/granular emissions data resolves. As such, an inventory baseline for category 1 and 2 emissions could be established alongside a GHGP compliant baseline recalculation policy (GHGP, 2011).

Blackpool could go on to identify high emitting cost centres explored by account name for each directorate (repeating steps 5 and 6 in Section 5.1 above). Possibly developing performance targets related to directorate emissions hotspot identification for the first year of emissions management e.g. top ten highest emitting cost centres identified for each department with immediate opportunities for refinement explored (such as checking the spend was originally assigned to the correct account name/cost centre [the spend-based method assumes spend is correctly categorised in the first instance which is often not the case as Ozawa-Meida et al., {2013} and NRW {2018} highlight] and the EF assignment category is correct).

**Table 7** Stage one iteration summary actions

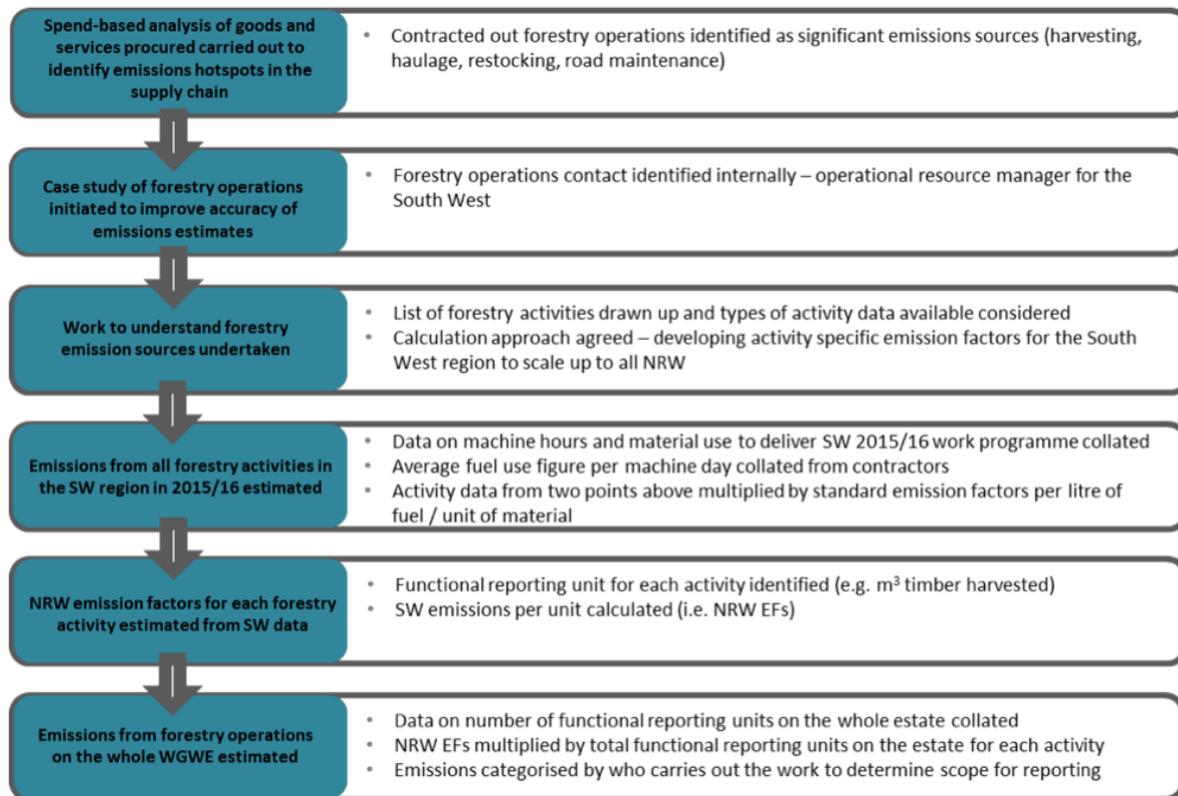
Example iteration actions	<ul style="list-style-type: none"> <li>• Full organisation or by directorate category 1 and 2 emissions estimate and disclosure using spend-based method</li> </ul>
	<ul style="list-style-type: none"> <li>• Performance targets related to emissions hotspot identification by directorate established e.g. <ul style="list-style-type: none"> <li>- Top ten highest emitting cost centres per directorate identified</li> <li>- Spend data reviewed for account code assignation accuracy and method improvements identified</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>• Inclusion of emissions in overarching net zero target (e.g. net zero 2050 for scope 1, 2 and 3 emissions) and inventory baseline for category 1 and 2 emissions and baseline recalculation policy establishment (GHGP, 2011).</li> </ul>
Possible mitigation levers	<ul style="list-style-type: none"> <li>• Minimal but emissions hotspots can be identified and explored</li> </ul>

### 5.3.2 Stage two

Due to difficulty obtaining VAT inclusive spend data from Blackpool and time limitations, spend without VAT was used for the proof of concept. This is not compliant with the DEFRA spend-based method as set out by the Welsh Government and the UK Government in annex E of Environmental Reporting Guidelines (UK Government, 2019). NRW (2018) also struggled to obtain VAT inclusive spend data and so used a proxy method detailed on pages 52 and 53 of their carbon footprint report which Blackpool may find useful (NRW, 2018). Alternatively, as Blackpool iterate, they may establish an internal process to collate/use VAT inclusive spend data. Depending on how significantly VAT inclusion impacts estimates, baseline establishment may need to wait until an appropriate VAT inclusive method is established.

NRW identify emission hotspots as part of their spend-based GHG inventory calculation and detail a 'refinement case study' in appendix B of their footprint report (NRW, 2018). Forestry activities were identified as being responsible for a significant portion of their category 1 scope 3 emissions with DEFRA EF estimates particularly lacking in granularity for forestry-based activities. NRW therefore explored ways to refine emissions estimates and better understand how category 1 and 2 emission

hotspots could be 'built out' (Fig.26) (NRW, 2018). The overview steps in Fig.26 outline a possible route to refinement for high emitting cost centres/contracts at Blackpool. This example (Fig.26) would be analogous to seeking scope 1 and 2, primary activity data or EFs from a large supplier/contract to refine emissions estimates.



**Figure 26** NRW schematic of their refinement case study, where forestry was identified as an emissions hotspot using the spend-based calculation method, the steps above outline actions taken to improve the emissions estimate and inform reduction action (NRW, 2018).

Refinement can progress simultaneously in multiple directions including improving the EFs used (e.g. product specific), data collection (e.g. supplier engagement or better internally resolved spend data) and in governance/process (e.g. targets, processes, monitoring, reporting), with the aim of supporting the implementation of mitigation levers (e.g. sustainable procurement actions such as specific emissions related clauses in contracts/tenders).

In terms of the calculation method (i.e. the EF used) and data collection refinement, work can commence alongside procurement teams to engage with suppliers and seek product/material specific EFs from peer-reviewed literature, BEIS conversion factors (BEIS, 2022a) or companies directly. For example, there may be immediate opportunity to access more granular project/construction spend data (e.g. invoices)

to determine weights of materials purchased and replace spend and DEFRA EFs with primary activity data and BEIS conversion factors (BEIS, 2022a).

Depending on capacity/capabilities work may be conducted by a combination of carbon teams, procurement teams, financial/accountancy staff and wider staff involved in purchasing and monitoring. As discussed above (Section 5.2), situating the calculation and data collection refinement process across departments/teams and outside of (but supported by) carbon/estates teams could be beneficial – supporting carbon literacy and awareness building across the organisation. Especially if emissions estimates can be calculated and reported on (in the context of wider net zero/emissions targets) in real time to make the carbon associated with decisions visible. Governance/process iteration could therefore also involve altering the timing of emissions calculation to assign EFs in real time as spend occurs. This can be established with the DEFRA 2019 EFs (updated annually). When the work for this report was presented to Blackpool, they immediately chose to explore embedding the DEFRA EFs into their accountancy software update to establish opportunities for real time EF assignation and automated tracking/calculation of emissions associated with spend.

As data resolves and the accuracy of emissions improves, Blackpool will effectively have two emissions estimates for some spend areas; a high-level estimate (using DEFRA EFs) and a more accurate estimate likely calculated using primary data (tonnes of material) or supplier data. A policy for transparently adjusting their total footprint estimate in disclosure material, to avoid double counting, will need to be established. Blackpool may choose to continue reporting the overall high-level DEFRA EF based emissions and additionally report improved estimates, disclosing both and explaining any reductions/increases to the overall footprint until emissions tracking processes can handle multiple calculation methods (Welsh Government, 2022).

Much of the iteration for emissions management of category 1 and 2 scope 3 emissions intersects with sustainable procurement tools, both HM Treasury (2021) and LGA (2022) guidance require or encourage tool uptake to progress public sector action on scope 3. For English authorities, these tools include the UK Government's Flexible Framework tool and Prioritisation tool (UK Government, 2014) and the LGA's Sustainable Procurement toolkit (LGA, 2021a). The tool's support the use of high-level emissions estimates based on spend to identify high emitting spend areas for supplier engagement. Blackpool may choose to adopt a sustainable procurement tool to support refinement, supplier engagement and the development of mitigation levers such as building in requirements around emissions into contracts.

However, each of the sustainable procurement tools listed above are multi-issue (e.g. considering social value, local suppliers, fair wages, circular economy, GHG emissions

etc.) supporting data collection on a number of sustainability and social value issues to build socially and environmentally conscious tenders and contracts, set targets and measure progress. This is much needed and the role of public procurement in addressing a range of social and environmental issues is widely recognised (Scottish Government, 2022; LGA, 2021a; UK Government, 2014) but can mean that GHG emission focus and action on reductions may be diluted, as an array of issues are concurrently considered and embedded into tendering/contracts. In addition, supplier engagement (data collection), tendering requirements and sustainable contract development will understandably progress at varying rates meaning a partial picture of the impact of spending on a range of issues (and actions to minimise the impact) will emerge.

To ensure robust GHG inventory and emissions management, clear and consistent inventory and target boundaries and transparent annual disclosure is required. This means a full, not partial, picture of emissions where the emission scopes and categories covered are explicit with clear plans to improve emissions estimates and target coverage (Hans et al., 2022; NCI and CMW, 2022; GHGP, 2011; GHGP, 2013). Interim targets which set near-term goals are of priority importance to focus efforts on achieving 50% reductions in global emissions by 2030. Using sustainable procurement tools in the absence of robust emissions management strategy outlined above could obscure the full impact of activities on emissions, failing to place important progress on emissions reductions (due to tool supported supplier engagement for example) in the context of a complete footprint and wider net zero targets. This report suggests that sustainable procurement tool adoption can support category 1 and 2 scope 3 emissions data collection and reduction if progress is placed in the context of wider emissions management. This can ensure net zero is prioritised, and refinement and reductions are contextualised and disclosed as part of a coherent strategy, further facilitating scrutiny.

Similar to the extensive sustainable procurement tools/resources available (UK Government, 2014; LGA, 2021a; Scottish Government, 2022) many councils, universities and consultancies are developing tools to accurately estimate specific areas of scope 3 emissions e.g. contract areas such as waste (LGA, 2022a). As part of the iteration process Blackpool may choose to explore best practice authority developments on source/contract/category specific scope 3 calculation tools for adoption. Much of the work in this area is coordinated by the LGA and their Net Zero Innovation Programme where funding is available for universities and councils to develop specific tools and strategy to further action on net zero, with case studies/links published on their website (LGA, 2022b). In addition, the GHGP and Oxford Net Zero publish tool libraries which include a wide range of calculation tools suitable for various sectors and sub-national organisations (see Table.3) (Oxford Net Zero, 2022; GHGP, 2022).

**Table 8** Stage two iteration summary actions

Example iteration actions	<ul style="list-style-type: none"> <li>• VAT inclusive spend-based category 1 and 2 emissions calculation method for disclosure</li> </ul>
	<ul style="list-style-type: none"> <li>• Performance targets related to refinement of emissions estimates within hotspots e.g. <ul style="list-style-type: none"> <li>- Supplier engagement target to seek scope 1 and 2 data of top five emission hotspots in each directorate</li> <li>- Product or regional/supplier specific EFs sought for highest emitting purchase areas</li> <li>- Quantities of high emitting materials purchased (e.g. steel) identified from invoice/spend data and BEIS material specific EFs used to calculate emissions (BEIS, 2022a)</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>• Sustainable procurement tool adoption to support emission estimate refinement and reduction action</li> </ul>
	<ul style="list-style-type: none"> <li>• Governance/process innovation; situating calculation, tracking, collation, and reporting roles across departments e.g. procurement, carbon/estates, financial etc. to support carbon visibility/literacy/awareness</li> </ul>
	<ul style="list-style-type: none"> <li>• Real time EF assignment processes established e.g. incorporation into accountancy software to support high-level emissions estimates as spend occurs</li> </ul>
	<ul style="list-style-type: none"> <li>• Multiple method emissions disclosure format established. Such as - consistent high level SIC based reporting for category 1 and 2 scope 3 emissions, supplemented with more accurate data/action for specific sources, with transparently adjusted footprint estimate</li> </ul>
	<ul style="list-style-type: none"> <li>• Emission source or contract specific calculation tool research and adoption for high emitting outsourced areas e.g. waste (LGA, 2022a)</li> </ul>
Possible mitigation levers	<ul style="list-style-type: none"> <li>• Sustainable-procurement-based action including incorporating emissions considerations into procurement policy and procedures such as tenders and contract specifications (in the context of wider net zero strategy)</li> </ul>
	<ul style="list-style-type: none"> <li>• Requirements can include supplier scope 1 and 2 emissions disclosure (see GHGP for allocation of supplier emissions in organisational GHG</li> </ul>

	inventory management [GHGP, 2011]) or specific agreed emission reductions
	<ul style="list-style-type: none"> <li>• SBTi type scope 3 supplier engagement targets, where SBTi requires corporations to ensure all suppliers are SBTi compliant – with disclosed GHG inventories and science-based reduction targets (SBTi, 2021).</li> </ul>

### 5.3.3 Stage three

As capability/knowledge increases and emissions further resolve, more detailed emissions analysis can feature in project, policy and procurement decision making. Even in the early stages of iteration high-level DEFRA EFs can give decisions a real time quantitative emissions context relative to targets. For example, Blackpool could choose to require high-level emissions estimates for all projects and policies relative to emission reduction ambitions to be published in officer and elected member reports, so the emissions context of a decision and the councils net zero/emissions management commitments would be, at minimum, *visible* to decision makers.

Similar to many authorities (e.g. Cornwall Council, 2021; Chesterfield Borough Council, 2022) Blackpool uses a qualitative Sustainability Impact Assessment (SIA) tool designed to indicate the ‘positive’ or ‘negative’ impact of a decision within a ‘theme’ (e.g. on procurement, journeys, waste, water etc.). Qualitative tick box activities such as this often have a limited effect on reducing the emissions impact of a decision, as despite uptake, major authority decisions are still inconsistent with decarbonisation targets (CCC, 2020). This is partially due to stretched resources and tight project/policy timeframes, meaning authorities can experience difficulties persuading staff to properly assess impacts. Additionally, sustainability considerations often add further administrative burden and may be completed late in the decision-making process once time and effort has been invested (i.e. sunk costs), making sustainable alterations less likely (Scottish Government, 2021). This issue is well documented and authorities’ carbon teams are particularly aware that emissions need to be considered much closer to policy/project/procurement inception (CCC, 2020; Scottish Government, 2022; Tingey and Webb, 2020).

Assigning a high-level DEFRA construction EF to a capital project for example, and including the emissions estimate in elected member and officer reports is unlikely to sway a decision from the outset. However, analogous to GHG inventory/footprint iteration where detail is built out over time, *starting* to embed high-level emissions estimates into policy/project/procurement procedure (in the context of emission reduction targets and performance measures) can slowly establish mechanisms and

build staff knowledge to make the carbon context of decisions and their impact on decarbonisation target performance more visible. As awareness and knowledge of footprinting (e.g. sourcing more specific EFs and data) builds, the emissions associated with a decision and its impact on overarching and source/category/scope specific targets can become a primary consideration. Potentially paving the way for more in-depth emissions assessment to be built into decision making procedure such as carbon planning (Environment Agency, 2016) or cost-benefit-analysis-based tools.

Similar to sustainable procurement resources and source specific footprinting tools there are numerous detailed tools to support the calculation of emissions associated with a specific project or policy. Most of which stem from HM Treasury's Green Book (HM Treasury, 2022) cost benefit analysis (CBA) based appraisal and evaluation guidance, which supports the public sector to embed sustainability criteria into business case development. Examples include the Greater Manchester Combined Authority's (GMCA) CBA based tool which enables authorities to account for and model the emissions associated with policies and projects (GMCA, 2019), and the Environment Agency's (2016) carbon planning tool. Due to authorities stretched capacities, limited finance/staff resources and often limited emissions accounting/modelling expertise, detailed green book aligned CBA appraisal, which accounts for full project/policy life cycle emissions, is often prohibitively time consuming and complex and so is not typically conducted.

If knowledge and capabilities have built over time, and net zero strategy and associated performance mechanisms become well established, detailed appraisal tools supporting low carbon decision making may become more suitable for adoption, featuring as part of the iteration process. The GHGP also publish guidance on estimating the GHG effect of policies and actions (GHGP, 2014b), specific mitigation projects (GHGP, 2004) and designing and assessing progress toward sub-national mitigation goals (GHGP, 2014) (see Table.3).

**Table 9** Stage three iteration summary actions

Example iteration actions	<ul style="list-style-type: none"> <li>• Governance/process innovation; include the emissions context of a project policy decision relative to targets in internal communication/reports (Fig.2)</li> </ul>
	<ul style="list-style-type: none"> <li>• Use in depth GHGP guidance (GHGP, 2014; GHGP, 2014a; GHGP, 2014b) and/or CBA/carbon planning tools to properly account for the effect on GHGs of policies and projects relative to targets (goal mitigation accounting) in annual emissions disclosure</li> </ul>
	<ul style="list-style-type: none"> <li>• When policy, procurement and project emissions data reach sufficient granularity for progress toward reduction targets to be measured, set scope 3 category and/or source specific emission reduction targets e.g. 90% reduction in capital expenditure emissions by 2045. Ensure targets are science-based as a minimum (SBTi, 2021).</li> </ul>
Possible mitigation levers	<ul style="list-style-type: none"> <li>• Adopt CBA or carbon planning type tool to enable detailed emissions calculation for policy and project options appraisal, to support low carbon decision making</li> </ul>
	<ul style="list-style-type: none"> <li>• Include emissions estimates and use overarching, category, or source specific emission reduction targets to contextualise high carbon decisions and steer decisions toward low carbon alternatives</li> </ul>
	<ul style="list-style-type: none"> <li>• Use product or material specific EFs to compare purchase choices and support low carbon decision making</li> </ul>

## 6 Blackpool integration and future considerations

The process of applying a spend-based scope 3 calculation method to Blackpool revealed critical opportunities for development and has resulted in Blackpool's commitment to utilise the method to broaden scope 3 emissions coverage.

Blackpool was provided with the full method calculation spreadsheet and a summary version of tables and chapters in this report including the method detailed in Section 4.1 and iteration opportunities in Section 4.2.3. Additionally, an overview presentation of the approach was given to senior officers who approved method uptake, tasking their net zero strategy manager with implementation. Subsequent meetings have gathered accountancy staff, performance managers and members of the climate team to discuss implementation and facilitate knowledge transfer – especially to staff members outside of the climate team. Discussions were fruitful and key concerns surrounding the accuracy of the emissions data, how to handle 'spend to save' projects which aim to reduce emissions in the long term and barriers to real time EF assignment were explored. Importantly this offered an opportunity to explain to non-carbon/climate specialists the indicative and iterative nature of the emissions estimates and method.

This included discussing the estimates primary uses, highlighting emission hotspots, directing refinement efforts and making the carbon impact of decisions more visible. In the case of the 'spend to save' project concerns, carbon accounting detail was explored but ultimately, given that Blackpool is not consistently estimating the carbon impact of decisions at present, it was understood that the priority is to first establish a baseline for the emissions associated with project and procurement expenditure (i.e. using the spend-based method), capturing further detail on emissions savings as data quality improvements are made over time. This interaction was important, serving to liberate thinking from accuracy constraints and demonstrate the value of uncertain estimates in and of themselves but also to provide a manageable starting point.

Discussion around barriers to EF assignment included assumptions that the spend data was correctly categorised in the first instance, highlighting the relevance of utilising the knowledge of departmental accountants more familiar with specific areas of spend to assign the EFs. Understandably this resulted in time burden concerns due to the limited capacity of accountancy staff, and so it was suggested that opportunities for automated EF assignment embedding EFs in Blackpool's accountancy software be explored.

Concluding meetings with Blackpool comprised accountancy and climate staff and the external accountancy software update team. Staged options for in-house

implementation were discussed and a drop-down menu, ultimately allowing EFs to be assigned at the point of purchase (data from which could be regularly collated to inform manager decision making to improve the emissions profile of activities), was deemed most suitable. However, concerns that users would choose the 'closest' category or incorrectly categorise spend to EFs were raised, and a nested option grouping the SIC factors into broader categories was discussed. There was appetite for real-time EF assignment, but the process would need to be developed and refined. In the interim, Blackpool's climate team aim to replicate and develop the spend-based method for each directorate, to gain an overview of category 1 and 2 scope 3 emissions and inform discussions with accountants and managers that may be tasked with tracking, collating and acting on emissions data in the future.

To develop the approach, numerous staff members from the accounting and climate teams were consulted, input was mainly technical ensuring appropriate spend data was received but discussions around method innovation and uses were also invaluable. Key examples include the director of Communities and Environment response to the method presentation, he observed how the simplicity of the method could immediately arm his managers (e.g. in catering) with indicative information on high emitting activities, suggesting that at first iteration low carbon decisions could be made and informed by the high-level emissions data. Additionally, a discussion with a member of the accountancy team to confirm accountancy codes and categorisation resulted in numerous ideas for innovations surrounding the breakdown of spend and job codes indicating emission data could be monitored monthly with capital and procurement separation.

## 6.1 Applied net zero strategy

In the absence of UK central government requirements for English local authority net zero/emissions management, guidance summarised in Table.10 is sub-national and UK public sector relevant, and includes guidance from the GHGP, LGA, Scottish government, Welsh government, SBTi and the Corporate Climate Responsibility Monitor. SBTi was chosen as the most widely used (and first) science-based net zero standard (Hans *et al.*, 2022) alongside assessment criteria published by Corporate Climate Responsibility Monitor which assess both corporate net zero ambition and the robustness of SBTi standards (Hans *et al.*, 2022; NCI and CMW 2022).

Local authority relevant emissions management/net zero guidance reviewed in Section 4 is built on in Table.10 and sub-national *own operation* (opposed to area-wide) and *scope 3* specific guidance focused on robust:

- Tracking and disclosure of emissions
- Setting and disclosing emission reduction targets

is summarised in the context of Blackpool's existing emissions management (Section 3).

Requirements and guidance for 'accounting for reductions, and offsets' (i.e. accounting for progress toward targets) is not included in Table.10 but is detailed for scope 1 and 2 by GHGP (2004) and for scope 3 in chapter 9 of the GHGP (2011). NCI and CMW (2022) also detail their assessment methodology guidance for accounting for reductions and offsets and SBTi require GHGP method alignment (SBTi, 2021).

**Table 10** Summary of robust own operation, scope 3 focussed guidance for a) tracking and disclosing GHG emissions and b) setting and disclosing GHG emission reduction targets. Guidance is considered in the context of Blackpool council's own operation emissions management, areas where robust guidance and Blackpool strategy differ are highlighted and observations on possible alignment are made. Emissions management guidance is sub-national and UK public sector relevant and includes guidance from the GHGP (Greenhouse Gas Protocol), LGA (Local Government Association), Scottish government, Welsh government, SBTi (Science-based targets initiative) and the Corporate Climate Responsibility Monitor. This range of guidance is summarised as no UK central government guidance on net zero and emissions management strategy for English local authorities exists. SBTi was chosen as the most widely used/first science-based net zero standard (Hans et al., 2022) alongside guidance/analysis published by Corporate Climate Responsibility Monitor which assess both corporate net zero ambition and the robustness of SBTi standards (Hans et al., 2022).

Theme	Subtheme	Guidance	Blackpool application
Emissions tracking	GHG inventory boundary	<ul style="list-style-type: none"> <li>• GHGP requires organisations to determine their organisational boundary. The control approach applies for authorities; a financial or operational approach can then be chosen to define which assets and operations make up an organisation (GHGP, 2004)</li> <li>• GHGP requires organisations to determine their operational boundary once the organisational boundary is agreed. Emission scopes, sources and categories are identified for inclusion (GHGP, 2004)</li> <li>• GHGP recommends the inclusion in the GHG inventory of all seven gases covered by the Kyoto Protocol in units of CO<sub>2e</sub>, if they are emitted by direct activities (scope 1 and 2) or in the value chain (scope 3) (GHGP, 2004; GHGP, 2011)</li> <li>• GHGP compliant emissions calculation methods are detailed/recommended for use (for scope 1 and 2 see GHGP, 2004). Scope 3 methods are set out in the technical guidance for calculating scope 3 emissions (GHGP, 2013). Multiple calculation methods are permitted for scope 3 and are ranked in order of</li> </ul>	<p>Blackpool's current organisational boundary is unclear. The Carbon Trust footprint report (Carbon Trust, 2022) only states that data was provided for Blackpool Airport, Blackpool Coastal Housing, Blackpool Entertainment Company, Blackpool Housing Company, Blackpool Operating Company, Blackpool Transport Services and Lancashire Management Operations. Estates, facilities, and transport are stated to be 'of primary focus' but detailed clarification is needed.</p> <ul style="list-style-type: none"> <li>• Consider publishing boundary diagram for clarity/transparency (e.g. page 31 NRW [2018] and page 61 NRW [2019]) alongside narrative detail on asset databases.</li> </ul> <p>Blackpool operational boundary included in Carbon Trust 19/20 footprint report (Carbon Trust, 2022).</p> <ul style="list-style-type: none"> <li>• In boundary: scope 1 owned transport and fuel combustion, scope 2 purchased electricity, scope 3 upstream fuel and energy relation activities (category 3) and business travel (category 6).</li> <li>• Out of boundary: scope 1 process and fugitive emissions, scope 2 purchased heating/cooling, scope 3 purchased goods and services (category 1), capital goods (category 2), upstream transport and distribution (category 4), waste (category 5), upstream leased assets (category 8), employee commuting (category 7), downstream leased assets (category 8), downstream transport and distribution (category 9), franchises (category 14), end of life treatments (category 12), use of sold products (category 11), processing sold products (category 10) and investments (category 15).</li> </ul>

		<p>specificity – organisations should select calculation method based on:</p> <ul style="list-style-type: none"> <li>- Relative size of emissions, data availability, data quality, cost/effort required to apply each method</li> </ul> <p>Data quality is expected to improve over time as knowledge builds and more specific calculation methods can be chosen (GHGP, 2011)</p> <ul style="list-style-type: none"> <li>• GHGP requires all scope 1 and 2 emissions as a minimum to be included in an organisation’s GHG inventory. If choosing to include scope 3 then all scope 3 emission categories and sources must be included by the ‘minimum boundary’ (see table 5.4 page 34 GHGP [2011]) with any exclusions disclosed and justified (GHGP, 2011)</li> <li>• Wales’ GHG public sector inventory and reporting boundary includes all GHGP scope 1 and 2 emission categories/sources and GHGP scope 3: purchased goods and services (category 1), capital goods (category 2), upstream transport and distribution (category 4), waste (category 5) , upstream leased assets (category 8), employee commuting (category 7) and downstream leased assets (category 8). <ul style="list-style-type: none"> <li>- downstream transport and distribution (category 9), franchises (category 14), end of life treatments (category 12), use of sold products (category 11), processing sold products (category 10) and investments (category 15) are partially or fully excluded (Welsh Government, 2022).</li> </ul> </li> <li>• Scotland requires all scope 1 and 2 emission sources and categories to be included in the GHG inventory and all relevant and significant areas of scope 3</li> </ul>	<ul style="list-style-type: none"> <li>• Carbon Trust footprint reports emissions in CO<sub>2</sub>e so all Kyoto gases included are included in the inventory</li> </ul> <p>Consider including all scope 1 and 2 emission categories in inventory boundary and all relevant scope 3 categories, calculated using available data (regardless of uncertainty) to support full GHG inventory. Plan to improve data quality over time for all scopes.</p>
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		<p>emissions 'in line with the GHGP'. Legislation is technically open to interpretation, so few bodies currently report significant scope 3 emissions (SSN, 2021). Scottish Government states that over time public bodies will be expected to report on scope 3 emissions as fully as possible (Scottish Government, 2021).</p> <ul style="list-style-type: none"> <li>• SBTi require 90% of scope 1 and 2 emissions and 67% of an organisations scope 3 emissions (increasing to 90% over long term) (SBTi, 2021) to be included in the inventory boundary for organisations to be compliant with their Net Zero Standard ((SBTi, 2021)</li> <li>• Corporate Climate Responsibility Monitor requires all scope 1, 2 and 3 emission categories to be included in an organisations inventory boundary, even if minor or irrelevant, for an organisation's net zero strategy to be rated as having 'reasonable' transparency and integrity (NCI and CMW, 2022)</li> </ul>	
Emissions disclosure	GHG reporting boundary	<ul style="list-style-type: none"> <li>• GHGP GHG inventory reporting for all scopes should be based on <ul style="list-style-type: none"> <li>- Relevance: inventory reflects GHG emissions of organisations, serving decision-making needs both internally and externally</li> <li>- Completeness; account and report on all emission sources/activities in the inventory boundary. Disclose and justify exclusions</li> <li>- Consistency; use and report consistent methodologies for meaningful performance tracking. Transparently document changes to data, boundary, methods etc.</li> <li>- Transparency: disclose all assumptions and reference accounting/calculation methods used</li> <li>- Accuracy: reduce uncertainties as far as practically possible, work toward achieving</li> </ul> </li> </ul>	<p>Consider public annual disclosure on Blackpool website of <i>all emissions calculated as part of GHG inventory</i>. Include:</p> <ul style="list-style-type: none"> <li>• calculation methods and assumptions, emissions for each GHGP scope and category with uncertainties, plans/processes to improve accuracy of scope 3 data and organisational/operational boundaries.</li> </ul> <p>Consider voluntary disclosure using Local Partnerships and LGA GHG accounting tool (Local Partnerships, 2022) to enable benchmarking and standardisation. Certain scope 3 source options may be too resolved to report on immediately and less accurate scope 3 calculation/emissions reporting is not accommodated in the tool at present so consider reporting on all scope 1 and 2 emissions as a minimum.</p>

		<p>sufficient accuracy to enable users to make decisions with reasonable confidence based on the emissions information.</p> <ul style="list-style-type: none"> <li>• GHGP requires all inventory emissions to be publicly disclosed by scope. Inventory and reporting boundaries are the same (i.e. all scope 1 and 2 emissions as a minimum. If including scope 3 then all scope 3 emission categories and sources must be included by the minimum boundary (see table 5.4 page 34 GHGP [2011]) with any exclusions disclosed and justified). Organisational and operational boundaries must also be disclosed.</li> <li>• Voluntary reporting boundary for English authorities is available using Local Partnerships and LGA GHG accounting tool which accommodates all scope 1 and 2 emissions and limited scope 3 emissions (<i>not organised by GHGP category</i>) that can be calculated using primary data and BEIS conversion factors only, including; transport miles travelled by vehicle type, transport and distribution losses by Kwh, water treatment by cubic metre, waste by tonnes of material and consumption by tonnes of plastic/paper/electrical/food (Local Partnerships, 2022)</li> <li>• Wales and Scotland local authority reporting boundaries are the same as their inventory boundaries detailed in GHG inventory boundary above.</li> <li>• SBTi require annual, public disclosure of emissions included within the GHG inventory. They recommend disclosing through standardised, comparable data platforms such as CDP's climate change annual questionnaire (SBTi, 2021)</li> <li>• Corporate Climate Responsibility Monitor require <i>all</i> scope emissions to be disclosed publicly and annually on corporations' websites to gain their</li> </ul>	
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		'reasonable' transparency and integrity rating (NCI and CMW, 2022)	
Target setting	Target base year	<ul style="list-style-type: none"> <li>GHGP allows for scope 3 target base year/s to be set more recently than scope 1 and 2 or inventory base years. Until a base year is chosen for scope 3 target/s an organisation must report that one has not been chosen yet. GHGP also requires <ul style="list-style-type: none"> <li>A base year recalculation policy to be published articulating when recalculations will occur (e.g. if alteration in calculation method alters emissions by more than 10%)</li> <li>Base years to be recalculated if any significant changes in organisation structure or inventory methodology occur (GHGP, 2011)</li> </ul> </li> <li>SBTi require target base years to be set no earlier than 2019 (SBTi, 2021)</li> <li>LGA have minimal emissions reduction target setting guidance but state that inventory and target base years can differ, especially for scope 3 where reporting can commence ahead of setting a target or inventory base year (LGA, 2022).</li> <li>Wales offer no guidance on setting target base years as they have a centrally imposed 'net zero by 2030 public sector' target so authorities are not required to set their own emissions reduction targets. Public sector base year for 2030 target is likely first year of public sector reporting 2021-2022 (Welsh Government, 2021b).</li> <li>Scotland requires direct and indirect emissions targets to have clearly defined base years, stating that base years may differ for scope 1 and 2 and scope 3 targets but do not prescribe base years. Scotland's</li> </ul>	<p>Existing 'net zero carbon by 2030' has no clear base year set (Blackpool Council, 2021).</p> <ul style="list-style-type: none"> <li>Set base year alongside further target clarifications including absolute reduction value, offset use, GHGs included/covered and target boundary</li> <li>and/or reevaluate target/set additional scope 3 target/s and base year/s</li> </ul> <p>Until emissions data is resolved enough to set a base year and measure progress to scope 3 target/s, disclose that a base year has not been set for overarching scope 3 or scope 3 category/source specific target/s.</p> <p>Allow scope 3 target base year/s to be set more recently than scope 1 and 2 base year if necessary (i.e. data is not resolved enough).</p> <p>Ensure base year recalculation policy is in place and published when a base year for any specific target/s is chosen.</p> <p>Consider aligning with SBTi and choose base year/s no earlier than 2019.</p>

		<p>national target (which authorities are required to contribute to achieving) is set as a 90% GHG emissions reduction by 2040 from a 1990 base year and net zero by 2045 (Scottish Government, 2021).</p>	
	<p>Target type</p>	<ul style="list-style-type: none"> <li>• GHGP explains that organisations may set intensity (expressed as a reduction in the ratio of GHG emissions relative to a metric e.g. output/production) or absolute reduction targets (reduction amount in tCO<sub>2</sub> or tCO<sub>2e</sub> to be achieved via specific abatement measures) can be set for scope 3 emissions. They allow organisations to <ul style="list-style-type: none"> <li>- meet targets entirely from internal reductions of sources included in the target boundary</li> <li>- or from additionally using offsets at sources external to the target boundary.</li> <li>- They encourage organisations to achieve reduction targets solely from internal reductions within the target boundary, but if this is not possible organisations may use offsets. These must be specified, and internal emissions and offsets should be reported on separate accounts. Offsets should be based on credible accounting standard to avoid double counting of offsets.</li> </ul> </li> <li>• SBTi allow physical intensity contraction, economic intensity or engagement targets (suppliers representing a certain percentage of emissions are required to set a SBTi target) to be set for scope 3 emissions. Offsets or carbon dioxide removal are not permitted as valid emission reduction activity within SBTi compliant targets (SBTi, 2021).</li> <li>• Scotland allows authorities to set overarching net zero or carbon neutrality targets where offsetting or emission sequestration/removal is permitted to reach the <i>balance</i> of zero emissions by a certain date –</li> </ul>	<p>Consider clarifying and/or setting additional targets to supplement/replace existing 'net zero carbon by 2030' target as the absolute reduction value, offset use, GHGs included/covered, base year and target boundary are unclear (Blackpool Council, 2021).</p> <ul style="list-style-type: none"> <li>• If a net zero or carbon neutrality is set, be explicit about level of offset permitted. Consider aligning with at least 90% absolute reduction with limited/10% or less offset reliance.</li> <li>• Consider setting scope/category specific absolute reduction targets as <i>well</i> as an overarching net zero target (with explicit offset reliance).</li> </ul>

		<p>which can cover scope 3 emissions, as long as residual emissions for offsetting are as small as possible and interim targets are set. They require scope 1 and 2 emissions to be absolute targets where possible. They require additional absolute reduction targets for scope 3 emissions to be specified, these may be for specific categories or sources (Scottish Government, 2021).</p> <ul style="list-style-type: none"> <li>Corporate Climate Responsibility Monitor state that irrespective of target type targets must explicitly include deep emission reduction commitments that are independent of offsetting and carbon dioxide removals. Specific short- and medium-term interim targets requiring immediate action must also be set as the main focus of corporate target setting (NCI and CMW, 2022).</li> </ul>	
	<p>Target reduction level and date</p>	<ul style="list-style-type: none"> <li>GHGP state that for scope 3 reduction targets a numerical reduction value must be set, they suggest organisations use their guidance (GHGP, 2011) to examine potential GHG reduction opportunities and estimate their effects on total GHG emissions. They recommend organisations set ambitious targets which 'reduce emissions significantly below an organisations business-as-usual scope 3 emissions trajectory' (GHGP, 2011).</li> <li>SBTi require near term targets to be set with a 5–10-year range with all long-term targets set for 2050 or sooner. Long term targets must reduce by 4.2% or more linearly per year, short term scope 3 targets must reduce by 2.5% or more linearly per year. Ultimately, they require all organisations to commit to emissions reductions of at least 90% below 2019 levels across all emission scopes (SBTi, 2021).</li> <li>Corporate Climate Responsibility Monitor require minimal SBTi alignment of 90% reduction below 2019</li> </ul>	<p>Consider reevaluating/clarifying existing 'net zero carbon by 2030' target as the absolute reduction value, offset use, GHGs included/covered, base year and target boundary are unclear (Blackpool Council, 2021).</p> <ul style="list-style-type: none"> <li>Ensure all target/s are set with 2050 or sooner date with interim targets (5-10 years) to substantiate as a minimum</li> <li>Be explicit about reduction amount included in target</li> <li>Consider aligning with 90% absolute reduction below 2019 levels by 2050 for all emission scopes</li> <li>Consider aligning with SBTi linear reduction requirements of 4.2% yr<sup>-1</sup> for long term targets and at least 2.5% yr<sup>-1</sup> for short term (5-10 years) scope 3 targets (SBTi, 2021) (see GHGP [2011] for guidance measuring/reporting progress/reductions toward scope 3 target/s)</li> </ul>

		<p>levels across all emission scopes (NCI and CMW, 2022)</p> <ul style="list-style-type: none"> <li>• Scotland requires authorities to set targets that will 'reduce indirect emissions in advance of the 2045 target' and 'reduce scope 1 and 2 emissions where possible to absolute zero' (Scottish Government, 2021)</li> <li>• Wales has a net zero by 2030 public sector target which all authorities are required to contribute to. They haven't clarified the percentage of emissions to be offset so absolute reduction level is unclear (Welsh Government, 2021b).</li> </ul>	
	<p>Target boundary</p>	<ul style="list-style-type: none"> <li>• GHGP allows the following target boundaries (including all GHGs arising from activities or in the value chain) <ul style="list-style-type: none"> <li>- One target for total scope 1, 2 and 3 emissions</li> <li>- One target for total scope 3 emissions</li> <li>- Separate targets for individual scope 3 categories</li> <li>- A combination of targets e.g. total target for all scopes plus individual scope 3 category targets (GHGP, 2011)</li> </ul> </li> <li>• Scotland allows separate direct (scope 1 and 2) and indirect (scope 3) targets to be set if they are <ul style="list-style-type: none"> <li>- Clear on which indirect emission categories/sources are included in the target</li> <li>- Cover any significant areas of indirect emissions that can be appropriately measured (Scottish Government, 2021)</li> </ul> </li> <li>• SBTi require target boundaries to be the same as inventory boundaries i.e. 90% of scope 1 and 2 emissions and 67% of an organisations scope 3</li> </ul>	<p>Consider clarifying and/or setting additional targets to supplement/replace existing 'net zero carbon by 2030' target as the absolute reduction value, offset use, GHGs included/covered, base year and target boundary are unclear (Blackpool Council, 2021).</p> <p>Be clear about own operation targets opposed to area-wide targets. Current target boundary communication is unclear, stating that Blackpool is committed to 'making the council's carbon emissions net zero', 'using 100% clean energy across the council's services by 2030', 'ensuring strategic decisions, budgets and approaches to planning are in line with shift to zero carbon by 2030' and 'supporting and working with other relevant agencies toward making the entire area zero carbon within the same timescale' (Blackpool Council, 2021). The climate action plan page states that the plan 'sets out how the council and town can aim for net zero carbon emissions by 2030' (Blackpool Council, 2021b).</p> <ul style="list-style-type: none"> <li>• Language (e.g. 'aim for') and organisation, operational and target boundaries (i.e. which emission scopes/categories/sources are included) are ambiguous and need clarification</li> <li>• Own operation target boundary/s need to be separate to area-wide target/s and boundary/s</li> <li>• Emission sources/scopes included in each target need to be explicit</li> <li>• Which GHGs are included in target/s need to be explicit</li> </ul> <p>Consider altering or replacing existing target and setting additional targets e.g.</p>

		<p>emissions for near term targets (increasing to 90% over long term) (SBTi, 2021)</p> <ul style="list-style-type: none"> <li>Corporate Climate Responsibility Monitor recommend targets to be explicit in coverage of the 'complete spectrum of emissions sources and greenhouse gases' <ul style="list-style-type: none"> <li>They state that all mandatory GHGP scope 3 emission categories are vital to include despite uncertainties and indirect influence (NCI and CMW, 2022)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Clarify boundaries of current net zero carbon by 2030 target e.g. 90% absolute reduction in council own operation scope 1 and 2 emissions from 2019 levels by 2030 <ul style="list-style-type: none"> <li>An additional long-term scope 3 target can be set to cover all scope 3 categories in GHG inventory e.g. 90% absolute reduction in all scope 3 emissions by 2050</li> <li>Additional scope 3 category/source specific targets can also be set (once data quality is sufficient) e.g. 90% reduction in construction emissions by 2045</li> <li>Interim targets should be set to substantiate long term targets</li> </ul> </li> <li>Or set overarching all scope net zero target e.g. 90% absolute reduction in all scope 1,2 and 3 emissions from 2019 levels by 2050 <ul style="list-style-type: none"> <li>Interim and scope 1 and 2 targets can be set within this target e.g. 90% absolute reduction in council own operation scope 1 and 2 emissions from 2019 levels by 2030</li> <li>Scope 3 category/source specific targets can also be set (once data quality is sufficient) e.g. 90% reduction in construction emissions by 2045</li> </ul> </li> </ul>
Target disclosure	Headline pledge	<ul style="list-style-type: none"> <li>SBTi require clear and succinct target wording: the emission scopes, reduction amount (e.g. 90%), target date and base year must be communicated in the headline pledge. Organisations with multiple targets must state each target including the detail above (SBTi, 2021).</li> <li>Scotland has new statutory target disclosure requirements for public bodies including <ul style="list-style-type: none"> <li>Disclosure of a body's target date for achieving direct zero emissions of GHGs</li> <li>Where applicable, targets for reducing indirect emissions (Scottish Government, 2021)</li> </ul> </li> </ul>	<p>Consider communicating existing or revised target/s clearly in the headline pledge, ensuring each target pledge includes:</p> <ul style="list-style-type: none"> <li>The emission scopes/categories/sources included</li> <li>The absolute reduction amount, independent of offsets</li> <li>Target date</li> <li>Base year</li> </ul>

		<ul style="list-style-type: none"><li>• Corporate Climate Responsibility Monitor require the headline pledge, if a net zero or carbon neutrality target, to state the specific emission reduction component (i.e. not reliant on offsets) which must be at least 90% below 2019 levels to ensure net zero target terminology is not misleading. They also require the specific emission reduction component to be in line with a 1.5°C compatible trajectory according to sector and/or academic literature for an organisation's net zero strategy to be rated of 'reasonable' integrity and transparency (NCI and CMW, 2022).</li></ul>	
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## 7. Conclusions

Local authorities in the UK have a key role to play in sub-national emission reductions, both through their own operation and area-wide net zero strategies from social housing, transport, and waste to their wider influence through investment and procurement decisions as well as leading by example in their role as place makers. As detailed in this report, England, Scotland, and Wales are taking a devolved approach to local authority emissions management. Scotland and Wales have published detailed greenhouse gas (GHG) inventory, reporting and target guidance bolstered by statutory requirements. In contrast, UK central government has failed to set out English local authorities' role in the net zero transition or provide target, GHG inventory or reporting guidance, or statutory requirements.

The lack of clarity from central government on English local authorities' roles and responsibilities and the myriad of relevant guidance, standards, and approaches in circulation from diverse public and private sector sources mean there is little consistency in reporting and strategy on net zero. The result is diverse and opaque carbon accounting, target setting and disclosure which undermines net zero strategy and hinders scrutiny. As evidenced in this research via close interactions with Blackpool authority, internal governance, and capability barriers such as siloed environmental teams and a lack of carbon literacy and accounting expertise often also limit the extent to which strategic climate ambitions are embedded. This means that significant policy and project decisions do not reflect decarbonisation pledges.

In addition, the absence of central government guidance means external consultants are often relied on for GHG inventory, reporting and target management to support the ambitious pledges that many authorities are struggling to act on. This was evident at Blackpool where they employed the Carbon Trust to calculate their own-operation emissions inventory using data Blackpool had struggled to collate over ten months. Employing consultants can be costly and can undermine authorities' internal emissions management capability as carbon accounting is outsourced. This can further distance staff and elected members, responsible for overseeing council functions and decisions, from emissions management and the emissions context of activities.

This is further exacerbated by significant differences in authorities' powers, functions, and local circumstances, including 52% reductions in authority spending power since 2010, meaning severely under-resourced authorities, such as Blackpool, have less ability to attract and establish large carbon teams, forcing further reliance on expensive consultants to develop strategy. Top-down guidance and regulation is urgently needed. In the interim, under-resourced English authorities need support

interpreting and identifying robust emissions management practices within the sea of available approaches, suited to the capability, capacity, and resource constraints they operate under.

This work has used Blackpool Unitary Authority as a case study partner to address this ambiguity and dearth of clear requirements. It has done this by:

- Establishing Blackpool's existing net zero strategy and identifying ambiguities
- Identifying, summarising, and interpreting relevant public and private sector emissions management guidance
- Presenting an in-house method for spend-based, iterative scope 3 emissions management
- Detailing how Blackpool can align with the robust net zero strategies reviewed in this report

The research has explicitly focussed on Blackpool's *own operation*, opposed to area-wide, *scope 3* emissions management to address this significant and important gap in net zero strategy. Scope 3 emissions suffer from persistent underreporting and ambiguous inclusion in GHG inventories and targets, despite often comprising over 70% of an entity's GHG footprint. The exclusion of scope 3 results in a partial representation of an organisations total emissions impact, which is defined by the Greenhouse Gas Protocol (GHGP) as all scope 1, 2 and 3 emission categories, and is recognised as a key source of ambiguity in sub-national net zero strategy by the IPCC.

Accounting for scope 3 emissions facilitates the simultaneous action of multiple entities to reduce emissions throughout society. Yet because they are situated externally, as they are by definition, the direct emissions of another entity, organisations experience difficulty obtaining accurate, granular emissions estimates to measure progress toward reduction targets against. This results in their exclusion from inventory and target boundaries, likely exacerbated by GHGP guidance, which considers scope 3 inclusion in a GHGP compliant inventory optional – requiring at minimum all scope 1 and 2 categories.

Whilst the GHGP is the authority on GHG accounting standards, components of the guidance are optional to allow for the diversity of organisations interested in managing their emissions. This results in organisations or sectors interpreting aspects of the standards differently. As this interpretation has not been completed by central government for English authorities specifically, Welsh public sector, Scottish public sector, Local Government Association, UK Treasury and UK Government corporate emissions management guidance is relevant to English authority practice. Additionally, numerous independent corporate net zero standards and assessment methodologies have been established to scrutinise sub-national net zero strategy and

provide robust frameworks. The most widely used independent corporate accreditation is the Net Zero Standard from the Science-based Targets initiative (SBTi). The Corporate Climate Responsibility Monitor also provides comprehensive corporate assessment of net zero strategy which includes critique of various net zero standards employed, including SBTi accreditation.

This diversity of guidance is often a source of confusion and represents an additional time burden for staff in English authorities trying to design an effective emissions management approach. In response, this report has collated and reviewed relevant GHG inventory, reporting, target setting and disclosure-based guidance, with scope 3 focus, to identify robust local authority emissions management practices. These public and private standards were then applied to Blackpool's emissions governance practices in Table.10, resulting in a set of clear recommendations for Blackpool to consider aligning with best practice. These include:

- Widen the GHG inventory boundary to account for all scope 1 and 2 categories and relevant scope 3 categories
- Use available data such as spend to begin the process of estimating a complete footprint instead of waiting for the 'most accurate' data
- Plan to improve data quality over time for all scopes
- Publicly disclose all emissions calculated as part of the GHG inventory with any caveats on methods used and data quality
- Clarify decarbonisation target/s by setting a base year, stating the absolute reduction value, stating intended use of offsets and clarifying what GHGs and scopes are included in the target boundary
- Consider replacing 'net zero carbon by 2030' target with a long term 2050 target, ambitious interim targets (5-10 years) and additional category specific scope 3 targets
- Be explicit about the tCO<sub>2e</sub> reduction amount of any target and consider aligning with SBTi linear reduction requirements of 4.2% yr<sup>-1</sup> for long term targets and at least 2.5% yr<sup>-1</sup> for interim targets (5-10 years)
- Consider communicating target/s more clearly in the headline pledge. Include: scopes, sources and categories of emissions, the absolute reduction amount independent of offsets and the target date

Whilst these recommendations are tailored to Blackpool, the detailed breakdown of guidance and interpretation for local authorities in Table.10 is highly applicable to any English local authority looking to improve its net zero strategy.

More specifically, the iterative spend-based method developed and applied in this report has been developed to support a diverse range of councils to start addressing scope 3 emissions. It is based on GHGP, Welsh Government and UK Government Environmental Reporting Guidelines and uses sectoral emissions factors published by The Department for Environment Food and Rural Affairs (DEFRA). It was formulated using Blackpool's spend data to estimate significant scope 3 emissions. After working closely with Blackpool to establish existing performance, accountancy and carbon management practices and opportunities, over a six-month period, a simple proof-of-concept was developed using Blackpool's Community and Environment directorate annual spend data. Category 1 – purchased goods and services and category 2 – capital expenditure scope 3 emissions were calculated. The method details how these emissions can be quickly and easily calculated in-house. These emissions can then be publicly reported to support more complete GHG footprint disclosure and high emitting spend areas or hotspots can be immediately identified to indicate areas to focus refinement efforts.

The method was ultimately presented to senior officers at Blackpool who approved uptake and tasked their net zero strategy manager with implementation. Subsequent meetings gathered accountancy staff, performance managers and members of the climate team to discuss implementation and facilitate knowledge transfer – especially to staff members outside of the climate team. Importantly this offered an opportunity to explain to non-carbon/climate specialists the indicative and iterative nature of the emissions estimates and method. This included discussing the estimates primary uses, as highlighting emission hotspots, directing refinement efforts and making the carbon impact of decisions more visible.

This approach demonstrates that when the inherently uncertain and iterative nature of scope 3 emissions, set out by the GHGP, is more widely embraced by organisations and guidance producing bodies and regulators, a complete and more honest picture of the emissions associated with sub-national organisations activities can emerge. This in turn can enable proper scrutiny of climate pledges and emissions management efforts, and more fully leverage an organisations carbon management potential, especially regarding significant value chain emissions. The value of using the spend-based method more broadly, not only as a simple starting point for estimating emissions, but also to help iteratively increase knowledge and embed emissions estimates into local authority functioning and decision-making has also been demonstrated by this research.

This report concludes that due to existing accountability, performance, and management processes already in place in local authorities, accountancy practices lend themselves well to facilitating the incorporation of spend-based emission calculation and refinement processes in council functioning. High-level emissions assessment processes, placed in the hands of those external to environment teams, tasked with day-to-day management and decision-making, can begin a process of organisational carbon literacy building. This can ultimately equip under-resourced authorities with the necessary skills to make the GHG emissions associated with decisions visible, so they can be integrated into decision making processes more explicitly.

## 8. References

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## 9. Appendices

### 9.1 Appendix A

Prior to June 2022 no single source of up-to-date indirect supply chain emission factors (which account for emissions in the supply chain wherever in the world they occur) by SIC code for the UK existed. The last update was published by DEFRA in 2013 and detailed UK indirect supply chain emission factors in kg CO<sub>2</sub>e/£ (and kg CO<sub>2</sub>/£) using 2011 data (DEFRA, 2013). Owen and Barrett (2022) detail the methodology, assumptions and limitations of the UK Multi Regional Input-Output (MRIO) model used to estimate the UK carbon footprint and calculate the updated 2019 indirect supply chain EFs. The 'consumption emissions', calculated as part of the UK carbon footprint, include emissions directly generated by UK households and those associated with UK consumption spend on goods and services as well as emissions directly produced by households (opposed to territorial emissions which refer only to emissions produced within UK borders).

Due to the age and uncertainty of the 2011 indirect supply chain emission factors (DEFRA, 2013) they were marginally updated, using the UK 2011 and 2019 direct (territorial) emission factors (ONS, 2022), for use estimating Blackpool council's category 1 and 2 scope 3 emissions from spend data. The UK 2011 emission factors (DEFRA, 2013) were updated (see Table.11) for this report using UK direct emission factors (ONS, 2022) as a proxy for changes in tax/inflation/trade flows by dividing 2011 *indirect* EFs by the 2011 *direct* EFs and using the quotient as a multiplier for the 2019 direct emission factors (EF) i.e.  $\frac{2011 \text{ indirect EF}}{2011 \text{ direct EF}} \times 2019 \text{ direct EF} = \text{updated EF}$ . Minor SIC code category alignment between 2019 direct and 2011 indirect emission factor sets was also completed. Categories; 7B Mining of metal ores, 60J Programming and broadcasting services, 65.3K Pension services, 68.2 Owner-Occupiers' Housing Services, 87Q Residential care services and 88Q Social work services without accommodation were removed from the direct emission factor data set. 41F, 42F and 43F Construction categories were combined to align with the combined category 41-43F Construction in the indirect EF set (an average of the three was used to determine the 2019 direct EF multiplier). All categories removed were captured by combined categories. The original 2011 indirect EF was used when the direct EF was zero and when the 2019 EF was larger than the 2011 indirect EF.

The 2018 COICOP (classification of individual consumption according to purpose) emission factors in Table.12 were also applied to more granular spend lines (e.g. milk and outer garments) as they provided more up to date EFs with reduced uncertainty. The Excel icon below links to a spreadsheet of the indirect and direct emission factor

alignment and update method used, prior to the 2019 indirect emission factor publication in June 2022.



Table.11 and Table.12 detail England-specific 2019 indirect supply chain emission factors by SIC code and COICOP consumption respectively, published by DEFRA (2022). These data will be updated by DEFRA annually with a three-year lag as part of the UK carbon footprint publications and are now the most up to date source of indirect supply chain emission factors for use with UK spend on goods and services. As such, this report recommends their use over the updated 2011 SIC (Table.11) and 2018 COICOP (Table.12) combined sets originally utilised in Section 5.1 to calculate Blackpool’s 20/21 category 1 and 2 scope 3 emissions for the Community and Environment directorate.

**Table 11** Updated UK indirect supply chain 2011 GHG (kg CO<sub>2e</sub> /£) and CO<sub>2</sub> (kg CO<sub>2</sub>/£) emission factors (EFs) (also referred to as ‘multipliers’) by SIC code. \* UK 2011 emission factors (DEFRA, 2013) were updated using UK direct emission factors (ONS, 2022) as a proxy for changes in tax/inflation/trade flows by dividing 2011 indirect EFs by the 2011 direct EFs and using the quotient as a multiplier for the 2019 direct emission factors (EF) i.e.,  $\frac{2011 \text{ indirect EF}}{2011 \text{ direct EF}} \times 2019 \text{ direct EF} = \text{updated EF}$ . Minor SIC code category alignment between 2019 direct and 2011 indirect emission factor sets was completed. Categories; 7B Mining of metal ores, 60J Programming and broadcasting services, 65.3K Pension services, 68.2 Owner-Occupiers' Housing Services, 87Q Residential care services and 88Q Social work services without accommodation were removed from the direct emission factor data set. 41F, 42F and 43F construction categories were combined to align with the combined category 41-43F Construction in the indirect EF set (an average of the three was used to determine the 2019 direct EF multiplier). All categories removed were captured by combined categories. The original 2011 indirect EF was used when the direct EF was zero and when the 2019 EF was larger than the 2011 indirect.

SIC code	SIC code	SIC category	Updated* 2011 indirect emission factor (Kg CO <sub>2e</sub> /£)
1	A	Products of agriculture, hunting and related services	4.00
2	A	Products of forestry, logging, and related services	1.04
3	A	Fish and other fishing products; aquaculture products; support services to fishing	1.55
5	B	Mining of coal and lignite	10.45
6	B	Crude petroleum and natural gas	1.11
8	B	Other mining and quarrying products	0.60
9	B	Mining support services	0.67
10.1	C	Processing and preserving of meat and production of meat products	1.09
10.2-3	C	Processing and preserving of fish, crustaceans, molluscs, fruit and vegetables	1.00
10.4	C	Manufacture of vegetable and animal oils and fats	1.07
10.5	C	Manufacture of dairy products	1.72

10.6	C	Manufacture of grain mill products, starches, and starch products	1.86
10.7	C	Manufacture of bakery and farinaceous products	0.94
10.8	C	Manufacture of other food products	0.87
10.9	C	Manufacture of prepared animal feeds	1.24
11.01-6	C	Manufacture of alcoholic beverages, including spirits, wine, cider, beer and malt	0.85
11.07	C	Manufacture of soft drinks: production of mineral waters and other bottled waters	0.46
12	C	Tobacco products	3.38
13	C	Textiles	0.86
14	C	Wearing apparel	0.63
15	C	Leather and related products	0.36
16	C	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	1.00
17	C	Paper and paper products	0.76
18	C	Printing and recording services	0.47
19	C	Coke and refined petroleum products	5.25
20.11+20.13+20.15	C	Industrial gases, inorganics, and fertilisers (all inorganic chemicals)	6.05
20.14+20.16+20.17+20.6	C	Manufacture of petrochemicals	2.16
20.12+20.2	C	Manufacture of dyestuffs, agro-chemicals	0.98
20.3	C	Manufacture of paints, varnishes & ink	1.97
20.4	C	Manufacture of cleaning & toilet preparations	1.30
20.5	C	Manufacture of other chemical products & man-made fibres	1.68
21	C	Basic pharmaceutical products and pharmaceutical preparations	0.29
22	C	Rubber and plastic products	1.05
23.1-4 & 23.7-9	C	Manufacture of glass, refractory, clay, other porcelain and ceramic products, Stone, & abrasive products	2.52
23.5-6	C	Cement, lime, plaster and articles of concrete, cement and plaster	3.33
24.1-3	C	Manufacture of basic Iron & Steel	5.01
24.4-5	C	Other basic metals and casting	2.08
25.1-3+25.5-9	C	Fabricated metal products, except machinery and equipment, excluding weapons and ammunition	0.67
25.4	C	Manufacture of weapons and ammunition	1.25
26	C	Computer, electronic, communication and optical products	0.49
27	C	Electrical equipment	0.76
28	C	Machinery and equipment n.e.c.	0.91
29	C	Motor vehicles, trailers and semi-trailers	0.47
30.1	C	Building of ships and boats	0.64

30.3	C	Manufacture of air and spacecraft and related machinery	0.42
30.2+4+9	C	Manufacture of other transport equipment, excluding ships, boats, air and spacecraft	0.25
31	C	Furniture	0.57
32	C	Other manufactured goods	0.45
33.15	C	Repair & maintenance of ships	0.46
33.16	C	Repair & maintenance of aircraft & spacecraft	0.84
33 (not 33.15-16)	C	Rest of repair; Installation	0.49
35.1	D	Electric power generation, transmission and distribution	3.86
35.2-3	D	Manufacture of gas; distribution of gaseous fuels through mains and steam and air conditioning supply	1.76
36	E	Natural water; water treatment and supply services	0.62
37	E	Sewerage services; sewage sludge	0.68
38	E	Waste collection, treatment and disposal services; materials recovery services	2.79
39	E	Remediation services and other waste management services	0.27
41-43	F	Buildings and building construction works	0.37
45	G	Wholesale and retail trade and repair services of motor vehicles and motorcycles	0.18
46	G	Wholesale trade services, except of motor vehicles and motorcycles	0.27
47	G	Retail trade services, except of motor vehicles and motorcycles	0.24
49.1-2	H	Rail transport	0.43
49.3-5	H	Land transport services and transport services via pipelines, excluding rail transport	0.81
50	H	Water transport services	1.55
51	H	Air transport services	7.98
52	H	Warehousing and support services for transportation	0.28
53	H	Postal and courier services	0.40
55	I	Accommodation services	0.37
56	I	Food and beverage serving services	0.40
58	J	Publishing services	0.23
59-60	J	Motion picture, video and television programme production services, sound recording and music publishing	0.11
61	J	Telecommunications services	0.32
62	J	Computer programming, consultancy, and related services	0.18
63	J	Information services	0.18
64	K	Financial services, except insurance and pension funding	0.15
65.1-2	K	Insurance & Reinsurance	0.18

66	K	Services auxiliary to financial services and insurance services	0.15
68.1-2	L	Buying and selling of own real estate: renting and operating of own or leased real estate, excluding imputed rent	0.13
68.2IMP	L	Owner-Occupiers' Housing Services	0.11
68.3	L	Real estate activities on a fee or contract basis	0.07
69.1	M	Legal activities	0.10
69.2	M	Accounting, bookkeeping, and auditing activities: tax consultancy	0.12
70	M	Services of head offices; management consulting services	0.13
71	M	Architectural and engineering services; technical testing and analysis services	0.12
72	M	Scientific research and development services	0.24
73	M	Advertising and market research services	0.20
74	M	Other professional, scientific and technical services	0.08
75	M	Veterinary services	0.20
77	N	Rental and leasing services	0.15
78	N	Employment services	0.14
79	N	Travel agency, tour operator and other reservation services and related services	0.08
80	N	Security and investigation services	0.16
81	N	Services to buildings and landscape	0.25
82	N	Office administrative, office support and other business support services	0.13
84	O	Public administration and defence; Compulsory social security	0.22
85	P	Education services	0.11
86	Q	Human health services	0.20
87-88	Q	Residential care services	0.39
90	R	Creative, arts and entertainment services	0.24
91	R	Library, archive, museum and other cultural services	0.25
92	R	Gambling and betting services	0.17
93	R	Sporting services and amusement and recreation services	0.29
94	S	Services furnished by membership organisations	0.15
95	S	Repair services of computers and personal and household goods	0.15
96	S	Other personal services	0.27
97	T	Services of households as employers of domestic personnel	0.04

**Table 12** UK 2018 consumption emission factors for GHG and CO<sub>2</sub> in kg CO<sub>2</sub>e and kg CO<sub>2</sub> per pound categorised by COICOP (classification of individual consumption according to purpose). These data are no longer available since the UK carbon footprint update in June 2022. The 2019 updated version of UK consumption emission factors categorised by COICOP contains less categories than the 2018 version, many have been consolidated e.g. beef, lamb, poultry, bacon and ham, sausages and offal are now combined and categorised singularly as meat. Data is published as a full set spanning 1990-2019 and so backdated years are now categorised using the combined 2019 COICOP categories.

COICOP categories	GHG (kg CO <sub>2</sub> e per £)	CO <sub>2</sub> (kg CO <sub>2</sub> per £)
1.1.1.1 Rice	0.154	0.100
1.1.1.2 Bread	0.154	0.100
1.1.1.3 Other breads and cereals	0.154	0.100
1.1.2 Pasta products	0.154	0.100
1.1.3.1 Buns, crispbread and biscuits	0.676	0.387
1.1.3.2 Cakes and puddings	0.676	0.387
1.1.4 Pastry (savoury)	1.134	0.574
1.1.5 Beef (fresh, chilled or frozen)	2.471	0.603
1.1.6 Pork (fresh, chilled or frozen)	2.471	0.603
1.1.7 Lamb (fresh, chilled or frozen)	2.471	0.603
1.1.8 Poultry (fresh, chilled or frozen)	2.471	0.603
1.1.9 Bacon and ham	2.471	0.603
1.1.10.1 Sausages	2.471	0.603
1.1.10.2 Offal, pate etc	2.471	0.603
1.1.10.3 Other preserved or processed meat and meat preparations	2.471	0.603
1.1.10.4 Other fresh, chilled or frozen edible meat	2.471	0.603
1.1.11.1 Fish (fresh, chilled or frozen)	0.170	0.212
1.1.11.2 Seafood, dried, smoked or salted fish	0.170	0.212
1.1.11.3 Other preserved or processed fish and seafood	0.170	0.212
1.1.12.1 Whole milk	0.454	0.169
1.1.12.2 Low fat milk	0.454	0.169
1.1.12.3 Preserved milk	0.454	0.169
1.1.13 Cheese and curd	0.454	0.169
1.1.14 Eggs	0.454	0.169
1.1.15.1 Other milk products	0.454	0.169
1.1.15.2 Yoghurt	0.454	0.169
1.1.16 Butter	0.454	0.169
1.1.17 Margarine and other vegetable fats and peanut butter	0.454	0.169
1.1.18.1 Olive oil	0.643	0.248
1.1.18.2 Edible oils and other animal fats	0.643	0.248
1.1.19.1 Citrus fruits	0.072	0.137
1.1.19.2 Bananas	0.072	0.137
1.1.19.3 Apples	0.072	0.137
1.1.19.4 Pears	0.072	0.137
1.1.19.5 Stone fruits	0.072	0.137
1.1.19.6 Berries	0.072	0.137
1.1.20 Other fresh, chilled or frozen fruits	0.072	0.137
1.1.21 Dried fruit and nuts	0.072	0.137
1.1.22 Preserved fruit and fruit based products	0.072	0.137
1.1.23.1 Leaf and stem vegetables	0.072	0.137

1.1.23.2 Cabbages	0.072	0.137
1.1.23.3 Vegetables grown for their fruit	0.072	0.137
1.1.23.4 Root crops, non starchy bulbs and mushrooms	0.072	0.137
1.1.24 Dried vegetables	0.072	0.137
1.1.25 Other prepared or processed vegetables	0.072	0.137
1.1.26 Potatoes	0.072	0.137
1.1.27 Other tubers and products of tuber vegetables	0.072	0.137
1.1.28.1 Sugar	0.458	0.187
1.1.28.2 Other sugar products	0.458	0.187
1.1.29 Jams and marmalades	0.458	0.187
1.1.30 Chocolate	0.458	0.187
1.1.31 Confectionery products	0.458	0.187
1.1.32 Edible ices and ice cream	0.458	0.187
1.1.33.1 Sauces, condiments	0.458	0.187
1.1.33.2 Bakers yeast, dessert preparations, soups	0.458	0.187
1.1.33.3 Salt, spices, herbs and other food products	0.458	0.187
1.2.1 Coffee	0.397	0.171
1.2.2 Tea	0.397	0.171
1.2.3 Cocoa and powdered chocolate	0.397	0.171
1.2.4 Fruit and vegetable juices	0.208	0.391
1.2.5 Mineral or spring waters	0.397	0.171
1.2.6 Soft drinks	0.261	0.186
2.1.1 Spirits and liqueurs	0.080	0.039
2.1.2.1 Wine from grape or other fruit	0.080	0.039
2.1.2.2 Fortified wine	0.080	0.039
2.1.2.3 Champagne and sparkling wines	0.080	0.039
2.1.3.1 Beer and lager	0.080	0.039
2.1.3.2 Ciders and Perry	0.080	0.039
2.1.4 Alcopops	0.080	0.039
2.2.1 Cigarettes	0.061	0.031
2.2.2.1 Cigars	0.061	0.031
2.2.2.2 Other tobacco	0.061	0.031
3.1.1 Mens outer garments	0.278	0.206
3.1.2 Mens under garments	0.278	0.206
3.1.3 Womens outer garments	0.278	0.206
3.1.4 Womens under garments	0.278	0.206
3.1.5 Boys outer garments	0.278	0.206
3.1.6 Girls outer garments	0.278	0.206
3.1.7 Infants outer garments	0.278	0.206
3.1.8 Childrens under garments	0.278	0.206
3.1.9.1 Mens accessories	0.126	0.096
3.1.9.2 Womens accessories	0.126	0.096
3.1.9.3 Childrens accessories	0.126	0.096
3.1.9.4 Protective head gear	0.126	0.096
3.1.10 Habershery, clothing materials and clothing hire	3.071	2.197
3.1.11.1 Dry cleaners and dyeing	0.192	0.214
3.1.11.2 Laundry, laundrettes	0.192	0.214
3.2.1 Footwear for men	0.311	0.241
3.2.2 Footwear for women	0.311	0.241

3.2.3 Footwear for children and infants	0.311	0.241
3.2.4 Repair and hire of footwear	0.416	0.326
4.1.1 Actual rentals	0.162	0.132
4.1.2 Imputed rent	3.993	3.819
4.2.1 Central heating repairs	0.001	0.001
4.2.2 House maintenance	0.099	0.068
4.2.3 Paint, wallpaper, timber	0.088	0.058
4.2.4 Equipment hire, small materials	0.099	0.068
4.3.1 Water charges	0.310	0.126
4.3.2 Other regular houseing payments incl service charge for rent	0.310	0.126
4.3.3 Refuse collection including skip hire	0.310	0.126
4.4.1 Electricity	2.249	2.332
4.4.2 Gas	6.966	6.749
4.4.3.1 Coal and coke	0.528	0.382
4.4.3.2 Oil for central heating	0.528	0.382
4.4.3.3 Paraffin, weed, peat, hot water etc	0.528	0.382
5.1.1.1 Furniture	0.183	0.162
5.1.1.2 Fancy/decorative goods	0.436	0.356
5.1.1.3 Garden furniture	0.183	0.162
5.1.2.1 Soft floor coverings	0.263	0.203
5.1.2.2 Hard floor coverings	0.011	0.010
5.2.1 Bedroom textiles including duvets and pillows	0.979	0.791
5.2.2 Other household textiles, including cushions,towells, curtains	0.979	0.791
5.3.1 Gas cookers	0.151	0.099
5.3.2 Electric cookers, combined gas/electric cookers	0.151	0.099
5.3.3 Clothes washing machines and clothes drying machines	0.151	0.099
5.3.4 Refridgerators, freezers and fridge freezers	0.151	0.099
5.3.5 Other major electrical appliances e.g. dish washers, microaves, vacuum cleaners, heaters	0.151	0.099
5.3.6 Fire extinguishers	0.151	0.099
5.3.7 Small electric household appliances	0.151	0.099
5.3.8 Spare parts for appliances and repairs	0.357	0.180
5.3.9 Rental/hire of major hhold appliances	0.357	0.180
5.4.1 Glassware, china, pottery, cutlery and silverware	1.239	0.993
5.4.2 Kitchen and domestic utensils	1.239	0.993
5.4.3 Repair of glassware, tableware and household utensils	-00	0.993
5.4.4 Storage and other durable household articles	1.239	0.993
5.5.1 Electrical tools	0.116	0.099
5.5.2 Garden tools, equipment and accessories	0.116	0.099
5.5.3 Small tools	0.116	0.099
5.5.4 Door, electrical and other fittings	0.116	0.099
5.5.5 Electrical consumables	0.116	0.099
5.6.1.1 Detergents, washing-up liquid, washing powder	0.083	0.062
5.6.1.2 Disinfectants, polishes, other cleaning materials, some pest controls	0.083	0.062
5.6.2.1 Kitchen disposibles	0.091	0.068
5.6.2.2 Household hardware and appliances, matches	0.091	0.068
5.6.2.3 Kitchen gloves, cloths etc	0.091	0.068
5.6.2.4 Pins, needles, tape measures, nails, nuts and bolts	0.083	0.062

5.6.3.1 Domestic services including cleaners, gardeners, au pairs	0.031	0.025
5.6.3.2 Carpet cleaning , ironing service and window cleaner	0.031	0.025
5.6.3.3 Hire/repair of household furniture and furnishings	0.031	0.025
6.1.1.1 NHS prescription charges and payments	2.548	1.895
6.1.1.2 Medicines and medical goods (not NHS)	2.080	1.562
6.1.1.3 Other medical products	2.080	1.562
6.1.1.4 Non-optical appliances and equipment	2.080	1.562
6.1.2.1 Purchase of spectacles, lenses, prescription sunglasses	0.255	0.201
6.1.2.2 Accessories/repairs to spectacles/lenses	0.255	0.201
6.2.1.1 NHS medical, optical, dental and medical auxiliary services	0.297	0.258
6.2.1.2 Private medical, optical, dental and auxiliary services	0.297	0.258
6.2.1.3 Other services	-00	0.258
6.2.2 In-patient hospital services	0.297	0.258
7.1.1.1 New cars/vans outright purchase	0.260	0.185
7.1.1.2 New cars/vans loan/HP purchase	0.260	0.185
7.1.2.1 Secondhand cars/vans outright purchase	0.260	0.185
7.1.2.2 Secondhand cars/vans loan/HP purchase	0.260	0.185
7.1.3.1 Outright purchase of new or secondhand motorcycles	0.197	0.121
7.1.3.2 Loan/HP purchase of new or secondhand motor cycles	0.197	0.121
7.1.3.3 Purchase of bicycles and other vehicles	0.197	0.121
7.2.1.1 Car/van accessories and fittings	0.111	0.094
7.2.1.2 Car/van spare parts	0.111	0.094
7.2.1.3 Motorcycle accessories and spare parts	0.111	0.094
7.2.1.4 Bicycle accessories and spare parts	0.111	0.094
7.2.2.1 Petrol	4.390	4.237
7.2.2.2 Diesel oil	0.918	0.576
7.2.2.3 Other motor oils	0.918	0.576
7.2.3.1 Car or van repairs, servicing and other work	0.561	0.457
7.2.3.2 Motor cycle repairs and servicing	0.561	0.457
7.2.4.1 Motoring organisation subscription	0.491	0.396
7.2.4.2 Garage rent other costs, car washing	0.491	0.396
7.2.4.3 Parking fees, tolls and permits	0.491	0.396
7.2.4.4 Driving lessons	0.512	0.413
7.2.4.5 Anti-freeze, battery water, cleaning materials	0.498	0.401
7.3.1.1 Rail and tube season tickets	0.505	0.488
7.3.1.2 Rail and tube other than season tickets	0.505	0.488
7.3.2.1 Bus and coach season tickets	0.705	0.682
7.3.2.2 Bus and coach other than season tickets	0.705	0.682
7.3.3.1 Combined fares other than season tickets	9.496	7.663
7.3.3.2 Combined fares season tickets	9.496	7.663
7.3.4.1 Air fares within UK	0.895	0.910
7.3.4.2 Air fares international	0.895	0.910
7.3.4.3 School travel	1.191	1.153
7.3.4.4 Taxis and hired cars with drivers	0.705	0.682
7.3.4.5 Other personal travel and transport services	10.371	8.557
7.3.4.6 Hire of self drive cars, vans, bicycles	0.705	0.682
7.3.4.7 Car leasing	0.705	0.682
7.3.4.8 Water travel, ferries and season tickets	8.325	6.526
8.1 Postal services	0.481	0.326

8.2.1 Telephone purchase	0.283	0.190
8.2.2 Mobile phone purchase	0.283	0.190
8.2.3 Answering machine, fax machine purchase	0.283	0.190
8.3.1 Telephone account	0.174	0.091
8.3.2 Telephone coin and other payments	0.174	0.091
8.3.3 Mobile phone account	0.174	0.091
8.3.4 Mobile phone othr apyments	0.174	0.091
8.4 Internet subscription fees	0.174	0.091
9.1.1.1 Audio equipment, CD players incl. in car	0.760	0.583
9.1.1.2 Audio accessories e.g. tapes, CDs, headphones	0.760	0.583
9.1.2.1 Purchase of TV and digital decoder	0.760	0.583
9.1.2.2 Satellite dish purchase and installation	0.760	0.583
9.1.2.3 Cable TV connection	0.760	0.583
9.1.2.4 Video recorder	-00	-00
9.1.2.5 DVD player/recorder	0.760	0.583
9.1.2.6 Blank, pre-recorded video cassettes and DVDs	0.760	0.583
9.1.2.7 Personal computers, printers and calculators	0.760	0.583
9.1.2.8 Spare parts for TV, video, audio	0.760	0.583
9.1.2.9 Repare of AV	0.760	0.583
9.1.3.1 Photographic and cine equipment	0.948	0.614
9.1.3.2 Camera films	0.948	0.614
9.1.3.3 Optical instruments, binoculars, telescopes	0.948	0.614
9.2.1 Purchase of boats, trailers and horses	1.602	0.752
9.2.2 Purchase of caravans, mobile homes	0.999	0.672
9.2.3 Accessoris for boats, horses, caravans and motorhomes	0.999	0.672
9.2.4 Musical instruments	0.030	0.020
9.2.5 Major durables for indoor recreation	0.999	0.672
9.2.6 Maintenance and repair or other major durables for recreation and culture	0.999	0.672
9.2.7 Purchase of motor caravan - outright purchase	0.999	0.672
9.2.8 Purchase of motor caravan - loan/HP	-00	0.672
9.3.1 Games, toys and hobbies	0.432	0.335
9.3.2.1 Computer software and games cartridges	1.502	1.048
9.3.2.2 Console computer games	1.502	1.048
9.3.3 Equipment for sport, camping and open-air recreation	0.432	0.335
9.3.4.1 BBQ and swings	0.410	0.318
9.3.4.2 Plants, flowers, seeds, fertiliers, insecticides	1.199	0.537
9.3.4.3 Garden decorative	0.406	0.361
9.3.4.4 Artificial flowers, pot pourri	0.406	0.361
9.3.5.1 Pet food	1.246	0.380
9.3.5.2 Pet purchase and accessories	0.920	0.279
9.3.5.3 Vetinary and other services for pets	0.574	0.300
9.4.1.1 Spectator sports - admission charges	0.151	0.101
9.4.1.2 Participant sports	0.151	0.101
9.4.1.3 Subscriotions to sorts and social clubs	0.151	0.101
9.4.1.4 Hire of equipment for sport	0.151	0.101
9.4.1.5 Leisure class fees	0.151	0.101
9.4.2.1 Cinemas	0.241	0.156
9.4.2.2 Live entertainment, theatre, concerts, shows	0.241	0.156

9.4.2.3 Museums, zoological gardens, theme parks	0.241	0.156
9.4.3.1 TV licences	0.241	0.156
9.4.3.2 Satellite subscriptions	0.241	0.156
9.4.3.3 Rent for TV/Satellite/VCR	0.241	0.156
9.4.3.4 Cable subscriptions	0.241	0.156
9.4.3.5 TV slot meter payments	0.241	0.156
9.4.3.6 Video, cassette and CD hire	0.241	0.156
9.4.4.1 Admissions to clubs, dances. Discos, bingo	0.423	0.329
9.4.4.2 Social events and gatherings	0.423	0.329
9.4.4.3 Subscriptions for leisure activities	0.423	0.329
9.4.5 Development of film, photos	0.045	0.029
9.4.6.1 Football pools stakes	0.351	0.237
9.4.6.2 Bingo stakes	0.351	0.237
9.4.6.3 Lottery	0.351	0.237
9.4.6.4 Bookmaker, tote, other betting stakes	0.351	0.237
9.5.1 Books	0.186	0.136
9.5.2 Diaries, address books, cards etc	0.186	0.136
9.5.3 Cards, calendars, posters and other printed matter	0.186	0.136
9.5.4 Newspapers	0.186	0.136
9.5.5 Magazines and periodicals	0.186	0.136
10.1 Education	0.297	0.153
10.2 Educational trips	0.297	0.153
11.1.1 Restaurant and café meals	0.430	0.296
11.1.2 Alcoholic beverages	0.430	0.296
11.1.3 Takeaway meals	0.430	0.296
11.1.4.1 Hot food and cold food	0.430	0.296
11.1.4.2 Confectionery	0.430	0.296
11.1.4.3 Ice cream	0.430	0.296
11.1.4.4 Soft drink	0.430	0.296
11.1.5 Contract catering	0.430	0.296
11.1.6.1 School meals	0.430	0.296
11.1.6.2 Meals bought in workplace	0.430	0.296
11.2.1 Holiday in the UK	0.425	0.266
11.2.2 Holiday abroad	0.425	0.266
11.2.3 Room hire	0.425	0.266
12.1.1 Hairdressing, beauty treatment	0.314	0.250
12.1.2 Toilet paper	0.831	0.730
12.1.3.1 Toiletries	0.123	0.086
12.1.3.2 Bar of soap, liquid soap, shower gel	0.123	0.086
12.1.3.3 Toilet requisites	0.123	0.086
12.1.4 Baby toiletries and accessories	0.123	0.086
12.1.5.1 Hair products	0.123	0.086
12.1.5.2 Cosmetics and related accessories	0.123	0.086
12.1.5.3 Electrical appliances for personal care	0.123	0.086
12.2.1.1 Jewellery clocks and watches and other personal effects	0.335	0.271
12.2.1.2 Leather and travel goods	0.335	0.271
12.2.1.3 Sunglasses	0.335	0.271
12.2.2.1 Baby equipment	0.335	0.271
12.2.2.2 Prams, pram accessories	0.335	0.271

12.2.2.3 Repairs to personal goods	0.335	0.271
12.3.1.1 Residential homes	0.432	0.288
12.3.1.2 Home help	0.432	0.288
12.3.1.3 Nursery, creche, playschools	0.432	0.288
12.3.1.4 Child care payments	0.432	0.288
12.4.1.1 Structure insurance	0.143	0.124
12.4.1.2 Contents insurance	0.143	0.124
12.4.1.3 Insurance for household items	0.143	-00
12.4.2 Medical insurance premiums	0.143	0.124
12.4.3.1 Vehicle insurance	0.143	0.124
12.4.3.2 Boat insurance	0.143	0.124
12.4.4 Non package holiday, other travel insurance	0.143	0.124
12.5.1.1 Moving and storage of furniture	0.011	0.007
12.5.1.2 Property transaction - purchase and sale	0.011	0.007
12.5.1.3 Property transaction - sale only	0.011	0.007
12.5.1.4 Property transaction - purchase only	0.011	0.007
12.5.1.5 Property transaction - other payments	0.011	0.007
12.5.2.1 Bank building society fees	0.001	0.001
12.5.2.2 Bank and post office counter charges	0.001	0.001
12.5.2.3 Credit card fees	-00	-00
12.5.3.1 Other professional fees	2.792	3.024
12.5.3.2 Legal fees	2.792	3.024
12.5.3.3 Funeral expenses	2.792	3.024
12.5.3.4 TU and professional organisations	2.792	3.024
12.5.3.5 Other payments for services	2.792	3.024

**Table 13** England-specific indirect supply chain 2019 GHG (kg CO<sub>2</sub>e/£) and CO<sub>2</sub> (kg CO<sub>2</sub>/£) emission factors (also referred to as 'multipliers') by SIC code from the [UK carbon footprint webpage](#) published by DEFRA (2022).

SIC code	SIC category	GHG (kg CO <sub>2</sub> e per £)	CO <sub>2</sub> (kg CO <sub>2</sub> per £)
01	Products of agriculture, hunting and related services	2.189	0.463
02	Products of forestry, logging and related services	0.282	0.164
03	Fish and other fishing products; aquaculture products; support services to fishing	0.659	0.500
05	Coal and lignite	1.883	0.657
06	Crude petroleum and natural gas	0.868	0.697
08	Other mining and quarrying products	0.692	0.491
09	Mining support services	0.409	0.248
10.1	Preserved meat and meat products	0.766	0.300
10.2 -3	Processed and preserved fish, crustaceans, molluscs, fruit and vegetables	0.680	0.363
10.4	Vegetable and animal oils and fats	0.983	0.429
10.5	Dairy products	0.874	0.358
10.6	Grain mill products, starches and starch products	0.824	0.458
10.7	Bakery and farinaceous products	0.582	0.307
10.8	Other food products	0.696	0.304

10.9	Prepared animal feeds	0.747	0.321
11.01-6	Alcoholic beverages	0.745	0.350
11.07	Soft drinks	0.495	0.262
12	Tobacco products	0.705	0.325
13	Textiles	0.869	0.620
14	Wearing apparel	0.782	0.568
15	Leather and related products	0.739	0.476
16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	0.553	0.442
17	Paper and paper products	0.698	0.534
18	Printing and recording services	0.418	0.313
19	Coke and refined petroleum products	1.908	1.128
20.3	Paints, varnishes and similar coatings, printing ink and mastics	1.151	0.759
20.4	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	0.568	0.387
20.5	Other chemical products	0.818	0.577
20A	Industrial gases, inorganics and fertilisers (all inorganic chemicals) - 20.11/13/15	1.307	0.926
20B	Petrochemicals - 20.14/16/17/60	1.134	0.940
20C	Dyestuffs, agro-chemicals - 20.12/20	1.005	0.742
21	Basic pharmaceutical products and pharmaceutical preparations	0.514	0.343
22	Rubber and plastic products	0.589	0.425
23.5-6	Cement, lime, plaster and articles of concrete, cement and plaster	1.465	1.388
23OTHER	Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products - 23.1-4/7-9	1.395	1.185
24.1-3	Basic iron and steel	1.659	1.453
24.4-5	Other basic metals and casting	1.155	0.844
25.4	Weapons and ammunition	0.544	0.441
25OTHER	Fabricated metal products, excl. machinery and equipment and weapons & ammunition - 25.1-3/25.5-9	0.515	0.425
26	Computer, electronic and optical products	0.468	0.380
27	Electrical equipment	0.534	0.435
28	Machinery and equipment n.e.c.	0.448	0.361
29	Motor vehicles, trailers and semi-trailers	0.366	0.293
30.1	Ships and boats	0.292	0.243
30.3	Air and spacecraft and related machinery	0.414	0.341
30OTHER	Other transport equipment - 30.2/4/9	0.303	0.251
31	Furniture	0.563	0.460
32	Other manufactured goods	0.725	0.570
33.15	Repair and maintenance of ships and boats	0.359	0.296
33.16	Repair and maintenance of aircraft and spacecraft	0.432	0.355
33OTHER	Rest of repair; Installation - 33.11-14/17/19/20	0.190	0.149
35.1	Electricity, transmission and distribution	1.774	1.536
35.2-3	Gas; distribution of gaseous fuels through mains; steam and air conditioning supply	1.403	1.095
36	Natural water; water treatment and supply services	0.215	0.182

37	Sewerage services; sewage sludge	0.388	0.083
38	Waste collection, treatment and disposal services; materials recovery services	1.427	0.294
39	Remediation services and other waste management services	3.425	0.512
41.2	Buildings and building construction works	0.240	0.200
42.1-2	Constructions and construction works for civil engineering	0.306	0.268
42.99	Specialised construction works	0.238	0.203
45	Wholesale and retail trade and repair services of motor vehicles and motorcycles	0.155	0.125
46	Wholesale trade services, except of motor vehicles and motorcycles	0.377	0.264
47	Retail trade services, except of motor vehicles and motorcycles	0.197	0.154
49.1-2	Rail transport services	0.325	0.283
49.3-5	Land transport services and transport services via pipelines, excluding rail transport	0.518	0.447
50	Water transport services	1.672	1.612
51	Air transport services	1.669	1.549
52	Warehousing and support services for transportation	0.181	0.138
53	Postal and courier services	0.178	0.148
55	Accommodation services	0.247	0.147
56	Food and beverage serving services	0.241	0.155
58	Publishing services	0.091	0.070
59	Motion picture, video and TV programme production services, sound recording & music publishing	0.095	0.073
60	Programming and broadcasting services	0.083	0.063
61	Telecommunications services	0.110	0.087
62	Computer programming, consultancy and related services	0.100	0.077
63	Information services	0.164	0.131
64	Financial services, except insurance and pension funding	0.070	0.055
65.1-2	Insurance and reinsurance services, except compulsory social security	0.068	0.053
66	Services auxiliary to financial services and insurance services	0.059	0.046
68.12	Real estate services, excluding on a fee or contract basis and imputed rent	0.087	0.065
68.2IMP	Owner-Occupiers' Housing Services	0.027	0.022
68.3	Real estate services on a fee or contract basis	0.077	0.063
69.1	Legal services	0.043	0.032
69.2	Accounting, bookkeeping and auditing services; tax consulting services	0.145	0.113
70	Services of head offices; management consulting services	0.104	0.082
71	Architectural and engineering services; technical testing and analysis services	0.157	0.120
72	Scientific research and development services	0.157	0.122
73	Advertising and market research services	0.104	0.081
74	Other professional, scientific and technical services	0.149	0.111
75	Veterinary services	0.066	0.051
77	Rental and leasing services	0.115	0.090
78	Employment services	0.133	0.104

79	Travel agency, tour operator and other reservation services and related services	0.117	0.093
80	Security and investigation services	0.103	0.082
81	Services to buildings and landscape	0.142	0.113
82	Office administrative, office support and other business support services	0.129	0.100
84	Public administration and defence services; compulsory social security services	0.120	0.094
85	Education services	0.067	0.053
86	Human health services	0.151	0.106
87	Residential care services	0.131	0.094
88	Social work services without accommodation	0.108	0.080
90	Creative, arts and entertainment services	0.094	0.071
91	Libraries, archives, museums and other cultural services	0.123	0.093
92	Gambling and betting services	0.099	0.071
93	Sports services and amusement and recreation services	0.155	0.114
94	Services furnished by membership organisations	0.096	0.073
95	Repair services of computers and personal and household goods	0.095	0.070
96	Other personal services	0.070	0.055
97	Services of households as employers of domestic personnel	0.054	0.042

**Table 14** England-specific 2019 consumption emission factors for GHG and CO<sub>2</sub> in kg CO<sub>2</sub>e and kg CO<sub>2</sub> per pound categorised by COICOP (classification of individual consumption according to purpose) from the [UK carbon footprint webpage](#) published by DEFRA (2022).

COICOP categories	GHG (kg CO <sub>2</sub> e per £)	CO <sub>2</sub> (kg CO <sub>2</sub> per £)
1.1.1 Bread and cereals	0.720	0.360
1.1.2 Meat	2.464	0.633
1.1.3 Fish and seafood	0.209	0.140
1.1.4 Milk, cheese and eggs	0.656	0.268
1.1.5 Oils and fats	0.232	0.101
1.1.6 Fruit	0.079	0.042
1.1.7 Vegetables	0.079	0.042
1.1.8 Sugar, jam, honey, chocolate and confectionery	0.253	0.110
1.1.9 Food products n.e.c.	0.253	0.110
1.2.1 Coffee, tea and cocoa	0.125	0.055
1.2.2 Mineral waters, soft drinks, fruit and vegetable juices	0.436	0.220
2.1.1 Spirits	0.148	0.070
2.1.2 Wine	0.148	0.070
2.1.3 Beer	0.148	0.070
2.2.1 Tobacco	0.056	0.026
3.1.1 Clothing materials	1.203	0.855
3.1.2 Garments	0.284	0.206
3.1.3 Other articles of clothing and clothing accessories	1.669	1.204
3.1.4 Cleaning, repair and hire of clothing	0.030	0.023
3.2.1 Shoes and other footwear	0.351	0.226

3.2.2 Repair and hire of footwear	0.501	0.337
4.1.1 Actual rentals paid by tenants	0.168	0.126
4.1.2 Other actual rentals	0.168	0.126
4.2.1 Imputed rentals of owner occupiers	0.168	0.126
4.3.1 Materials for the mainenance and repair of the dwelling	0.112	0.086
4.3.2 Other services for the maintenance and repair of the dwelling	0.112	0.086
4.4.1 Water supply	0.274	0.117
4.4.2 Refuse collection	0.274	0.117
4.4.3 Sewage collection	0.274	0.117
4.4.4 Other services relating to the dwelling n.e.c.	0.274	0.117
4.5.1 Electricity	2.876	2.490
4.5.2 Gas	10.392	9.497
4.5.3 Liquid fuels	0.704	0.387
4.5.4 Solid fuels	0.704	0.387
5.1.1 Furniture and furnishings	0.250	0.203
5.1.2 Carpets and other floor coverings	0.516	0.368
5.1.3 Repair of furniture, furnishings and floor coverings	0.829	0.615
5.2.1 Household textiles	1.090	0.774
5.3.1 Major household appliances whether electric or not	0.213	0.174
5.3.2 Small electric household appliances	0.213	0.174
5.3.3 Repair of household appliances	0.386	0.301
5.4.1 Glassware,tableware and household utensils	1.341	1.128
5.5.1 Major tools and equipment	0.140	0.110
5.5.2 Small tools and miscellaneous accessories	0.140	0.110
5.6.1 Non-durable household goods	0.127	0.090
5.6.2 Domestic services and household services	0.060	0.047
6.1.1 Pharmaceutical products	1.948	1.310
6.1.2 Other medical products	1.948	1.310
6.1.3 Therapeutic appliances and equipment	0.181	0.145
6.2.1 Medical services	0.218	0.153
6.2.2 Dental services	0.218	0.153
6.2.3 Paramedical services	0.218	0.153
6.3.1 Hospital services	3.978	2.798
7.1.1 Motor cars	0.290	0.232
7.1.2 Motor cycles	0.145	0.119
7.1.3 Bicycles	0.145	0.119
7.2.1 Spare parts and accessories for personal transport equipment	0.113	0.087
7.2.2 Fuels and lubricants for personal transport equipment	3.112	2.665
7.2.3 Maintenance and repair of personal transport equipment	0.619	0.495
7.2.4 Other services in respect of personal transport equipment	0.565	0.453
7.3.1 Passenger transport by railway	0.589	0.512
7.3.2 Passenger transport by road	2.047	1.762
7.3.3 Passenger transport by air	1.283	1.187
7.3.4 Passenger trasnport by sea and inland waterway	15.080	14.541
7.3.5 Combined passenger transport	17.668	16.776
7.3.6 Other purchased transport services	0.849	0.656
8.1.1 Postal services	0.504	0.419
8.2.1 Telephone and telefax equipment	0.726	0.589
8.3.1 Telephone and telefax services	0.231	0.183

9.1.1 Equipment for the reception, recording and reproduction of sound and pictures	0.712	0.570
9.1.2 Photographic and cinematographic equipment	0.596	0.479
9.1.3 Information processing equipment	0.596	0.479
9.1.4 Recording media	0.743	0.591
9.1.5 Repair of audio-visual, photographic and information processing equipment	0.596	0.479
9.2.1 Major durables for outdoor recreation	1.624	1.216
9.2.2 Musical instruments and major durables for indoor recreation	1.354	1.097
9.2.3 Maintenance and repair of other durables for recreation and culture	2.249	1.834
9.3.1 Games, toys and hobbies	0.566	0.429
9.3.2 Equipment for sport, camping and open-air recreation	1.835	0.795
9.3.3 Gardens, plants and flowers	0.239	0.180
9.3.4 Pets and related products	1.539	0.454
9.3.5 Veterinary and other services for pets	0.487	0.232
9.4.1 Recreational and sporting services	0.139	0.103
9.4.2 Cultural services	0.293	0.220
9.4.3 Games of chance	0.359	0.257
9.5.1 Books	0.159	0.117
9.5.2 Newspapers and periodicals	0.159	0.117
9.5.3 Miscellaneous printed matter	0.159	0.117
9.5.4 Stationery and drawing materials	0.159	0.117
10.1.1 Pre-primary and primary education	0.338	0.266
10.2.1 Secondary education	0.338	0.266
10.3.1 Post-secondary non-tertiary education	0.338	0.266
10.4.1 Tertiary education	0.338	0.266
10.5.1 Education not definable by level	0.338	0.266
11.1.1 Restaurants, cafes and the like	0.485	0.311
11.1.2 Canteens	0.485	0.311
11.2.1 Accommodation services	0.460	0.283
12.1.1 Hairdressing salons and personal grooming establishments	0.231	0.175
12.1.2 Electrical appliances for personal care	0.231	0.175
12.1.3 Other appliances, articles and products for personal care	0.231	0.175
12.3.1 Jewellery, clocks and watches	0.231	0.175
12.3.2 Other personal effects	0.231	0.175
12.4.1 Social protection	0.379	0.292
12.5.1 Life insurance	0.379	0.292
12.5.2 Insurance connected with the dwelling	0.379	0.292
12.5.3 Insurance connected with health	0.379	0.292
12.5.4 Insurance connected with transport	0.379	0.292
12.5.5 Other insurance	0.379	0.292
12.6.2 Other financial services n.e.c.	0.379	0.292
12.7.1 Other services n.e.c.	0.379	0.292

