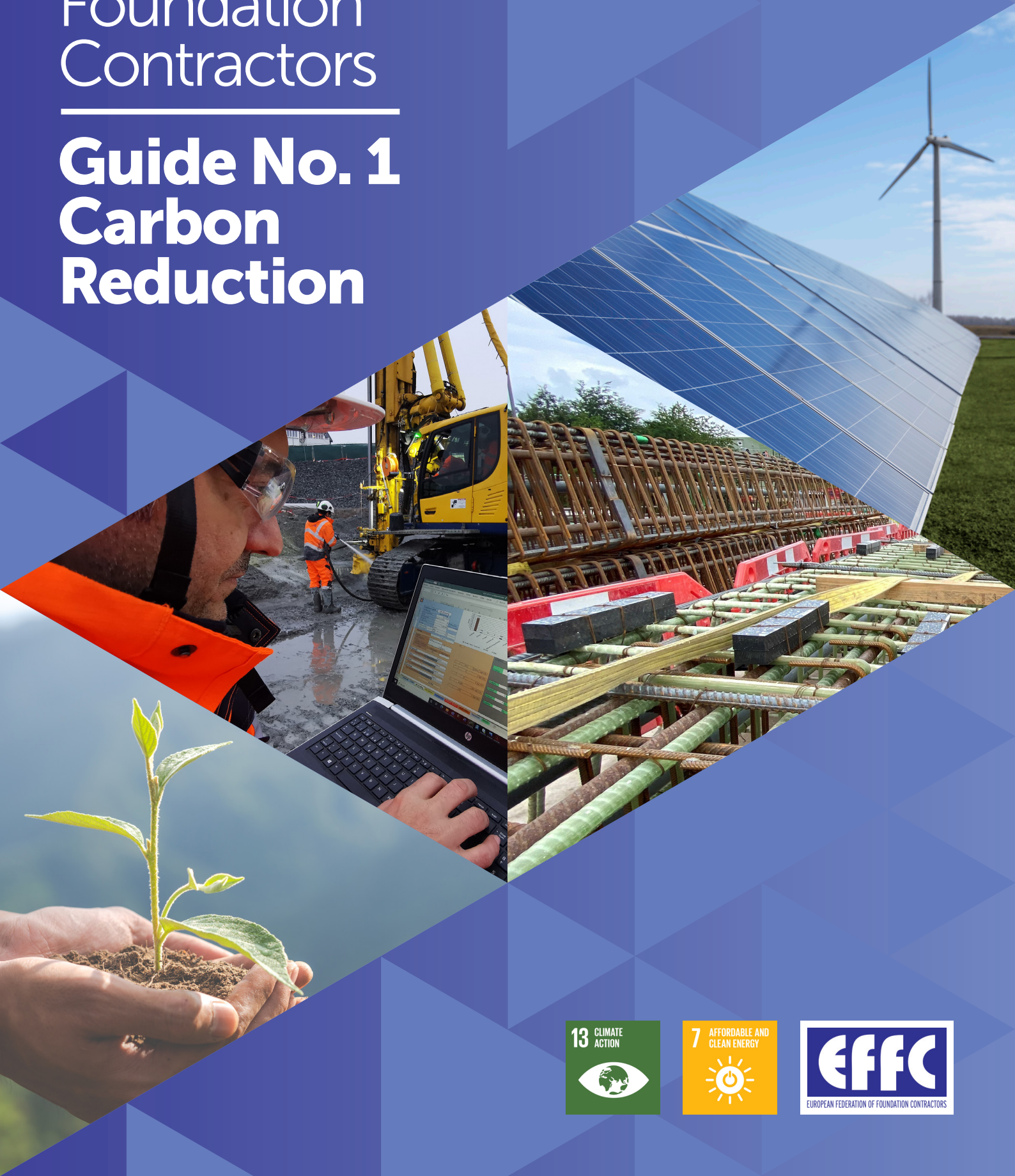
First Edition 2022

# EFFC Sustainability Guides for Foundation Contractors

# Guide No. 1 Carbon Reduction



13 CLIMATE ACTION

7 AFFORDABLE AND CLEAN ENERGY

EFFC
EUROPEAN FEDERATION OF FOUNDATION CONTRACTORS

# Working Group Members

**Chris Harnan (Chairman)** Ceecom Consult
**Alice Berry*** Arup
**Luca Bruni** Injectosond
**Luke Deamer*** Keller
**Jaap Estié** NVAF
**Jan Kreuziger** Aarsleff
* Members of the Carbon Reduction Guide Sub Group

**Juliette Lechard** Soletanche Freyssinet
**Rick Riggelink*** Voorbij Funderingstechniek
**Jeroen Ritzer van Dinther*** Mobilis TBI
**Alexander Rostert** Züblin
**Ruben Van den Broeck** Dewaal Solid Foundations
**Alexander Zöhrer** Keller

EUROPEAN FEDERATION OF FOUNDATION CONTRACTORS

The European Federation of Foundation Contractors represents European geotechnical contractors across 16 countries. Our Members comprise approximately 370 companies with a combined turnover of approximately €4 billion. We collaborate to improve the standard of workmanship, technical competence, safety and innovation. We bring together experts from across Europe to produce leading guidance on critical industry topics from the safety of the machinery we use through to collaborative contracting. Our work encompasses advancing the interests of Members through engaging with the wider industry, clients and the EU. We also invite our industry partners and suppliers to participate in our activities to find common solutions to challenges for our industry.

www.effc.org.

DEEP FOUNDATIONS INSTITUTE

The Deep Foundations Institute has joined forces with EFFC on several guidance documents such as the Guide to Tremie Concrete for Deep Foundations, Guide to Support Fluids for Deep Foundations, and Guide to Working Platforms.

Following the release of this Guide, additional guides on the topic of sustainability are planned and DFI's Sustainability Committee will be working with EFFC's Sustainability Working Group to develop each guide. This collaboration will provide perspective from other world regions.

www.dfi.org.

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# 1 / Introduction

Sustainability can be divided into three key pillars, covering environmental, social and economic sustainability. Within these pillars, the EFFC Sustainability Working Group (EFFC SWG) aligns sustainability initiatives with the UN Sustainable Development Goals. There are 17 Sustainable Development Goals, which every UN country has signed up to achieve by 2030. This means the Goals are global and holistic, covering all areas of sustainability. They are also used by a number of geotechnical and other construction companies to report on sustainability. This means the Goals become a common language to communicate sustainability.

A lot of work is needed to achieve these SDGs. We need to adapt current standards, redesign construction projects and invest considerably in innovation if we are to meet these goals by 2030. Geotechnical companies can do many things, but they cannot do this alone. Therefore, legislators, construction clients, designers, main contractors, geotechnical companies and their supply chains all must play their fair part in achieving these SDGs.

The EFFC SWG plans to publish sustainability guides for the most relevant SDGs. These guides are intended to support geotechnical companies, with practical suggestions for how they can play their part in enabling the SDGs. They are not minimum requirements or sector standards, but rather practical support guides, sharing good practice.

Each guide uses a "what, why, how, measure" approach to sustainability:

- What - What is this specific Sustainable Development Goal? What impacts do geotechnical companies have on this goal?
- Why - Why does this area of sustainability matter to geotechnical companies? Why should geotechnical companies bother to improve this area of sustainability?
- How - How can geotechnical companies improve their impact, and have a positive impact, on this area of sustainability?
- Measure - What metrics should geotechnical companies use to measure their progress and set targets on this area of sustainability?

This first guide focuses on carbon reduction, with Sustainable Development Goal 13 (Climate Action) and Sustainable Development Goal 7 (Renewable and Clean Energy).

For more general advice on sustainability key terms, concepts, legislation and accreditations for geotechnical companies, see the **EFFC SWG Sustainability Overview.** Updates of this guide, alongside the guides for other SDGs, can be found on the **EFFC website**.

# 2 / What are carbon, climate change and carbon reduction?

There are two Sustainable Development Goals that focus on reducing carbon emissions and mitigating climate change. Renewable and Clean Energy (SDG 7), focuses on increasing the supply of green energy and reducing energy use. Climate Action (SDG 13), focuses on reducing carbon emissions and improving resilience to climate change.

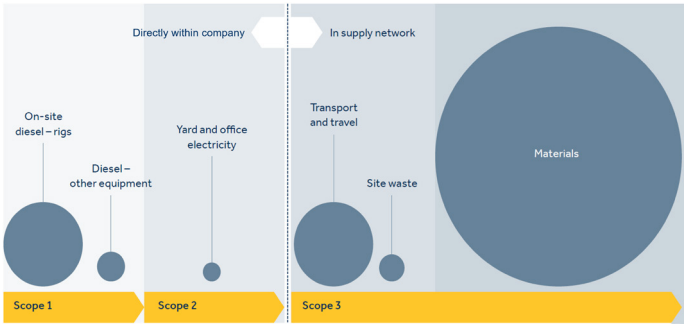

Pre-COVID, construction and the built environment represented 39% of global greenhouse gas emissions (IEA, 2019). Foundations represent a proportion of these emissions, with the relative proportion varying depending on the ground conditions, the project and the foundation requirements. Construction clients, designers, geotechnical companies and their supply chains have a notable part to play in reducing global emissions.

Regardless of our individual impact, climate change will influence how geotechnical companies operate. The physical effects of climate change, such as extreme weather events and sea level rise, can delay geotechnical projects and damage infrastructure. However, these physical impacts also present opportunities for geotechnical companies. For example, geotechnical companies will see more work on resilience projects, such as sea defences and dams. Climate change also presents transition risks and opportunities as the World moves to a low carbon economy. For example, demand for low carbon solutions is likely to increase, so geotechnical companies can upsell low carbon solutions. There will however also be risks to working on higher carbon projects or installing resource intensive solutions.

Greenhouse gas emissions are typically measured in $CO_2$ equivalent ($CO_2e$). This metric combines the emissions of all greenhouse gases into a single metric, using multipliers based on their greenhouse warming potential. For geotechnical companies looking to measure and report these emissions, the Greenhouse Gas Protocol then breaks down these emissions into three Scopes:

- **Scope 1:** Direct emissions, mostly from fuel use (e.g. rig emissions on site)
- **Scope 2:** Indirect emissions from electricity used (e.g. offices and maintenance yards)
- **Scope 3:** All other indirect emissions (e.g. supply network material manufacture and transport)

**FIGURE 1.** Relative emission Scope sizes on a heavy foundations project (*Keller, 2022*)




Scope 3 emissions from the supply chain can make up around 80% of geotechnical company emissions for heavy foundation projects (*Figure 1*). This is because cement and steel are both carbon intensive to produce. Scope 1 emissions depend on the efficiency of rigs and equipment that geotechnical companies use. Finally, Scope 2 is the smallest emission source for most geotechnical companies.

When it comes to reducing carbon emissions, companies may set absolute or net zero carbon targets for each of the three emission Scopes. Net zero is when the cumulative emissions from a company (and its supply chain if Scope 3) equal the carbon sequestered (drawn down). Ideally, net zero should be achieved by reducing emissions to zero. However, net zero allows for offsetting of emissions, where companies can purchase 'carbon credits' in projects that remove carbon from the atmosphere or prevent emissions.

Companies may also want to set science based targets. Science based targets are like net zero targets, but they cap the cumulative emissions of a company. This cap is based on the contribution of the company to a +1.5ºC global warming, the same as the Paris Accord. Effectively, the emission cap

# 2 / What are carbon, climate change and carbon reduction?

means if a company emits more carbon now, they must decarbonise more rapidly, or go carbon negative, in the future.

In thinking of the projects they work on, and their operations, companies should consider the whole life carbon impact. Whole life carbon comes from three sources:

- ***Capital carbon:*** the carbon associated with constructing an asset. For example, for a road bridge, the materials used to construct the bridge, energy used to transport the materials to site and energy used on site. Capital carbon is easiest for the foundation contractor to control.
- ***Operational carbon:*** the carbon associated with running an asset. For example, for a road bridge, the energy needed to provide lighting on the bridge and maintenance of the bridge. There may be less scope for the foundation contractor to influence this, but it depends on the asset.
- ***User carbon:*** carbon associated with using an asset. For example, for a road bridge, the increased emissions from enabling more road use, or the decreased emissions from creating short and more efficient journeys. This may be the largest source of carbon, so it may sometimes be best to invest more capital carbon in foundations in order to enable lower user carbon.

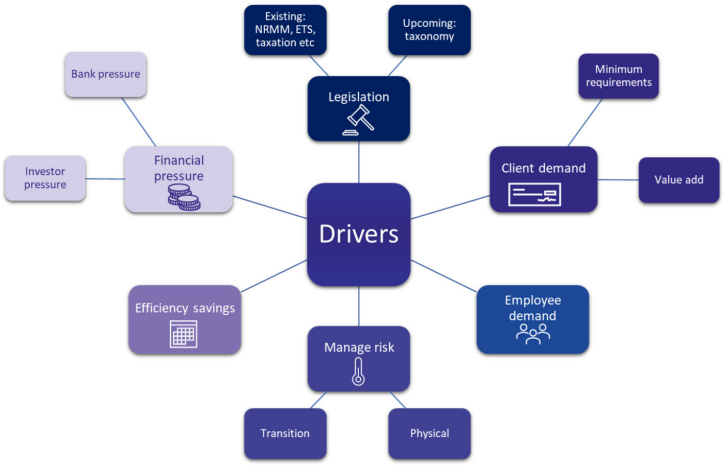
The lowest whole-life carbon solution may not necessarily be the lowest capital carbon solution.

# 3 / Why should geotechnical companies decarbonise?

## 3.1 Overall drivers of sustainability

Geotechnical Contractors must reduce their carbon emissions to meet increasing national and international commitments to mitigate climate change. Increasingly these commitments are driving market requirements, both commercial and legislative. Whilst carbon reduction may once have only been a requirement for certain clients or certain markets, it is now becoming increasingly in demand.

**FIGURE 2.** Drivers of decarbonisation (*Deamer et al., 2022*)




There are many reasons why geotechnical companies must reduce their carbon emissions (*Figure 2*). If we look at legislative requirements to begin with, non-financial reporting requirements already require many geotechnical companies to disclose their Scope 1 (direct fuel) and Scope 2 (indirect electricity) emissions. Likewise, offices and maintenance yards face energy efficiency audits. Rigs and equipment are also already subject to emissions regulations through the non-road mobile machinery directive. For more information on carbon reduction legislation, see the see *section 3.2*.

Carbon reduction legislation is only likely to increase. Globally, almost all countries have signed up to the Paris Accord to limit global warming. A significant number of countries have taken this further, signing up to being net zero by 2050. We are therefore starting to see the introduction of carbon taxation on materials and fuels, such as in the UK and Austria, as well as a 'cap and trade' emission trading scheme for cement and steel suppliers. Other legislation, such as the EU taxonomy legislation, also looks to offer more favourable funding to those companies that can demonstrate they are reducing carbon emissions. These country carbon targets have also been built into the tender process by governments and clients (e.g. $CO_2$ Performance Ladder, 2021).

This client demand is not just limited to governments though. Reflecting growing investor and public interest, certain clients are also starting to demand lower carbon geotechnical solutions and projects. From oil and gas companies to public-facing technology giants, carbon reduction is increasingly factored in when choosing geotechnical contractors for a project.

Likewise, investors have also started to focus on carbon reduction as part of wider Environmental, Social and Governance (ESG) priorities. Particularly with key legislation, such as the EU taxonomy legislation defining 'sustainable' investments, investors have increasingly pressured companies to reduce emissions and improve Board oversight of carbon reduction initiatives.

Young people also increasingly factor in the sustainability of an organisation when deciding who to work for (Aziz, 2020). To attract and retain the next generation of geotechnical employees, we therefore need to demonstrate a commitment to carbon reduction.

## 3.2 Key EU carbon legislation

The European Commission has committed to reducing net greenhouse gas emissions by at least 55% by 2030 (compared to 1990 levels) and will be net zero by 2050. To achieve this goal, the EU have introduced a range of legislation that impacts geotechnical companies.

### 3.2.1 EU Energy Efficiency Directive

Also known as the Energy Savings Opportunity Scheme (ESOS), this directive aims to help companies identify the commercial opportunities for carbon savings. The directive is mandatory for companies with:

- 250+ employees OR
- >€50 million annual turnover and >€43 million annual balance sheet

# 3 / Why should geotechnical companies decarbonise?

It requires companies to have an internal accredited assessor to calculate their total energy consumption, identify the largest areas of energy consumption and establish what improvements can be made to reduce these. Significantly, this also must estimate the payback period for making any carbon savings. This includes energy used in transport of staff and materials, manufacturing processes, office processes and facilities construction. Therefore, this legislation can help geotechnical companies identify ways to reduce their carbon emissions through efficiency savings.

### 3.2.2 EU Non-financial Reporting Directive (NFRD)

The EU NFRD directive is required for quoted companies that have shares floated on a European stock exchange. Among various other criteria, for carbon it requires companies to report GHG scope 1 & 2 emissions. Emissions are reported in $CO_2$ equivalent ($CO_2e$), incorporating all greenhouse gases by their global warming potential. Companies must also publish the methodology used to calculate these emissions in their annual report, as well as linking them to their income or business activities, such as $CO_2e$ per € million, or $CO_2e$ per 100 site hours worked.

### 3.2.3 Corporate Sustainability Reporting Directive (CSRD)

The EU CSRD is upcoming legislation, expected to be introduced in 2023-2024. It extends sustainability reporting to all small-medium enterprises with at least two of the following three criteria:

- >€20+ million balance sheet
- >€40 million net sales revenue
- 250+ employees

CSRD also increases the requirements for sustainability reporting. In terms of carbon, businesses will have to disclose Scope 1 and 2 carbon emissions. However, they will also have to highlight the risks and opportunities that climate change poses to their business and supply chain. This includes the physical effects of climate change, such as damage to supply networks or more work on projects like flood defences. It also includes transition effects of moving to a low carbon economy, such as the costs of upgrading rigs or reputational risks. CSRD is also expected to require disclosure of a decarbonisation strategy, as well as a governance disclosure to highlight roles and responsibilities for sustainability in the company.

### 3.2.4 Low Emission Zones

Low and ultra-low emission zones, common in cities across Europe, impose a daily charge on engines beyond a certain age or that exceed specified emission limits. The schemes aim to improve air quality in cities, as well as decreasing relative greenhouse gas emissions, decreasing fuel consumption and increasing engine efficiency. Any vehicles used to transport people and materials on to sites within these zones are directly affected by these zones. Increasingly, these low emission zones are also being applied to machinery and rigs. This is often achieved by linking zones to the EU Emission Standards for new non-road machinery, setting minimum engine tiers to which rigs and machinery must conform. This may render older, more polluting rigs unable to operate in the low emission zones, or incur large fines for their continued operation in these areas.

### 3.2.5 EU Emissions Trading System and Carbon Border Adjustment Mechanism

The EU Emissions Trading System (ETS) is designed to reduce carbon emissions in carbon-intensive sectors. Whilst foundation contractors are not part of ETS directly, all steel, concrete and fuel suppliers have to conform. The ETS therefore indirectly affects the work of foundation contractors by controlling the price of goods and services in the supply chain. The ETS works by allocating an emissions cap on each company. Companies that reduce their emissions can auction their remaining 'carbon credits' to more polluting businesses. If a company exceeds their emissions targets, they have to buy more carbon units or face heavy fines. This emissions trading scheme is designed to provide a financial incentive for carbon reduction. Therefore, supply chains are likely to pass any ETS carbon credit costs on to foundation contractors. However, this push for decarbonisation in the supply chain can help reduce foundation contractors Scope 3 emissions.

The Carbon Border Adjustment Mechanism (CBAM) is a carbon tax applied to cement, steel and fuel imported from outside the EU. It aims to balance the cost of these materials compared to inside the EU, since EU materials have to meet the ETS (see above). Importers of these materials have to buy CBAM certificates to allow for the carbon emitted during the manufacture of the cement / steel / fuel. The price of

# 3 / Why should geotechnical companies decarbonise?

these certificates is based on the tonnes of $CO_2$ emitted and the average 'carbon credit' price of the ETS that week. Geotechnical companies should be aware this can increase the price of materials they use, but ultimately should help decarbonise their Scope 3 emissions.

### 3.2.6 EU Taxonomy Directive

The Taxonomy Directive controls what investors can term 'sustainable' investments. It also controls the sustainable grants and funding that companies and projects can access. To obtain this funding / investment, companies need to prove they have a positive impact on at least one of six environmental objectives, and do no significant harm to the others. These objectives are:

- Climate change mitigation
- Climate change adaptation
- Sustainable use and protection of water resources
- Transition to a circular economy
- Pollution prevention and control
- Protection of biodiversity

The first two objectives focus on carbon reduction and climate change. The first one requires companies to focus on reducing carbon, whilst the second ensures companies help adapt to the physical and transition risks to climate change. For more on these risks and opportunities of climate change, see *section 3.3* on CSRD.

Note that countries outside the EU may have different legislative requirements. There are also a number of country-specific directives and pieces of legislation. More information on all EU directives is given on the EU law search facility: **https://eur-lex.europa.eu/homepage.html**

# 4 / How can geotechnical companies decarbonise?

The EFFC SWG has compiled many good practices that can help geotechnical companies reduce their carbon emissions. Whilst the full list is included at the end of this guide, here we pick out our top key ways to decarbonise certain parts of a geotechnical construction company. These key ways are intended as a starting point to help direct companies towards saving carbon. They are suggestions, and are not intended as an exhaustive list, nor as minimum standards for the geotechnical sector.

Broadly, it helps to work towards the Institute for Environmental Management & Assessment (IEMA) carbon reduction hierarchy, to help make the largest improvements first:

1. ***Eliminate:*** e.g. reuse of foundations for urban sites, video call rather than travel
2. ***Reduce:*** e.g. ground improvement rather than piling, efficiency improvements, smaller diameter / shorter piles or fewer piles
3. ***Substitute:*** e.g. low carbon cement / steel, biofuels
4. ***Compensate:*** as a last resort e.g. accredited carbon offsetting

Steps higher up on the IEMA carbon reduction hierarchy (*Figure 3*) are likely to enable the biggest carbon reduction.

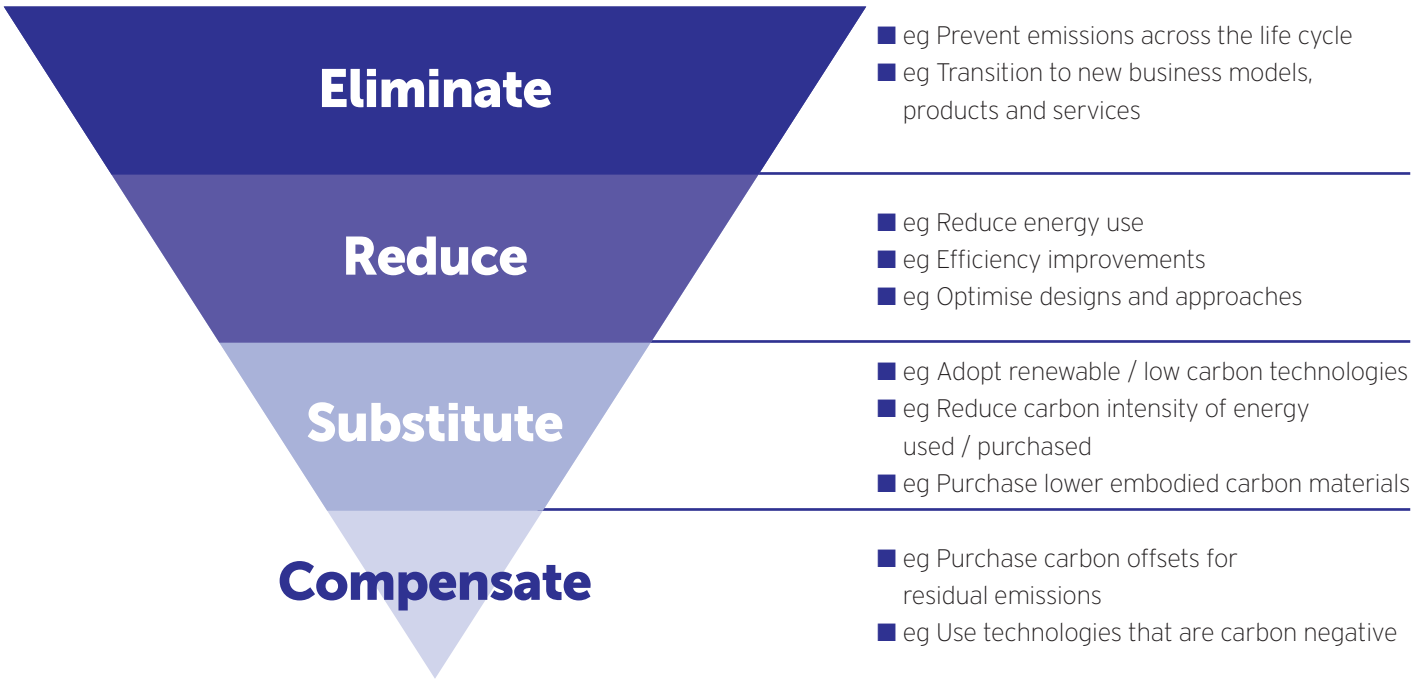
Similar carbon reduction hierarchies exist in other guidance documents, for example PAS 2080: 2016 (Publicly Available Standard for Carbon Management in Infrastructure) focuses on whole life carbon reduction, and uses a broadly similar hierarchy of:
Build nothing → build less → build smart → build efficiently.

## 4.1 The carbon reduction cycle

In order to reduce the carbon impact of your business, it helps if you understand your current impact. This allows you to identify the areas where you could have the largest influence and where you may be able to make the fastest changes. *Figure 4* illustrates the process.

Before you start, define the boundaries where you will consider your carbon impact. It may be simplest to start with Scope 1 and 2 emissions (the company's direct fossil fuel and direct electricity use) and then start to consider Scope 3 emissions (emissions associated with the supply chain), although Scope 3 emissions may be significantly larger than Scope 1 and 2.

**FIGURE 3.** Carbon reduction hierarchy (*IEMA, 2020*)



# 4 / How can geotechnical companies decarbonise?

1. Measure carbon emissions for your company.
2. Create a plan for reducing carbon emissions. With insight about your emissions you can define your goals and targets. Focus on the areas with the biggest carbon impact and / or the simplest implementation first.
3. Offset remaining emissions (if aiming to achieve net zero emissions)
4. Report emissions, and emissions reduction, to stakeholders. This might be on a quarterly, bi-annual or annual basis.
5. Review and repeat, seeking for continuous improvement.

**FIGURE 4.** Carbon reduction cycle (*adapted from FairClimateFund, 2022*)


## 4.2 Key quick wins

- ***Reuse materials*** for instance sheet piles, steel piles, demolition rubble, or existing foundations on brownfield sites.
- ***Reduce overconsumption*** of fuel and materials, by promoting efficient use of equipment, and optimising designs.
- ***Connect to the electric grid*** if possible, in order to reduce use of generators.
- ***Reduce waste, following the waste reduction hierarchy:*** eliminate, reduce, substitute, compensate.
- ***Target efficiency improvements*** when replacing / upgrading equipment.
- ***Education and awareness:*** For example, educate site teams about energy efficiency, designers about whole life carbon and carbon payback periods.
- ***Reduce cement use:*** Design cement-free ground improvement solutions and specify low Ordinary Portland Cement (OPC) mixes. For example by cement replacement with Ground Granular Blast Furnace Slag (GGBS) / Pulverised Fly Ash (PFA) (e.g. CEMIII B) where locally available.

## 4.3 Key ways to decarbonise materials

- ***Reduce materials quantities:*** if you are able, propose other, non/less- cement based techniques of ground improvement (e.g. stone columns or well-designed soil-mixing). If you are able to determine or adapt the design, you can optimise it. These changes may also save money. The EFFC/DFI Carbon Calculator is an excellent tool to compare different concepts, designs and use of (alternative) materials to determine the option with the lowest carbon footprint.
- ***Use lower carbon materials:*** propose the use of cement-types with less impact than the classical Portland Cement. (use CEMII or CEMII to replace CEMI). Beware the technical suitability of course e.g. EFFC Tremie concrete for Deep Foundations. See replacement of Cement by the use of GGBS (Ground Granulated Blast Furnace Slag). Propose alternative materials. E.g. alkali activated materials (AAM's). micro-macro synthetic fibre to replace steel reinforcement.
- ***Focus on the re-use of materials:*** if you are able to, consider re-use of sheet piles from previous sites, or existing foundations already on the site. Recycled aggregates are possible in concrete (if standards allow it). Waste materials can be re-used as aggregate and for working platforms.
- ***Engage with suppliers:*** express your intentions for carbon reduction and optimization. Learn about their research and development activities. Consider rewarding lower-carbon suppliers during procurement. Ask suppliers to provide the carbon footprint of their products.

# 4 / How can geotechnical companies decarbonise?

## 4.4 Key ways to decarbonise procurement

Procurement must continue to promote fair competition with equal opportunities for all bidders. The practical implementation of measures to promote decarbonisation through procurement, such as those suggested below, should be carefully reviewed with this in mind.

- ***Incentivise the supply chain:*** award a percentage of the tender based on the supplier's carbon footprint and commitment to carbon reduction. Our end clients must also ensure this is transparently built into their procurement process as standard.
- ***Set minimum standards:*** ensure suppliers meet minimum compliance with carbon reporting and local and other applicable standards (ISO14001, EMAS, Eco lighthouse etc)
- ***Request products with a lower carbon footprint:*** Environmental Product Declarations (EPDs) can assist with decision making, but may not yet be available. Include the whole lifecycle of a product (LCA) when choosing a supplier.
- ***Consider long-term partnerships*** with particular suppliers in order to decarbonise mutually and reduce risk when investing.
- ***Review your balance of plant and asset ownership*** versus leasing. This impacts the amount of calculated Scope 1 and 2 emissions. Ownership places more emissions directly in your control, leasing may allow access to lower carbon options for less capital invested
- ***Consider repair and maintenance of equipment:*** prioritise whole life cycle impacts when procuring equipment. Focus on both the equipment efficiency, as well as the amount of energy and materials required to maintain it.

## 4.5 Key ways to decarbonise transport

- ***Choose the best vehicle:*** rail and water transport are often the most carbon efficient. For road transport, using fewer, larger (fully laden) vehicles is more fuel-, carbon- and often cost- efficient than many small deliveries. Minimise empty or half-laden vehicle movements.
- ***Local suppliers and yards:*** transport distances will be shorter, and therefore lower carbon, when using local suppliers. Similarly, the number and distance of empty journeys during construction site set-up is determined by the location of storage yards and construction yards.
- ***Workforce journeys:*** choose lower carbon modes of transport. Start by prioritising public transport, then car sharing, shorter journey distances and ultimately electric company cars. Shorter journeys and public transport use also improves safety.
- ***Electric power:*** where an electricity supply is available, plug in electric equipment for a low-cost, low-carbon solution. Alternatively, battery powered equipment can be used where no electric grid connection is available.
- ***HVO:*** the use of hydrotreated vegetable oil (HVO) reduces carbon emissions of existing equipment, so can be useful as a transition measure. However, HVO from non-waste sources can have significant and long-lasting negative ecological effects, including loss of biodiversity and reduction in carbon draw-down potential of land.

## 4.6 Key ways to decarbonise a site

Once a design is confirmed, there are still a number of improvements that can be made on the site itself.

- ***Use an electricity grid connection:*** if available, such as on brownfield sites, grid electricity is a low carbon power source. It can be used to power generators, pumps, small machinery, site lighting and welfare cabins. New electric rigs and cranes can also either be charged or plugged into the grid, providing a cheap and low carbon power source for site machinery.
- ***Specify and use the right equipment:*** specifying the right sized generators and rigs is important to avoid unnecessary emissions. Running large generators at full capacity when not needed uses extra diesel, creating unnecessary emissions and cost. Specifying the latest equipment, with tier 4 final or tier 5 engines, helps improve fuel efficiency and reduce emissions. Anti-idling or start-stop systems are also a great way to reduce emissions.

# 4 / How can geotechnical companies decarbonise?

- ***Transport to, from and around site:*** this emission source often goes unseen, but how people, materials and waste get onto and off of site is a big source of emissions. Using local materials, local employees, public transport, fewer vehicles and more efficient vehicles can all help decarbonise a site. For more on this see section 4.5.
- ***Reduce your use of equipment:*** planning a project to reduce days on site and reduce rig / welfare cabin moves reduces emissions on site, but also reduces emissions by staff commuting fewer days.
- ***Consider transition fuels:*** certified Hydrotreated Vegetable Oil (HVO) has been approved in certain European countries for use in many different piling rigs. This can be a way to decarbonise existing rigs, however HVO from non-waste sources can have significant and long-lasting negative ecological effects, including loss of biodiversity and reduction in carbon draw-down potential of land.
- ***Automation:*** encourage the automation of construction machinery and processes to improve efficiency. This reduces material and energy consumption, as well as reducing employee time on site.
- ***Measure:*** measuring carbon allows us to reduce it in the future. Any steps that can be put in place to automate this data collection, from using reporting / monitoring equipment on rigs to engaging directly with suppliers and delivery notes, helps identify carbon hotspots whilst freeing up site teams.

## 4.7 Key ways to decarbonise use of electricity

- ***Switch to the national grid*** energy supply where available, rather than running on diesel generators.
- ***Improve energy efficiency:*** consider an energy efficiency audit, to show where you can save carbon and save money. Key changes include improving efficiency of electric engines / machinery, anti-idling for rigs, specify smaller generators.
- ***Educate the workforce*** on ways to lower energy use, reduce idling and improve their own processes.
- ***Substitute electricity supply:*** Change to a green energy supplier, or generate your own renewable electricity, for offices, maintenance yards and general site equipment (e.g. by installing solar panels).

## 4.8 Key ways to improve a carbon mature businesses

- ***Educate and intrinsically motivate the entire workforce:*** carbon reduction should be built-in to the way you do business. Empowering sustainability-conscious employees can help to change the culture in your company. Complementary to communication, education is key. Carbon reduction should be an integral part of induction and training programmes.
- ***Inform your people:*** communicate progress of the company or results from projects to the employees. It emphasises the importance of the commitment of the company to sustainability. It allows successes to be celebrated and encourages continuous improvement.
- ***Commit the company to an accreditation*** for an environmental or sustainability management system (see *Section 4.11*). Setting up procedures will help you to understand your emissions, to benchmark them, to follow up progress and to communicate your commitment to your existing and future clients.
- ***Carry out carbon calculations and compare projects:*** carry out carbon calculations for each project to establish a carbon baseline and improve your emissions, using the **EFFC-DFI carbon calculator** (see *Section 5*). Working with project accreditations (see *Section 4.10*) can also help you to start doing this correctly.
- ***Hotspot analysis:*** determine which processes have the most impact for the company (which parts of your work have the largest carbon footprint, and which areas you can have the biggest influence). Start working groups to address these processes.
- ***Engage your stakeholders:*** develop relationships with supply chain, legislators, standards bodies and long-term clients to drive decarbonisation in the industry.

## 4.9 Key ways to reduce the whole-life carbon of an asset

Some of these ideas may be outside the direct scope of the foundation contractor's contract, but it is still useful for the contractor to understand the carbon context of each project. Sometimes it may be possible to collaborate, or challenge the brief, in order to achieve lower overall carbon.

# 4 / How can geotechnical companies decarbonise?

- ***Challenge the project scope:*** does the client know what their desired outcomes are? Is there a lower carbon way of achieving them? What can be done to de-risk the construction of lower carbon designs?
- ***Think whole-life carbon:*** sometimes it is worth investing carbon by constructing an asset in order to reduce whole life carbon. For example, providing the best route alignment for a road bridge would minimise user carbon. This may mean building foundations in difficult ground conditions.
- ***Challenge standards and specifications:*** there may be opportunities to challenge standards/specifications where they are overly conservative. For example over-specification of loads.
- ***Retrofit and refurbishment projects*** tend to have a lower carbon footprint than new build - seek opportunities to work on these types of projects
- ***Protect the carbon sequestration potential of the ground:*** look after the topsoil on sites, so that it can be reused; minimise trafficked areas on greenfield sites; minimise impacts on groundwater permeability if you are able to influence the choice and size of foundations.

## 4.10 Possible project accreditations

- ***CO2 performance ladder:*** CO2 management system and procurement tool, used to reward lower carbon suppliers in procurement processes.
- ***BREEAM (Building Research Establishment Environmental Assessment Method)*** is a sustainability rating scheme, usually used for buildings, though can be applied for master planning and infrastructure.
- ***CEEQUAL (Civil Engineering Environmental Quality Assessment & Award Scheme).*** UK sustainability rating scheme for infrastructure projects.
- ***LEED (Leadership in Energy and Environmental Design):*** US Green Building Council's rating system, adopted globally.
- ***DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen):*** German Green Building Council certification for building sustainability and the "sustainable building site".

## 4.11 Possible company accreditations

- ***PAS 2080 (carbon management in infrastructure):*** this publicly available specification for carbon management in infrastructure sets out a process for managing whole life carbon. It states the responsibilities of the involved parties (such as clients, designers and contractors). It encourages continual improvement in reducing whole life carbon, including establishing a baseline, setting targets for carbon reduction, enabling carbon reduction and reporting throughout the project lifecycle.
- ***ISO 14090 (adaptation to climate change):*** although less common than ISO 14001, this can help companies identify and respond to the specific physical and transition risks of climate change in their business.
- ***ISO 14001 (environmental management standard):*** an environmental management system (EMS) standard, aiming to protect and improve the environment, as well as balancing it with social and economic sustainability. It ensures companies have various policies and procedures in place to improve their environmental impact.
- ***EMAS (Eco-Management and Audit Scheme):*** an environmental management standard for companies, like a slightly stricter ISO 14001. It requires continual environmental management improvements, and EMAS audits must be carried out by government auditors for every individual entity in a company.

## 4.12 Full list

The full list of carbon saving opportunities for geotechnical companies is available here:
https://www.effc.org/effc-carbon-reduction-guide

# 5 / Measuring progress on carbon reduction

A key part of the carbon reduction cycle is to measure carbon emissions and set reduction targets. These targets and progress should be regularly reviewed and updated. The outline below is current good practice, based upon the GHG Protocol and ISO 14067-3 guidance for verifying and validating greenhouse gases. Note that carbon reduction targets are not yet mandatory for most geotechnical companies in Europe, so this guidance may be superseded by the upcoming CSRD requirements (see *Section 3.2.3*).

- ***Absolute metrics:*** Absolute metrics are the basis for net zero targets, since they deal with total amounts. Examples include our annual Scope 1 or Scope 2 emissions.
- ***Relative metrics:*** Relative metrics help to drive change towards net zero. Examples include emissions per £m revenue or per 100,000 hours worked.
- ***Lagging targets:*** Lagging targets set an overall aim to achieve. Examples of lagging targets include total tonnes of $CO_2e$ or tonnes of $CO_2e$ per €m revenue
- ***Leading targets:*** Leading targets then sit underneath these lagging targets, seeking to drive change. Examples of leading targets include measuring, training, and investment.

When setting targets, it may be useful for companies to use the SMART approach:

- ***Specific:*** target a specific area of carbon reduction with a tangible outcome
- ***Measurable:*** clear metrics for measuring progress and success
- ***Achievable:*** the target should be sufficiently realistic, whilst also being ambitious
- ***Relevant:*** the target should be relevant to your company and reaching net zero
- ***Timely:*** is there a date to achieve it (e.g. net zero by 2050 or 10% reduction by 2030)

## 5.1 Company level measurement

### 5.1.1 Setting carbon reduction targets

To set a company carbon reduction target, you should:

- ***Measure*** all relevant carbon emissions
- ***Establish a baseline*** year to measure carbon reduction progress from
- ***Establish a carbon reduction pathway***, setting out how you will achieve net zero
- ***Set interim lagging targets*** to achieve carbon reductions - don't leave it until the last year
- ***Set a number of leading targets*** to drive the carbon reduction process

If you want to make this net zero target a 'science based target', you must also:

- ***Scope 3:*** ensure your target covers Scope 3 emissions
- ***Fair share of emissions:*** Calculate how much carbon you can release to meet your share of +1.5°C climate change
- ***Cumulative emissions:*** calculate and cap your cumulative emissions since your baseline year
- Click here for more information on Science Based Targets

### 5.1.2 EFFC company data collection

The EFFC have started their own trial of collecting carbon figures from companies across Europe. This is an entirely optional pilot to help geotechnical companies, so there is currently no obligation for companies to participate. For those companies that already calculate their emissions and are volunteering to participate in the trial, the EFFC asks for quarterly:

- Scope 1 emissions (absolute and per €m revenue)
- Scope 2 emissions (absolute and per €m revenue)
- Optional Scope 3 emissions (business travel, waste disposal, material transport, materials and / or others)

# 5 / Measuring progress on carbon reduction

For those companies that do not currently calculate their own emissions and want to participate in the trial, the EFFC have created a simple template to help geotechnical companies calculate these carbon metrics. The emission factors, to convert litres or kWh to $CO_2e$, can be found in the EFFC tool or the EFFC-DFI carbon calculator. Certain countries also have publicly available, local emission factors. The data that is needed to calculate Scope 1 and 2 data is set out below.

The most common sources of Scope 1 emissions for geotechnical companies are:

- Diesel use consumption
- Petrol / gasoline consumption
- Natural gas consumption
- Oil and grease consumption
- Biofuel consumption (e.g. hydrotreated vegetable oil)

Scope 2 emissions are dependent upon:

- The amount of electricity used (e.g. offices, maintenance yards, sites)
- The carbon intensity of the national grid (e.g. how much electricity comes from renewable vs non-renewable sources)
- Whether the electricity is purchased from a renewable energy tariff
- Whether the geotechnical company generates any of its own renewable energy

Scope 3 can cover multiple areas. Note these emissions mostly occur in the supply chains of geotechnical companies, so can be harder to measure. The most common impacts for geotechnical companies include:

- Material extraction, manufacture and transport
- Waste transport and disposal
- Business travel emissions

For more guidance on Scope 3 system boundaries and conversion factors, see the **EFFC-DFI carbon calculator** or the EFFC guidance on company carbon reporting.

# 5 / Measuring progress on carbon reduction

## 5.2 Project level measurement

In 2014, the EFFC and DFI created a **standardised carbon calculator** to calculate the carbon emissions for geotechnical projects. This calculator replaced many company-specific carbon calculators, ensuring a level playing field for calculating carbon emissions across the geotechnical sector. It is regularly maintained with the latest carbon multipliers by the EFFC and DFI, in partnership with Carbone 4.

This carbon calculator is cradle-to-gate, meaning it captures emissions from raw material extraction through to the installation of the foundations in the ground. This allows geotechnical companies and their clients to compare the embodied carbon of different geotechnical solutions and therefore promote low carbon solutions (*Figure 5*).

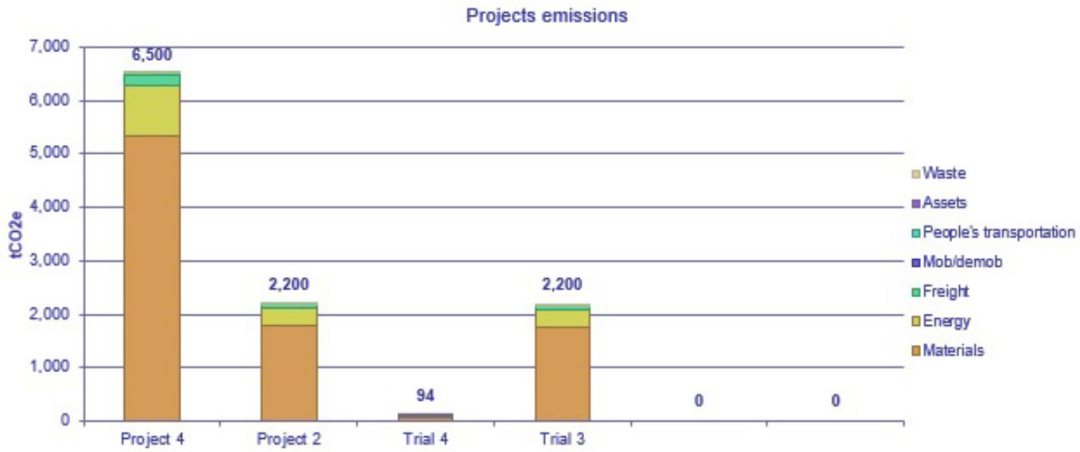
This carbon calculator has been widely adopted by geotechnical companies in Europe. Some companies also use this tool to compare designed vs actual carbon emissions for their projects, to see if they can reduce their overall carbon budget.

**FIGURE 5.** Example output from the EFFC DFI carbon calculator

EFFC DFI carbone 4

**Comparison sheet (1/2)**

| | Project 4 | Project 2 | Trial 4 | Trial 3 | | | |
|---|---|---|---|---|---|---|---|
| Materials | 5,327 | 1,782 | 72 | 1,762 | | | tCO2e |
| Energy | 963 | 321 | 16 | 321 | | | tCO2e |
| Freight | 188 | 66 | 2 | 56 | | | tCO2e |
| Mob/demob | 2 | 1 | 0 | 0 | | | tCO2e |
| People's transportation | 17 | 6 | 3 | 5 | | | tCO2e |
| Assets | 29 | 10 | 0 | 9 | | | tCO2e |
| Waste | 17 | 6 | 0 | 6 | | | tCO2e |
| **Total** | **6,500** | **2,200** | **94** | **2,200** | **0** | **0** | tCO2e |
| Working days | 0 | 0 | 50 | 25 | | | days |
| Workforce | 0 | 0 | 3 | 10 | | | full-time equivalent |
| Project value | 152,000 | 51,000 | 0 | 50,000 | | | € |
| Functional unit 1 | Functional un | Functional un | value | value | | | unit problem |
| Functional unit 2 | Functional un | Functional un | value | value | | | unit problem |




This carbon calculator is certified to common life cycle standards, including ISO 14067, the GHG Protocol and PAS 2050. This means it is likely to be consistent with other tools used by geotechnical company clients.

# 6 / References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**CEEQUAL (2022):** https://bregroup.com/products/ceequal

**CO2 Performance Ladder (2022):** https://www.co2-prestatieladder.nl/en

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**ISO 14090 Adaptation to climate change (2019):** https://www.iso.org/standard/68507.html

**LEED (2022):** https://www.usgbc.org/leed

**PAS 2080 (2021):** https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/Guidance-Document-for-PAS2080_vFinal.pdf

**Science Based Targets Initiative (2022):** https://sciencebasedtargets.org