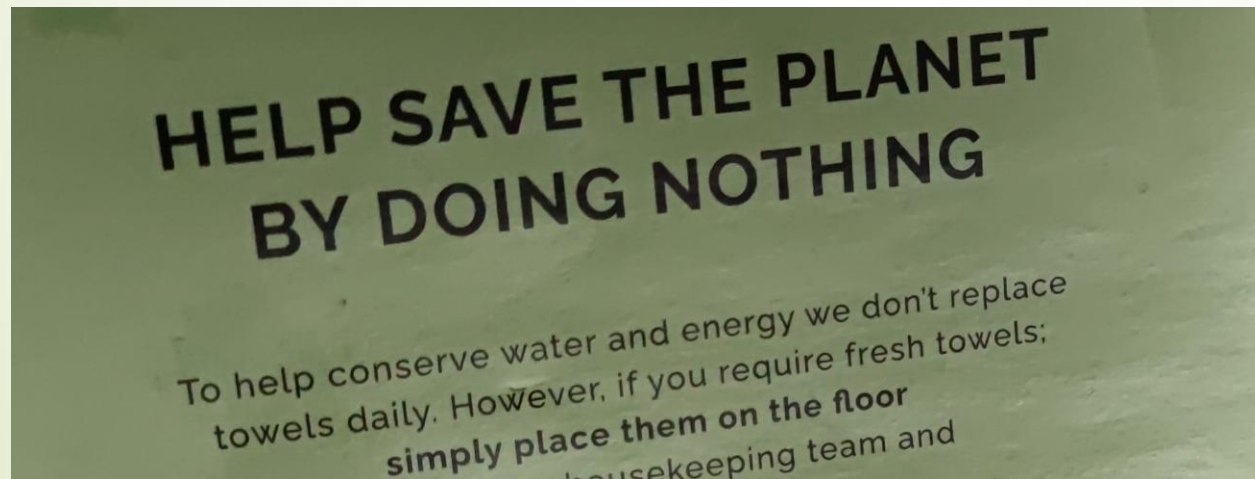


Environmental Awareness in the UK, 2024



Growth, Resilience and Sustainability

Environmental Engineering in the light of climate change adaptation.

Rail Cymru Conference 2024. Cardiff, April 17th 2024

Matthias Denk, Msc. Environmental Engineering ETH Lausanne, Switzerland



Environmental engineering the light of climate change



Environmental protection



Recycling concepts



Global warming reduction



Air pollution reduction



Solar power



E-mobility



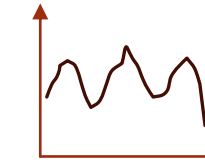
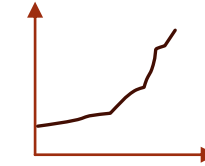
Low carbon transport



Growth

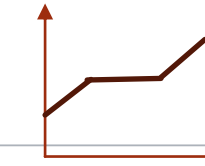
Biology [\[edit \]](#)

- [Auxology](#), the study of all aspects of human physical growth
- [Bacterial growth](#)
- [Cell growth](#)
- [Growth hormone](#), a peptide hormone that stimulates growth
- [Human development \(biology\)](#)
- [Plant growth](#)
- [Secondary growth](#), growth that thickens woody plants
- A tumor or other such [neoplasm](#)



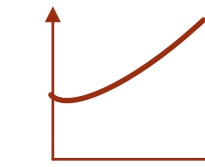
Economics [\[edit \]](#)

- [Economic growth](#), the increase in the inflation-adjusted market value of the goods and services
- [Growth investing](#), a style of investment strategy focused on capital appreciation



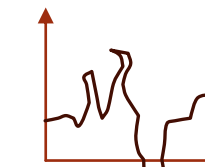
Mathematics [\[edit \]](#)

- [Exponential growth](#), also called geometric growth
- [Hyperbolic growth](#)
- [Linear growth](#), refers to two distinct but related notions
- [Logistic growth](#), characterized as an S curve



Social science [\[edit \]](#)

- [Developmental psychology](#)
- [Erikson's stages of psychosocial development](#)
- [Human development \(humanity\)](#)
- [Personal development](#)
- [Population growth](#)



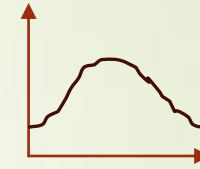
Glasgow / 08.03.2024

Company 200

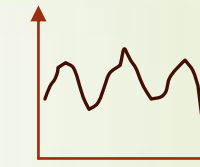


Resilience: Examples

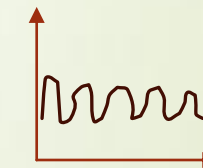
Ecological resilience: The capacity of an ecosystem to recover from perturbations



Organizational and psychological resilience: The ability of a system/society or individual to withstand changes in its environment and still function



Resilience in engineering and construction: the ability of buildings and infrastructure to absorb assaults without suffering complete failure (example elastic behaviour of a structure)



Sustainability: A point of view rather than a rigid concept

“Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs” (Brundtland report – 1987).

“the property of being environmentally sustainable; the degree to which a process or enterprise is able to be maintained or continued while avoiding the long-term depletion of natural resources“ (Oxford Dictionary)

“ Sustain – ability: The ability to sustain life of mankind on earth (philosophical or ethical concept) “

**Fair use of natural
ressources**



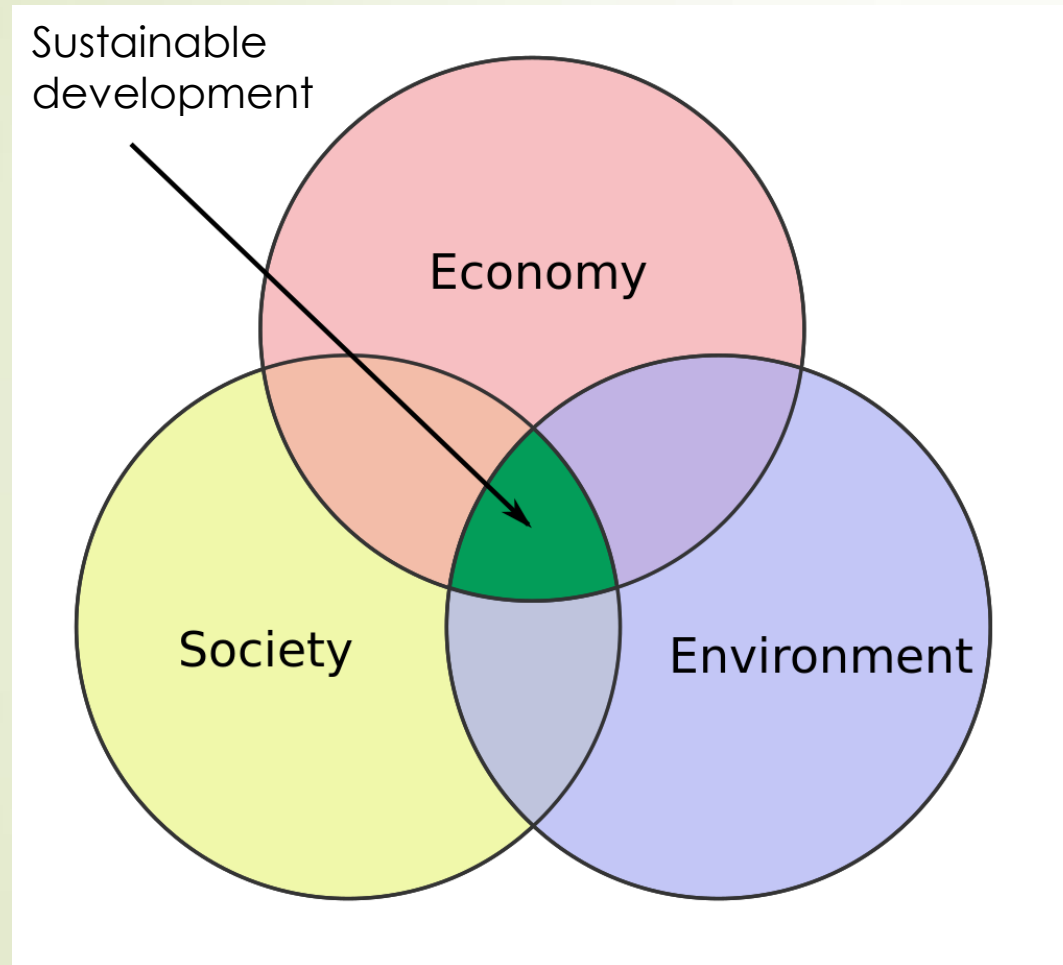
**Society / Human Kind
Ethics**



**Economic prosperity /
welfare**



Sustainable development – concept of the 3 circles



**Fair use of natural
ressources**



**Society / Human Kind
Ethics**



**Economic prosperity /
welfare**



Strategic framework for companies and organizations



Companies and organisation are encouraged to set own strategic goals by choosing 1 or more SDGs in their environmental strategy.

In general, companies are adopting a action plans to reduce greenhouse gaz emmissions by 2030 and 2050.



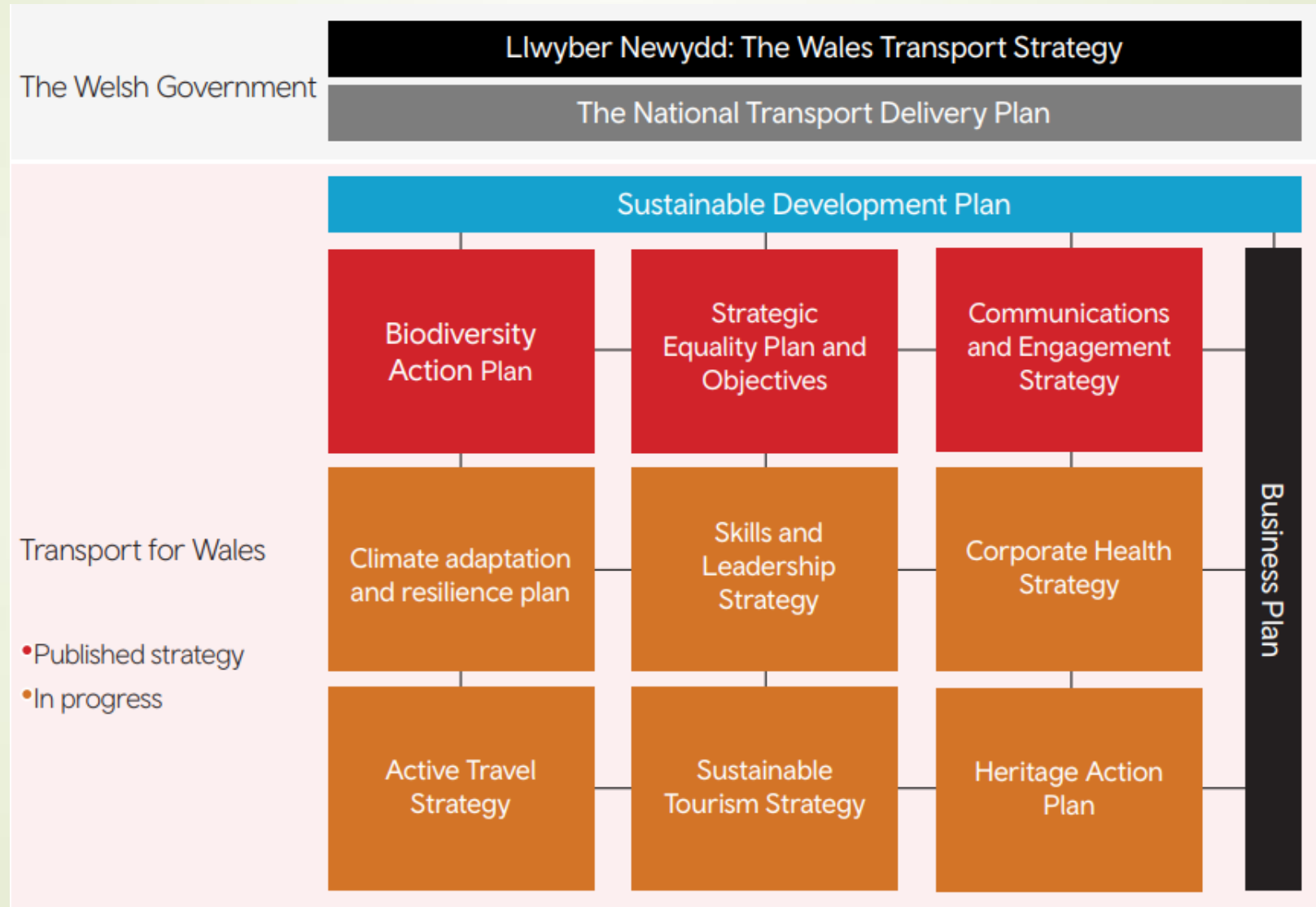
Action plans: Example Transport for Wales



Company 200



Action plans: Example Transport for Wales



Challenge in 2024: How do we include sustainable development in environmental engineering, in our projects?



1. Accounting of carbon emissions



Corporate
carbon footprints

Product
carbon footprints

Climate related
risk assessments



1. Accounting of carbon emissions

- UK will become first G20 country to make it mandatory for Britain's largest businesses to disclose their climate-related risks and opportunities, in line with Taskforce on Climate-related Financial Disclosures (TCFD) recommendations
- new legislation will require firms to disclose climate-related financial information, with rules set to come into force from April 2022
- follows publication of UK's landmark Net Zero Strategy and forms part of the government's commitment to making the UK financial system the greenest in the world

www.gov.uk

Corporate
carbon footprints

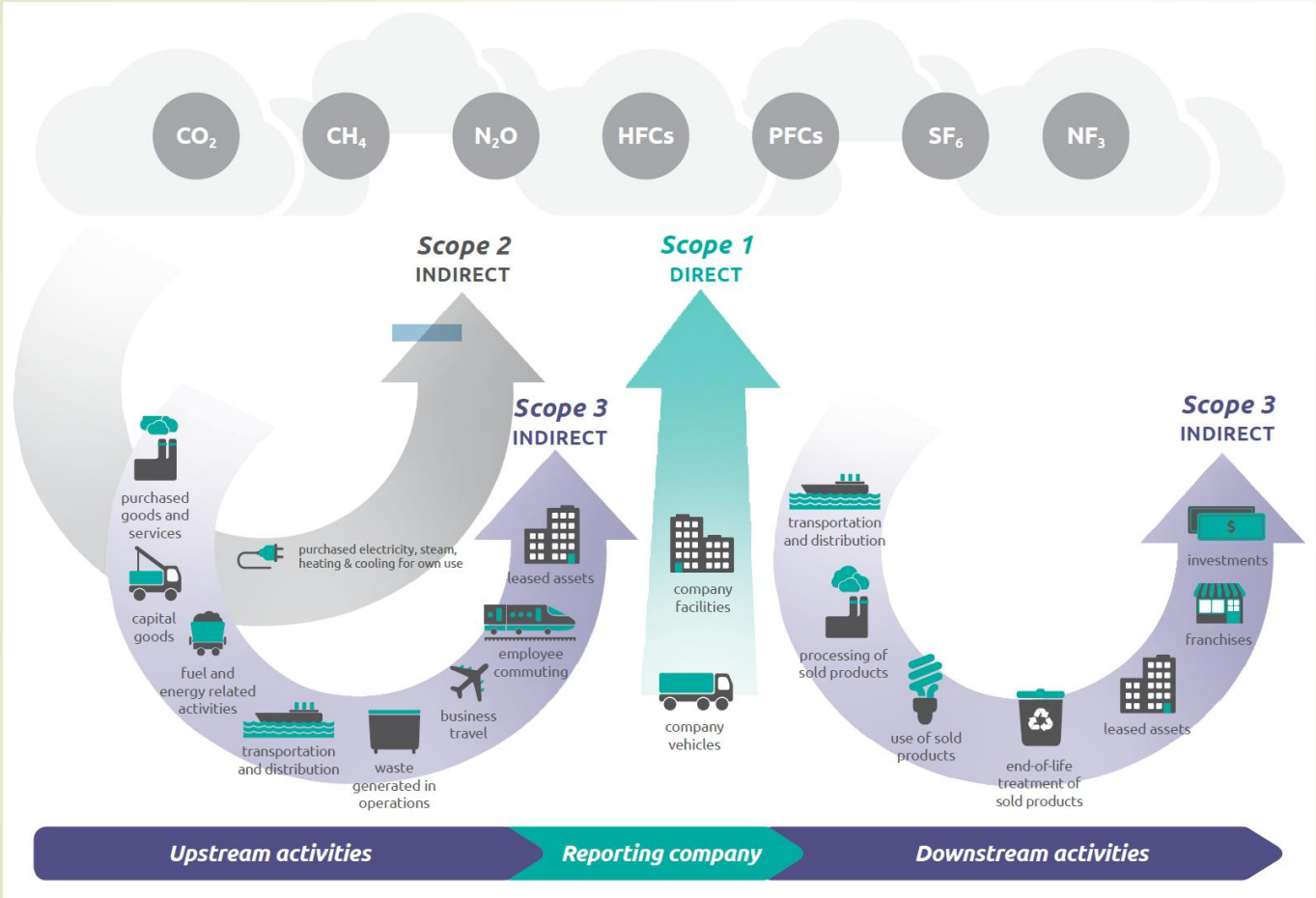
Product
carbon footprints

Climate related
risk assessments

In 2021, UK has become the first G20 country to make it mandatory for Britain's large business' to disclose their climate related risks



1. Accounting of carbon emissions



Scope 1:
direct emissions

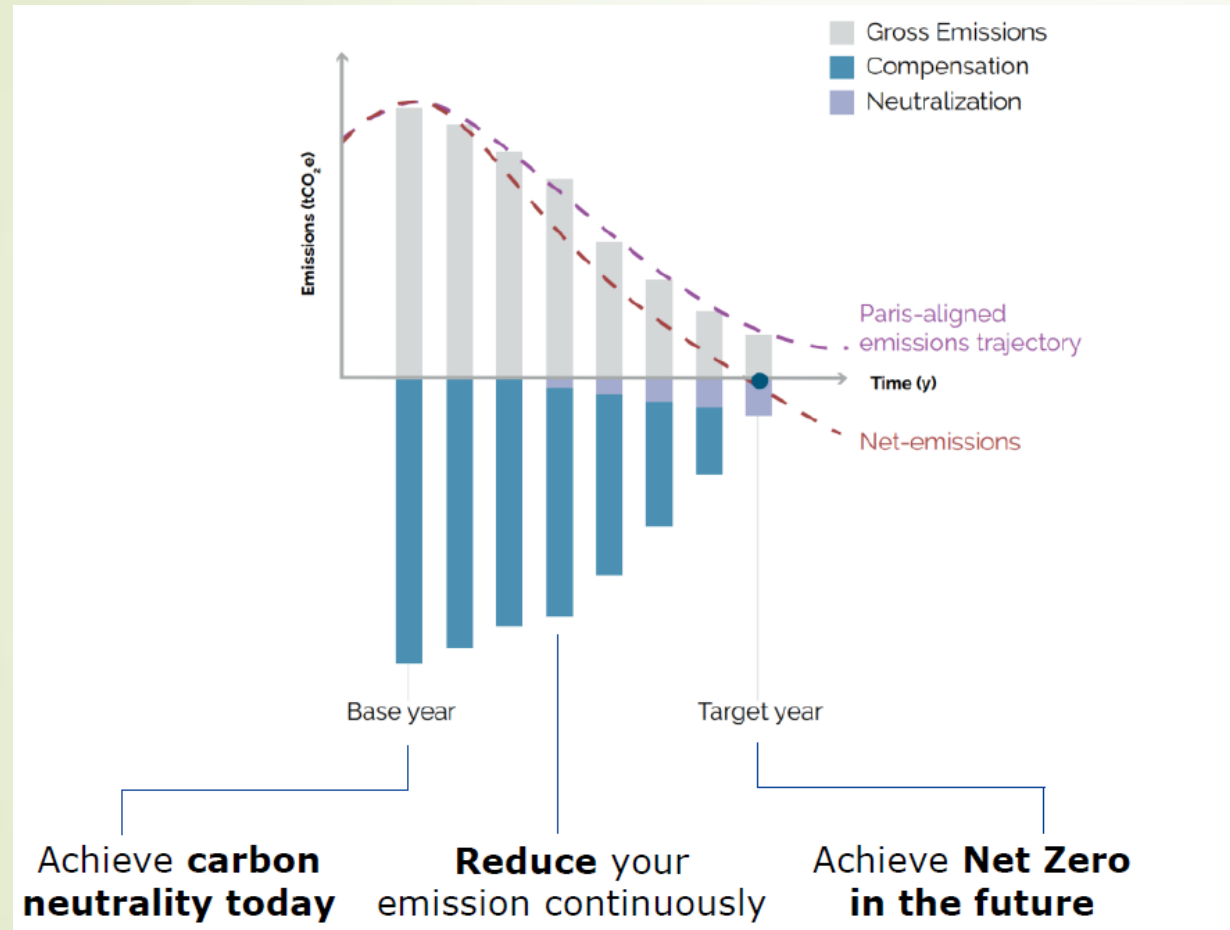
Scope 2:
purchased power
for own use

Scope 3:
All other emissions
Related to supply chain

**Standard: GHG
(greenhouse gas protocol)
Using data bases for carbon emissions**



2. Set reduction goals over time



Corporate
reduction goals

Product
reduction goals

Country reduction
goals

e.g. „Net zero by 2050“



Increasing demand of low carbon material in construction

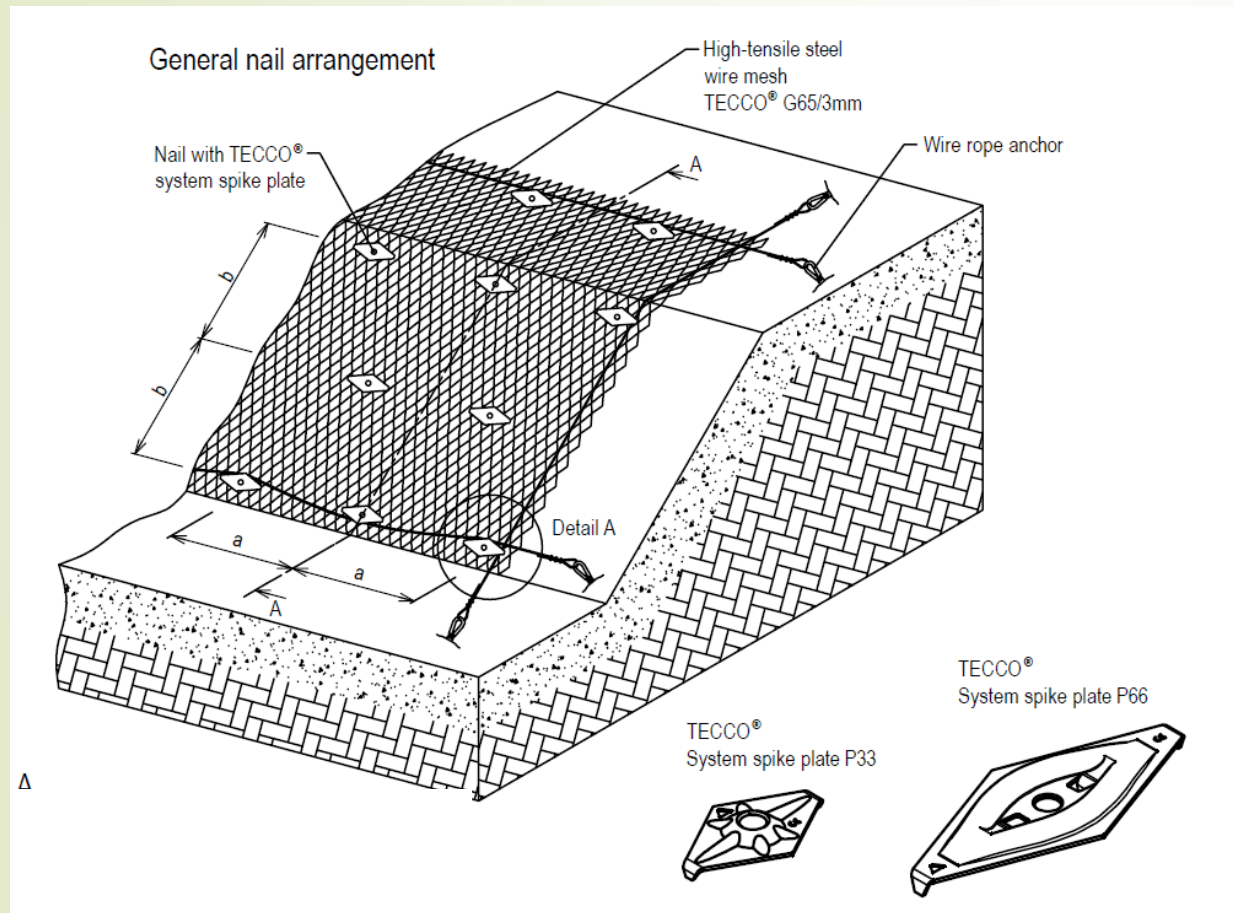
3 Building materials

80. To decarbonise the construction of new buildings, fewer materials need to be used more efficiently, and the carbon content of the construction materials that are used needs to be reduced. The construction industry currently relies principally on brick, concrete, steel, timber, diesel fuel and, increasingly, plastics.¹⁰⁴ Buildings must be fit for purpose, meet the necessary Building Regulations and be safe, so issues relating to structural performance, durability, integrity and safety are essential.¹⁰⁵

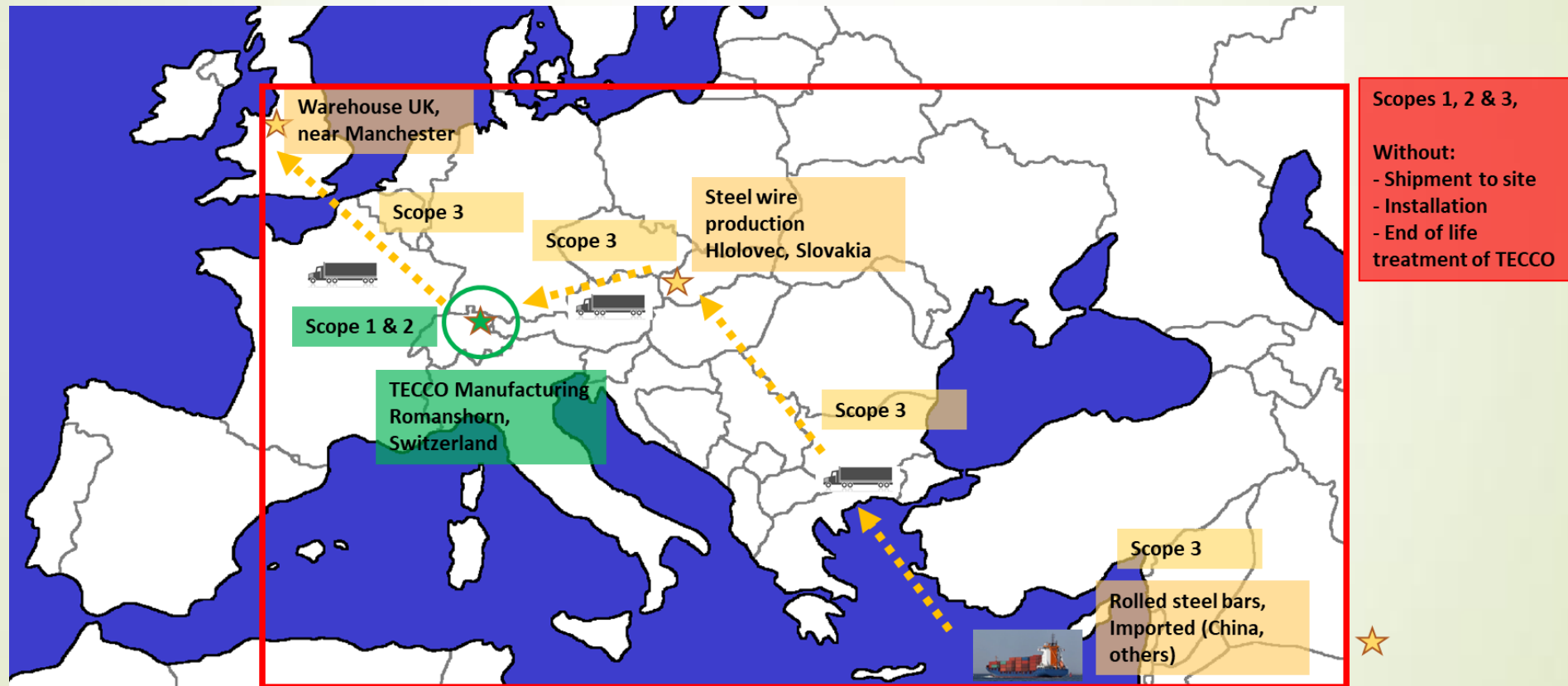
81. Steel and concrete are the predominant building materials in the UK, chosen for their stability, longevity and resilience,¹⁰⁶ yet both are highly energy intensive to create.¹⁰⁷ During our inquiry into *Energy Efficiency of Existing Homes*, we heard that sustainable building materials were under-utilised in the UK, despite being well established in other major European countries.¹⁰⁸ Sustainable products



Example low carbon material in slope stabilization: TECCO System – High tensile steel wire mesh(2022)



Product carbon footprint: High tensile steel wire mesh TECCO for slope stabilization (2022)



Product carbon footprint: High tensile steel wire mesh TECCO for slope stabilization (2022)

Product	TECCO G65/3 mm, Class A	230 [g/m ²]
Manufacturer	GeobruGG AG	
Location	Romanshorn, Switzerland	
Shipping Address / Warehouse location	Hough, Crewe, CW2 5NQ, United Kingdom	

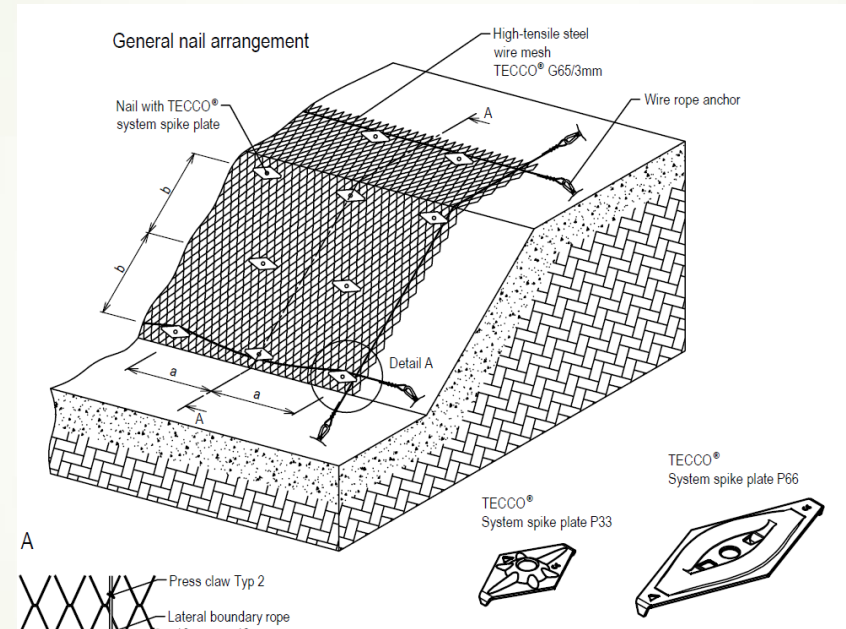
Step	Type of CO ₂ -Emission	Scope	Location	[t CO ₂ e / t steel]	[t CO ₂ e]
Production high tensile steel wire, incl. coating	Material sourcing	3 upstream	Slovakia	2.1	245.7
Spike plates, clips, ropes, spiral ropes anchors	Material sourcing	3 upstream	Slovakia/Italy	2.1	92.4
Transport	Transport 700 km by truck	3 upstream	to Switzerland		10.8
Production Final Product	TECCO Production	1 & 2, incl. Flights	Switzerland		5.81
Transport to Warehouse UK	Transport 1100 km by truck	3 downstream	to UK		14.4
Total					369.1

Carbon footprint "TECCO G65/3 mm SUCO class A"	delivered to warehouse UK	[kg CO₂e / m²]
		5.2

Not included are:
 Anchor rods and grouting (locally sourced)
 Transport of all material from warehouse UK to site
 Material installation



Product carbon footprint: High tensile steel wire mesh TECCO for slope stabilization (2022)



Generic value for carbon footprint TECCO G65/3, Supercoating: 5.2 [kg CO₂ e /m²]

Net only:
2.4 kg CO₂ e /m²

- includes raw material supply, transport and manufacturing of TECCO mesh, spike plates and clips T3
- cradle to gate warehouse UK (Hough, Crewe CW2 5NQ)
- Does NOT include rod anchors and grout (sourced locally)
- Does NOT include installation of the TECCO system on the slope



Example low carbon material in shore protection TECCO cell system (2022)

Shore Protection against Erosion: Carbon Footprint of an innovative Steel Wire Mesh Cell Solution compared with other Solutions

Matthias Denk, MSc. Env. Eng., Company 200, St. Gallen, Switzerland

Special Topic

1 Introduction

Many shorelines in Europe are subject to erosion. For example, of Great Britain's around 17,600 km of overall shoreline, at least 3,000 km are estimated to face erosion issues. Approximately 2,300 km of Great Britain's shorelines are artificially protected [1]. For many other European countries with long shorelines, such as Norway, Greece, Italy, Croatia and Denmark (including Greenland) [2], wave erosion and artificial protection against it is and remains a major issue for local communities, politicians, researchers and planners.

Rising sea levels and the expected increase in extreme weather events such as storms may lead to an increasing demand for coastal management and artificial protection structures in the coming years. In accordance with international efforts to limit and reduce greenhouse gases (Paris Agreement, recent COP26 in Glasgow), the demand of low carbon footprint solutions for shore protection is expected to rise. Sound and sustainable shore management methods include coastal

Geobrugg developed an innovative solution of steel mesh cells in high-tensile stainless steel for coastal protection. This article estimates the carbon footprint compared with rock armour and concrete revetments for a case study in Devon, United Kingdom.

Geotechnics • Hydraulic engineering • Shore protection • Mesh • Carbon footprint • Innovation • United Kingdom



1 Rock armour

Source: Jonathan Wilkins, www.geograph.co.uk



2 Precast-concrete elements

Source: Coastalwiki, www.coastalwiki.org



Example low carbon material in shore protection TECCO cell system (2022)



Tecco Cell: installation in 2021

Source: Landmarc,
<https://landmarc.co.uk/>



**Finished installation of shore protection
in 2021**

Source: Landmarc, <https://landmarc.co.uk/>

Fig. 3: Tecco Cell installation and finished work at Beesands, Devon UK



Product carbon footprint: TECCO cell

Table 1: Results of carbon footprint calculations for three options of shore protection for the Beesands case study (length = 70 m, width = 12 m)

Stage	Carbon footprint [t CO ₂]		
	Option 1: Tecco Cell	Option 2: Rock armour	Option 3: Concrete revetment
Total material + transport	38.8	57.5	199.6
Total installation	9.16	17.09	10.69
Total material + transport + Installation	48.0	74.5	210.3



Recommendations:

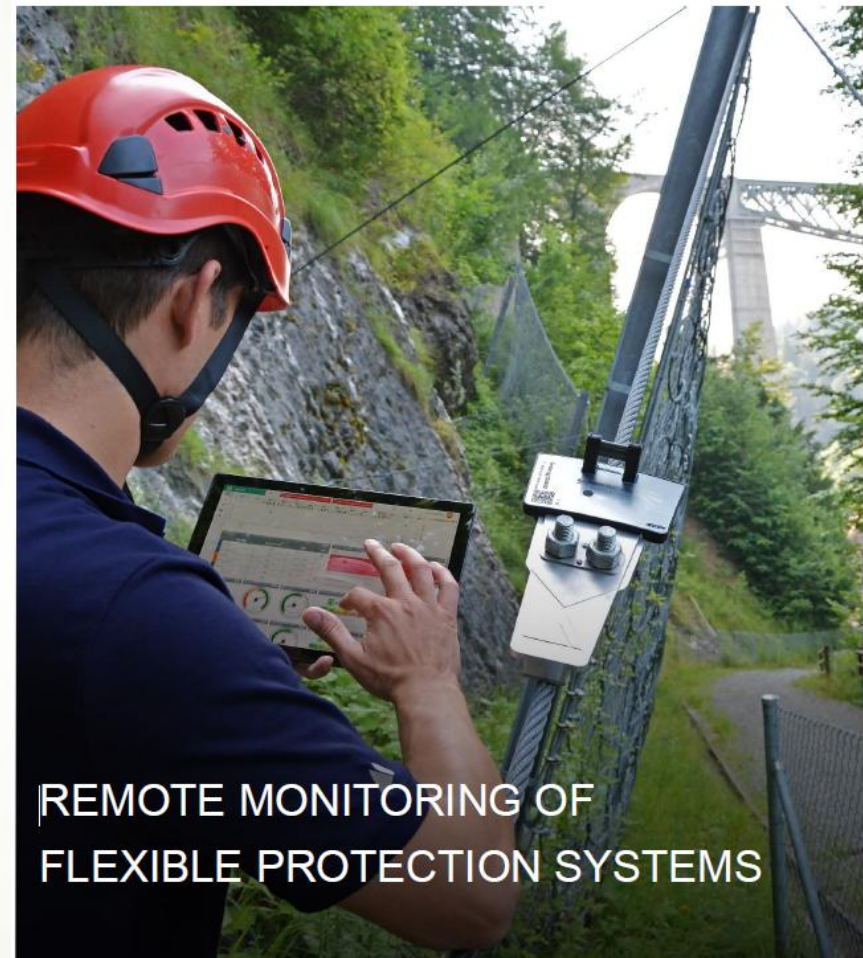
- Look out for low carbon alternatives when planning constructions.
- Ask your supplier for an environmental product declaration (EPD) of their product.
- Ask whether carbon accounting has been independently carried out.
- Check whether other products considered use the same frame („do not compare apples and oranges“)



Example: Environmental monitoring

- Detection of impacts on fences (rockfall, debris flow etc.)
- Dashboard on mobile app
- Monitoring of systems 24/7

Denk M., Schultes S. (2023): Gebrugg GUARD Use Guide.
Remote Monitoring for flexible Protection Systems. Gebrugg AG (Editor).



REMOTE MONITORING OF
FLEXIBLE PROTECTION SYSTEMS

Gebrugg GUARD
Practical guide



Example: Eden Project, Cornwall UK (hybrid of conventional and nature based solutions)

- Renaturation of a quarry
- Since 2001
- Botanical Garden
- Important tourist attraction in Cornwall
- Focus on environmental education



Example: Eden Project, Cornwall UK (hybrid of conventional and nature based solutions)

- Combination of conventional and nature based solutions for slope stabilizations (nettings, drainage systems, plants).
- Long term experience
- Local outcrops and repairs necessary (e.g. Dec. 2020)



Cornwall Live

