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Carbon Offsets and Tree Planting

Briefing paper by Dr Robin Russell-Jones and Dr Ulrich Loening

Definitions

Carbon Footprint

The term carbon footprint is the total amount of carbon dioxide plus other greenhouse gases (GHG's) released into the atmosphere as a result of a defined human activity. It may be applied to an individual, a business, a town, a country, a product or a process, and it is expressed in tonnes of carbon dioxide equivalent, written tonnes CO₂e. The term "other greenhouse gases" includes methane (CH₄), nitrous oxide (N₂O), and ozone (O₃) as well as trace gases such as chlorofluorocarbons (CFC's).

The average carbon footprint of a citizen can be calculated by taking the total GHG emissions of a country (As reported to the UN in the annual "National Inventory Report") and dividing that figure by the population of that country. For the UK the "official" carbon footprint of an individual is just under 7 tonnes of CO₂ equivalent per annum. However this figure does not give the entire picture as it excludes imported goods, such as processed food, clothes and electronics. It also excludes construction materials such as steel and cars manufactured abroad. Any industrial process has a carbon footprint, and the carbon emissions used to manufacture a particular product is known as the "embedded carbon". Over the past 30 years the manufacturing sector in the UK has shrunk, whilst the services sector has expanded. This means that materials and goods that were previously produced by industries based in the UK are now imported from abroad, and do not feature in the UK's carbon inventory. Thus the overseas component of the UK's overall carbon footprint has increased from 14% in 1990 to 46% today (<http://wwf.org.uk/carbon-report-2020>). In addition international transport, such as aviation and shipping, is also excluded from the national carbon inventory.

The Government likes to claim that the UK has reduced its carbon footprint by more than 45% since 1990, the base-line year for the UN's Framework Convention on Climate Change (UNFCCC); better known as the Kyoto protocol. This gives the impression that successive UK Governments have taken climate change seriously and have been implementing far-sighted policies to reduce the UK's carbon emissions. In fact an analysis by Carbon Brief shows that most of the reductions are in the energy sector, with little change in the transport, construction and food sectors.

<https://www.carbonbrief.org/analysis-why-the-uks-co2-emissions-have-fallen-38-since-1990>

In addition, if UK emissions were calculated to allow for the difference between imported and exported goods (so-called consumption-based emissions), then the UK's carbon footprint would have fallen by less than 20% over the past 30 years (<http://wwf.org.uk/carbon-report-2020>). Thus the average "consumption-based" carbon footprint of a UK citizen is not 7 tonnes CO₂e per annum. But closer to 10 tonnes, and 11 tonnes if aviation and shipping are factored into the calculation. This is why Greta Thunberg has described Britain's accounting of its carbon emissions as "inventive".

Zero carbon

Zero carbon is defined as producing no man-made carbon emissions at all. This may be achievable for individuals who live off-grid and have forsaken all modern conveniences, but since every industrial process has a carbon footprint, it is hard to imagine how zero carbon can be achieved by organisations and companies, let alone by towns and cities. Even within a specific sector such as public transport it is difficult to be genuinely zero carbon. For example it is possible to run buses entirely on renewable energy; but bus shelters made of concrete and buses made of steel contribute significantly to the overall carbon footprint of public transport, even if "low carbon" methods have been used to manufacture the steel and produce the concrete. Claims to be zero carbon usually involve only one aspect of the enterprise: ie travelling from A to B, and ignore the contribution to carbon emissions from manufacturing and construction. Equally individuals can claim zero carbon driving if they purchase an electric car powered by PV panels; but it is still necessary to ignore the carbon footprint involved in manufacturing the cars and the PV panels, let alone the concrete used in the building, platform or blocks to which they are attached. Zero carbon therefore involves a serious reappraisal of how society uses the resources at its disposal. For instance it means using timber and recycled materials for construction rather than steel and cement.

Scope 1,2 and 3 emissions.

When referring to organisations, businesses and councils, the fuel that they burn, and the electricity that they use is referred to as Scope 1 and 2 emissions. The materials used in the construction and manufacture of the

products they buy or build is known as Scope 3 emissions. When councils set a net zero target date, it may refer only to Scope 1 and 2 emissions. Other councils will set a separate date for Scope 3 emissions. Thus the City of London Corporation has set a target date of 2027 for its Scope 1 and 2 emissions; and 2040 for Scope 3.

Carbon Neutral

Rather than achieve zero carbon, many businesses councils and countries have decided that a more realistic goal is to become net zero carbon (which is synonymous with carbon neutral). This means balancing carbon emissions with carbon removal. This balance can be achieved by reducing or eliminating man-made emissions of carbon dioxide and other greenhouse gases (GHG's) at source (ie: working towards zero carbon); or by removing carbon. This can be achieved in several ways: either by capturing carbon dioxide and storing it underground (eg Carbon Capture and Storage (CCS); removing carbon from the atmosphere (Direct air capture) or by locking up carbon in a carbon sink (eg tree planting/ soil sequestration). CCS is a technology that is much trumpeted by the fossil fuel industry who seem to think that it will allow them to continue burning fossil fuels. However CCS is a technology still under development; it is very expensive and very energy intensive; and has not yet been deployed commercially anywhere in the world. Carbon sinks do benefit climate change particularly if forested areas and peat-bogs are left undisturbed. Planting trees is of limited value as trees are part of the natural carbon cycle. This is discussed in more detail below. As regards direct carbon capture, this has yet to be achieved at a scale that might benefit global warming. Currently the only method of directly capturing carbon from the atmosphere is photosynthesis, something that mankind has yet to replicate in a laboratory. The bottom line is that reducing emissions at source is currently the only reliable method of mitigating climate change. This means that reducing a carbon footprint anywhere close to zero is a far more challenging enterprise than is generally understood, and requires a far more comprehensive and fundamental change in the way we do things than has been acknowledged by politicians or the media.

Carbon negative

It is theoretically possible to create an energy supply with a negative carbon footprint. Growing a biofuel captures carbon dioxide from the atmosphere through photosynthesis. If CCS or some equivalent technology is used successfully to capture CO₂ when the biofuel is burnt, then you have produced an energy source which is carbon negative (More CO₂ is captured than is released). The biofuel could be grown on land, which displaces land for food production, or seaweed which can be harvested from the marine environment. In both cases there is a problem with scalability.

Carbon Offsetting

When organisations invest in processes that reduce or remove carbon and other greenhouse gases, but which they do not themselves own, it is known as carbon offsetting. Thus a company could support a certified project in the developing world to replace diesel generators with batteries charged by PV panels. This sort of arrangement could provide developing countries with renewable energy and is one way for the financial community to transfer monies to the Global South. Unfortunately these schemes are often used by airlines and other fossil fuel dependent industries to claim carbon neutrality when they have made little or no effort to reduce their own emissions at source. For example diesel generators are still widely used to refuel planes! In addition, airlines will often pass the costs of carbon offsetting to their passengers as a carbon levy. So they have done nothing to reduce their own emissions and their claim to be carbon neutral is also cost free.

Alternatively companies may purchase carbon credits through international or national emission trading schemes. Even customers buying from Amazon can voluntarily purchase carbon credits to offset the cost of transporting goods. James Hansen has described carbon credits as being the equivalent of medieval indulgences whereby individuals with a guilty conscience ensure freedom from climate sin.

Even so companies and councils are very enthusiastic about carbon offsets and the financial community appears keen to forge ahead. Mark Carney for example has called for \$100 bn to be invested in carbon offsetting. At a national level, when governments set a target date for net zero, they are conceding that there are certain sectors which may be very difficult to decarbonise, and they see carbon offsets as an alternative to zero carbon emissions. Janet Yellen, US Treasury secretary, has also promoted the value of carbon offsets. In the final analysis however the only parameter that matters is the level of greenhouse gases in the atmosphere. The danger of relying too much on carbon offsets is that it will delay any significant reduction in GHG levels. From that perspective carbon offsets are at best a diversion; and at worst a delusion.

Planting trees

Perhaps the only activity which all governments and councils can agree on is planting trees. However it is a fantasy to think that planting trees is going to have a significant impact on climate change; and here's why.

1. We have cut down approximately 60 % of the world's forests since the start of the agricultural revolution 10,000 years ago. The human population is estimated to have been about 7 million in 9000 BC at which time there was approximately 1 million trees for every human on the planet. Today the figure is 400. Thus when we plant trees we are simply paying back a debt to nature that we have already incurred
2. Trees are part of the natural carbon cycle: as trees age they die, decompose and emit green house gases back into the atmosphere. By contrast global warming is caused mainly by the burning of "geological" carbon: fossil fuels that were laid down aeons ago by the transformation of organic matter into oil, gas or coal. These energy sources have been created by "ancient sunlight". When they are dug out of the ground and burnt you are adding ancient energy to the existing biosphere. You cannot use the natural carbon cycle to neutralise the effects of burning geological carbon.
3. Firstly the timing does not work. It takes 30 years or more for a newly planted tree to absorb a significant amount of carbon. To be of any use to offset carbon emissions now, the trees would have to have been planted 50 years ago.
4. Tree-planting is in effect taking out a carbon mortgage. You are borrowing from future trees to sequester the carbon you emit now. It is difficult ever to catch up. You can go on planting trees in offset projects every year for years while you continue with your carbon emissions, such as by flying. After some 3 decades, when your trees are beginning to be useful, you will in the meantime have emitted another 3 decades worth of carbon.
5. Some companies hope to achieve carbon neutrality by purchasing tracts of primary forest. However there is nothing that connects the trees with the companies carbon emissions. The biosphere cannot know that the new trees belong to them or anybody else. The offset is purely in our minds,
6. One of the most spurious offsetting schemes did not even involve new planting; an English company bought up a Scottish peat bog to be the offset against their own emissions. Nothing had actually changed, the peat bog doesn't know anything about it. What difference does it make who owns it?
7. Biomass is never carbon neutral, for the same reasons of timing. Burning biomass emits carbon; even if the trees are replaced, there is always a time lag. Even in a continuously growing forest, if biomass is harvested annually and trees replanted, more carbon will be emitted than would have been the case if the forest had just been left alone. Harvesting sustainably within a forest, diverts biomass from slow decomposition to rapid burning, and also deprives the forest of valuable nutrient.
8. Sunlight hits the earth with 8000 times the power of all our fossil energy use. This continues whether we use it or not, as does wind and water power. By contrast biomass has to be renewed by photosynthesis.
9. The use of annually cropped waste can reduce emissions. The non-food parts of our crops, like straw, can be anaerobically digested to give methane and valuable compost. The methane provides a replacement gas supply without emitting more carbon than would have been if the waste had been thrown away.
10. Tree planting does help to regenerate old forests. They are part of the biosphere and through photosynthesis they are essential in maintaining the Earth in a habitable state. If most of our forests had remained intact, they would have helped to absorb some of the industrial carbon dioxide and make climate mitigation a bit easier. Tropical forests continue to sequester more carbon than they emit even when 'mature'; but even that is in danger of failing now, through both deforestation and degradation of existing forest.
11. Restored forests of the world will continue to buffer atmospheric carbon dioxide but cannot be expected to sequester the excess amounts emitted by industrial societies over centuries. The take-away message is that not cutting down trees is way more important than planting new ones.

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