CIRCULAR ECONOMY CARBON TOOL
Feasibility Study – Summary Report

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November 2023

Executive Summary

In 2019, the UK introduced new targets to bring all Greenhouse Gas emissions to net zero by 2050. Scotland has set a more ambitious target of becoming net zero by 2045. Twenty local authorities across Scotland have declared climate emergencies, underlining the belief that climate change is a serious threat to our planet and that action is required.

Scotland has a diverse community circular economy sector, made up of a range of organisations that facilitate the purchase of second-hand items and provide opportunities for the community to repair and borrow items rather than buy new. In addition, the sector offers a range of community-focused services such as employment and volunteering opportunities, access to affordable items, and opportunities for residents to feel empowered to make planet-friendly choices and feel included within their community regardless of income or skills.

Research commissioned by Zero Waste Scotland in 2021 indicated that approximately 80% of Scotland's carbon footprint arises from the goods, materials and services that are consumed[1].

A review of some of the carbon models utilised by the community circular economy sector indicated that there is currently no one tool that covers reuse, repair and sharing. Engagement with the sector indicated that it was important for any model to have a user- friendly interface and for the calculations and assumptions to be clearly accessible.

Without such a tool it is difficult for the circular community sector to demonstrate the environmental impacts they have as clearly as say green energy or green transport. This in turn means that the charitable resources sector does not attract its share of funding. For this reason the Environmental Funders Network has referred to the waste and resources sector as the "Cinderella issue" of sustainable funding.[2]

The following design principles are considered important to encourage uptake of the carbon tool:

1. Documented Assumptions - The assumptions built into the model should be based on publicly available, peer reviewed data wherever possible. They should be clearly explained for transparency.
2. Simple or Complex - Two options should be provided for advanced and simple data input.
3. Weight or Units - There should be an option for users to input either a weight or number of units to calculate the carbon savings.
4. Aesthetically pleasing - Web-based interface, which is easy to use. Uptake is likely to be lower if data must be put into an Excel spreadsheet for example.
5. Range of Activities - One tool that can be used across the organisation's operations e.g., incorporating reuse, repair, sharing, and to a lesser extent, upcycling and recycling operations.

[1] Everything we buy has a carbon cost | Zero Waste Scotland
[2] Supporting effective environmental action in Scotland | Environmental Funders Network

6. Futureproofing and Adaptability - Model should be capable of being constantly updated e.g. through the future addition of detailed categories e.g. types of clothing or bikes.
7. Future Integration - Maintain the option to be integrated into a till system at a future point in time.
8. Member Validation - Option to be integrated into Circular Communities Scotland's CRM Salesforce for data integration reasons (e.g., so membership status can be validated and to allow comparisons by LA region, sector etc.).
9. Security - The model should be secure to enable an ongoing log/ data tracking.
10. Wider Benefits - Option to integrate social and economic benefits to enable organisations to keep data in one portal and enable sector-wide benefits to be reported.

Reuse organisations process and sell a wide range of items. The model will need to strike a balance between accuracy of output and the practicality of collating data. To overcome this, it is recommended that the tool be based on 'super-categories' of items (further information is given in body of report – Simple and Advanced Data Entry):

- Large Household Appliances
- Small Household Appliances
- IT
- Furniture
- Other
- Bikes
- Textiles
- Wood; and
- Food

The stakeholder engagement indicated that there is support from several organisations for one universally accepted carbon tool, the feeling amongst the sector was that there are clear benefits from collaborating to create a tool and that Circular Communities Scotland appeared to be well positioned to take the research forward as the membership body for the sector. The Circular Communities Scotland Board identified the development of a carbon model as a key project going forward and endorsed exploring potential funding opportunities to take this work forward.

The stakeholder engagement indicated that an accepted carbon model for the sector will help organisations to communicate more effectively with customers, potential funders, and other interested stakeholders such as Local Authorities, the Scottish Government, retailers, manufacturers, and customers.

Indicative costings for a carbon model and associated project have been assessed for a three-year project.

The next steps involve engaging with potential partners and funders to apply for funding to develop a tool and firming up on outline costs.

This report is a brief overview of a more detailed piece of work (over 100 pages). Interested parties can request to see this report by getting in touch with Circular Communities Scotland info@circularcommunities.scot

Background

The benefits of monitoring carbon for the community circular economy sector include a better understanding of the impact of their organisation on the environment, opportunities to lower energy or waste costs, as well as an opportunity to communicate the positive impact of their work.

The community reuse sector has historically focused on reporting tonnages diverted from landfill, however, as Scotland moves towards monitoring carbon as a truer measure of the impacts of goods and services it consumes, it is considered likely that the reuse sector will also need to learn the language of carbon. Many of the organisations active in the sector are small, heavily reliant upon volunteers, and focus on responding to local need. The development of one carbon model for the sector is crucial, to provide consistency and to prevent many different approaches being adopted. One accepted carbon model would enable the sector to communicate more effectively with stakeholders and potentially open-up funding opportunities to drive forward reuse activities on a scale previously unseen in Scotland.

There are fragmented examples of organisations utilising existing carbon calculators to attempt to record their carbon savings. However, no single tool exists for the reuse sector that is universally accepted or certified. Discussions with organisations have highlighted concerns that their calculations may not stand up to scrutiny, with wide ranging assumptions being used within the tools that are currently available.

Th feasibility study explores the appetite for recording carbon savings amongst Circular Communities Scotland's members and carries out research to determine whether there is a suitable carbon tool that could be adopted, or adapted, to meet the needs of the Scottish reuse sector.

The feasibility study carried out the following tasks:

- Membership Consultation: an online workshop was held on the 26th of September 2023 to explore member views in detail. This was followed up by an online survey to all paying members (i.e., those with an annual turnover over £100,000).
- Desktop Research into Existing Tools: a desktop review alongside preliminary stakeholder engagement was carried out with developers of existing carbon tools, focussing on tools currently being used by the community reuse sector.
- Research Potential Partners: the desktop review informed a review of potential partners and funding opportunities to support the further development of a carbon tool.

REUSE, REPAIR AND SHARING LIBRARY CARBON CALCULATOR

Introduction

The following provides example content for a proposed carbon calculator. This 'rough draft' has been developed as an example of how the model could function. It indicates the research that is required to develop the model and recommends research that could be carried out to refine the inherent assumptions to ensure that they are applicable where possible to the sector.

A new tool is proposed for the following reasons:

- There is no one tool that covers reuse, repair and sharing.
- Engagement with the reuse sector indicated that it was important to have a user friendly interface that was not a 'Black Box'.
- Creating a purpose built model provides CCS with the ability to create a carbon tool that doesn't over or under exaggerate carbon savings and carries out research which will enable the assumptions to be amended and updated over time.

There is strong support from a number of organisations to collaborate on a carbon tool, and include Zero Waste Scotland, RREUSE, EPOS providers and several reuse organisations.

A simple and a more detailed model is recommended to take account of the range of organisations that are operating within the reuse sector from small-scale, entirely volunteer run through to larger charities with annual turnovers in excess of £1million.

The recommended approach is to focus on 'super-categories'. The simple model has 9 recommended categories. The detailed model 15. The categories have been selected to cover the items most commonly processed by reuse organisations. A carbon factor will be applied per super category. This approach has been proposed as the alternative is to list indicative items, which is open to error, with individuals making assumptions about where to input items, and data collection becomes more difficult. Some till systems already allow reporting per super-category e.g. KUDOS.

It is recognised that this approach may not be suitable for organisations that focus on just one item e.g. clothes or bikes, where they are likely to be able to provide more detailed data to get a more accurate carbon saving. There will also be a limited number of organisations that are already set up with data collection systems that would enable a more complex approach to carbon modelling than the one proposed. It is recommended that in the longer term further research is undertaken with these organisations to develop the calculations and sense check the proposed model.

Introduction to the Simple Carbon Calculator

The simple calculator is recommended for organisations with an annual turnover of less than £100k or under 5 members of paid staff. This calculator provides a rough estimate of carbon savings based on average data. It will take less than 5 minutes to complete and requires organisations to only collect information on either the total number of items or tonnage of reused/ repaired/ shared.

Data can be input on a monthly, quarterly or annual basis.

Introduction to the Detailed Carbon Calculator

The detailed carbon calculator is recommended for larger organisations (>£100k and with more than 5 members of staff). Depending upon the complexity of the operations the calculator will take between 10 - 30 minutes to complete. It is recommended that the detailed carbon model includes an option to store data on social benefits, with a view to integrating these in the model in the longer-term (subject to funding).

The benefit of having the option to store a range of data that is commonly reported to funders, Board members, customers, etc in one place is seen as a potential incentive to encourage uptake and was indicated within the stakeholder engagement as being of significant interest.

Benchmarking

The detailed carbon model should enable benchmarking against the average for the sector (based on anonymised carbon savings reported by organisations of a similar size (using turnover and number of employees) doing similar work.

Progress

The calculator should be developed so that users can complete it monthly, quarterly or annually. All data should be saved within the organisation's secure interface.

Linking the model into Circular Communities Scotland Salesforce portal would enable clear validation of membership details and status and would enable benchmarking to take place (see report for further details)

Certification of Model

Certification of the model through a University or Zero Waste Scotland, could be considered in order to increase uptake by the sector.

It is recommended that all reference data built into the model is obtained from publicly available peer reviewed sources.
All assumptions and references should be clearly laid out (see examples).

The model should contain links to all primary research, to enable organisations and potential funders to understand the inherent assumptions within the model.

Data Required

The most time consuming part of calculating the carbon savings will be ensuring that organisations collect the right data. The following data is required to complete the detailed model. If this information is not available, it is possible to make a professional estimate, however this should be indicated in the model.

Data required	Data	Estimate
Number/ weight of items reused/ repaired/ shared		
Power usage e.g. electricity/ gas bills		
Business transport - staff and deliveries/ collections (miles per gallon) and number of miles		
Tonnes of waste landfilled (by category)		
Tonnes of waste recycled (by category)		

Accuracy Versus Pragmatism

The carbon calculator aims to strike a balance between the level of accuracy that is required to get a result that can be trusted with the level of work that is required to obtain the input data.

It is impossible to create one model that deals with all of the items processed by a reuse organisation, to overcome this, the model groups items into ‘super categories’.

REUSE Simple Data Input

Does your organisation take part in:

Reuse Repair Sharing

Insert your reporting period:

Month Quarter Annual

Would you like to input weight or number of items reused?

Number Weight

Based on your professional judgement, indicate what percentage of the following categories the reused items have originated from:

Upcycled items

IT

Large Household Appliances

Small Household Appliances

Textiles

Furniture

Bikes (excluding e-bikes)

Bric-a-Brac

Wood

CO2 Saving = XXX. Equivalent to X,Y,Z

REUSE

Detailed Data Input

Does your organisation take part in:

Reuse | Repair | Sharing

If you would like to calculate carbon savings based on the SOURCE of the item (e.g. from a council HWRC site/retailer), select from the following:

all donations (not split by source)

Household donations

Business donations

Collections

Council HWRC

User defined donor

Insert your reporting period:

Month | Quarter | Annual

Select whether you would like to input weight or number of items:

Number | Weight

Indicate the number/weight of items within the following categories. Note for the category 'Other', indicate the main material composition of the item.

Large Furniture (e.g. wardrobe)

Small Furniture (e.g. coffee table)

Sofa

Upcycled

IT

Large Household Appliances

Small Household Appliances

Textiles (including shoes & bags)

Clothing

Bikes (excluding e-bikes)

Other (plastic)

Other (paper)

Other (metal)

Other (glass, ceramics)

Do you have items from other sources to include?

Yes

No

The model will automatically loop back to enable the user to input items based on their source, until all sources have been included.

IF the organisation also has repair/ sharing libraries, the model will also loop through these before going onto the next section.

The next section of the carbon model will take you through the carbon emissions generated by your organisation.

Conversion Factors from:
https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020

Waste & Recycling

Input the following information regarding the waste generated by your organisation:

Item	Units	Recycling	Landfill	Waste to energy	Composting/AD
Batteries	tonnes				
	tonnes				
Scrap metal	tonnes				
Electrical items	tonnes				
	tonnes				
Wood	tonnes				
Glass	tonnes				
Plastics	tonnes				
landfill	tonnes				
Paper/ cardboard	tonnes				
Textiles/ Clothing	tonnes				
Mattresses	tonnes				
Paint	tonnes				
Food wastes	tonnes				

Power

The following information should be available from your utility bills.

Insert the kWh of electricity that your organisation has used within this reporting period:

If you know, insert the percentage of renewable electricity:

Insert the m3 of natural gas used by your organisation:

Transport

How much fuel has your organisation used to cover both deliveries and staff transport?

	Miles per gallon	Distance (miles)
Diesel (van)		
Petrol (van)		
Diesel (car)		
Petrol (car)		
	kWh electricity	
Electric vehicles		

Enter in mileage via public transport for the reporting period:

Train mileage

Bus mileage

Taxi mileage

Carbon equivalent savings/emissions will be reported based on:

- Overarching carbon saving
- Activity (e.g. reuse, sharing, recycling)
- Source of item
- Super category
- Emissions from operational activities

Assumptions for Simple Calculator

- For the simple calculation there will be no requirement for the user to input fuel or waste data. To initially test the model, ZWS have assumed a GWP of a charity shop of 76kg CO2e based on (outdated) research carried out through the Charity Retail Association. It is recommended that this number be updated through organisations using the model or a scaled back survey of small organisations.
- Assumption that the reused item remains in use for ONE year post purchase. This should be updated based on primary research.
- Recommended that the 'ZWS spreadsheet' is used as a starting point for the calculations.
- The embodied carbon of the average item(s) is calculated from cradle to gate.
- Embodied carbon data taken from publicly available, peer reviewed sources where possible (Any exclusions to be listed here).
- References to be listed here.

Methodology: Avoided Emissions

Avoided emissions based on the embodied carbon of the items being reused, which are grouped by super category. This is based on either weight or number of items (if number is used, a weight conversion is needed).

This will either be based on example items within the group or the main material composition of the group, dependent on the research available (Recommended to be based ZWS spreadsheet and expanded).

The GHG emissions avoided through the item not being landfilled or recycled. This is based on either weight or number of items (if a number is used, need a weight conversion). This will either be based on example items within the group or the main material composition of the group, dependent on the research available.

Recommended to base this on DEFRA GHG Reporting Factors (Note: will need to be updated yearly) and ZWS spreadsheet.

The avoided emissions should be multiplied by the DISPLACEMENT FACTOR this will be determined by:

How long the lifespan of the product is extended.

Methodology: Displacement Factor

To calculate product lifespan, two pieces of research are required:

Desktop research to calculate the average length of time a 'supercategory' is likely to be in use for e.g. typical lifespan of a table/ wardrobe/ bed base is X years (and an average taken for the super-category).

Primary research to determine how long someone is likely to use a second-hand item for e.g. if a typical lifespan of a product is X years, how much extra life does a second-hand product have. This is likely to be very variable depending on the category e.g. electronics have a limited lifespan due to operating requirements.

Secondly, research is required to determine the probability that the second-hand purchase displaces a new purchase. Some models have assumed a 100% displacement rate, whereas other models take out impulse purchases for example.

It is anticipated for example that whilst people may impulse buy a new sofa because their one is 'looking tired', they are unlikely to buy multiples due to space constraints.

It is recommended that primary research is carried out to determine purchasing habits and views on second-hand items e.g. is there less value attached to a second hand item which shortens its lifespan.

Methodology: Operational Savings & Emissions

The detailed calculation will subtract operational emissions based on emissions associated with business travel e.g. deliveries and staff transport and waste and recycling tonnages.

It is recommended at the outset that the carbon factors are based on the UK Government GHG Conversions. Recommended that the DEFRA conversion factors are utilised and updated yearly.

Note: The ZWS Reuse Carbon Factors spreadsheet provides estimates for the GWP of refurbishment of items. The source of these estimates is currently uncertain and further discussions should be undertaken to determine the basis of these figures. In the short term it is recommended that refurbishment is not included within reuse because of the relatively small amount of refurbishment compared to direct reuse.

If significant refurbishment of certain items is being carried out by the organisation, it is recommended that these are put through the 'repair' pathway, which will allow for this.

It is recommended that a separate piece of research be carried out on 'upcycled items'.

REPAIR

The format and questions for the simple Repair calculator will be the same as that for Reuse.

Assumptions for Simple Calculator

- For the simple calculation, it is assumed to be a one-off set up e.g. in a hall therefore no operational deductions are required.
- Assumption that the repaired item remains in use for ONE year post repair.
- The recommendation is that the calculation is based loosely on the FARNHAM model, but updated to take into account Scottish characteristics.
- The embodied carbon of the item is calculated from cradle to gate.
- Embodied carbon to be taken from publicly available, peer reviewed sources where possible (Any exclusions to be listed here).

Methodology: Avoided Emissions

It is recommended that the avoided emissions are based on the embodied carbon of the items being repaired. This is based on either weight or number of items (if number is used, need a weight conversion). There are a number of weight conversions, it is recommended that in the short-term the ZWS weight conversions could be utilised as they are based on publicly available data. However, these cover a limited range of items, the ideal scenario would be to utilise the Reuse Networks comprehensive database of weights which are more robust, however this will need to be purchased and may have an ongoing cost as data is updated.

The avoided emission could either be based on example items within the group or the main material composition of the group, dependent on the research available.

The GHG emissions avoided through the item not being landfilled or recycled. This is based on either weight or number of items (if a number is used, need a weight conversion). This will either be based on example items within the group or the main material composition of the group, dependent on the research available.

Recommended to base this on DEFRA GHG Reporting Factors (Note: will need to be updated yearly).

Methodology: Displacement Factor

The avoided emissions will need to be multiplied by the DISPLACEMENT FACTOR. The displacement factor will be determined by two factors.

Factor One: How long the product lifespan is extended by the repair.

To calculate product lifespan, it is recommended that the following research is carried out:

Desktop research to calculate the average length of time a 'super category' is likely to be in use for e.g. the average lifespan of IT is X years, based on the product lifespans of a laptop/ phone/ desktop.

Primary research to determine customer attitudes to their repaired item e.g. how long someone is likely to use a repaired item for?

The second factor would consider the probability of the owner not buying a new product post repair. Many repair cafes collect details of customers and therefore the easiest way to determine this could be via a survey one year after an item has been repaired, to determine how many people are still using the product.

Methodology: Avoided Emissions

For the detailed calculation, it is recommended that at the project outset these are based on the Farnham methodology and research carried out to ensure that they are suitable for Scotland (subject to gaining approval for this).

The Farnham model is based on:

Emissions associated with travel e.g. exhaust emissions/ embodied carbon in a car/ bike, etc.

The calculation will also require an average number of miles to be calculated by customers.

It is anticipated that there may be significant differences in the form of travel and number of miles between users of a service in Scotland compared to England, it is therefore recommended that this should be informed by primary research and in the longer term, users should be able to select whether their reuse organisation is rural or urban to provide more accurate savings.

Embodied carbon in spare parts

- Desktop research to determine the LCA of the spare parts most commonly used (could be based on the research already carried out by Farnham initially).
- Primary research to determine the percentage of repairs that require spare parts.
- Primary research to determine the most common spare parts by category.

Methodology: Operational Savings & Emissions

Recommended that the DEFRA conversion factors are utilised and updated yearly.

Note: The Farnham model also takes into account a ‘ReBound Effect’ which is based on the likelihood of someone treating themselves e.g. to a meal after a successful repair. It is not recommended that this be considered due to the already complex nature of carbon modelling.

SHARING

Simple & Detailed Data Input

Does your organisation take part in:

Reuse Repair Sharing

Insert your reporting period:

Month Quarter Annual

Would you like to input weight or number of items reused?

Number Weight

Categories should be determined based on discussions with lending libraries. In the interim, it is recommended that discussions take place with Edinburgh Tool Library (ETL) to determine whether their carbon factors could be utilised.

Recommend including the following additional categories (using the same carbon factors as above):

- Clothing (formal wear)
- Small Household Appliances
- IT
- Other (plastic)
- Other (metal, etc.)

CO2 Saving = XXX. Equivalent to X,Y,Z

Assumptions for Simple Calculator

- For the simple calculation there will be no requirement for the user to input fuel or waste data. To initially test the model, ZWS have assumed a GWP of a charity shop of 76kg CO2e based on (outdated) research carried out through the Charity Retail Association. It is recommended that at the outset, this number or a similar be utilised. It is recommended that this number be updated through organisations using the model or a scaled back survey of small organisations.
- The desktop research did not reveal an average displacement value for shared items. Until primary research can be carried out, an option could be to take an average displacement factor per category based on reuse/ repair data.
- Recommended that the 'ZWS spreadsheet' and ETL is used as a starting point for the calculations.
- The embodied carbon of the average item(s) is calculated from cradle to gate.
- Embodied carbon data taken from publicly available, peer reviewed sources where possible (Any exclusions to be listed here).
- References to be listed here.

Methodology: Avoided Emissions

It is recommended that the avoided emissions are based on the embodied carbon of the items being shared. This is based on either weight or number of items (if number is used, need a weight conversion). There are a number of weight conversions, it is recommended that in the short-term the ZWS weight conversions could be utilised as they are based on publicly available data. However, these cover a limited range of items, the ideal scenario would be to utilise the Reuse Networks comprehensive database of weights which are more robust, however this will need to be purchased and may have an ongoing cost as data is updated.

The avoided emission could either be based on example items within the group or the main material composition of the group, dependent on the research available.

The GHG emissions avoided through the item not being landfilled or recycled. This is based on either weight or number of items (if a number is used, need a weight conversion). This will either be based on example items within the group or the main material composition of the group, dependent on the research available.

Recommended to base this on DEFRA GHG Reporting Factors (Note: will need to be updated yearly).

The avoided emissions will need to be multiplied by the DISPLACEMENT FACTOR. This will need to be determined through primary research with users of sharing libraries to determine how likely it is that the loan has off-set a purchase.

It is recommended that in the interim, this forms part of a student project to look at this in detail.

It is considered that the deductions of carbon for operational activities e.g. power, fuel, waste could follow the methodology as for a reuse/ repair organisation to tie in with the assumptions for the rest of the model.

In the longer-term it would be useful to link the research in with the myturn software or similar.

Proposed Next Steps

The Circular Communities Scotland Board gave approval to seek funding to pursue developing a carbon calculator. It is therefore recommended that the first stage is to undertake a thorough review of the potential funding opportunities and engage with potential partners.

Conclusions

The review has indicated the following:

- There is widespread demand amongst stakeholders for a sector wide carbon model and a desire to collaborate.
- There is currently no one model that can be utilised by the sector.
- It will be essential to ensure that organisations are well trained and able to capture superior quality data.
- Circular Communities Scotland are well placed to co-ordinate the development of a carbon model and carry out the primary research required to ensure that assumptions are scientifically sound.
- There is funding available for organisations to address the climate emergency, without a robust carbon model, the sector is unlikely to be able to access the large-scale funding that is required to maximise carbon savings by the sector.
- Linking the carbon model in with reuse targets (if these are implemented) or landfill diversion may also help to increase uptake.
- The IT technology is available for a model, but work is still needed to select the best platform.