ACT CARBON CUTTERS TRAINING PROGRAMME NOTES

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Section 1. Preparatory Reading (taken from the TECs E-Pack):

ACT CARBON CUTTERS TRAINING PROGRAMME

SOME USEFUL INFORMATION ON ENERGY AND ASSOCIATED EMISSIONS

- Energy bills are given in kWh (kilo Watt hour) also referred to as a "unit" of Energy.
- 1 kW (or kWh) = 1000 Watt hour (or Wh); 1000 times for each kilo, Mega, Giga, Tera, peta.
- Energy (in kWh) = Power (in kW) x Time (in hours).
- Every 1 Watt on all the time is costing you £2.20 a year (assuming a unit price of 25p).
- 2kg of CO2 is about 1 cubic m of greenhouse gas. This is similar to an 8 mile trip in an average petrol car (based on 2021 UK data) which generates 2 kg of CO2 from the exhaust. Another 2kg for every 8 miles from associated processes like making, maintaining and scrapping the car.
- Emissions for different primary fuels will vary. As a rough guide, 2 kg of CO2e are emitted into the atmosphere from (based on 2021 UK data):
    - ~6.9 kWh of grid **electricity**, excluding device efficiency (~50-350%);
    - ~7.6 kWh of **oil** (or ~0.8 L), excluding boiler/engine efficiency (~25-80%);
    - ~9.3 kWh of natural **gas**, again excluding boiler/cooker efficiency (~30-95%).

  The amount of usable energy will depend on the efficiency of the device used:
  Useable (output) energy = amount of primary (input) energy x device efficiency

Different fuels have different Carbon Intensities (**CI**), some of these will vary from year to year.

Green House Gas (**GHG**) emissions represent a number of different gases which cause atmospheric temperatures to rise by trapping more heat from sunlight. The largest component of these GHGs is Carbon Dioxide (**CO2**), about 80%. Other GHGs, such as Methane (~10%), make a significant contribution as they are more 'potent' despite being shorter lived.

The shorthand for GHG emissions often used are: Carbon; CO2 equivalent (**CO2e**).

Energy can be measured using different scales, most people are familiar with Calories (**Cal**) or more accurately a kilocalorie (**kcal**) where:

1 kWh = 860.421 kcal

How we calculate GHG emissions

The GHG emissions are calculated on a consumption basis. That is, we include all emissions associated with the item or activity, irrespective of where these emissions occurred. Put another way, we include the embodied emissions (also referred to as scope-3 emissions or cradle emissions) associated with manufacturing an item or in providing a service.

Emissions associated with end-of-life (i.e. waste or grave emissions) are also included where available, these tend to represent a small % of the lifetime emissions.

Section 2. Session #1 > Energy, Carbon, Actions:

The purpose is to get a common understanding of how our energy use relates to our Carbon emissions. If we are to talk to others about Carbon emissions, specifically those involved in the Carbon Cutters (**CC**) scheme, we need to have the basic facts. Without this there is a real danger that actions proposed/taken will increase emissions, not something we want to be promoting.

In this session we will not go into the phycology of how this should be used when talking to others (see session #2). The purpose here is to make the maths and physics (i.e. the science) accessible and understood. The session is aimed at anyone who wants to become a CC. As a minimum, they need to have handled money, i.e. receives/spends it in any form.

Depending on what people know and want, the session will include:

- What Energy is and why it is central to life on earth!
- Where does the energy we use come from and what are the consequences of using it?
- How does energy relate to climate change?
- What do we need to do in the activities we have some direct control or influence over, to stay within the 1.5^{O}C increase in atmospheric temperature?
- How to determine effective actions and for what purpose?

Hopefully the session is interactive and takes everyone along to better understand the answers to the above. It should only go to a level of detail, on each of the above, that makes sure no one is left behind. Make sure that before session #1, everyone receives the preparatory text in Section 1 and that they have had an intro session where they are briefed on what a CC is and the training. After session #1, send the notes in section2.1.

Zoom recording of this session is available on the ACT's G-Drive. This may need editing if we are to make it available to CCs.

2.1 Notes for this session

intro: We'll look at what energy is, how it relates to climate change and how this should inform our actions.

Energy

- A couple of things to remember from school
  - Energy can't be created or destroyed (it is cycled from one form into another including matter). Energy can either be potential (stored) or Kinetic (dynamic/moving).
  - Life on earth, and possibly our universe, is carbon based.
- The sources of energy is a result of:
  - Chemical (reaction between elements), e.g. Carbon combining with Oxygen to make CO_2 (i.e. combustion).
  - Nuclear (sub-atomic bonds), fission/fusion processes, this generates much more energy for the same mass of material compared to chemical.
  - Gravity, this is a weaker form of energy for the same mass of material, e.g. hydropower.
  - Thermal (heat), resulting from movement of molecules, present in any material.
  - Electrical and radiant (movement of charged particles), electricity, radiation and light.

    - Others like mechanical, sound and elastic forms of energy, e.g. wind, sound and any object in motion.
- 2 complex lifeforms evolved, plants and animals. Evidence strongly points to life starting as an interaction between matter and energy, but life's origin is not important to this discussion.
- Most energy is used to exist, reproduce, move and do other things.
- Two essential chemical reactions for life to exist:
    - Photosynthesis, CO_2 in the air is combined with water and other elements to produce various hydrocarbons using sunshine as the primary source of energy and releasing O_2 into the air (carbon dioxide + water → glucose + oxygen)
    - Respiration (breathing), oxidises (burns) the hydrocarbons to release energy to live from (glucose + oxygen → carbon dioxide + water)
- All life on earth does respiration, some do both respiration and photosynthesis, e.g. plants.
- Just living needs ~100 Watts (**W**), we are constantly burning carbon through respiration. A human can however produce as much as 2000W for short periods.
    - 100 W x 24 hrs = 2400W per day, ~3kWh to carry out a few other necessities.
    - The bigger and more active we are, the more carbon we need to burn, and vice versa.
- Humans don't just live, we want to create and experience more things. We need extra energy to do this.
- kWh is the universal unit of energy.
    - Eating 3000 Cal worth of food is equivalent to ~2.4 kWh
    - Driving an Electric vehicle ~2-4 miles consumes ~1kWh (depending on what/how/where)
    - 1 Litre (**L**) of oil can generate ~10 kWh if perfectly burnt
    - 1 kg of coal can generate ~8 kWh if perfectly burnt
    - 1 kg of seasoned wood can generate ~ 4 kWh if perfectly burnt
    - Humans consume ~160,000 TWh of energy annually or ~ 23,000 kWh on average per person. Many in the Global South consume less than 1,500 kWh annually with much of that renewable energy (subsistence farming/living).

There are 8,760 hrs in a year, use this to work out annual energy from Power used, and visa versa, e.g. 23,000 kWh = 2,626 W continuous and 1,500 kWh = 171 W continuous.

Carbon

- The reason life can exist is thanks to photosynthesis in plants removing CO_2 from the atmosphere over millions of years. This lowered the CO_2 concentration to ~250 parts per million (**ppm**) which has been relatively stable for 100,000s of years with some fluctuation due to natural events (e.g. large volcanoes and glacial periods).
- Vast amounts of CO_2 circulate the earth in a natural carbon cycle. The natural carbon cycle is ~150 years (the average life-span of living organisms)**.** Some of the carbon captured by photosynthesis or in organisms is released back as these rot in the air, but some is locked into the soil. It remained undisturbed for millions of years, eventually turning into coal, oil and gas (fossil fuels). Shale gas is also a fossil fuel, just locked differently underground.
- The industrial revolution disrupted the natural carbon cycle. It started the extraction of highly efficient fossil fuels and burnt these to produce more and cheaper energy. Our

economic system is now hooked on this for our energy use, some 80% of our energy comes from these fossil fuels with coal representing ~40% of this (~32% of total energy).

- Millions of years' worth of locked carbon was released back into the atmosphere in a short 150–200-year period. Once released, natural systems will require very many years to extract and store it again. About 50-150 kg CO2e/tree/year is sequestered by a mature tree.
- We knew about greenhouse gas concentration and its impacts in 1896, however this was not taken seriously (proven beyond reasonable doubt) until the 1970s.
- There is a linear relationship between temperature and greenhouse gas concentration in the atmosphere.
- Emitted carbon takes 150 years to be absorbed again which means that its impacts last for 150 years, i.e. cumulative impact.
- Humans emits roughly 40 Gigatons of CO_2 a year (40,000,000,000,000 kg), a lot of trees!
- Another 400 Gigatons CO_2 (since 2019) in the atmosphere will cause a temperature increase of 1.5°C. This is the remaining **Carbon Budget** after which we will cause irreversible changes to our climate, making life on earth as we know it impossible. This is the **Climate Tipping Point**, an existential challenge.

Action

- This has to be treated as an emergency, because of the scale of the challenge:
- 400 – 4 x 40 = 240 Gt CO2 budget left to emit before Climate Tipping Point
- At current rate, only 5 years left to get to Net Zero emissions.
- The full impacts are not seen for decades, by which time it is impossible to reverse runaway climate changes and its consequences.
- All actions are necessary, at organisational and individual level.
- The most direct (and only) effective action is to reduce GHG emissions. Several ways this can be done:
  1. Best is to know what your emissions are and how much different actions reduce this by, to stay within your personal/organisational Carbon Budget. Use a representative Carbon Footprint calculator/tracker or bespoke analysis for larger organisations.
  2. Use simple rules of thumb to check what difference major actions could make. These rules will change year on year.
     - Carbon Intensity (**CI**) for electricity/gas ~ 0.25 kg CO2e/kWh ; private car travel ~ 0.5 kg CO2e/kWh or per 1-4 miles; food ~ 0.75 kg CO2e/kWh (~860 Cal, but can vary by 10 fold, 7.5 - 0.075 kg CO2e); goods/services varies a lot so need a lookup list/categories.
     - <5,000 mi p.a. = keep old car until it dies; >10,000 mi p.a. = buy an appropriate EV
     - <50 kWh/m2 p.a. = install a heat pump ; >100 kWh/m2 p.a. = do not install a heat pump
     - You can save 8-12% on annual heating bills for every 1°C reduction on the main heating thermostat.
  3. Follow general actions that, as a minimum, ensure emissions do not increase. Follow the 'safe' actions list which always applies. (see section 4.11)
- Indirect actions such a lobbying, organising events to engage your community in direct action are important, especially if tangible reductions in ghg emissions follow in a short period of time.

- Worst of all is to blindly perpetuate other peoples'/organisations' lists without considering their appropriateness to the new situation.
- For those able and willing to do more than follow a general 'safe' list, they will also need to follow a common-sense process to ensure actions remain effective:

1. Know your emissions, the annual total and what causes these.
2. Identify the largest sources of emissions that you have most control over and will cost least money/effort.
3. Plan your actions to achieve maximum return in the shortest time, be realistic, start small and build up. Cutting out unnecessary things (waste) is by far the best action.
4. When action is complete, check if it actually did and will continue to reduce emissions, then start again to identify the next action. Recording these, helps you stay within your 1.5^{O}C limit.

Section 3. Session #2 > Audience, Message, Materials:

One of the challenges, and often a question councils ask, is how Climate mitigation can be made more accessible to more people. If we want to ensure that CCs do not end up simply repeating 'popular' messages especially on actions, we will need to equip them with methods/tools on how to avoid this as well as training them in how to use these.

A regular sentiment is "my experience of 'taking the message to the people' is that there is a very big barrier to acknowledging the *emergency* of the situation, and most enquiries were to do with Recycling, Plastic Free, wildflower verges, and tree planting. All good, but not effective in mitigating Climate Change. These are 'popular' actions found in abundance, but not really related to cutting carbon at least not appropriate to this being an emergency."

The first training session laid the foundation for an understanding of how we use Energy and what its consequences are in relation to Climate Change, the Carbon connection. It will be necessary to distil this down to a few key messages and information as part of the training for CCs.

The purpose of session #2 is to address the challenge of how to engage more people in meaningful Carbon reduction (i.e. as effective as possible), as opposed to suggesting 'popular' actions. That is not to say CCs cannot continue to promote the 'safe' actions. Ideally CCs should help people move from these to the first 'essential' action, namely measuring their Carbon Footprint. Without this, actions are unlikely to be effective.

It will cover:

- Who are the people CCs should talk to and why, social, ecological and climate challenges?
- How to capture the attention of people, what is an appropriate message and how to maintain momentum?
- What are the reasons ~85% are concerned about the Climate Emergency but only ~4% are acting effectively to mitigate this? See BEIS attitude survey and Devon's Climate Emergency Survey.
- What materials are available for what audience and what events CCs could use. These resources can range from PP slides, posters, info leaflets, books, in-depth explanatory documents and games.

3.1 Notes for the session

Audience

- Will depend on:
  - individual CC preference & ability;
  - the wishes/aims of the group the CC may represent;
  - the method/channels used to contact the audience;
  - the demographics of the audience; and
  - many other factors including the purpose of the engagement.
- Unless this is given some thought, it could result in poor outcomes due to mismatch between expectations (objectives)/ability of CC to help.
  - We end up doing what is possible rather than working towards what is needed.
  - We end up focusing on the process of getting a large number of contacts/events and forget the purpose (Carbon Cutting).
  - We do not measure how effective we are at meeting the set objective(s).
- Different people are at different points in this journey. They tend to fall into distinct categories:
  - Motivated to take measurable/effective action, probably no more than 5% in a community.
  - Concerned about Climate Change, around 90% of the population.

- Do not believe Climate change is a problem or that it is caused by human activity, less than 5% of the population.

A good majority (maybe ~75%) of those in the second category have taken action to reduce their GHG emissions. They and even those in the first category have little knowledge of how to measure the impact of their actions. See the latest government attitude survey on this.

- We are all children who don't like to be told what to do or how to behave. In any case, unless we are intimately familiar with an individual's circumstances, why are we qualified to suggest specific actions to others?
- **Self-discovery** is the most powerful motivator for long-term behavioural change.
  However, cognitive biases are barriers (e.g. facts vs feelings- Cognitive Dissonance barrier; ostrich effect- Doom Barrier; loss aversion- Identity Barrier; blame others for our actions but others are responsible for their actions- Actor/Observer Barrier).
  Also, routines and everyday priorities, even adhering to our social norms, can distract and make us forget.
- Fear/guilt are poor motivators for the long-term behavioural change, as is the promise of an instant prize/reward. The different effects of how our brains learn a new reward system, serotonin and dopamine are in play. It takes cognitive effort (energy) to change behaviour which releases serotonin, the long-term feel-good hormone. Low-effort reward releases dopamine a short-term addictive feel-good hormone.
- To help overcome these counter influences to behavioural change, CC's interaction (i.e. messaging) needs to be tailored to the different audience categories and probably to the individual(s) they are engaging with. This requires training and experience but is not everyone's cup of tea.
- Not tailoring the message to the audience, i.e. generic messaging, has been used for decades and has resulted in very little overall impact in reducing emissions, yet everyone continues to plough that furrow because that is the norm (we feel safe and it's less effort when we copy others).
  Nevertheless, messaging a generic audience can be the first step to a subsequent bespoke conversation, it should only be used as such.
- Pick your audience carefully. Experiment with a targeted/limited group or individuals. Measure outcomes and adjust accordingly.

Message

- The messaging to attract members of the general public as well as the communication channel will depend on the individual CCs and their groups. These channels are well established/known, but ACT can provide examples of what media is seen by what audience category, how word-of-mouth or local council networks can be used and how to piggyback on local events. Running an Energy event may be a good option for some (see **Error! Reference source not found.**).
- Unless you know your audience is already motivated to find out more about mitigating climate change, avoid mentioning climate change! Start any engagement on tangentially related topics of concern to many, like the natural environment, the cost of living or even social and political trends if you are brave enough.
- Once you have the attention of an individual/small group (no more than 7-10 at a time, unless it is a larger public event) the messaging needs to be personal, relevant and engaging.
- Start by understanding your audience, their desires/concerns and constraints. Expand on what Climate Change is, but only as necessary and appropriate to the audience. What causes it and how best to tackle it with minimum effort and maximum impact for them.

- Select one relevant (to the audience) area (e.g. transport or heating) and elicit ideas from the audience on what actions they think are most effective. Use the discussion to explain the most relevant concepts of how to assess the impact of an action on Carbon emissions (e.g. CO2/CO2e, Carbon Intensities and Carbon Factors, Cradle-grave calculation, tools/methods to determine emissions).
  You only need the basics, make sure everyone understands these. There is no need to go into information overload, the degree of detail will depend on the audience. Having an audience with similar backgrounds and understanding makes things easier, but a mixed audience could also encourage cross-support.
  As a CC, you'll need to know a little more than your audience. When you don't have the answer find it later. Our intuitions can be wrong, CCs need to maintain the confidence of their community.
  - depending on the context of the engagement, the audience and their willingness to engage, use some of the following:
    - visualisation props (e.g. bucket with a hole, ACT posters, CFT tool);
    - Interactive games (e.g. $E=MC^2$, Carbon Footprint stacking cards)
    - examples/lists or apps (e.g. How Good Are Bananas, CFT or E-Pack app)
    - for those who do not want to engage, use the 'safe' list of actions, make sure they include Carbon as well as money saving numbers.
- The engagement (messaging) needs to be relevant, easy, attractive and social for the particular audience. Selection of an audience group will be necessary to avoid under/over messaging and to enable communal interaction.
- Never use "don't"! Suggest 'trying' or 'considering' actions. Best if you can get them to come up with actions to solve their problems, with your guidance when requested.
- Remember the 3 As that need to be met for an effective outcome, which is that the audience goes away motivated to act:
  - Advertising: 'tell the truth', the existential challenge of Climate Change to human society and the natural ecology we depend on should be expressed in an appropriate way and always with realistic solutions. The actions needed are well known and doable, what is missing is the will to do them. This is true at all levels, global, national and individual.
  - Accessible: the actions are relatively easy to undertake, start small …
  - Affordable: actions should be within the individuals' budgets, ideally they should save money over a short period (less than a year).
- Most audiences will need reminding and ongoing support.
- Practice your engagement with family, friends or other CCs. See the CC Roleplay resource.

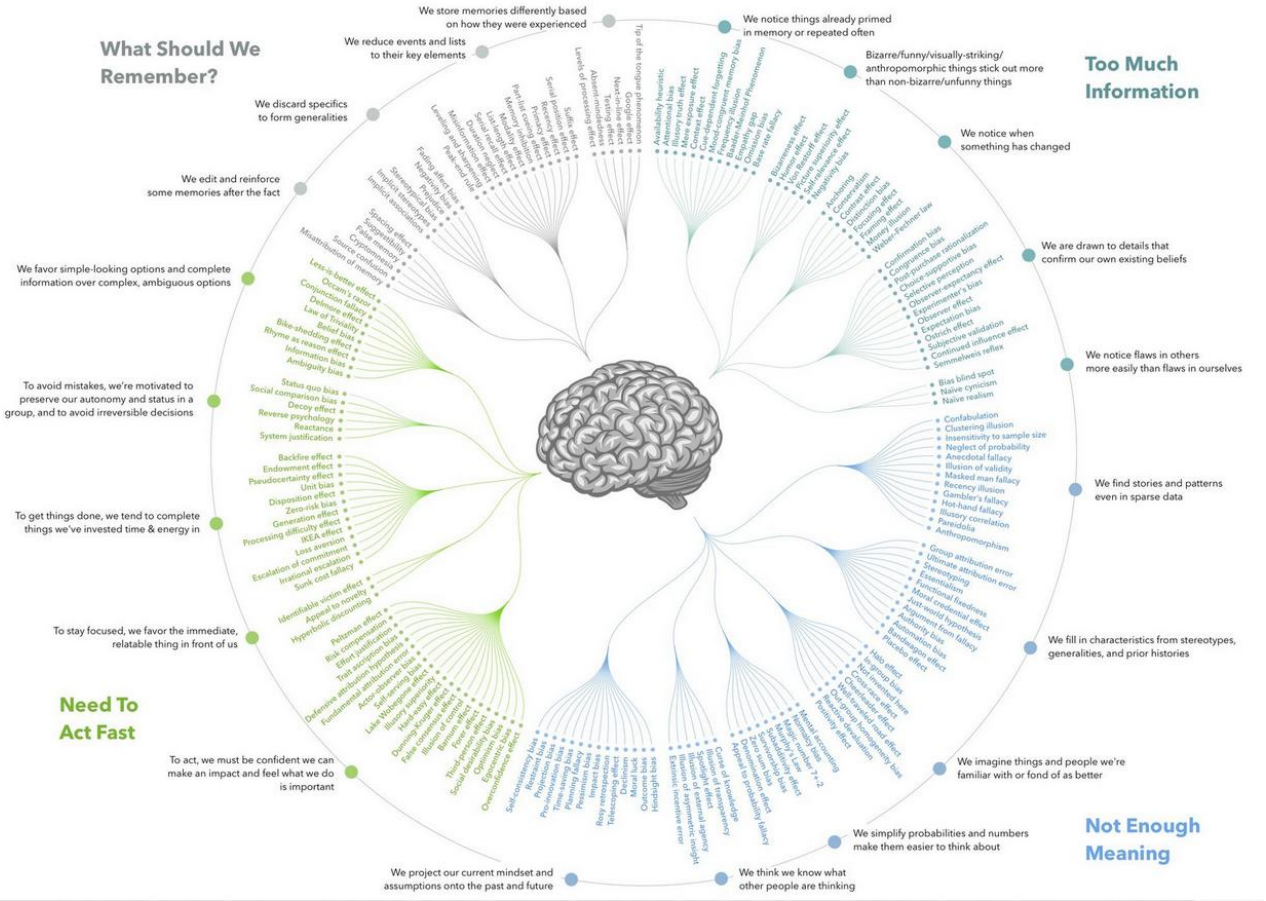
Materials

- Everything is available on the internet! ACT has done the hard work of assessing this and summarising the essential information in a series of tools and info packs/docs/pictures at varying levels of accessibility to suit everyone.
- PowerPoint on GHG calculation and associated terminology (section 4.4)
- Resource Pack for councils/groups not individuals, but elements of which can be referenced e.g. why is it an emergency (section 4.5)
- Impact app and info behind this (section 4.6)
- CFT for a quick personalised assessment (section 4.6)

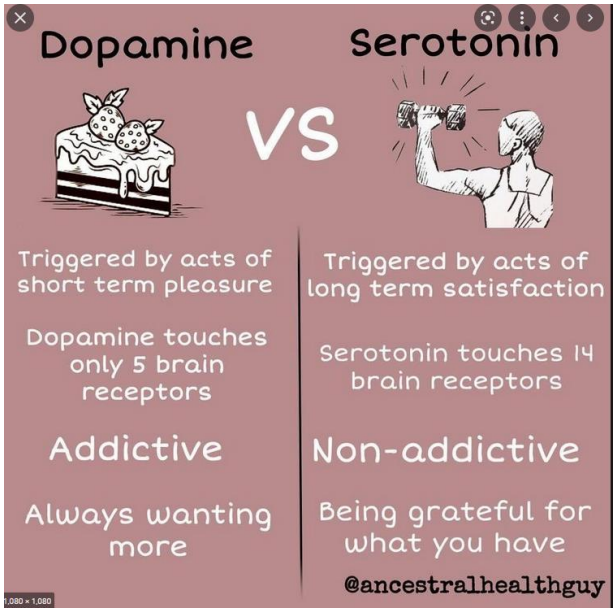
- TECs E-Pack assessment app for a more in-depth personalised assessment (section 4.7)
- E-MC2 for use with individuals, examples can be expanded (section 4.8)
- Various props/posters/information for use at Energy Road Show (section 4.9)
- Safe list of actions, to cover the 4 areas of our energy consumption: Buildings (Electricity and heating); Transport; Food; Stuff (Goods & Services). (section 4.10 and 4.11)
- Other recommended resources, books and links. <add to website ref.>
- Follow-up training, support and request for further resources via CC coordinator (cc@actionclimateteignbridge.org).

Section 4. References

4.1 Cognitive Biases



4.2 Serotonin and Dopamine



4.3 Attitudes

Survey in spring 2022, see DCE consultation report here

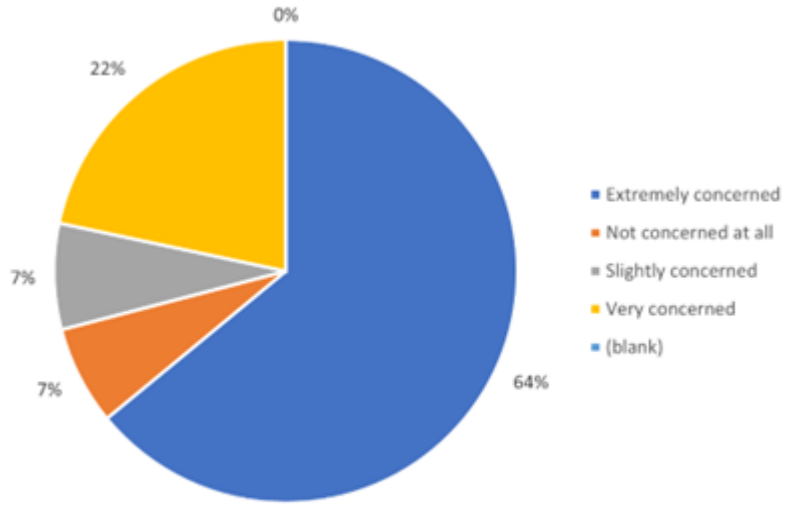


Figure 9. Pie chart showing how concerned respondents are about climate change

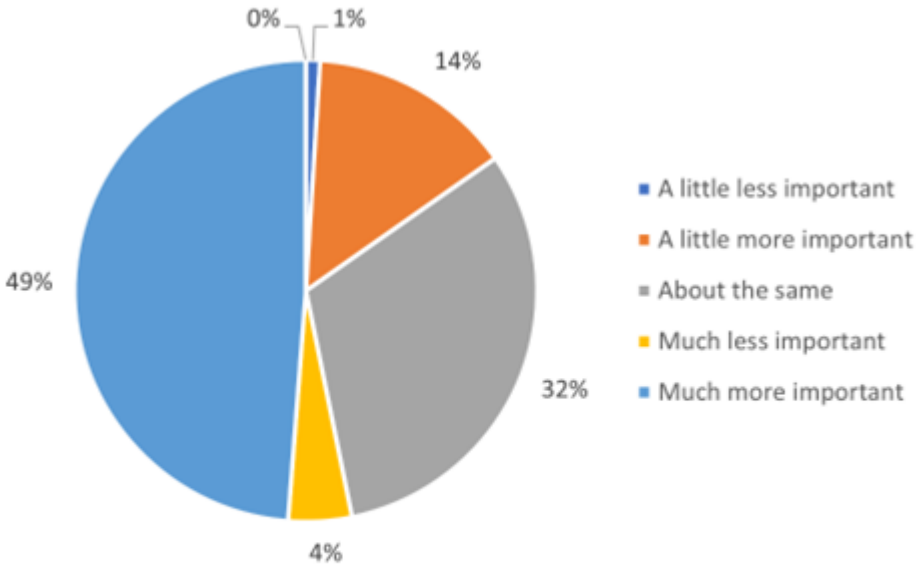


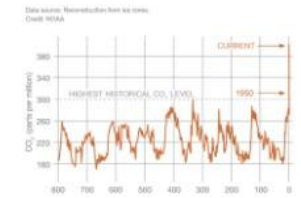
Figure 10. Pie chart showing whether climate change is more or less important to respondents than it was two years ago.

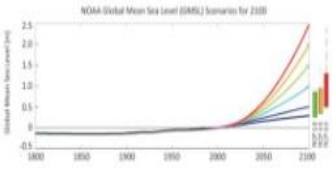
4.4 The Science and Terminology

ACTion on Climate in Teignbridge,
https://actionclimateteignbridge.org

Why do we need to calculate?

Year on year emission reduction is needed to avoid a Climate Tipping Point at 1.5 ^{O}C

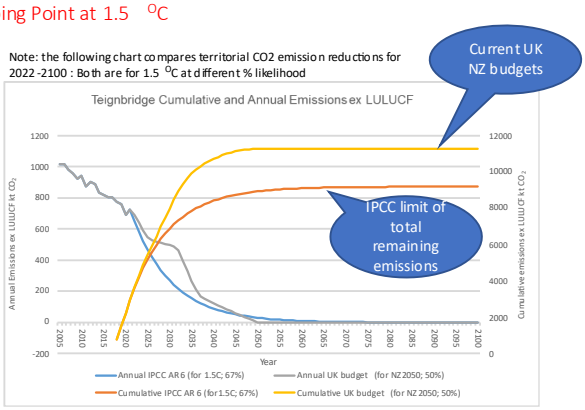




Science Based Targets

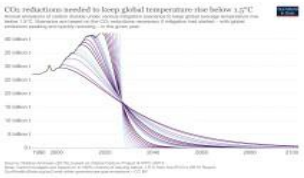
For an equitable allocation of global emissions in 2021

Note: the following chart compares territorial CO2 emission reductions for 2022 -2100 : Both are for 1.5 ^{O}C at different % likelihood



Climate Tipping Point:

Reverting the atmosphere to condition of high concentration of greenhouse gases, including methane currently locked by permafrost, making the earth uninhabitable for humans and other complex lifeforms.

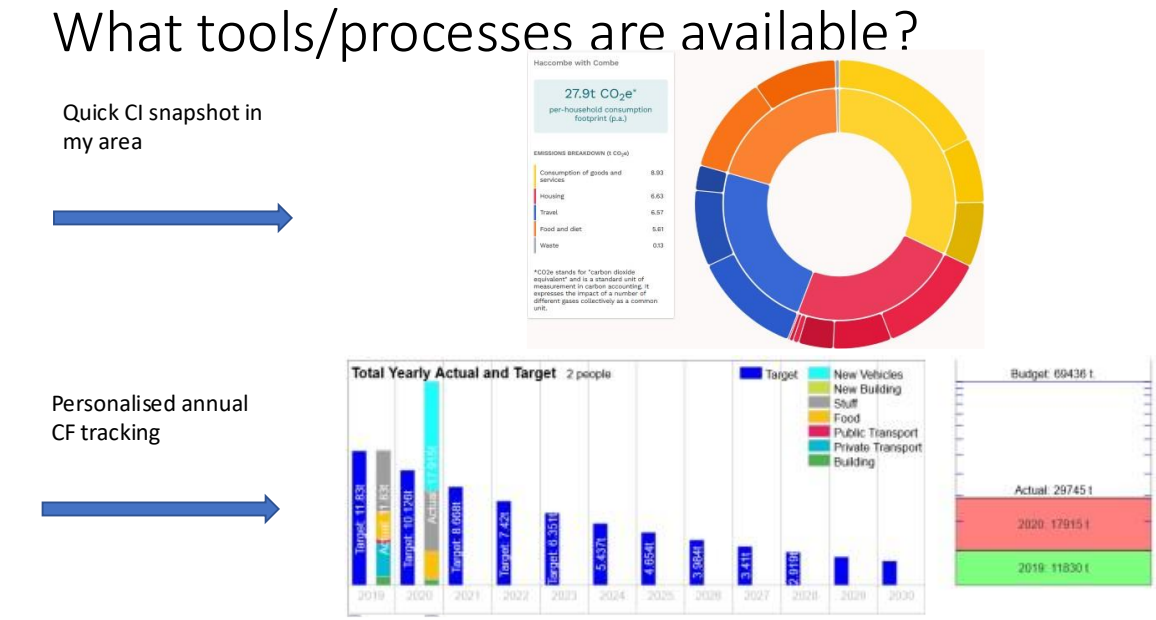


Net Zero =

4.5 Resource Pack

4.6 Carbon Calculators

ACTion on Climate in Teignbridge, https://actionclimateteignbridge.org



4.7 The Energy Assessment Pack

4.8 Games (E=MC²)

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4.9 Bucket prop & displays

This, together with a selection of displays/information is available to help engage people in different aspects of Climate Change, Energy use, Carbon emissions and Money.

4.10 The general 'safe' list of actions

ACTion on Climate in Teignbridge,
https://actionclimateteignbridge.org

Actions that are effective/immediate

If you have not done the personalised Carbon Footprint Tracker

things that will reduce emissions without the need for further analysis ('safe' actions):

•Consume less (don't fall for the sales/discount trap unless it is essential)
•Reuse, repurpose, recycle and share things you only use occasionally, they could make great presents
•Buy local (ideally made/grown locally), everything, food, goods, services
•Eat seasonally and grow your own food
•Eat less red meat, avoid imported meat
•Use a microwave and induction hob where possible, avoid ovens especially agas that run all the time
•Travel less in your car and fly less often
•Use public transport, walk or cycle
•Buy green electricity/gas, where this is 100% from renewables
•Heat only the area you need, set this to the lowest temperature to remain comfortable
•Improve your home's insulation and ventilation, get impartial advice
•Move your investments to low Carbon businesses

4.11 The detailed 'safe' action list

This is an expanded version of the general list for use by CCs. It covers several of the most common actions people are taking organised under the main areas; electricity, heating, transport, food and goods/services. Each action in a typical situation is accompanied by estimates of emissions and price so that the user gets a feel for how significant, or otherwise, an action is likely to be.

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