Glossary of Terms: Carbon Net Zero and Smart Solutions

This document outlines the key terms used when discussing Carbon Net Zero and Smart Solutions.

This glossary accompanies the Crown Commercial Service's key strategy as a procurement agency to deliver Carbon Net Zero and Smart Solutions for public sector customers. These products and services can be found on the CCS Carbon Net Zero webpage.

Net Zero Target

In June 2019 the UK government committed to a Net Zero carbon target for 2050, which would effectively end the UK's contribution to climate change.

According to the Climate Change Committee, this would mean almost total decarbonisation of all sectors of the UK economy, with any residual emissions offset by the removal of carbon dioxide (CO_2) from the atmosphere. The aim is for the UK to achieve the target entirely through action in the UK without recourse to international offsets.

A large number of organisations, both public and private, are declaring their own Net Zero Target, often ahead of the 2050 date. This would require them to achieve Carbon Net Zero in their operations, as defined by their carbon footprint and by following their carbon strategies.

Some of these organisations are also aiming to make their targets science-based to add more weight to their decarbonisation efforts and avoid greenwashing.

Carbon Net Zero

Sometimes known as Net Zero Carbon or just Net Zero, this describes a state where any CO_2 or Greenhouse Gas (GHG) emissions left over after decarbonisation are offset by negative emissions of an equivalent amount of CO_2 from the atmosphere, resulting in no net GHG impact.

The offsets need to actively remove carbon dioxide from the atmosphere, as opposed to only avoiding emissions elsewhere which is allowed in the specification for carbon neutral.

There is not yet an agreed standard on what constitutes Net Zero Carbon for an organisation, product or country, although there are multiple organisations with working definitions, for example, the Science Based Targets Initiative.

Carbon Neutral

A carbon neutral footprint is one where the sum of GHG emissions produced is offset by natural carbon sinks and/or carbon credits.

PAS 2060 is the internationally recognised specification for carbon neutrality. It sets out requirements for quantification, reduction and offsetting of GHG emissions for organisations, products and events.

The rules around carbon neutrality are less strict than for Net Zero Carbon as they allow for products, services and companies to claim neutrality now in ways that will not contribute to achieving the Net Zero Target for 2050, such as, through buying offsets for avoided emissions in developing countries, rather than eliminating their own emissions or paying for removed emissions.

Zero Carbon

At the most basic level, something which emits no GHG emissions during its use phase, for

example, electricity from wind turbines could be called 'zero carbon electricity'.

Net Zero Compatible

A concept which has started recently, to show that the organisation is taking into account the Net Zero Target by developing a long-term strategy to achieve the target and/or by making investments now to enable long-term decarbonisation.

For example, Science-based Targets need significant decarbonisation every year for it to consider the target Net Zero Compatible.

Decarbonisation

Reduction of emissions of CO_2 or other GHGs from a product, service, organisation or country.

For example the electricity grid can decarbonise by increasing the use of renewable energy and the transport sector can decarbonise by moving to low emission vehicles.

Organisations and countries decarbonise as they reduce their carbon footprint to meet their carbon targets.

Carbon Emissions

The generally accepted term for the release of carbon dioxide and often greenhouse gases of any type, usually measured in tonnes of carbon dioxide-equivalent (t CO_2e).

Other GHGs are 'converted' to an equivalent amount of carbon dioxide to allow for easy comparison between the gases, using their Global Warming Potential (GWP). For example, methane has a GWP of 34 over a 100-year timeframe. This means that 1kg of methane contributes the same amount of warming as 34kg of carbon dioxide over 100 years.

Although many of the lesser known GHGs have GWPs higher than carbon dioxide, carbon dioxide is present in much larger amounts and is therefore much more responsible for climate change than the other gases (estimated at two-thirds of the effect, compared to around a fifth for methane and a tenth for nitrous oxides).

Carbon offsetting

There are several accredited schemes for offsetting emissions including the Clean Development Mechanism, Voluntary Carbon Standard or the Gold Standard.

These schemes exist to 'offset' GHG emissions to reduce the carbon footprint of an organisation, product or service, through buying certificates or 'credits' to buy an equivalent amount of avoided or negative emissions.

These schemes typically invest in similar projects, with examples from the Gold Standardincluding: renewable energy in developing countries, cleaner cookstoves and forest regeneration. The first two of these are examples of avoided emissions, and forest

regeneration is an example of removed emissions.

The Greening Government Commitments and voluntary Emissions Reduction Pledge do not currently allow for offsetting in this way to achieve their targets, meaning it is in effect impossible for a central government body to be Net Zero.

The next revision of the GGC due in Spring 2021 may change these rules and set a long-term goal for Net Zero for public sector bodies.

Avoided emissions

Many offsetting schemes focus on helping other parties reduce their carbon emissions, thereby reducing the total amount of GHG emissions released into the atmosphere - so-called avoided emissions.

These schemes often focus on the developing world as carbon reductions can be cheaper, meaning the cost of offsets is lower. There can also be additional benefits to some of the schemes, through, for example, reducing costs of energy or pollution, which are of particular benefit in some communities.

Some organisations focus on helping other organisations in their supply chain: this can give the additional benefit of reducing their own Scope 3 carbon footprint.

The Taskforce on Scaling Voluntary Carbon Markets sees value in this kind of offsetting as it can help developing countries decarbonise on the way to 2050. However these offsets cannot be used to hit our Net Zero targets as we will need to actively remove emissions, not merely avoid them.

Negative emissions

Also known as removed or sequestered carbon, this is where CO_2 is actively removed from the atmosphere and stored for an extended period of time.

Examples include:
- tree-planting programmes, which absorb CO_2 as they grow, although this requires the resulting forest to exist for significant periods of time
- BioEnergy with Carbon Capture and Storage (BECCS), which uses biomass (for example, wood pellets) to generate energy, captures the resulting CO_2 and then stores it
- Direct Air Capture (DAC) and storage, which would take CO_2 directly from the air and store it

To hit Net Zero targets all remaining emissions in 2050 will need to be offset by a reliable source of negative emissions of this type. Given the difficulty and expense in generating negative emissions, deep decarbonisation will be required before this can be considered for any residual emissions.

Concerns

There have been concerns about the existing schemes for carbon offsetting, including potential fraud, double counting of reductions, carbon leakage and the short term nature of some solutions.

Partly because of these concerns, offsetting is not currently considered to be a high-quality decarbonisation solution and is not accepted as a Net Zero solution for central government in the UK.

The Taskforce on Scaling Voluntary Carbon Markets is investigating the possibility of a new market specifically focussed on carbon offsets which would address these concerns and which could help push decarbonisation faster across the economy by providing funding for developing countries and developing an innovative market for negative emissions.

Sustainability

The most widely used definition of sustainable development was developed in 1987 by the World Commission on the Environment and Development, as:

> "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

There are three pillars of sustainable development: environmental, social and economic.

Decarbonisation has often been managed as part of an organisation's sustainability work as part of the environmental pillar, although the urgent and revolutionary nature of the Net Zero Target means that it will be increasingly important with impact across all aspects of an organisation. This may mean more dedicated Net Zero teams working outside the normal sustainability remit.

Other parts of the environmental pillar of sustainability would include pollution (including air, water and noise pollution), biodiversity, water, waste and more. All of these factors remain important in their own right, not as part of the Net Zero transition.

Carbon footprint

The sum of GHG emissions from an individual, product, organisation or country, used to measure their climate change impact.

The carbon footprint can depend on the boundaries drawn around the organisation: for instance, it is usual to include areas within an organisation's operational control but limit what is included outside operational control.

The Greenhouse Gas Protocol is the international standard for carbon footprint reporting, and largely replicated by Department for Environment, Food and Rural Affairs (Defra) guidance in the UK. This separates emissions into different scopes (sections) within a report. Scopes 1 and 2 are mandatory within a published carbon footprint and scope 3 emissions are voluntary.

- scope 1 - direct emissions from the activities that are under an organisation's direct control, such as fuel combustion, vehicles and fugitive emissions
- scope 2 - indirect emissions related to the production of electricity, heat and steam that is bought by the organisation
- scope 3 - all other indirect emissions resulting from activities that are not owned or controlled by the organisation (this includes emissions related to the use of consumer goods, transportation, waste treatment, and employee travel)

Under the PAS 2060 standard, to be carbon neutral a carbon footprint must cover scopes 1 and 2 and any scope 3 emissions responsible for more than 1% of the total footprint.

There is not yet a standard for a Net Zero Carbon organisation, but it is suggested that this should cover all scope 1, 2 and 3 emissions and require a Net Zero compatible strategy. This first requirement would be particularly demanding. The NHS has estimated the scope 3 emissions outside its control are 3 times higher than the scope 1, 2 and 3 emissions within its control.

Carbon

We often talk about 'carbon' as a shorthand term for carbon dioxide (CO_2), which is the primary greenhouse gas responsible for climate change.

It is also used to describe the entire range of greenhouse gases when discussing carbon emissions.

Greenhouse Gases

This is the catch-all term for gases that contribute to climate change by trapping heat in the atmosphere. Some greenhouse gases (GHG) are naturally occurring, but human activity is increasing the concentration in the atmosphere which is resulting in a rising global temperature.

The standard for managing GHGs comes from the Kyoto Protocol, which contains mechanisms for managing the so-called 'basket of gases':

Carbon dioxide CO_2
Mainly emitted from burning fossil fuels, industrial processes and land use change.

Methane CH_4
A fossil fuel that is also emitted from agriculture landfilled waste and land use change.

Nitrous oxide N_2O
Mainly emitted from fertiliser used in agriculture, burning fossil fuels and industrial processes.

Fluorinated gases (HFCs, PFCs, SF_6, NF_3)
A range of artificial gases used in refrigeration, aerosols and industrial processes.

Science-based Targets

Many organisations are now calling for 'science-based targets', as a way of showing ambition and rigour through their rapid decarbonisation efforts, and to avoid accusations of 'greenwashing'.

Net Zero Targets are considered 'science-based' if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement in managing climate change.

There is no accepted standard for 'science-based targets', but the Science Based Targets Initiative (SBTi) has been working on a voluntary process for corporations that provides a comprehensive methodology for putting together a Science-Based Target.

The SBTi is a partnership between the CDP, the United Nations Global Compact (UNGC), World Resources Institute (WRI) and the World Wide Fund for Nature (WWF), and uses the GHG Protocol carbon footprinting methodology developed by WRI. It focuses on scopes 1 and 2 as being under the direct control of the organisation and therefore the areas which the organisation can decarbonise.

SBTi does not currently work with the public sector, although they recommend using the methodologies they have developed to inform the targets and strategies developed by the public sector.

Carbon Strategies

Also known as Climate, Climate Action or Net Zero [carbon] Strategies, these are the plans or actions which have been identified as leading the decarbonisation of the organisation in order to achieve their Net Zero targets.

This is one of the most important components of an organisation's approach to Net Zero, along with measuring their carbon footprint to understand their current GHG emissions, and setting a Net Zero Target to define where they want to be and when.

Climate Emergency Declaration

A climate emergency declaration is an action taken by local or central governments or other bodies to acknowledge humanity is in a climate crisis.

In declaring a climate emergency, the organisation admits that climate change exists and that the measures taken up to this point are not enough to limit the changes brought by it. The decision stresses the need for the organisation to devise measures that try and stop man-made climate change.

A huge number of local councils and other public sector bodies across the UK have declared a climate emergency, as has the UK government itself, often together with setting a Net Zero Target.

Climate Change

Climate change, sometimes referred to as man-made or anthropogenic climate change, is the disruption to the climate system due to the ongoing increase of greenhouse gases in the atmosphere.

The Paris Agreement is the international agreement regarding climate change and aims to limit global warming to well-below 2°C above pre-industrial levels and pursuing efforts to limit warming to 1.5°C.

It is expected that climate change will continue to accelerate until the entire global economy is Net Zero Carbon, and the longer it takes to reduce carbon emissions the worse the

impacts of climate change will be. This is why many organisations are looking into Science-based Targets to make sure they are aligned with the latest view on how best to limit these negative impacts through rapid decarbonisation.

Although the net effect of GHGs is to increase the average temperature of the planet, local effects can be variable which is why this term has replaced the previous term Global Warming.

Greenwashing

A somewhat disparaging term defined as "behaviour or activities that make people believe that a company is doing more to protect the environment than it is."

This could include actions like buying carbon offsets instead of decarbonising their own carbon footprint, or declaring a Net Zero target that is not based on the latest climate science, or excludes important sources of emissions.

Since greenwashing aims to gather the public relations benefits of climate action without actually performing the actions, it should be avoided at all costs.

Smart Solutions

This could refer to a range of different things, including smart technology, smart energy, smart systems and smart building controls.

Overall, this refers to the use of digital technology to add functionality to systems, usually with a 2-way monitor and control arrangement that offers communication with both customers and other smart technology to achieve outcomes. For instance, a smart building control system could monitor occupancy in a room and control the air conditioning system and lighting system appropriately.

It is expected that introducing smart systems will be a significant part of an organisation's decarbonisation journey, as smart controls can be much more efficient than a standard control system and smart technology can create new opportunities where none existed before.

It is expected that smart technology will improve a wide range of different areas and technologies, and will link into other technology-led developments including Artificial Intelligence (AI), Big Data and the Internet of Things (IoT).

Internet of Things (IoT)

The Internet of Things (IoT) is the web of connections and communications created as Smart Technologies send and receive information to each other. Such as thermostats communicating with boilers or traffic lights communicating with public transport vehicles. The IoT uses data networks, such as WiFi or cellular networks.

IoT networks are meant to encourage efficiency and reduce waste by sharing live and accurate information between devices. Artificial Intelligence (AI) can also be part of this process to adapt and learn more efficient processes. 35% of US manufacturers are already

using Smart Sensors to communicate with other parts of their production lines.

Artificial Intelligence (AI)

Artificial Intelligence (AI) are devices that can monitor their environments and take actions to maximise their chances of achieving a pre-defined outcome. Central to this is that these devices can 'learn' from previous attempts, becoming better at achieving their goals, sometimes called 'machine learning'.

AI devices benefit from being connected to other devices and the IoT as this can improve the amount and accuracy of the information they are receiving. They can also communicate with these other devices and send instructions for how to improve the chances of achieving their goals. A self-driving car could receive signals from the outside of the car that it was raining, allowing the AI to communicate to the engine that it should slow down and switch on the windscreen wipers.

Some examples for applications in public sector use could include forecasting and predicting events such as travel or disease patterns, personalised healthcare treatments, providing customer 'chat' services, and monitoring of internet content.

Big Data

Big Data are data sets that are considered so large and complex that traditional, often human, analytical tools are not as effective at interpreting them. Additionally, these data sets are often changing quickly, meaning effective analytical tools need to be able to interpret them before the underlying data has changed once again.

Being able to analyse these data sets can be useful. It can help an organisation to predict growing events by analysing big data for signs of growth even from a very low base. For example, a small but growing number of people using the internet to search for flu symptoms can be used to predict flu outbreaks. Big data can help tackle fraud by analysing suspicious patterns in large volumes of data. Customer products can also be optimised based on analysing customer behaviour.

AI is an important tool for analysing Big Data, as it can both interpret large amounts of data very quickly but also learn from it.

Smart Sensors

Smart Sensors are built to help to enable other smart devices and the IoT. They are usually purposed to measure and send physical data, such as temperature, traffic levels, pollution, to another device or a cloud host. Other devices such as smart enabled boilers, traffic lights, or buildings management systems, can then use that information to implement a predefined outcome. For example, a smart traffic light could receive information from a sensor that traffic was building up at one side of a junction, and turn green for that traffic to ease the congestion.

Application

An Application, more commonly known as an App, are types of software programs. They are usually downloaded and installed onto a user's device. They are often small, specialised applications that help users to achieve a specific goal.

Apps are generally useful as customer facing tools to help organisations and customers send and receive information to each other. For example, having measured the pollution levels with a Smart Sensor, an organisation could update users of the latest measurements using an App.

Cloud Computing

Cloud Computing refers to dedicated computer power held away from a users location and linked to them through the internet or mobile networks. Cloud Computing is most often used as a way of storing information for a user but it can also be used to perform tasks for a user.

Cloud Computing is useful as it can often store a much larger amount of data than a user can store on their local device. This is especially useful for very small devices such as Smart Sensors. For example, Cloud Computing can be used to store weather data measured from a Smart Sensor.

Buildings Management Systems (BMS)

A Buildings Management Systems (BMS) is a smart system installed in a building to monitor and control certain aspects, such as ventilation, lighting, energy, occupation and capacity, fire systems, and security systems. A BMS can make use of Smart Sensors to monitor conditions, and Apps to give users control, or it can control the building itself to achieve predetermined goals, such as a target temperature. BMSs allow for more optimised uses of buildings that meet user demands as efficiently as possible. Data collected by the BMS can be used to help building managers further optimise building use.

References

1. Climate Change Committee
2. Science Based Targets Initiative
3. BSI PAS 2060
4. Greening Government Commitments
5. Emissions Reduction Pledge
6. Gold Standard
7. Taskforce on Scaling Voluntary Carbon Markets
8. Greenhouse Gas Protocol
9. The Paris Agreement
10. UCLA Sustainability
11. IPCC Special Report on 1.5º
12. IPCC Fifth Assessment Report
13. The Carbon Trust on Carbon Neutral and Net Zero
14. World Resources Institute
15. Centre for Climate and Energy Solutions