Caroline Pomeroy: Carbon offsetting – a licence to pollute?

1. Some definitions and background

What is a carbon offset? *'A unit of carbon dioxide equivalent (CO_2e) that is reduced, avoided or sequestered to compensate for emissions occurring elsewhere'.*
(Sequestered/sequestrated means locked up or absorbed).

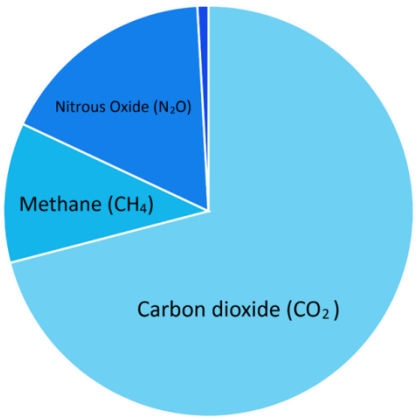
What is CO_2e?
CO2e is used to indicate that there are other gases in that atmosphere that have an impact on climate change. CO_2 makes up 0.04% of atmosphere (Nitrogen 78%, Oxygen 21%). After CO_2 the most significant of these is Methane, yet it only makes up 0.45420% of 1 kg of CO_2e. Each kg of CO_2e contains 994.64g of Carbon Dioxide

Gas	Percentage
Carbon Dioxide (CO_2)	99.46471%
Methane (CH_4)	0.45420%
Nitrous Oxide (N_2O)	0.08077%
Hydrofluorocarbons (HFCs)	0.00007%
Chlorofluorocarbons (CFCs)	0.00021%

This slide shows the composition of CO2e percentage by volume based on global concentrations[1].

What is Global Warming Potential?[2]

Gas	GWP	% weighted for GWP – i.e. relative effects
Carbon Dioxide (CO_2)	1	70.802667
Methane (CH_4)	34	10.992813
Nitrous Oxide (N_2O)	298	17.134529
Hydrofluorocarbons (HFCs)	1,550	0.791284
Chlorofluorocarbons (CFCs)	5,350	0.072669



[1] Source: http://cdiac.ornl.gov/pns/current_ghg.html
[2] Source: IPCC AR5

Global-warming potential (GWP) is a relative measure of how much heat a greenhouse gas traps in the atmosphere i.e. its **potency.** GWP is expressed as a factor of carbon dioxide (whose GWP is standardized to 1). If you released 1 kg of CO_2e into the atmosphere the CO_2 would contribute 71% of the warming effect on the atmosphere, Methane 11%, etc.

What's the difference between the compliance and voluntary carbon markets?
The 'compliance market' created by the 1997 Kyoto Protocol whereby nations trade carbon emission allocations using mechanisms such as the Clean Development Mechanism and European Union Emissions Trading Scheme. (CDM & EUETS allow private companies to sell carbon credits from projects in developing countries to other companies or governments in industrialised countries for use against their emissions targets).

This largely collapsed in 2012 because of too-high allowances due to strong negotiating by Annexe 1 (developed) countries, global recession, and lack of agreement on a replacement climate treaty. Its future will depend on international political will as demonstrated at COP 21.

Today we are looking at the small-scale voluntary carbon market. The voluntary market is regulated by ICROA (International Carbon Reduction and Offset Alliance) and includes bodies such as VCS, Gold Standard, Plan Vivo.

How does voluntary offsetting work?[3]
Projects, usually in the developing world, are funded by the sale of carbon credits in exchange for activities which reduce, avoid or sequester CO_2

In 2013 the voluntary carbon market was worth $379 million and was responsible for locking 76 million metric tonnes ($MtCO_2e$) of greenhouse gases (GHGs) out of the atmosphere. Both overall market value and average price per tonne fell from previous years, due in part to structural changes in California's carbon market which meant that millions of previously "voluntary" tonnes moved into the compliance market. Within this figure, projects that reduce emissions from deforestation and forest degradation more than doubled their transaction volumes to 22.6 $MtCO_2e$, and their market value also increased by 35% to $94 million. This growth came at a (lower) offset price of $\$4.2/tCO_2e$, down from $\$7.4/tCO_2e$ in 2012.

Projects fall into 3 main categories, where carbon emissions are
Sequestered

- Forestry and land use – afforestation (not forested in past 50 years), reforestation (replacing lost forest), enrichment planting, avoided deforestation. Protection of existing carbon sinks and creation of new ones

Avoided

- Household devices e.g. cookstoves, solar lamps, solar chargers, water filters.
- Renewables – run-of-river hydro (big dams outlawed), solar, wind, tidal, geothermal.
- Methane from landfill, biogas digesters (human, agricultural).

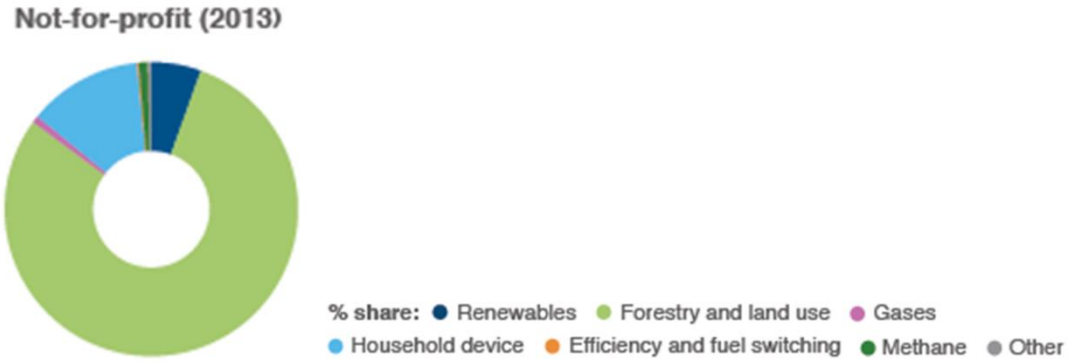
[3] Source: www.forest-trends.org/vcm2014.php

- Gases – HFCs, N_2O, geological sequestration.

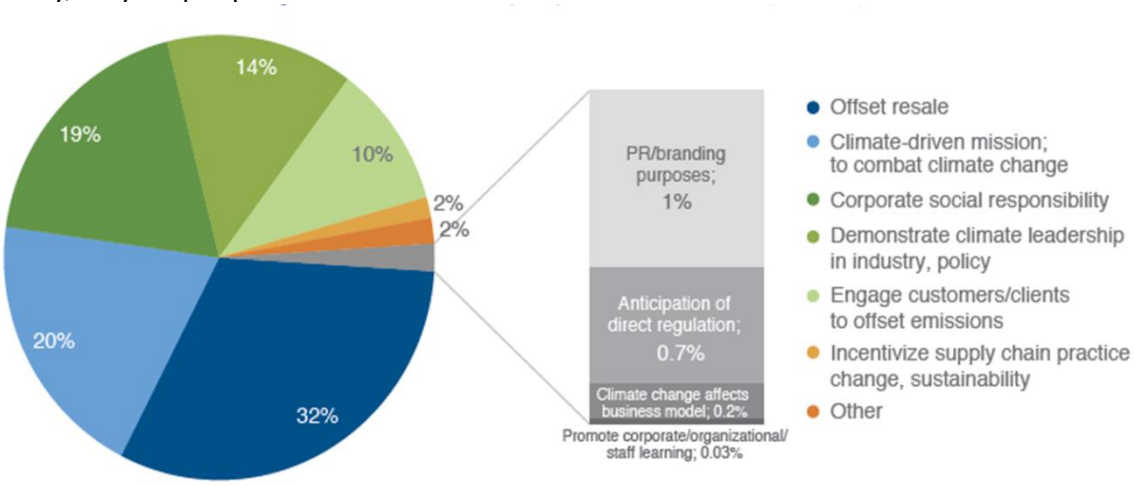
Reduced

- Energy efficiency and fuel switching – including insulation, coal to gas switching.

The pie chart below shows the split between project types in the not-for-profit sector.



Finally, why do people do it?



What are the criteria for offset projects?

Additional: Projects must exceed the likeliest "business-as-usual" scenario and demonstrate that GHG emission reductions or removals would not occur without revenue from the sale of credits.

Permanent: Projects in the Agriculture, Forestry and Other Land Use (AFOLU) sector must be designed to minimise the risk of unforeseen events such as fire or disease. A 'buffer' of 10-30% should be built in to insure against such events.

No leakage: Projects should be carefully planned in consultation with the local community to ensure that emission reduction in one area doesn't cause an increase in emissions outside the project boundary e.g. cutting trees elsewhere to make up for land lost due to afforestation.

Real, measurable and conservative: Projects must apply an approved methodology to ensure net GHG emission reductions or removals have either already taken place (ex-post) or are guaranteed in the future (ex-ante), and are measurable. Projects must use conservative assumptions, values and procedures to ensure emission reductions are not

overstated. For ex ante credits, risk of delivery is mitigated via protections (buffers, insurance stocks payment for performance).

A few final definitions!
Vintage – the year in which the reduction takes place
Retirement - Every carbon credit that is generated by a project has a unique identification number. When a carbon credit is purchased, it should immediately be retired through a third-party registry. This ensures the purchaser can claim an emission reduction and the credit cannot be sold to anyone else (i.e. prevents double counting).

2. The pros and cons of offsetting

Participants were split into four groups with 2-3 people in each. Each group had two pieces of writing about offsetting, one positive and one negative (texts attached at Appendix 1). Their task was to come up with arguments against each text

Some 'pros'

- can bring multiple additional benefits – livelihoods, biodiversity, health etc.
- enables individuals and organisations to become 'carbon neutral' (though beware the term)
- education – makes the connection between actual footprint and carbon cost (people can see that flying much, much worse than other activities)
- the indulgences criticism is not relevant to actual experience of offsetters - it is voluntary after all, and experience shows that offsetters are responsible and serious about reducing before offsetting

Some 'cons'

- 'indulgences'; a licence to pollute; dangerous distraction
- non-equivalence between forest carbon and fossil fuels (delay in absorption due to 'residence time' of atmospheric CO_2 but NB fungibility of CO_2)
- concerns re permanence, additionality, leakage;
- large scale issues eg land rights
- better to spend money of C reductions (e.g. video conferencing, renewables) than offsets

3. Carbon footprints

Average carbon footprint per head: UK 7.9, US 17.6, Rwanda 0.06 tonnes. And that's excluding embedded emissions. Reality of the global village – love miles – how many here have close family living overseas? Where? What can we do about this?

Climate Stewards carbon calculator[4] is based on DEFRA transport emissions factors[5] These include an 8% 'distance uplift' to reflect the reality that planes do not always fly on the most

[4] www.climatestewards.org/offset

direct route – they have to fly around international airspace, stack before landing etc. A much bigger change was also introduced in 2014, as the government sought to increase corporate responsibility for emissions. For the first time, companies were asked to increase the CO_2e emissions factor by 90%, to reflect 'radiative forcing' (RF) – the influence of other climate change effects of aviation, such as water vapour, contrails and Nitrous Oxide. At present this is voluntary and companies can 'opt out' of the uplift. The revised Climate Stewards calculator takes account of RF.

Built into the calculator are the 'great circle distances' i.e. shortest routes, between airports. The calculator then multiplies the distance between airports by the appropriate emission factor to arrive at a tonnage of CO_2e. This is divided by 3.67 to reach the figure for tonnes of carbon. Finally, this figure is multiplied by the offsetting cost per tonne of carbon to give the amount required to offset that particular flight.

4. What does a tonne of CO2 look like?

Here's what we do with schools and churches. Blow up a total of 28 balloons.

What is going into those balloons? 4% of exhaled air is CO_2 (by volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.039% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapour, on average around 1%.)

Other than humans and animals breathing out, what else puts CO_2 into the atmosphere?
Burning fossil fuels – power stations; engines – planes, trains, cars, buses all produce carbon emissions. We measure these emissions as tonnes of CO_2.
Once the balloons are all blown up, ask the group to guess, based on the size of the balloons that have been blown up, how many balloons could 1 tonne of CO_2 fill (presuming that the balloons would contain only CO_2 – unlike the balloons that have actually just been blown up). The answer: about 28,000 (which is equivalent to the volume of 4.5 London buses), 1,000 times more than our balloons. So that's what a tonne of CO_2 looks like.

How much tree does that make?
The tree in the photo is a 6 year old Ofram that stands around 20m tall. It absorbs (on average) about 380 kg of CO_2 per year. (*41.2 tC/ha with 400 trees per hectare = 0.103 tC per tree per year. 103 x 3.67 (C to CO_2) = 0.378 tonnes.)* So, this six year old tree has absorbed around 2,280 kg of CO_2 i.e. 621kg C, which is about 1/3 weight of total biomass (roots, leaves, water, bugs etc.) so the whole tree weighs around 1.8 tonnes. It is very hard, if not impossible, to get an exact figure – unless we cut the tree down and weigh it!

For comparison – this 1 kg (approx.) block of wood (dry, no leaves or roots) is 50% carbon – i.e. contains 500g of carbon. This translates to 1.84 kg of CO_2 – equivalent to the contents of 51 balloons.

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[5] https://www.gov.uk/government/publications/green-house-gas-conversion-factors-for-company-reporting-2013-methodology-paper-for-emission-factors

5. **Where does Climate Stewards work?**

In Ghana we partner with A Rocha Ghana to work with local farmers and school children to plant and care for indigenous trees. These small forests provide new wildlife habitat as well as fresh sources of income from beekeeping and the sale of forest products. School environment clubs teach practical lessons in conservation and use the new woodland as outdoor science labs.

In Kenya we're supporting our partner Paradigm to provide fuel-efficient cookstoves, water filters and solar lights at subsidised prices. The cookstoves are designed to cut the use of wood by 40 to 50%, while burning hotter and producing much less smoke; water filters cut out the need to boil water; and solar lamps replace ineffective, smoky paraffin lamps with brighter light. All in all, it's a win/win/win – fewer trees are cut down, women and children spend less time collecting wood, money spent on fuel is saved, respiratory and eye diseases are cut, and children have better light to read and work by.

In Mexico, our partner Scolel'te works with smallholder farmers in the Chiapas area of southern Mexico to create, restore and preserve indigenous forests through agroforestry. Over 25 varieties of indigenous trees are planted. Watersheds are protected and farmers are paid to preserve the trees and can use the thinnings.

Presented by Caroline Pomeroy on 7th March 2015 at Redcliffe College