

School of Engineering and the Built Environment  
MSc Energy and Environmental Management (Waste)

Defining Carbon Neutrality[[1]](#footnote-1)

*for policy makers*

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Abstract:

This paper aims to explain the concept of carbon neutrality to policy makers. The term carbon neutrality and its underlying concept of carbon footprinting and mechanism of carbon offsetting are defined. Weaknesses in carbon footprinting, such as the setting of boundaries and the lack of a global standard in carbon accounting, as well as discrepancies in the carbon offsetting mechanism are pointed out. Using the use cases of *Bananas* and flight offsetting by *Airline*, it is illustrated that in its current state carbon neutrality is motivated by marketing purposes and is making false promises to the consumer. As taking climate action is commendable even for the sole reason of marketing, the conclusion is to encourage corporations to seek carbon neutrality. However, recommendations for regulatory actions, such as the standardisation and protection of the term carbon neutral or the regulation of the NGO driven offsetting market, are advised in order to create transparency and protect the consumer.

# Introduction

With the Bonn talks just being over and the Paris Agreement still fresh off the press, climate friendly action is back in the focus. Awareness that too little is happening too slowly is on the rise and more and more individuals and corporations express their intention to do their part for mitigating climate change by transitioning to a low carbon economy.

With CO2 being the chosen culprit among the Greenhouse Gases (GHG), airlines offer their customers to offset their individualized CO2 emissions from their vacation flights; Murauer (Austrian beer brand) is offering carbon neutral beer; Bananas offers carbon neutral bananas to the world; Benn & Jerry’s offered CO2-guilt-free ice cream. Google lures its clients with carbon neutral information, Dell with neutral computers and HSBC with carbon neutral money (Kilian *et al.* 2012).

Now what is that *carbon neutrality* that they offer? Is it something the government should endorse or is it something the consumer needs to be protected from?

This essay aims to introduce the policy maker to the underlying concepts and mechanisms in order to ease an informed decision in the matter of carbon neutrality.

# The Concept of Carbon Neutrality (CN)

Generally, CN is used to describe a human activity where the same amount of CO2 caused by it, is also cancelled out by saving the same amount of CO2 from another human activity.

CN however is not a scientific term. In some cases CN refers to the compensation of CO2 emissions only, and in other cases all GHG emissions are taken into account. This will have a significant impact on achieving CN, as CO2 is only one of the six gases of the so-called Kyoto Basket. While CO2 is the most abundant of the gases, it is not the one with the highest global warming potential. To make the impact of the gases comparable, the other five GHGes are converted to their so called CO2-equivalent (CO2e) (UNFCCC 2017).

So in order for a process, product or more generally an activity, to be CN, the same amount of CO2e it causes, must be offset somewhere else by another human activity.

While any combustion process releases CO2 and e.g. the decomposition of organic material releases methane, these can be cancelled out by:

* **Reducing** an equal amount of CO2e.   
  This can also be in a different geographic location by e.g. planting trees, or preventing trees from getting cut down or an increase of efficiency in power generation; or
* **Preventing** the generation of an equal amount of CO2e.   
  By e.g. renewable instead of fossil fuel based power generation.

Or by recycling and GHG-reduced disposal or recovery of waste (Murray and Dey 2009). Recycled materials are intended to replace virgin materials. This is thought to lead to less CO2e released during the sourcing of primary materials and their processing into the desired product. However, the collection, separation and reprocessing of recyclates is not CN itself, so the possibilities of using waste management practices as offset mechanism is questionable or at least has to be corrected for the emissions caused during the recycling process.

CO2e reducing or preventing measures must also be of anthropogenic origin and must constitute an additional effort, i.e. must be a tree planted with the purpose of reducing GHG-concentration in the atmosphere. An already growing tree cannot be counted as an offset (Murray and Dey 2009).

The term carbon neutral may be misleading and imply there are no additional CO2 emissions from an activity classified as such. This is not the case, as there will always be additional CO2 emissions from energy consuming processes. They will merely be counter-balanced by CO2 mitigating actions.

In order to establish CN, one must first asses how much CO2e an activity causes and then determine how this can be mitigated. Assessing the amount of CO2e is done by calculating the so-called carbon footprint.

# The Concept of Carbon Footprint (CF)

Generally, the carbon footprint is understood as the total GHG emissions of the entity it is calculated for. CFs are mostly calculated for a product (e.g. banana), an activity (e.g. flight), or a person or household (on an annual basis). It is commonly expressed in CO2e.

Similar to CN, the CF is not a scientific term either. Footprinting has been driven by the private sector and there hence are various ways of calculating it (Weidema *et al.* 2008).

Weidema *et al.* (2008) argue that an activity’s GHG emissions are only one aspect of the activity’s environmental impact. And as it is described as the accounting of its emissions over its entire life cycle, footprinting should follow established standards for life cycle assessments (LCA) from the ISO 14000 family. However, different approaches are being developed such as the Publicly Available Specification – PAS 2050:2011 for the assessment of the life cycle GHG emissions of goods and services.

Approaches such as the PAS 2050 or the ISO 14040 are suitable for the footprinting of commercial activities. For personal, every-day use, these are too comprehensive. Many online footprinting calculators, varying in complexity and accuracy, have been developed for this purpose. These may only serve as rough indicators for changes in personal behaviour. As most of these calculators are unclear on their assessment of all GHGes or merely CO2 or on what their scope and system boundaries are (Weidema *et al.* 2008, Murray and Dey 2009).

Formalized approaches such as the ISO or PAS, will borrow from LCA tools for, amongst others, the setting of the scope and system boundaries of the CF (Menzies *et al.* 2013). When establishing a corporation’s CF it is important to define boundaries. This may already be a challenge, as the case of Banana shows (chapter 5.1) where problems in allocation of responsibility for emissions across the supply chain influenced the setting of boundaries.

The setting of boundaries together with the identification of a corporation’s GHG emissions, i.e. scoping, are at the centre of establishing an accurate CF. The biggest pitfall is not to double count or omit emissions: if the borders of what a corporation accounts for are blurred, then there is the possibility of overlaps in accounting emissions, leading to double counting (Murray and Dey 2009). And vice versa, blurred responsibilities may lead to emissions not being accounted for at all.

Guidance material defines the following three scopes for accounting:

**Scope 1: Direct emissions** are such which the accounting entity has direct control or ownership over – e.g. vehicle fuel emissions

**Scope 2: Indirect emissions from energy** consumption

**Scope 3: Other indirect emissions** which are caused by the corporation’s activities, such as waste disposal and commuting.

(DEFRA 2009)

If scoping and boundaries are not set accurately, the CF will not be representative.

The CF is only one of many indicators for the environmental impact of an activity and Weidema *et al.* (2008) warn of the potential of oversimplification. Furthermore, as long as there is no standard, CFs are not comparable, as they may include only CO2 emissions or all GHGes (Weidema *et al.* 2008). This will have an impact on the achievability of CN: if solely CO2 emissions are counted, the CO2e needed to offset will be less, making it easier to achieve so-called neutrality. However, the environmental impact of the other GHGes caused by the same activity will remain. This may mislead the consumer.

Therefore, standardising efforts such as the DEFRA’s *Guidance on how to measure and report your greenhouse gas emissions* (DEFRA 2009) or World Resources Institute’s *The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard* (Ranganathan *et al.* 2004) are commendable. However, as long as there is not one global standard, issues of double counting or omission of emissions accounting remain in a globalized economy.

# The Concept of Carbon Offsetting

After establishing its CF, a corporation can set up a strategy on reducing emissions in its activities which may also lead to financial savings (DEFRA 2009). The remaining CO2e can be compensated by offsetting.

A corporation’s GHG emissions can be offset by preventing GHG emissions in form of renewable energy projects instead of traditional fossil fuelled power production or land use change initiatives. This can either be done locally, in the country of the emissions’ origin (mostly a developed country), or in developing countries. This mechanism is not only used to offset emissions in a developed economy, but also to foster sustainable development in developing economies. The UN has institutionalized this mechanism under the Framework Convention on Climate Change (UNFCCC) in form of the so-called Clean Development Mechanism (CDM) (UNFCCC 2014). Most voluntary offset mechanisms work under the UN’s Clean Development Mechanism (CDM), which is one of three carbon control mechanisms, the so-called “flexible mechanisms”, established under the Kyoto Protocol:

1. international emissions trading (IET),
2. joint implementation (JI), and the
3. clean development mechanism (CDM)

The CDM’s main objectives are to:

* “(…) assist countries without emissions targets (ie developing countries) in achieving sustainable development.” (Sandbag 2011a)
* “(…) help those countries with emission reduction targets under Kyoto (ie developed countries) in achieving compliance by allowing them to purchase offsets created by CDM projects.” (Sandbag 2011a)

Many projects for offsetting are handled by NGOs which may apply for certification of their projects under the UNFCCC’s CDM. It is crucial for a project to demonstrate *additionality*, meaning that the project would not have been implemented, if it hadn’t been for offsetting purposes.

The application process can take years at the end of which the projects attain permits in form of CERs (Certified Emission Reductions). Projects following the principles of the CDM but that are too small to be certified, yield so called Verified Emission Reductions (VER). One CER or VER equals 1 tCO2. The NGOs sell their CERs or VERs as a whole or in part to corporations seeking to offset emissions (Murray and Dey 2009).

Carbon offsetting is not to be confused with emissions trading. Emissions trading has a legal framework, while carbon offsetting is unregulated and on a voluntary basis ruled by NGOs (Murray and Dey 2009). Normally corporations striving to achieve CN do not fall under the scope of National GHG Inventories. Hence, the carbon offsetting of these does not fall under the cap and trade of national Emissions Trading Schemes either (Sandbag 2011b).

Murray and Dey (2009) have investigated several offsetting projects used by corporations and concluded that information about offsetting projects on the ground are somewhat misleading. A corporation may pay for setting up a project that in fact is not offsetting any carbon at the moment of purchase, but only in the future. So strictly speaking, the corporation is not offsetting any emissions at that moment, but investing in a project that (hopefully) will offset emissions in a not further specified future.

The status of CDM registration, which is supposed to provide a quality standard to the customer, is not always clear either. A corporation may be supporting a project that is not registered with the CDM yet, but is applying for it, or is designed following CDM.

Another important aspect is the concept of *retiredness* of a CER/VER. There needs to be assurance that the CER/VER a corporation acquires are in fact retired and not resold to another corporation (Murray and Dey 2009) – i.e. are not double counted offsets.

The main issues with the NGO dominated offsetting market are:

* Lack of transparency: Is a sold credit retired? Is the project a corporation is investing in trustworthy?
* Time: today’s emissions will be offset later. An average tree will sequester 730kg of CO2 after 100 years. It is difficult to guarantee a tree planted today will still be there in 100 years (Murray and Dey 2009).

Furthermore, the classification of biomass for power production as renewable and its eligibility for offsetting CO2 is highly questionable (Johnson 2008).

Further basic questions on how to put a monetary value on emissions and their offsets are yet to be solved too.

# Use Cases

## Banana

*Banana* is one of the largest fresh fruit producers in the world and has pledged in 2007 to become CN. It has been evaluating 2 possibilities:

* Large-scale offset of emissions from the entire supply chain, through a dedicated fund, which is financed by increased product price, i.e. the consumer pays for the offset.
* Small-scale implementation of CN for products from certain farmers only. (Kilian *et al.* 2012).

*Banana* follows the Greenhouse Gas Protocol and PAS 2050 methodology. In order to achieve CN, *Banana* considered emissions from agriculture, processing and transportation. However, the following misrepresentations of its CF can be identified:

* exclusion of scope 3 emissions such as commuting and waste disposal (Banana 2011).
* exclusion of maritime transport (COHA 2009), which should be included due to its cradle-to-gate approach (PAS 2011), but transport partners would not assume responsibility for their emissions (Kilian *et al.* 2012).

*Banana* has reduced its agricultural emissions through modifying the production and application of fertilizers, significantly decreasing its fuel consumption and implementing small-scale waste-to-energy projects (biogas from mule feces) (Banana 2011).

However, *Banana* still heavily relies on offsetting mechanisms such as planting trees, which is questionable for reasons stated earlier.

## Airline

*Airline* claims to be the most sustainable airline since 12 years (Airline 2017a).

*Airline* bases its CN efforts on three pillars:

**Reduction** of GHG emissions is achieved through the gradual replacement of planes with more fuel efficient models (Airline 2017b). This is a good example of DEFRA’s (2009) point of an environmentally friendly option also being the economic favourable option.

However, one may argue that the GHG reduction in this case is merely the side effect of an economically driven decision. Especially, as some of the newly purchased aircrafts are not the most fuel efficient on the market (Leeham 2014, Airways News 2016).

*Airline* claims to extend its use of biofuels. However, recent research suggests that an increase in use of biofuels for aviation may lead to a decrease in CO2 emissions, but still lead to an increase of the remaining GHGes and hence hinder CN in the long term (Krammer *et al.* 2013).

**Control** is exerted over *Airline*’s emissions via the EU’s emissions trading scheme. This merely means that *Airline* is participating in its national GHG inventory for domestic aviation. Which it is legally obliged to take part in.

**Compensation** is offered to passengers in form of voluntary purchasing offset credits. These credits are attained from a reforestation project in Panama. Among others, the project aims to further sustainable timber production (Airline 2017c), which will merely be a viable offset, if that timber is used as building material and not combusted.

*Airline* calls this programme *CO2 Zero* implying that no CO2 emissions are caused at all. This is highly misleading to the consumer. Also, as the customer is paying for the offset, the moral credit *Airline* may take for this action is questionable.

# Recommendations and Conclusion

Given the nature of the corporations claiming CN, it is clear that this is being done for marketing purposes. Which is commendable and should be encouraged, as long as it does not mislead consumers.

In order to protect consumers, the following recommendations are given:

* Define and protect the term carbon neutral where
  + all GHGes from the Kyoto basket are included.
* Implement a global standard for CF and
  + establish a rule for embodied carbon.
* Regulate offsetting:

Control over the global carbon offsetting market by e.g. the CDM is desirable for fostering transparency and a common standard in accounting and verifying. However, the time it takes to verify a project under the CDM is a bottleneck in the system.

* + introduce a national regulating body that can operate faster
* Create consumer friendly and transparent communication towards the public, making it clear as to what CN means.

If no policy driven action is taken, CN will be an unregulated, greenwashing industry with potential to mislead consumers.

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# Appendix: Assignment Brief

MMH221233 Coursework 2:   
Defining Carbon Neutrality

**Your task:**

Write a 2,000-2,500 word essay on how you would define carbon neutrality.

You might want to do this from the perspective of someone working for an organisation trying to achieve this, e.g. a government department, a local council, a housing developer, a major company, or a small business; either in the UK or in your country of origin. Or you may want to write an independent critique of the various approaches being proposed by different organisations.

Your essay should be a report aimed at policy makers or your organisation's Chief Executive, and should cover the following:

* What carbon neutrality means to you or the organisation you are representing
* The costs and benefits of achieving carbon neutrality
* What emissions you or your organisation would include under the three scopes
* How you would set the boundaries for accounting - e.g. should embodied emissions be included?
* Any significant barriers to measuring, apportioning and justifying emissions
* What role, if any, should carbon offsetting be allowed to play - what is and isn't a valid offset option?
* How applicable is your recommended approach to other or all organisations or countries?

**You are not expected to cover all of these in depth, and you may wish to focus on one or more of them, depending on your chosen perspective or individual interests.**

**Highest marks** will be awarded to those who can demonstrate that they have understood and critically analysed the evidence and debate, and develop a logical and coherent argument in favour of their position.

Your submission should not be more than **10 pages** long (excluding figures and tables, if any, plus bibliography) and should be submitted via the *GCULearn* system by **5pm on Fri 15th December 2017**.

Late submissions will have marks deducted.

**Good luck!**

1. Companies evaluated in this report have been anonymized upon request of PRME. [↑](#footnote-ref-1)