



Review of Carbon Accounting Tools for New Zealand Application For the Wise Response Society Inc.

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1. Summary

This report aims to explore and evaluate the existing carbon accounting calculators for households, primarily those developed in New Zealand (NZ), in order to recommend a best practice model for Wise Response to use in the future. The purpose is to establish the best model of a calculator that allows individuals and households in NZ to measure the carbon footprint of their everyday actions and behaviours, and provides options for how they can change reduce their emissions by changing behaviours and actions. A multicriteria analysis was conducted, and the results displayed in a spreadsheet. The key findings outline that the best NZ carbon accounting tools are Future Fit, an Auckland and Wellington Council collaboration, and Eco Footprint, designed for the Kapiti City District City Council. As these two tools have different strengths, it is recommended that the detail of Future Fit is expanded using Eco Footprint as a guide.

2. Purpose of Study

According to the 2015 Paris Agreement on climate change, global mean temperature rise above pre-industrial levels needs to be kept well below two degrees, and it would be better to limit the temperature increase to at most 1.5 degrees.¹ If NZ is to achieve its target emissions reductions under the Paris Agreement, Kiwis need to start understanding their own carbon footprint. Therefore, developing a carbon accounting tool appropriate for New Zealand households is very crucial. The purpose of these calculators is to provide households with a relatively accurate estimation of their carbon footprint and present ideas of how they could reduce their greenhouse gas emissions (GHG) by shifting towards less emission-intensive products and actions. While the calculators are generally based on households, individuals are also be able to use them. It is anticipated that a carbon accounting tool will be effective in informing an action and adaptation plan at the community level and fill the void of social technology appropriate for change.² The available accounting software has been recorded, and the key features summarised in a spreadsheet.

3. Calculator Primary Components

In order to evaluate and compare the existing calculators, a multicriteria analysis was conducted. A range of key features were identified in NZ literature. These were determined the key drivers of GHG emissions inherent in what NZ households consume:

- Food/diet, transport, and housing utilities, accounting for a total of 89% of emissions.³
- Household waste was also identified as a primary element of a households carbon footprint.⁴

¹ https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

² Wise Response Society. *Productivity Commission Inquiry: "Transition to a lower net emissions economy"* Submission of: Wise Response Society Inc. (2017) <https://www.productivity.govt.nz/sites/default/files/sub-low-emissions-102-wise-response-society-inc-1490Kb.pdf>

³ Carl Romanos, Suzi Kerr and Campbell Will, "Greenhouse Gas Emissions in New Zealand: A Preliminary Consumption-Based Analysis," *Motu Economic and Public Policy Research*, (2014), 13, http://motu-www.motu.org.nz/wpapers/14_05.pdf

⁴ Ministry for the Environment. "Measuring Emissions: A Guide for Organisations, 2019 Quick Guide." *Ministry for the Environment* (2019) 25, <https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/2019-quick-guide.pdf>

Food/diet: The literature from Motu established that food contributes 32% of total consumption emissions for the average household.⁵ Of this, the report outlined that Red meat, poultry and fish made up 34%, dairy products and eggs 17% and fruit and vegetables 19%. To emphasise the importance of including food/diet in a calculator, Collins et al., (2020) conducted a study which showed that of the 78% of respondents who stated they were inspired to make changes to their CO₂ consumption, ‘food’ (56%) was one of the key areas where respondents were inspired to make a change.⁶

Housing utilities: Housing utilities contribute 24% of total emissions for the average household. Electricity usage makes up the largest component of this, consisting of 64% of total housing utilities emissions.⁷ Collins et al., (2020) found 27% were inspired to make changes to ‘housing’, and 38% motivated to change ‘energy’ consumption.⁸

Transport: Transport contributes 27% of total emissions for the average household, where petrol is the largest contributor, making up 69% of this category. Passenger transport services makes up 19% of this category.⁹ Collins et al., (2020) identified 47% of respondents were inspired to make changes to ‘travel’.¹⁰ It is important to include walking or cycling in this category as it illustrates how taking one action affects other actions.

Household waste: How a household deals with their waste whether they recycle or compost and how much rubbish is sent to a landfill has a large impact on a households carbon footprint. In NZ, each person sends on average 401 kg of residential waste to landfills each year.¹¹ Landfills release methane as waste is broken down by anaerobic bacteria; thus it is necessary to encourage households to limit their landfill waste. In the study by Collins et al., they found that of individuals motivated to reduce their carbon footprint, 56% were inspired to make changes to their waste and recycling habits.

These four primary categories are the main drivers of GHG emissions in NZ households. They also have the highest marginal emissions. These results are also in line with the 2019 guide for GHG reporting from the Ministry for the Environment.¹²

4. Wise Response Selection Criteria

Wise Response also outlined a series of criteria they believe are important for a good accounting tool. These features reflect the Wise Response Society’s hopes that an ideal carbon calculator could play a key role in motivating the Dunedin community as part of a wider initiative to awaken action against climate change.

- Focus on planning reduction, rather than offsetting

⁵ Romanos, Kerr and Will, 18

⁶ Andrea Collins, Alessandro Galli, Tara Hipwood and Adeline Murthy. “Living within a One Planet reality: the contribution of personal Footprint calculators,” *Environmental Research Letters* 15, no. 2 (2020), 10, <https://iopscience.iop.org/article/10.1088/1748-9326/ab5f96>

⁷ Romanos, Kerr and Will, 18

⁸ Collins, Galli, Hipwood and Murthy, 10

⁹ Romanos, Kerr and Will, 18

¹⁰ Collins, Galli, Hipwood and Murthy, 10

¹¹ Ministry for the Environment, “Waste generation and disposal in New Zealand,” *State of Environment 1997*, <https://www.mfe.govt.nz/publications/environmental-reporting/waste-generation-and-disposal-new-zealand>

¹² Ministry for the Environment. (2019) 25,

<https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/2019-quick-guide.pdf>

- In terms of target audiences, an ideal tool should be aimed at general New Zealanders, yet a specific targeted sub group is schools. A collaboration could occur with Enviroschools to determine the best way to present the calculator as a project for primary, secondary and tertiary curriculums.
- Facility to plan reduction by changing parameters (a sliding scale as opposed to absolute figures)
- Visual representation of current profile
- Ability to monitor and compare progress
- Fun factor, e.g. with cooperative and competitive elements, so it is suitable for school use.
- Includes embedded carbon: greenhouse gases that are released throughout the supply chain, (e.g. material consumption and use of services).¹³
- Appears robust and accurate to be able to accommodate for different or changing family behaviours.
- Incorporates some explanation as to the assumptions or factors included in the tool.

These criteria were used as a guide to create the additional categories for the spreadsheet. The categories are explained in paragraph 6.

5. Background

Prior Research Into The Strategic Approach

A significant gap has been identified in literature between a calculator being an effective tool for enhancing individuals' knowledge, and inspiring them to make changes.¹⁴ By themselves, facts are not enough to engage people on an issue with entrenched values and customs.¹⁵ A model tool needs to be demonstrated in a way that fosters long term change. Prior research for Wise Response, conducted by Ollie Leuthart, offers insight into understanding how the use of a mobile tool can encourage meaningful change. He identified the importance of “realise” and “resolve” as steps to improving household and individual sustainability.

The “realise” step aims to make individuals better informed about the environmental risks. “Resolve” aims to find a solution to the identified environmental risks, and to decide to respond in a particular way.¹⁶ The research analysed whether a mobile tool should focus on competition or cooperation. The conclusion was that cooperation is effective as it creates a sense of community, where groups can cooperate and share tips on how to reach their goals. This can emphasise the sustainability of behaviour change. By contrast, competition is more effective at capturing immediate change. It was recommended to conduct further research exploring how to incentivise cooperation as something attractive in the short term, particularly as cooperation has the ability to foster the relevant values.

¹³ Circular Ecology, “Embodied Carbon Assessment” Accessed 20th April 2020, <https://www.circularecology.com/embodied-carbon.html>

¹⁴ Collins, Galli, Hipwood and Murthy, 9

¹⁵ Holmes, T., Blackmore, E., Hawkins., R. & Dr. Wakeford, T. (2011) *The Common Cause Handbook: A Guide to Values and Frames for Campaigners, Community Organisers, Civil Servants, Fundraisers, Educators, Social Entrepreneurs, Activists, Funders, Politicians, and everyone in between.* [Online] United Kingdom, Public Interest Research Centre. http://www.commoncause.org.au/uploads/1/2/9/4/12943361/common_cause_handbook.pdf

¹⁶ Oxford Dictionaries (2018b) *Definition of resolve* [Online] Available: <https://en.oxforddictionaries.com/definition/resolve> [Accessed 17th April 2020]

The incorporation of cooperation and/or competition in a carbon accounting calculator involves having components where users can monitor progress and set goals, as well as platforms to share results with friends. The ability to set goals sets an expectation for behaviour and sustainable behaviours increase. This may be because expectations hold people accountable. Monitoring household progress is also important as it helps individuals build on a sense of achievement, as well as turning the new knowledge into action.¹⁷ Therefore it is preferable that an ideal carbon accounting calculator includes these features.

6. Assessment Methodology

The spreadsheet was created based on this criterion and key features identified. (Please refer to the attached spreadsheet). The ideal tool should recognise and include all these features.

Beyond the specific household GHG emissions, other features were also acknowledged as necessary to include. These tended to focus on the experience of using the calculator, and are in line with Wise Response's purpose and criteria, as well as those outlined in 'Living within a One Planet reality: the contribution of personal Footprint calculators'.¹⁸

Additional Categories

Below I have listed the categories, explaining them in more detail and why they were included.

- **Usability:** The ease of use as well as clearly explained key terms and phrases, and explanation for the features included in the tool.¹⁹
- **Average income:** Included in the best practice models and helps to establish socio-demographic correlation with socio status and behaviour.
- **Simple/advanced option:** Enables user to run through a simple version of the calculator and then answer more advanced questions if they wish. This allows the tool to be used by school children as well as adults, and the ability to obtain a more accurate footprint.
- **Adjust period:** Choose whether the tool is calculating data for your household for one year, or a number of months. This was included in some of the best models and is valuable as it can accommodate for changing family behaviours.
- **Sliding scale:** As opposed to absolute figures, this is important as often people's behaviours are not always the same: so being able to rate your behaviour on a scale is more accurate.
- **Local/organic produce:** Whether people buy locally, organically or grow food themselves has varying impacts on the environment and GHG emissions.
- **Square Footage:** The size of the individuals house provides more detail and accuracy for the calculator.
- **Goods and Services:** How much a household spends on varying goods and services. This includes, yet is not limited to: embedded carbon such as computers and IT equipment, clothing, pharmaceuticals, furniture, telephone bills, insurance and education. Goods and services contribute an additional 10-15% to the average US households GHG emissions.²⁰ Therefore this is an important element to consider.

¹⁷ Department of Conservation, "Monitor and Evaluate Progress", Accessed 8th April 2020, <https://www.doc.govt.nz/get-involved/run-a-project/community-project-guidelines/monitor-and-evaluate-progress/>

¹⁸ Collins, Galli, Hipwood and Murthy, 9

¹⁹ Barber, William (2018) Website and application programmer. (Personal Communication, 30th July)

²⁰ Christopher M. Jones, "A Lifecycle Assessment of US Household Consumption" *UC Berkeley: University of California International and Area Studies*. (2005) <https://escholarship.org/uc/item/1fb4q9bb>

Although it must be noted there is not a lot of detail about goods and service impacts on NZ households emissions. This is an avenue that should be further explored in NZ.

- **Extra detail:** Any additional details the calculator may include. Important to understand the depth of detail of each calculator. This includes elements such as water usage, which is important as a result of the energy used. Solar panels are another feature that some tools incorporate. In NZ in 2016, the share of electricity generated from renewable sources was 85%, although this is not specific to households.²¹ Thus understanding where households use renewable energy sources is useful to understand the relationships between actions; how taking one action impacts subsequent actions.
- **Average household emission rating:** Important to ensure users can understand their own footprint in relation to the average, and see their CO₂ emissions in a context.
- **Offset emissions option:** It is recommended that a tool focuses on reducing GHG emissions, as opposed to encouraging an individual to offset their emissions. There are considerable dangers in relying on offsetting emissions to reduce your carbon footprint. For example, unexpected events, such as disease or bush fires, can quickly destroy offsets in forestry.²² Further, they encourage people to think they are “offsetting their responsibilities.”²³ Finally, while carbon offsetting schemes vary in quality, with some providing much more robust additional emissions reduction than others, still, none of them is as immediately and unequivocally effective as direct emission reduction.
- **Summary of CO₂ emissions for each element:** Enables users to see which category the majority of their emissions are related to. This is also helpful to determine what areas households can focus on to reduce their footprint.
- **Summary graphs:** Enables individuals to see their footprint as a visual, as opposed to just a number. This is also useful to encouraging and aid understanding for children.
- **Reduce your impact tool:** An extra tool on the source that enables an individual to explore different ways they can reduce their carbon footprint. For example buying a more fuel efficient car next time or flying less.

For ease of use, the features of each calculator that meet the ideal requirement have been colour coded green on the attached spreadsheet. International sources have also been incorporated in the spreadsheet, as it is useful to compare and contrast what features have been included by other countries, and how NZ tools correlate. It must be acknowledged that only a sample of calculators from other countries have been identified in this research. Yet those calculators included are among the most well recognised at a global scale.

7. How emissions are calculated

The carbon methodology and model to calculate emissions tended to be similar across all NZ tools. To measure household expenditure in a specific category, the expenditure in said category (e.g. meat) is multiplied with the associated emissions factors; emissions from meat

²¹ Statistics New Zealand, ‘New Zealand’s greenhouse gas emissions’ (April 2019), <https://www.stats.govt.nz/indicators/new-zealands-greenhouse-gas-emissions>

²² Niklas Hagelberg, “Carbon offsets are not our get-out-of-jail free card” *UN Environment Programme*, (2019) <https://www.unenvironment.org/news-and-stories/story/carbon-offsets-are-not-our-get-out-jail-free-card>

²³ Sharon Beder. “Carbon offsets can do more environmental harm than good” *The Conversation*. (2014) <https://theconversation.com/carbon-offsets-can-do-more-environmental-harm-than-good-26593>

= emissions per dollar of meat consumed x expenditure on meat. Total household emissions is calculated by adding the emissions from each expenditure category.²⁴

8. The Preferred NZ calculators

After comparing the existing tools in NZ against each other according to the criteria discussed above, the best carbon accounting tools appear to be Future Fit and Eco Footprint. Future Fit is a collaboration between Wellington and Auckland City Councils, developed as a useful and motivating tool for New Zealanders to calculate their everyday impact on the environment.²⁵ Eco Footprint was developed by Ben Jack for the Kapiti District Council, primarily to support the participants in the Greener Neighbourhoods Competition, yet other communities are welcome to use it.²⁶

Future Fit and Eco Footprint are the most in line with the criteria outlined by both Wise Response and the literature. While including the standard information that all tools seem to have, these two tools also include additional details in the extra detail categories, thereby allowing a more accurate footprint calculation. As all calculators have to make certain assumptions, the extra level of detailed acquired builds on the confidence of each factor assumed in the model.

Another aspect of these two tools that makes them noteworthy is that they have the ability to monitor individual/family progress. No other NZ tool appears to include this feature.

Both these tools also propose each question in the calculator in the most simple yet clear way; increasing the usability of the tool for all ages, as well as the accuracy of the footprint.

Comparing Future Fit and Eco Footprint

i) *Eco Footprint*

Eco Footprint has a strong focus on food, breaking down the categories to specifics.

It also concentrates on organic/locally grown food, and it is the only NZ indicator that includes this. This is an important aspect to address as being more mindful of where food comes from and prioritising locally/organically grown food can drive significant reduction in a household's carbon footprint.²⁷

Eco Footprint also has a category called 'consumer goods', where it asks you how much you purchase and dispose of embedded carbon goods like electronics, clothing and furnishings. This is the only NZ tool that includes this, yet most well renowned global tools incorporate it. As previously stated, goods and services contribute a 10-15% to average household GHG emissions in the US, and is thus an important category for calculators to include.

²⁴ Corey Allen and Suzi Kerr. "Documentation for the Household Climate Action Tool" *Motu Economic and Public Policy Research*, (2015), <https://motu.nz/assets/Documents/our-work/environment-and-resources/emission-mitigation/shaping-new-zealands-low-emissions-future/Documentation-for-the-Household-Climate-Action-Tool.pdf>

²⁵ Future Fit, "About", Accessed 14th April 2020, <https://www.futurefit.nz/about>

²⁶ NZ Eco Footprint Calculator, "About", Accessed 14th April 2020, <http://www.ecofootprint.nz/about>

²⁷ IPCC, *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. (United Kingdom and New York, Cambridge University Press, 2014).

Eco Footprint also asks for the square footage of the relevant house, further enhancing the detail and accuracy of the tool. In addition to these details it also includes pet ownership, and breaks this down into categories such as low (fish, rabbit), medium (cat), high resource (large dog).

The tool to monitor progress is displayed as a bar chart, illustrating a household's various attempts at entering information into the questionnaire.

ii) Future Fit

Future Fit is not as detailed as Eco Footprint, and it categorises transport as the largest focus for household emissions. However, as previously mentioned, Future Fit includes more key features than other standard NZ tools. It also includes additional 'extra details', enquiring for example about solar panels and insulation, which are important features that reduce the need for relatively high emission energy such as electrical or gas usage.

While Eco Footprint appears to be slightly more detailed, the standout feature of Future Fit is its focus on behaviour change. The concluding section of the calculator allows the user to see their impact compared to average NZ households and global household. There is a 'latest actions' section, which lets an individual choose actions to reduce their carbon footprint and document the actions they have taken.

A key feature of Future Fit is the 'My goals' section, as well as the ability to earn badges and sign up to be a part of different teams and challenge friends to get "Future Fit". As previously discussed, it is important for people understand what to do and where to go with the information they learn about their carbon footprint. A frequently overlooked component in existing tools, this makes Future Fit an extremely appealing calculator.

An additional outstanding feature of Future Fit is the incorporation of a simple/advanced option. On first go of the calculator, a series of low-detail questions are asked. After completion, it asks whether the user would like to 'step it up', by answering a few more questions to get a more accurate footprint. The additional questions include the kilometres travelled in an individual's commute, and how much electricity a household uses per year. While these features appear to be embedded in the calculator as it is typically installed, only including them in a second detailed version of the calculator allows and encourages the usability of the tool for children. This is an extremely valuable extension to a carbon calculator and could be developed to a much greater extent than it has been in the existing Future Fit. For example, a better version might increase the level of detail in the advanced software or make the different stages of detail more explicit. The Berkeley Cool Climate Network includes this feature, although they too could develop this element further.

iii) Potential Improvements

Both Future Fit and Eco Footprint have some areas for improvement. As illustrated in the spreadsheet, neither calculator meets all the requirements for the 'ideal' tool.

Thus, it would be beneficial to explore ways in which the best of both tools could be included in one calculator, and also incorporating additional ideal features that neither tool included. Potential improvements include incorporating sliding scales in the calculator, as opposed to absolute figures, as well as allowing the user to adjust the period which they are calculating.

Further, careful thought needs to be given to the best ways in which to ask questions. All tools ask questions in varying ways. For example Future Fit proposes the travel questions like ‘how many days a week do you travel by... (foot/bicycle/car etc).’ ‘How many hours do you roughly spend traveling by... (foot/bicycle/car etc).’ Whereas Eco Footprint asks ‘how far do you travel by car each week?’ ‘And how much driving do you do in urban areas?’ It would be valuable to know what is the most direct way to ask a question that still ensures accuracy. This is particularly important when developing a tool that can be used by both school children and adults. Although, as previously stated, it may be that that the best way to go about this is to further develop the ‘simple’ and ‘advanced’ options in the calculator.

9. Recommendations

- i)* After comparing the existing New Zealand carbon accounting tools, Eco Footprint and Future Fit are the most appealing. It is apparent these two tools have different strengths. Eco Footprint appears simpler to use, with more explicit categories. Yet Future Fit is a better tool for analysing and monitoring progress.
- ii)* Thus, the best option going forward seems to be to expand the detail of Future Fit, using the Eco Footprint calculator as a guide. This would increase the value of each calculator while avoiding re-creating something that already exists. In advancing the detail, reference should also be made to the ‘ideal’ features identified on the spreadsheet, to ensure all criteria described in literature and that outlined by Wise Response is met.
- iii)* Such a hybrid calculator would provide an effective tool to help people better understand which components of their lives contribute most to GHG emissions, and therefore understand how they can most effectively reduce their personal or household footprint.
- iv)* This is a rational option to pursue as these two tools have been developed by local authorities, suggesting further improvement could be made without running into commercial or ownership issues. Further, Future Fit already has the ability for other councils to use their programme, and encourages feedback, see <https://www.futurefit.nz/get-involved>. Kapiti City District Council could be contacted to further explore the detail of Eco Footprint.

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Romanos C, Kerr S, Campbell W. “Greenhouse Gas Emissions in New Zealand: A Preliminary Consumption-Based Analysis,” *Motu Economic and Public Policy Research*, (2014), http://motu-www.motu.org.nz/wpapers/14_05.pdf

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Appendix A: Multicriteria analysis and comparison of Carbon Accounting Tools

Table 1: New Zealand Tools

Table 2: Selected Overseas Tools

(Shaded areas –the ideal criteria have been met)

Table 1: New Zealand Tools

Software	Ideal	Toitu	NZ Herald	EKOS	Carbon Neutral NZ Trust	Future Fit	Eco Footprint	Catalyst: ACE
URL		https://calculator.toitu.co.nz/?calculator=household	https://insights.nzherald.co.nz/article/climate-action-tool/	https://ekos.org.nz/lifestyle-calc	https://www.carbonneutraltrust.org.nz/calculator-login	https://www.futurefit.nz/questionnaire	http://www.ecofootprint.nz/surveys/1324/edit/7094/20938	http://catalystnz.co.nz/environment/ace---the-annual-carbon-emissions-calculator
Country		NZ	NZ	NZ	NZ	NZ	NZ	NZ
Focus	Reduction	Offsetting	Reduction	Offsetting	Reduction	Reduction	Reduction	Reduction
Usability	5 out of 5	4 out of 5	5 out of 5	5 out of 5	5 out of 5	5 out of 5	5 out of 5	3 out of 5
Average income	Yes	No	Yes	No	No	Yes	No	No
Simple/advanced option	Yes	No	No	No	No	Yes	No	No
Adjust period	Yes	Yes	No	Yes	No	No	No	No
Sliding scale	Yes	No	Yes	No	No	No	Yes	No
Diet	Beef/lamb, Pork, Poultry, Dairy, Eggs, Fruit and Vegetables, Grains	No	Red meat, Dairy	Meat lover, Average meat eater, No red meat, Vegetarian, Vegan	Meat lover, Average meat eater, Vegetarian, Pescatarian, Vegan	Beef/lamb, Pork, Poultry, Dairy, Eggs	Beef/lamb, Pork, Poultry, Dairy, Eggs, Fruit and Vegetables, Grains	No
Local/organic produce	Yes	No	No	No	No	No	Yes	No
Household waste	Recycling, Compost, Landfill waste	Recycling, Compost, Landfill waste	No	Landfill waste	Recycling, Compost, Landfill waste	Recycle, Compost, Landfill waste	Recycling, Compost, Landfill waste	Landfill waste
Housing utilities	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity	Electricity, Reticulated gas, Wood burner	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Natural gas, Coal
Travel	Private vehicle, Walking or cycling, Public transport, Air travel	Private vehicle, Air travel, Public transport, Accommodation	Private vehicle, Efficiency, Air travel, Public transport	Private vehicle, Air travel, Accommodation	Private vehicle, Air travel, Public transport	Private vehicle, Public transport, Walking or cycling, Air travel	Private vehicle, Walking or cycling, Public transport, Air travel	Private vehicle, Public transport, Air travel
Square Footage	Yes	No	No	No	No	No	Yes	No
Goods and Services	Yes	No	No	No	No	No	Yes	No
Extra detail	Water, Pets, Solar panels, Insulation, Type of house	No	No	No	No	Water, Solar panels, Insulation	Water, Pets	Refrigerant use
Average household emission rating	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Offset emissions option		Yes	No	Yes	No	No	No	Yes
Summary of CO2 emissions for each element	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Ability to monitor progress	Yes	No	No	No	No	Yes	Yes	No
Summary graphs	Yes	No	No	No	Yes	Yes	Yes	No
Reduce your impact tool	Yes	No	Yes	No	Yes	Yes	No	Yes
Summary		Well laid out simple tool. Yet is more focused on offsets than planning reduction and does not give direction for future actions.	Not a calculator. A platform that allows you to see ways you can reduce your emissions, based off an estimation from your behaviours.	Has the option for business, school or lifestyle calculator. Quite a simple tool to use. Yet once you have finished filling in the calculator, it tells you your average carbon footprint yet doesn't tell you what that means or what you should do with that information.	A well explained tool. Really good summaries at the end of the calculator that breaks down all the components and next steps, with graphs as well as words. And compares your CO2 emissions to other community averages. Yet not the most visually appealing or fun tool.	Quite a specific tool yet asks questions in a simple manor, increasing the user friendly nature of the tool. For example, how do you travel most often, when you travel in a car are you the driver or passenger, how many people do you normally travel in a car with? Has a very well-illustrated summary at the end, with colourful graphs and places to monitor your progress. However it could do with some direct links to understand what actions to take.	Quite a specific calculator, again asks, how much of the driving do you do in urban areas (where you have to break often?) Quite focused on diet, and whether it is organic, locally grown, unpackaged. Has the ability to monitor progress although not as appealing/efficient as Future fit. Should learn from this in the level of detail and simplicity of the tool, yet it would be suggested that this needs more links to understand what actions you can take to reduce your footprint.	A spreadsheet style calculator. Laid out quite plain and to the point, thus better for businesses.

Table 2: Selected Overseas Tools

Software	Ideal	Carbon Footprint	The Nature Conservancy	UN Carbon Offset Platform	Berkley Cool Climate Network	Resurgence
URL		https://www.carbonfootprint.com/calculator.aspx	https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-	https://offset.climateneutralnow.org/footprintcalc	https://coolclimate.berkeley.edu/calculator	https://www.resurgence.org/resources/carbon-calculator.html
Country		Global	Global	Global	US	UK
Focus	Reduction	Reduction	Reduction	Offsetting	Reduction	Reduction
Usability	5 out of 5	4 out of 5	5 out of 5	5 out of 5	5 out of 5	3 out of 5
Average income	Yes	No	Yes	No	Yes	No
Simple/advanced option	Yes	No	No	No	Yes	Yes
Adjust period	Yes	Yes	No	No	No	No
Sliding scale	Yes	No	Yes	No	Yes	No
Diet	Beef/lamb, Pork, Poultry, Dairy, Eggs, Fruit and Vegetables, Grains	Meat lover, Average meat eater, Vegetarian, Pescatarian, Vegan	Beef/lamb, Pork, Poultry, Dairy, Eggs, Grains, Fruit and Vegetables	Meat lover, Average meat eater, Vegetarian, Pescatarian, Vegan	Beef/lamb, Pork, Poultry, Dairy, Eggs, Grains, Fruit and Vegetables	Meat, Fish, Eggs, Dairy
Local/organic produce	Yes	No	No	Yes	No	Yes
Household waste	Recycling, Compost, Landfill waste	No	No	Recycling, Compost	No	No
Housing utilities	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG	Electricity, Natural gas, Heating oils	Electricity, Reticulated gas, Heating oil, Solid fuels	Electricity, Reticulated gas, Heating oil	Electricity, Reticulated gas, Liquid gas, Solid fuels, LPG
Travel	Private vehicle, Walking or cycling, Public transport, Air travel	Private vehicle, Air travel, Public transport, Accomodation	Private vehicle, Air travel, Public transport	Private vehicle, Walking or cycling, Public transport, Air travel	Private vehicle, Public transport, Air travel	Private vehicle, Public transport, Air travel
Square Footage	Yes	No	Yes	Yes	Yes	No
Goods and Services	Yes	Yes	Yes	No	Yes	Yes
Extra detail	Water, Pets, Solar panels, Insulation, Type of house	No	Water	Type of house	Water	No
Average household emission rating	Yes	Yes	Yes	Yes	Yes	Yes
Offset emissions option		Yes	No	Yes	No	No
Summary of CO2 emissions for each element	Yes	Yes	Yes	Yes	Yes	Yes
Ability to monitor progress	Yes	No	No	No	Yes	No
Summary graphs	Yes	No	Yes	Yes	Yes	No
Reduce your impact tool	Yes	Yes	Yes	No	Yes	Yes
Summary		A specific model that is easy to use as it makes lots of inferences for you. E.g when putting in information about your car, you select the brand, model and year and it calculates the average emission for you. Makes it more specific and simple for the user.	Very good tool but may be difficult to get software to develop this. At the end shows your total carbon footprint as well as how yours compares to the average as a percentage. A very good summary also illustrated in graphs. Then a very detailed tool to see how to reduce your emissions, this is broken down into transportation, housing and shopping. E.g. I will buy a more fuel efficient vehicle, the tons of CO2 saved is... dollars saved... upfront cost....	A simple tool, and has a focus on buying local/organic products. Yet is more focused on offsetting than reductions and does not give direction for future actions.	A very similar tool to The Nature Conservancy, just a different lay out. Gives a good summary at the end and many ideas for how to reduce your impact, an element of being able to monitor progress although it is not great. Also allows you to participate in a simple calculator vs an advanced questionnaire	This is a very accurate calculator which requires your domestic energy bills and MOT certificate. It is a very specific tool, but does have a simple option for a calculator.