



Construction CO₂e Measurement Protocol

A Guide to reporting against the Green House Gas Protocol for construction companies



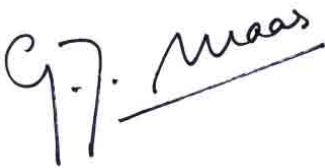
ENCORD Construction CO₂e Measurement Protocol.

A Guide to reporting against the Green House Gas Protocol for construction companies.

European Network of Construction Companies for Research and Development (ENCORD)

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A handwritten signature in black ink that reads "G. Maas". The signature is written in a cursive style with a horizontal line underneath the name.

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www.encord.org

Version 1.0 - May 2012

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1.0

The ENCORD construction CO₂e measurement protocol

Autovia del Sol, Spain

1.1 Introduction

The following measurement protocol has been developed by ENCORD (European Network of Construction Companies for Research and Development), to provide guidance on how an organisation within the construction sector can measure and report its greenhouse gas (GHG) emissions. The protocol sets out minimum requirements for measuring and reporting emissions in order to meet best practice.

The guidance is developed to complement the methodology of the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard March 2004 revision, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD)¹ (from here on referred to as the GHG Protocol). This sector guidance has been reviewed by the GHG Protocol and is in conformance with the GHG Protocol Corporate Accounting and Reporting Standard.

When measuring and reporting an organisation's GHGs the GHG Protocol should be consulted. References are made to the GHG Protocol throughout this document to assist those not familiar with the Protocol. Companies may also be required to report emissions against other standards. The ENCORD protocol should be followed to report construction specific emissions, where a company wishes to follow best practice.

This document identifies the intended users of this guidance, the main sources of emissions over which a construction company may have influence, and how these can be measured. Guidance is also provided on reporting methods at a company and project level. This is intended to assist current and future work undertaken to reduce emissions from specific construction related activities and operations. The GHG Protocol contains a full range of guidance which should also be followed eg on managing inventory quality, setting reduction targets, setting organisation boundaries and specific reporting requirements.

This document will be updated from time to time to take account of any new standards or changes to current methodologies and guidance. The latest version can always be found on the ENCORD website:

www.encord.org

¹ Available at: www.ghgprotocol.org/standards/corporate-standard.

1.2 Background

Global warming and climate change are key sustainable development issues. Companies must be able to understand and manage their GHG risks if they are to ensure long-term success in a competitive business environment. A well-designed and maintained corporate GHG inventory, which aligns with business specific issues, is an essential business tool and is increasingly seen as a marker for good management practice.

Those that perform well are demonstrating their ability to manage risk, drive efficiencies, and offer the best value to clients. Globally, buildings account for a significant proportion of our GHG emissions and increasing attention is being paid to the part that the construction industry can play in helping to reduce these. There are now a range of drivers impacting on the construction industry:

- Construction companies must seek to offer the best value to clients. Construction is an industry with a high turnover, but with relatively low margins. Energy costs, which make up a significant proportion of construction costs, have increased over the years. By measuring and managing GHG emissions, organisations can reduce energy consumption and therefore reduce costs, directly benefiting the bottom line.
- Many governments are taking steps to reduce GHG emissions through national policies that include the introduction of emissions trading programs, carbon or energy taxes, and regulations and standards on energy efficiency and emissions.
- For large listed companies, GHG emissions² reporting and management is becoming part of their investors' decision making process. The Carbon Disclosure Project (CDP) collects carbon reporting data from large companies on behalf of investors who have started to target the construction and property sector.
- Voluntary sustainability standards, such as the Global Reporting Initiative (GRI), are now becoming part of client selection processes. CO₂e emissions are a major part of such standards and as such, business

could be lost in cases where a company is seen to be ignoring its climate change impacts. The GRI have developed a sector supplement for construction and property, which means companies are expected to follow specific guidelines³ to meet best practice going forward.

The construction industry is complex, with different types of companies operating at different points in the value chain, spanning across finance, design, materials manufacture, construction and life cycle maintenance. It is important that companies are reporting against the same guidelines so that a clear picture is presented to external stakeholders. Given the diverse range of businesses within the construction sector it is also important that the methodology is able to draw distinct lines of responsibility for CO₂e emissions within the construction / building value chain. There is a danger that standards developed outside of the construction sector will misrepresent and inaccurately report emissions from the sector.

The ENCORD protocol and guidance has been developed to help ensure that a consistent approach is taken to measuring and reporting the key emissions from construction. The ENCORD membership comprises some of the largest construction services companies in the world, with a combined annual revenue of over 200 billion Euro (2008) and employing over 1.15 million people worldwide. ENCORD members are committed to improving sustainability within the construction sector and reducing GHG emissions is a key area of focus. Appendix B outlines how the protocol has been developed and the organisations involved.

²Including all six GHGs defined in the Kyoto protocol.

³The GRI Construction and Real Estate Sector Supplement (CRESS) can be found at: www.globalreporting.org/ReportingFramework/SectorSupplements/ConstructionandRealEstate
ENCORD has assisted GRI on its CO₂e measurement guidance and the CRESS contains references to this document.

1.3 Principles of GHG accounting

As outlined within the GHG Protocol, companies wishing to report their emissions shall ensure that GHG accounting is based on the following principles:

Relevance

Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users of the data – both internal and external to the company.

Completeness

Account for and report on all GHG emission sources and activities within the chosen boundaries. Disclose and justify any key exclusions.

Consistency

Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

Transparency

Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.

Accuracy

Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

Further guidance is provided in the GHG Protocol, Chapter 1 (pages 6 - 9).

1.4 Using the protocol

The guidance is designed to be used by construction companies (operating in any region) to measure CO₂e emissions that result from their operations and those of the supply chain.

While the principals of GHG measurement can be applied to any size of Construction Company, this guidance is primarily aimed at large companies which either act as a main contractor, or are a large subcontractor on major building and infrastructure projects.

A number of construction companies produce some of the materials used in the construction process. Therefore this guidance may also be applicable to construction companies who manufacture materials. However companies are also advised to refer to the GHG Protocol or sector specific protocols for materials manufacture where they exist⁴.

The guidance may also be applicable to construction companies who operate buildings or infrastructure (as part of a facilities management, maintenance contracts or as a landlord). Companies are advised to refer to the GHG Protocol or sector specific protocols for operation of buildings and infrastructure where they exist.

The outputs (ie reported emissions data) are intended to be used by regulatory bodies and governments, clients, standards bodies and any other organisation / individual that has an interest in the green house gas emissions from the construction sector. By adopting a standard approach to measurement and reporting, the industry will have the greatest opportunity to work with stakeholders to reduce emissions. Robust measurement will also allow companies to identify inefficiencies in their operations and develop solutions which will lead to both reduced costs and reduced emissions.

The guidance sets out the following:

Section 2 outlines the operational areas to which this protocol applies.

Section 3 provides guidance on setting organisational boundaries.

Section 4 introduces the concept of scope and significance in measuring emissions.

Sections 5 outlines the key sources of emissions for construction companies, provides guidance on how data may be collated and sets out minimum requirements for meeting best practice when measuring and reporting.

Section 6 provides more detailed guidance on each source of emissions and how they should be identified.

Section 7 provides guidance on reporting emissions.

Section 8 provides guidance on the most relevant KPIs that construction companies should use to normalise emissions data and track performance over time.

⁴The GHG Protocol has developed a number of sector toolsets and guidance which can be reviewed at: www.ghgprotocol.org/calculation-tools/sector-toolsets

2.0 Areas of operation



Biogas station for greener vehicles, Netherlands

2.1 Key areas of operation

Each area of operation, sector and type of project has the potential to be a significant source of green house gas emissions. However, they will have a different level of impact. To take this into account it is necessary to differentiate between the different areas of operation, sector and type of project to allow better targeting of emission reduction measures.

In this section we set out guidance to identify the operational activities to be included within the organisational boundary.

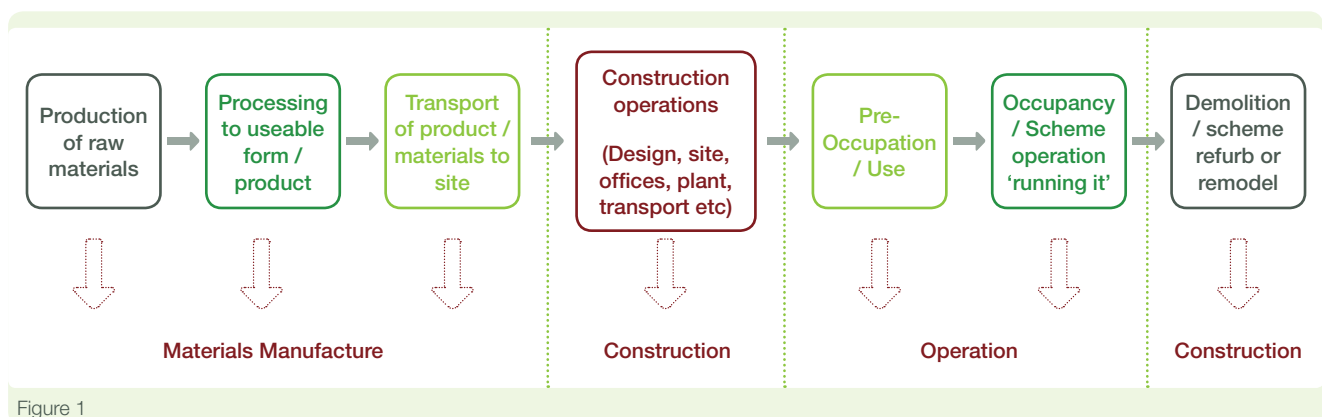
This guidance should be read in conjunction with the GHG Protocol chapters 3 and 4 (pages 16 – 33) on organisational and operational boundaries.

This guidance is intended to identify the emissions from key construction processes over which a construction company has control or influence (see section 3 for guidance on setting organisational boundaries). The construction sector is split between three broad areas of operation:

- Off-site production and transport of materials used for construction
- Project design and construction (civil engineering or building, including demolition and refurbishment, and on-site materials manufacture)
- Project operation (the management and / or use of the final product)

The ‘Construction Company’ reporting under this protocol may be involved in just one, or all three of these areas of operation.

An example of the value chain for a construction project is detailed below in figure 1.



To ensure transparency in reporting and comparison of performance, companies shall report their (relevant) operational emissions under the following broad headings.

- Materials manufacture
- Construction (and related activities)
- Operation

Example 1: Organisation A is involved in the design and construction of buildings and roads (Construction). They also manufacture Asphalt for use in road construction (Materials Manufacture), and manage buildings which are let to residents and occupiers (Operation). The emissions associated with each of these business activities will vary significantly in size and should therefore be reported separately, using the most relevant key performance indicators for each.

2.2 Construction sector and project type

The GHG Protocol outlines requirements for the information that shall be included in a GHG emissions inventory, including the disaggregation of emissions by scope⁵.

In addition to these requirements, it is recommended that where a construction services company chooses to benchmark between its different construction activities, the following sectors and project types are used⁶. The aim of disaggregating emissions using this approach is to provide clarity and consistency. The sector and project type has a significant impact on emissions and therefore the results should be benchmarked within the same sector and project types.

Tier 1 differentiates between the sector and Tier 2 differentiates between project types for construction.

Organisations should report each sector separately where possible (Tier 1). For best practice, projects should also be identified by their project type where these are being compared (Tier 2), and whether they are new build or refurbishment projects.

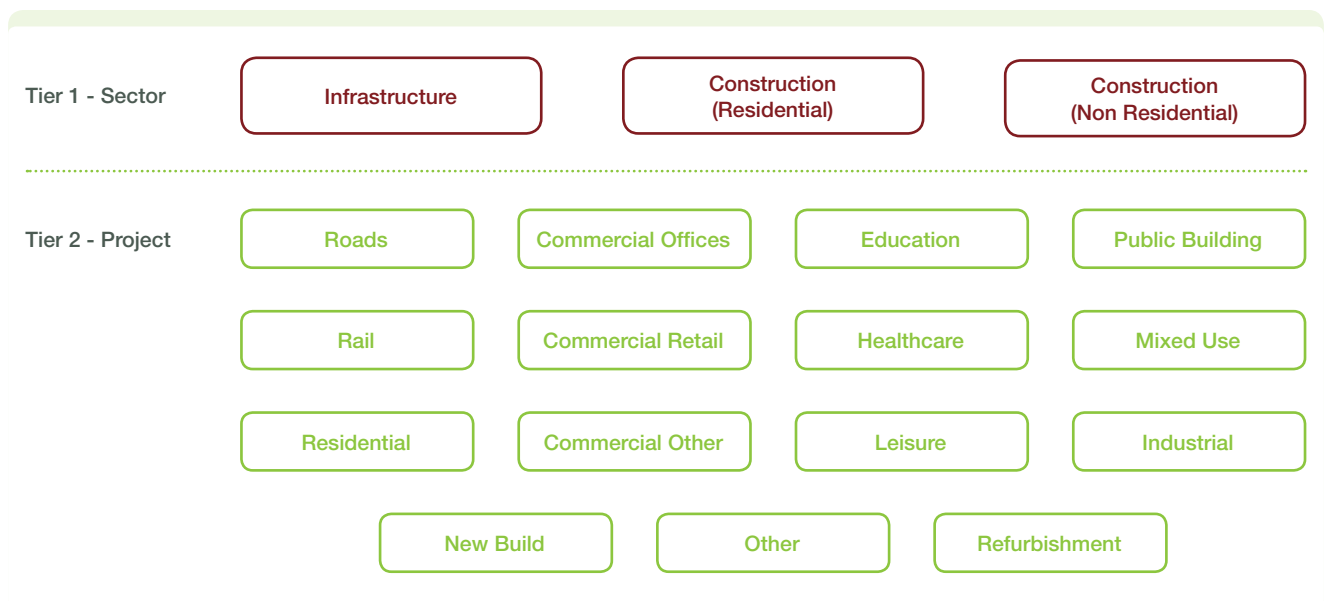


Figure 2

⁵ Chapter 9, GHG Protocol Corporate Standard.

⁶ The same split can be applied for operation of buildings, but since this protocol is aimed at construction services specific guidance on operation of buildings is not provided. This approach is not applicable for materials manufacturing.

2.3 Support services and activities

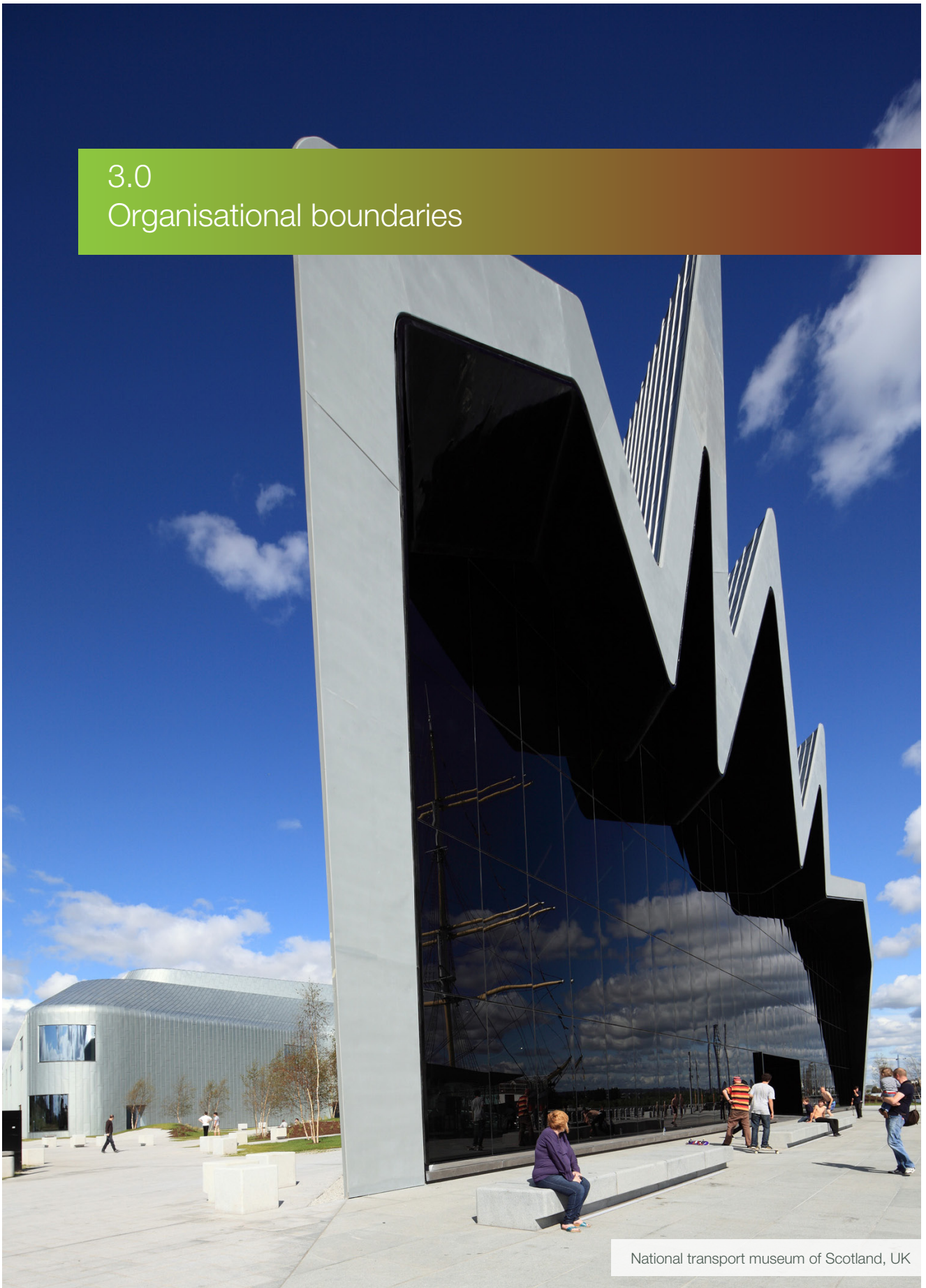
Emissions from support services, such as business travel and the operation of offices and other premises which support the core business activities (eg plant depots, warehouses), should also be included.

Where possible these should be measured under the applicable area of operation. Where this is not possible the emissions should be included under the main area of operation and be reported by source as described in section 5.

Example 2

Organisation A has an asphalt plant with associated offices on the same site; however its management of buildings, which accounts for only a small amount of turnover, operates out of the same offices as the construction business. Therefore, for organisation A, the support services for asphalt production would be reported within the materials manufacture emissions area. However the support services emissions from the management of buildings would be reported under the construction emissions area, which is the main area of operation.

3.0 Organisational boundaries



National transport museum of Scotland, UK

3.1 Overview

Business operations and structures can vary significantly between organisations. In order to consolidate GHG emissions across its operations, an organisation must identify the boundaries it will work within and be consistent in its approach over time.

The GHG Protocol defines two distinct approaches which should be used to define organisational boundaries, the equity share and the control approach. The control approach is split into financial and operational control.

A brief description of each approach is provided below. For further guidance, companies should consult the GHG Protocol, Chapter 3 (pages 16 – 23).

Equity share approach - Under this approach, a company would record its emissions according to (pro rata) the equity share it holds in each operation. This is based on the assumption that the economic risks and rewards for a company are comparable to its ownership share. There may be cases where equity share differs from ownership, in which case the economic share a company has in an operation would override its share of ownership, to better reflect the risks and rewards at stake.

Financial control approach - Under this approach a company would record emissions from facilities, sites or operations over which it has financial control, ie it has the ability to direct the financial and operating policies with a view to gaining economic benefits from its activities. A company accounts for 100% of the emissions of those operations over which they have financial control.

Operational control approach - Under this approach, a company would record emissions from facilities, sites or operations over which it or one of its subsidiaries, has operational control, ie the authority to introduce and implement its operating policies at the operation. A company accounts for 100% of emissions from operations over which it or one of its subsidiaries has operational control.

3.2 Construction company best practice

Companies can choose which approach they use based on their particular business. However, taking into account the activities that most construction companies are involved with, it is recommended best practice that the operational control approach is used⁷.

As described in section 2, companies operating within the construction sector may have varied business operations and they may differ in their legal and organisational structures. These may include wholly owned operations, joint ventures (especially in the case of PFI schemes) and wholly or partly owned subsidiaries. Where operational control is not clearly assigned, the equity share approach should be used eg in the case of PFI schemes.

Taking this approach is likely to identify those emissions over which the company has most influence to reduce and therefore emissions sources that stakeholders are most concerned with.

Given the complex and varied nature of the contractual mix within the construction sector, it may not be possible to choose one approach which is ideal. This is an area which requires further discussion within the sector as whole.

⁷ Chapter 3, GHG Protocol Corporate Standard.



4.0 Scope of measurement

Naturum Kristianstad, Visitor Centre, Sweden

4.1 Emissions scopes

The GHG Protocol breaks emissions down into three distinct areas known as ‘scopes’:

Scope 1

Direct Emissions (from the burning of fuel, fugitive emissions and chemical processes).

Scope 2

Indirect Emissions (from the use of Electricity and Steam).

Scope 3

Other Indirect Emissions (sources not controlled by the company eg supply chain).

Whether emissions are direct or indirect can be defined as follows:

Direct emissions – are from sources that are owned or controlled by the reporting organization

Indirect emissions – are from sources that are owned / controlled by a third party but whose emissions are nevertheless influenced by the reporting company.

Within each Scope a number of emission sources are quoted. The ENCORD protocol lists the key construction emission sources in sections 5 and 6, and links these to the scopes under the GHG Protocol. This is intended to assist companies in capturing and reporting on their key emissions sources, therefore meeting best practice. Although Scope 3 emissions are optional within the GHG Protocol, they can make up a significant proportion of the CO₂e emissions of a construction company.

For further information on scopes, see GHG Protocol Corporate Standard chapters 2 and 3 (pages 16 – 33) and the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

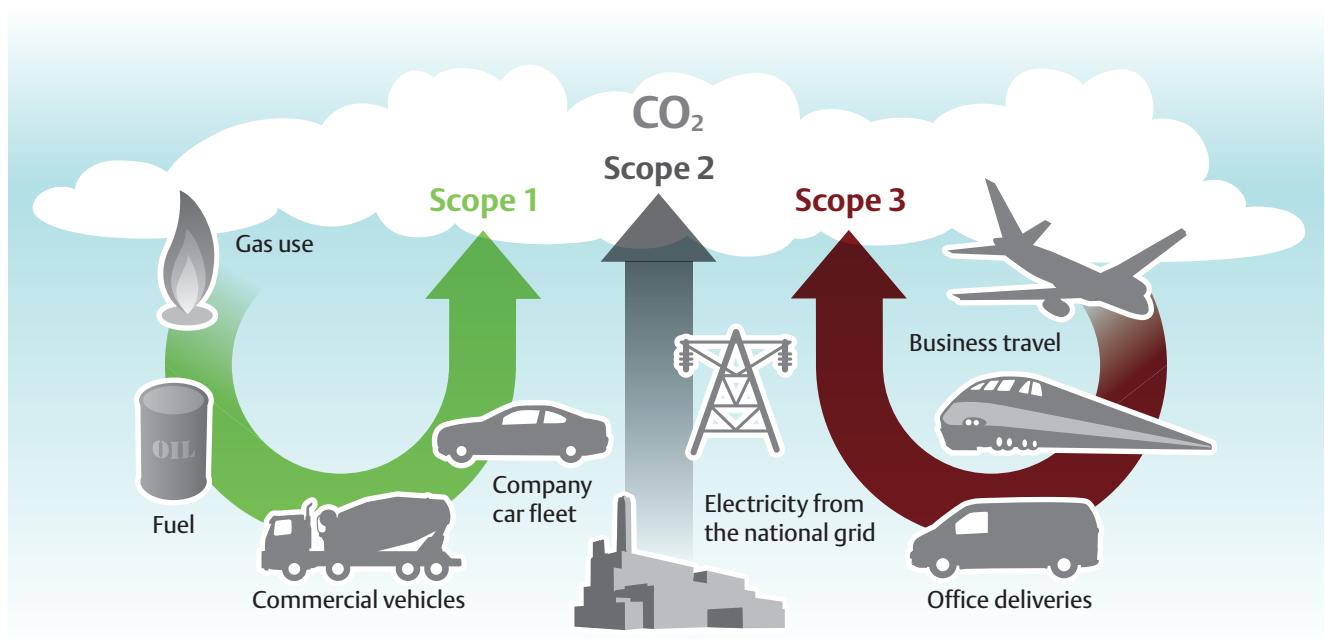


Figure 3

4.2 Significance

When assessing each emission source, organisations should consider the ‘significance’ of the emissions from that source. Significance can be determined by considering the following criteria:

1. Magnitude of GHG emissions - perform a screening to estimate which activities are expected to be the most significant sources of emissions and rank them accordingly.
2. Financial spend - prioritize activities based on their relative financial significance.
3. Stakeholders demands and relevance to your business.
4. Activities which the organizations has the most influence over.
5. Potential for reductions.
6. Contribution to risk exposure, eg security of supplies, price volatility etc⁸.

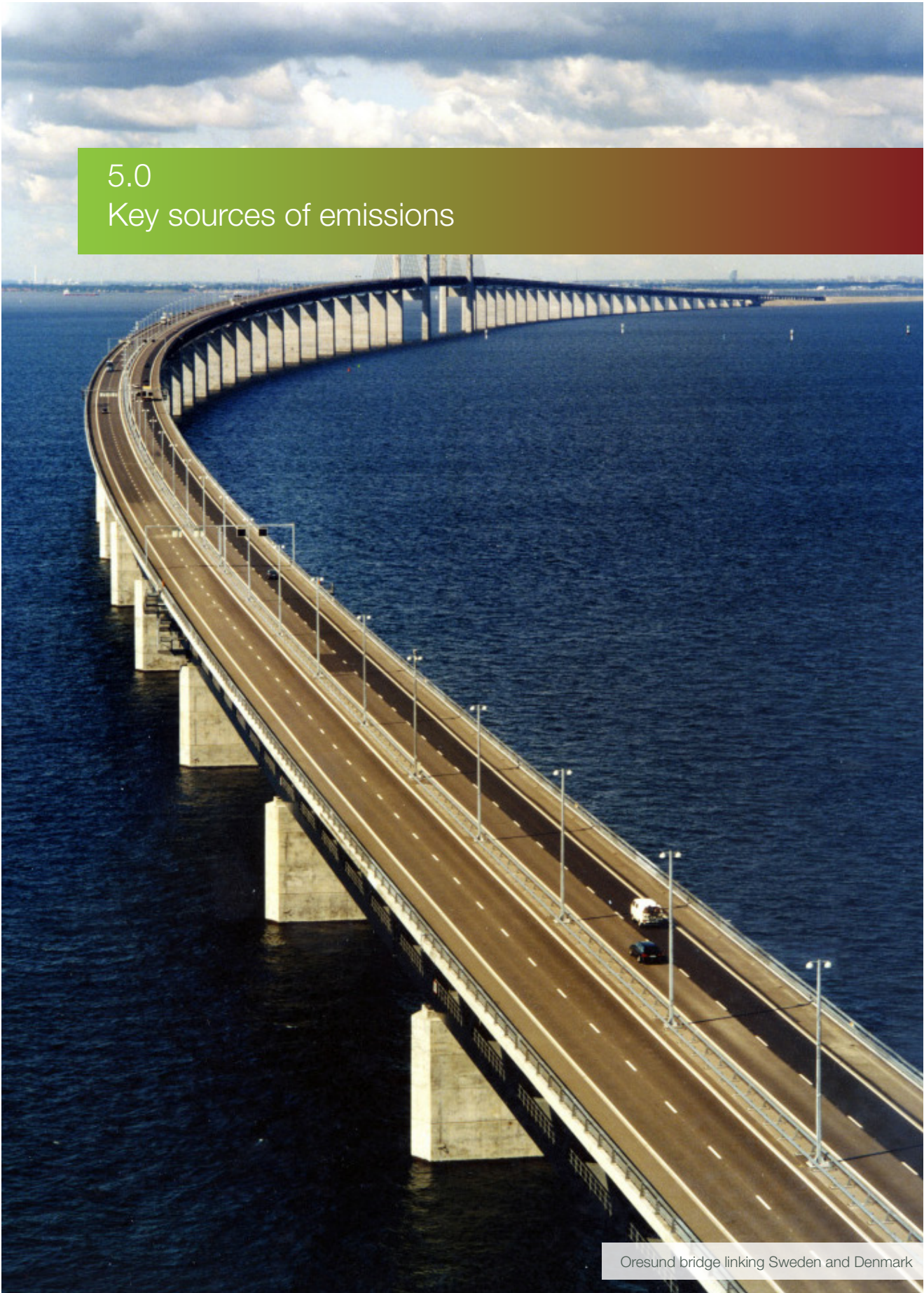
Or prioritize activities according to alternative methods, such as:

3. Stakeholders demands and relevance to your business.

When a construction company reports it's emissions it should state clearly and transparently which sources it has included, and which are excluded and the reasoning behind these decisions.

⁸ Based on guidance in the Corporate Value Chain (Scope 3) Accounting and Reporting Standard, pages 65-66, WBCSD/WRI.

5.0 Key sources of emissions



Oresund bridge linking Sweden and Denmark

5.1 Construction company ‘emission sources’

As described in section 2, companies are encouraged to report emissions under key operational areas (eg materials manufacture, construction, and operation). This section outlines the key emission sources from these operations, and provides guidance on the requirements for meeting best practice.

This section should be read in conjunction with Chapters 5 and 6 (pages 34 – 47) of the GHG Protocol Corporate standard and the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

A number of distinct sources of Green House Gas Emissions (Emission Sources) have been identified by ENCORD over which construction companies have influence. Figure 4 shows the most significant construction process emissions against GHG Protocol scope. Emissions source 7, Vehicle Fuel, is shown in

each scope as its placement will vary depending on how vehicles are powered, whether or not fuel / travel is paid for by the company, and whether or not travel / transport is carried out in company owned / leased vehicles or employee privately owned vehicles. In Section 6 we have provided more detail on how these emissions should be identified.

‘Appendix A’ provides a useful table for companies to quickly view key sources of emissions against the GHG Protocol scopes.

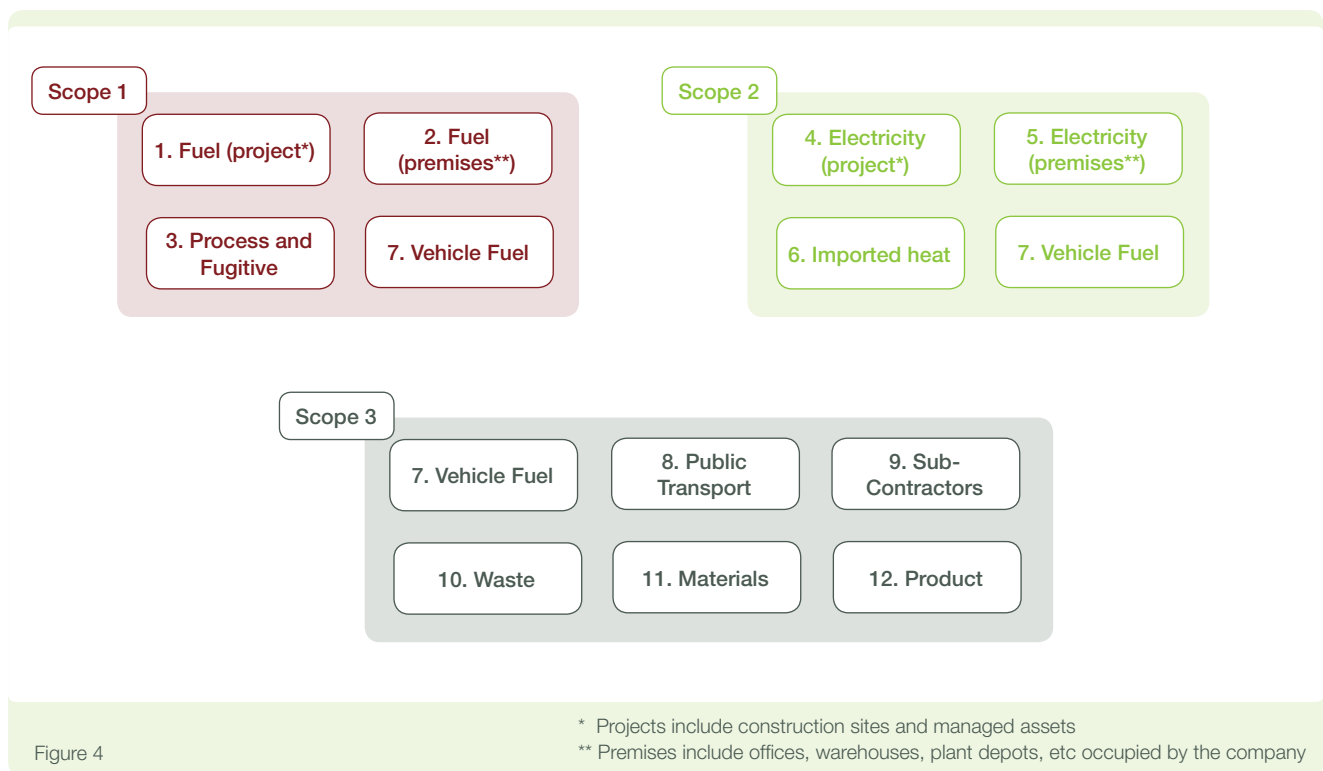


Figure 4

5.2 Best practice reporting requirements

Scope 1 and 2 emissions

Companies should measure emission sources 1 to 7 as a minimum as these are the areas over which a company exerts the most influence. For most companies these will be the most significant direct emissions. This is consistent with the GHG Protocol Corporate Standard requirement to measure and report scopes 1 and 2 as a minimum.

Scope 3 emissions

In 2011 the GHG Protocol launched the Corporate Value Chain (Scope 3) Accounting and Reporting Standard which provides a detailed approach to identifying and measuring significant Scope 3 emissions. The standard identifies 15 categories of Scope 3 emission which a company should assess in order to meet the requirements of the standard. Companies wishing to extend their scope 3 inventory should consult the Corporate Value Chain (Scope 3) Accounting and reporting Standard.

Construction services companies aspiring to meet best practices should aim to measure all relevant scope 3 emissions sources, however Scope 3 emissions identified in this protocol (and described below), are considered to be the most relevant and significant indirect emissions over which a construction services company may have some influence in reducing⁹.

Source 7: Vehicle Fuel - All construction companies have the potential to have a significant impact from the fuel used for commuting. This should be captured and reported.

Source 8: Public Transport - Many companies already report emissions from use of public transport and there are various methods of doing this (see section 6).

Source 9: Subcontractors - Emissions from subcontractors working on construction projects can be measured at the project level and this will also allow a complete picture to be painted of the impacts of the project. Measuring these emissions also helps to level out any inconsistencies between companies that subcontract and those that prefer to carry out more of the work themselves.

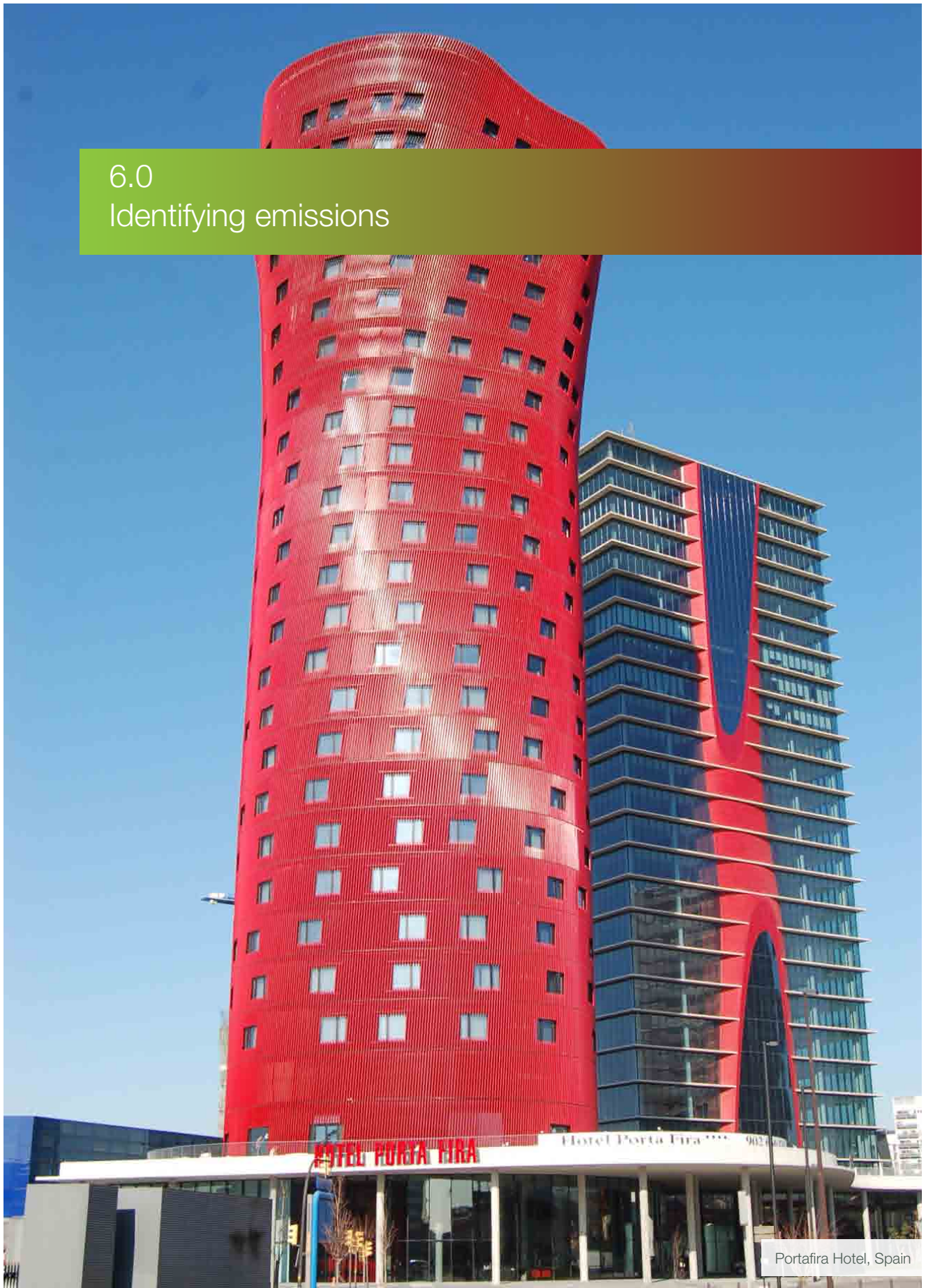
Source 10: Waste - Construction companies produce significant amounts of waste which requires transportation, processing and / or disposal of some kind. This can lead to significant GHG emissions. All construction companies can influence the amount of waste generated (through more efficient planning, operations and design) and how waste is dealt with (through re-use, recycling, recovery or disposal).

Source 11: Materials - The embodied GHG emissions of the materials purchased by construction companies can be significant and companies can sometimes influence the selection of materials to reduce embodied GHG emissions (through use of natural / renewable materials, increasing recycled content of materials and reducing quantities of energy intensive materials).

Source 12: Products - Emissions from the use of 'products' produced by construction companies (eg buildings and roads) can be measured, however construction services companies who do not hold responsibility for design, initial conception of building specifications or maintenance, have little influence over the ultimate performance of buildings or their use by owners / occupiers.

⁹ This is an area that will be updated over time as more work is carried out to identify the full range of relevant scope 3 emissions for construction.

6.0 Identifying emissions



6.1 Emission sources

The GHG Protocol, specifically chapters 5 and 6 (pages 34 – 47), should be consulted as a starting point for any organisation wishing to measure their emissions. As outlined in section 5, companies wishing to report against this protocol shall measure and report their emissions from sources 1 – 7 as a minimum.

The following sections outline the key sources of emissions (as outlined in section 5) and how they can be measured.

Source 1: Fuel (projects)

Include all fuel purchased by the organisation for use in plant and machinery in use on, or at, a project (including construction sites and managed assets such as buildings and roads). Where materials are manufactured on a construction site (eg concrete), then the fuel used in this process should be included. It should not include any fuel used in vehicles travelling on the public highway. The fuel used can be measured using a number of different units of measurement (eg kWh, litres, kg, m³, etc.) and includes the following:

- Gas Oil
- Diesel
- Petrol (Gasoline)
- Fuel Oil
- Heating Oil
- Natural Gas
- Liquefied Petroleum Gas (LPG)
- Compressed Natural Gas (CNG)
- Coal

Emissions should be calculated using actual data wherever possible, such as purchased fuel and a relevant conversion factor. Where not all of this information is available, or it is impractical to collect, emissions may be calculated using an estimate of fuel consumed. This

should be based on robust metrics such as the energy requirements of machinery / plant (eg horse power), working hours (typical period machinery is in use), and the machine efficiency. When reporting emissions calculated in this way, the company should clearly state the method used and assumptions made.

Source 2: Fuel (premises)

Include all fuel purchased by the organisation for use at premises which support the company's activities. This will include offices, production facilities, warehouses, plant storage / maintenance facilities, and / or sites used for assembly of construction materials. The fuels included will be largely the same as those listed for source 1 above.

Source 3: Process and Fugitive Emissions

Process – When applicable, include greenhouse gas emissions from physical or chemical processing involved in the production of mineral products (such as cement and lime) and metal products (such as steel and aluminium) within facilities owned or controlled by the company.

Fugitive - Includes green house gas emissions from air-conditioning and refrigerant leaks from equipment either owned or controlled by the company. Where applicable, emissions should be reported in CO₂e and converted using an appropriate global warming potential (GWP) conversion factor.

Further guidance on process and fugitive emissions is provided in the GHG Protocol, chapters 4, 6 and appendix D. There are also specific tools available to assist in calculating these emissions¹⁰.

¹⁰ Information about specific calculation tools can be found at: www.ghgprotocol.org/calculation-tools/all-tools

Source 4: Electricity (project)

Includes all electricity purchased by the organisation for use at a project (including construction sites and managed assets such as buildings and roads).

Where materials are manufactured on site, then the electricity used in this process should also be included. Where electricity is supplied by a client, this should be included and reported as a scope 3 emission to avoid double counting.

The conversion factors will include 'green' electricity in the mix; therefore all electricity will be measured on a gross basis. Where an organisation has signed up to green energy tariffs, and / or green energy certificates have been issued, then a net figure can also be quoted in addition to the gross figure, ie the total energy consumed and net CO₂e taking into account the amount of green energy purchased.

Source 5: Electricity (premises)

Include all electricity purchased by the organisation for use at premises which support the company's activities. This will include offices, production facilities, warehouses, plant storage / maintenance facilities, and / or sites used for assembly of construction materials. As indicated for source 4, emissions from electricity should be calculated on a 'gross' basis.

Source 6: Imported Heat

Include all heat (eg steam from combined heat and power) purchased by the organisation for use at the company's projects or premises. Conversion factors from the supplier should be used where available or relevant secondary data.

Source 7: Vehicle Fuel

Include all fuel paid for by the organisation (either directly, or indirectly through mileage allowances or expenses) for use in vehicles travelling on the public highway. Best practice is to differentiate between fuel used for business journeys and fuel used in commuting to and from work in vehicles owned, leased or hired by the company. The following types of vehicles should be included:

- Company owned vehicles (cars, vans, HGVs, etc)
- Leased vehicles (cars, vans, HGVs, etc)
- Privately owned vehicles (cars, vans, HGVs, etc)

The fuel used will generally be measured in litres and may include the following:

- Diesel
- Petrol (Gasoline)
- Liquefied Petroleum Gas (LPG)
- Compressed Natural Gas (CNG)
- Electricity (measured in kWh)

Emissions can be calculated using actual purchased fuel conversion factors, or where not all of this information is available, mileage or km conversion factors can be used. Where mileage / km conversion factors are used, these are to be broken down into the following three categories as a minimum:

- Average car (unknown fuel) including MPVs (kgCO₂e/km)
- Average vans up to 3.5 tonnes (kg CO₂e /km)
- Average HGV over 3.5 tonnes (kg CO₂e /km)

Where more accurate vehicle data is available for transport emissions (eg average government CO₂e emissions for cars in the fleet) then this should be used. When using vehicle emissions data to convert distance travelled to CO₂e, it is considered best practice to apply an uplift of at least 15% to account for real world driving conditions.

Vehicle fuel may be defined as scope 1, 2 or 3 emissions depending on the following factors:

Scope 1 – Business travel in company owned / leased vehicles or privately owned vehicles that is paid for by the company, ie where the company is deemed to have control over these emissions (this may include cases where companies pay employees a subsidy to run a car in addition to paying for business travel).

Scope 2 – Business travel in company owned / leased vehicles or privately owned vehicles that is paid for by the company powered by electricity.

Scope 3 – Commuting travel in company owned / leased vehicles or privately owned vehicles paid for by the company, ie where the company has less control as commuting distances are determined by employees.

Source 8: Public Transport

Include all public transport (air, train, bus, coach, taxi, etc) used by employees, and paid for by the organisation (either directly, or indirectly through allowances or expenses).

Information may be obtained from travel surveys of at least 10% of the organisations staff, covering all areas of operation, with the resulting data being aggregated to establish the total distances travelled. Emissions should be calculated based on approved standard conversion factors for miles / km travelled on each form of transport¹¹.

Source 9: Subcontractor

This should include all emissions associated with a subcontractor at a project level. These emissions should be measured in line with the guidelines above for fuel (project), electricity (project), vehicle fuel, and public transport (ie sources 1, 4, 7 and 8). Each emissions source should be measured and identified separately wherever possible.

Source 10: Waste

Includes CO₂e produced as a result of the disposal of waste, including transport off site.

Measurement of waste is to be carried out in accordance with agreed guidelines (eg ENCORD Waste Measurement Protocol¹²). These must, as a minimum, differentiate between the different sources of waste (construction, demolition and excavation), and the destination (eg landfill, incineration, recycling, reuse).

Emissions will be calculated on agreed standard conversion factors (eg Environment Agency / WRAP data in the UK). This is to include the CO₂e equivalent emissions for the various greenhouse gases produced as part of the disposal process (eg methane produced as a result of landfill), as well as any associated transport CO₂e emissions.

(Note: There are a number of conversion factors available to calculate emissions from waste; therefore further research is required to establish agreed standard conversion factors for the waste sources and disposal processes before companies can begin reporting in a standardised way.)

For further information and guidance companies should consult the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and guidance document¹³.

Source 11: Materials

This is to include the embodied CO₂e in materials purchased for construction projects, plus an allowance for transport to site. The following materials are considered to be of a high priority given their wide spread use and high energy and emissions intensity¹⁴:

- Ferrous metals (eg structural and reinforcement steel)
- Non-ferrous metals (eg aluminium cladding)
- Cement (as used in concrete and concrete products)
- Brick (ceramics as produced by firing in a kiln)
- Glass
- Insulation (from non-renewable materials)
- Gypsum based products (as used in plasterboard)
- Bituminous products (eg asphalt)

Embodied CO₂e in materials is to be measured in accordance with approved national / international standards once they have been fully developed and tested (eg PAS 2050 / ISO14067 and the GHG Protocol Product Lifecycle Standard), and is to include all emissions up to the factory gate.

¹¹ See 'GHG Emissions from transport or mobile sources' at: www.ghgprotocol.org/calculation-tools/all-tools

¹² The ENCORD waste measurement protocol has been developed by members of ENCORD to outline a common methodology for measurement and reporting of construction waste. See: www.encord.org

¹³ See the standard and guidance document at: www.ghgprotocol.org/standards/scope-3-standard

¹⁴ The production processes for these materials are highlighted by the EU Emissions Trading Directive as emissions intensive, see: www.ec.europa.eu/clima/policies/ets/index_en.htm

An allowance for transport CO₂e emissions to the production site will then need to be added to the material production figure based on distance travelled between the production and use sites. (Note: The transport emissions associated with materials delivery require further investigation to establish agreed metrics and conversion factors).

For further information and guidance companies should consult the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and guidance document.

Source 12: Product

The emissions from the product during its use (eg a building or length of road) are not specifically measured within the ENCORD protocol; however this is an area where there is significant potential to reduce emissions ie through better design of buildings and infrastructure. Therefore, where the company has influence over the specification, every effort should be made to reduce the impact of the product over its lifetime (within technological and financial constraints).

In addition to the above, where performance measures exist, companies should record the performance of the product. Currently this would include the 'Energy Performance in Buildings Directive' label / certificate rating per m² of the completed buildings (eg Energy Performance Certificate (EPC) in the UK).

The UNEP sustainable buildings and construction initiative (SBCI) 'Common Carbon Metric'¹⁵ is one of several methods to measure carbon emissions resulting from the use of buildings.

For further information and guidance companies should consult the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and guidance document.

Other emissions

Where other significant emissions are reported, the method of measurement, source of data, and assumptions made, should be explained.

¹⁵ UNEP SBCI have developed the common carbon metric for measuring the performance of buildings over their use phase. Updates on progress of the CCM can be found at http://www.unep.org/sbci/Activities/CCM_Pilot.asp



7.0 Emissions reporting

Wind turbine installation, new manufacturing facility, UK

7.1 Reporting guidance

The GHG Protocol provides tools and guidance¹⁶ to assist organisation in calculating emissions¹⁷. These are based on international and sector specific data sets. There are also specific national tools and guidance available which organisations may wish to follow.

The basic principles are however the same, using activity data (such as litres of fuel consumed) and converting it to GHG emissions.

For guidance figure 5 shows how data may be presented to identify the different sources of emissions, the relevant Scope and the key area of operation.

The data for each scope of emissions should be brought together at a company level and split between the three operational areas (see section 2.1).

Example Construction Services Company Emissions

	Source	Construction (tCO ₂ e)	Materials (tCO ₂ e)	Operation (tCO ₂ e)	Scope	
1	Fuel (project)	53,000	0	0	1	Fuel may be made up of gas oil, natural gas and LPG etc...
2	Fuel (premises)	200	400	200	1	
3	Process and fugitive	0	250	25	1	
4	Electricity (project)	24,000	0	0	2	
5	Electricity (premises)	2,000	1,200	3,000	2	
6	Imported heat	0	0	100	2	
7	Vehicle fuel	5,000	0	0	1	Scope 1 where this is business travel
7	Vehicle fuel	100	0	0	2	
7	Vehicle fuel	6,500	0	0	3	Scope 2 where Electric vehicles are used for Business travel
8	Public transport	160	0	0	3	
9	Subcontractors	30,000	0	0	3	Scope 3 where this is commuting travel
10	Waste	9,000	200	50	3	
11	Materials	1,100	0	0	3	
12	Product	25,000	0	0	3	
	Total	156,060	2,050	3,375		

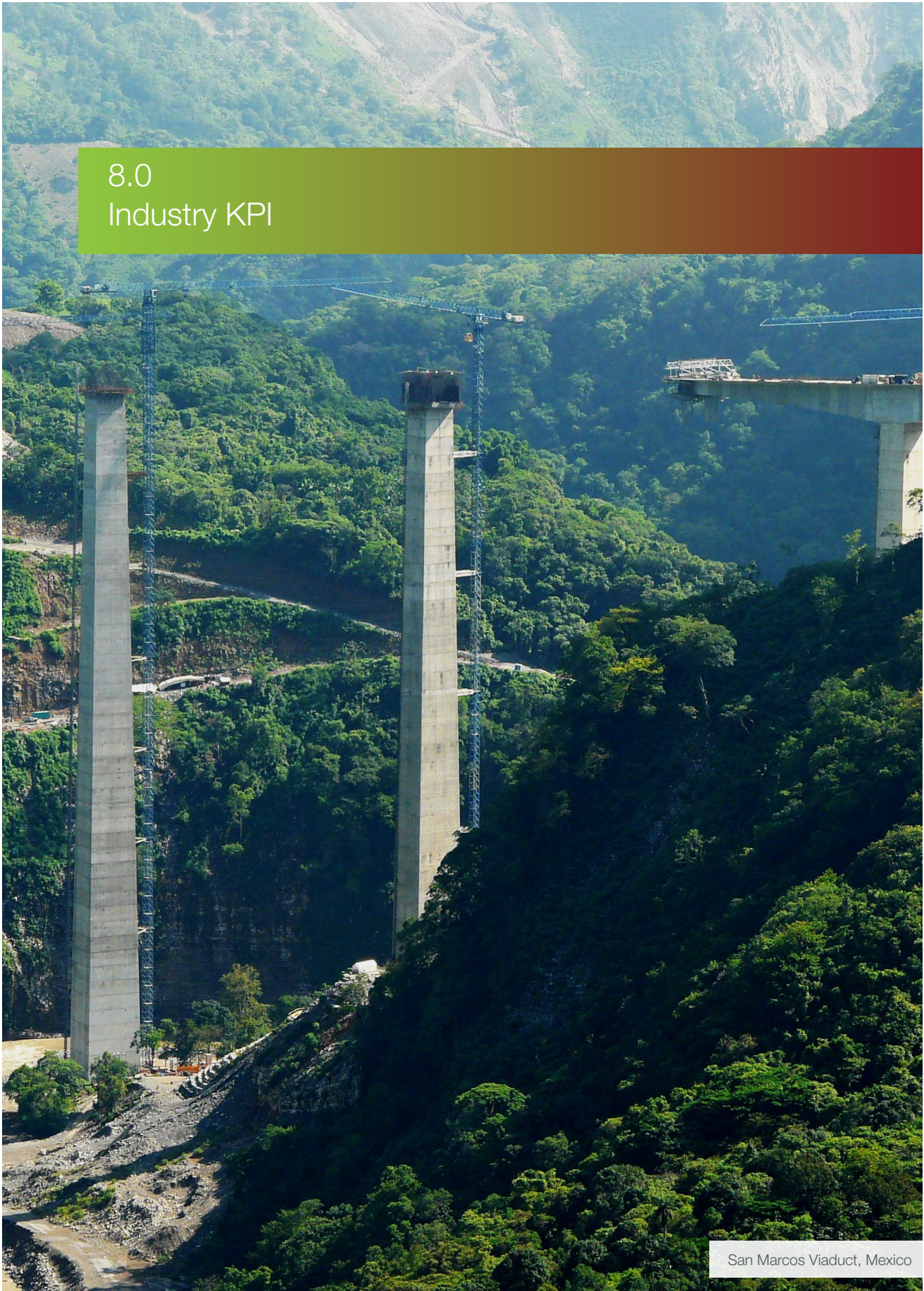
Figure 5

¹⁶ The GHG Protocol provides a range of tools that have been developed to assist organisations in calculating emissions.

See the up to date list of tools at: www.ghgprotocol.org/calculation-tools/all-tools

¹⁷ It is important to note that the tools currently offered by the GHG Protocol do not include life-cycle emission factors or calculation functions.

8.0 Industry KPI



San Marcos Viaduct, Mexico

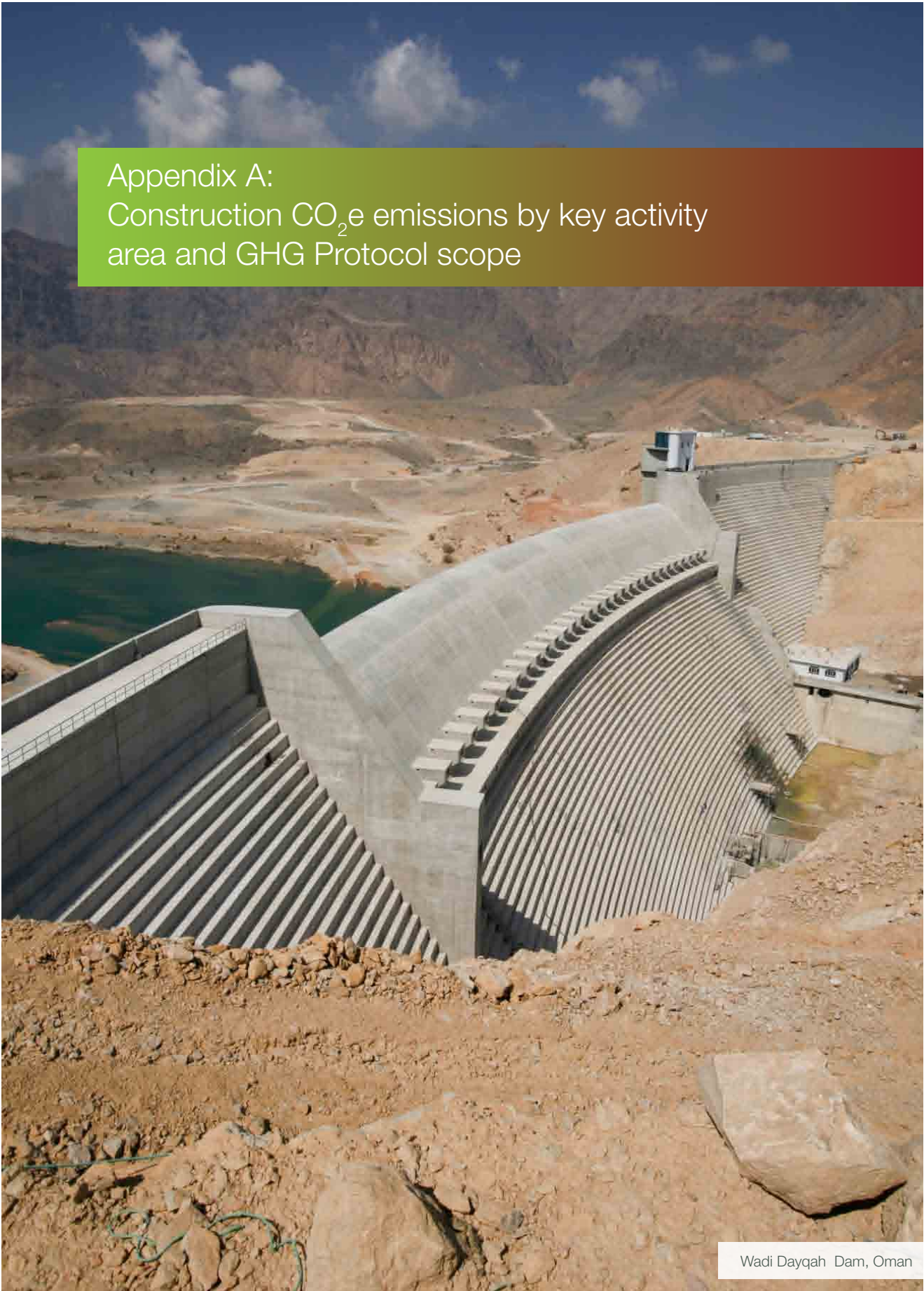
8.1 Industry KPI

When reporting construction company CO₂e emissions, the following normalised key performance indicators should be used. The primary indicator should always be measured and where possible it is best practice to also measure the secondary indicator. There may be additional / alternative secondary indicators that are relevant to specific organisations or activities that are not covered here.

Area of operation	Key performance indicator
Material manufacture	Tonnes CO ₂ e / unit of product
Construction	Tonnes CO ₂ e / (€ / £ / \$) 1 million turnover (primary indicator)
	Tonnes CO ₂ e / m ² gross internal floor area (secondary indicator)
	Tonnes CO ₂ e / km of road / rail (secondary indicator)
Operation	Kilograms (kg) of CO ₂ e / m ² gross internal floor area / annum
	Kilograms (kg) of CO ₂ e / km road or rail

Figure 6

Appendix A:
Construction CO₂e emissions by key activity
area and GHG Protocol scope



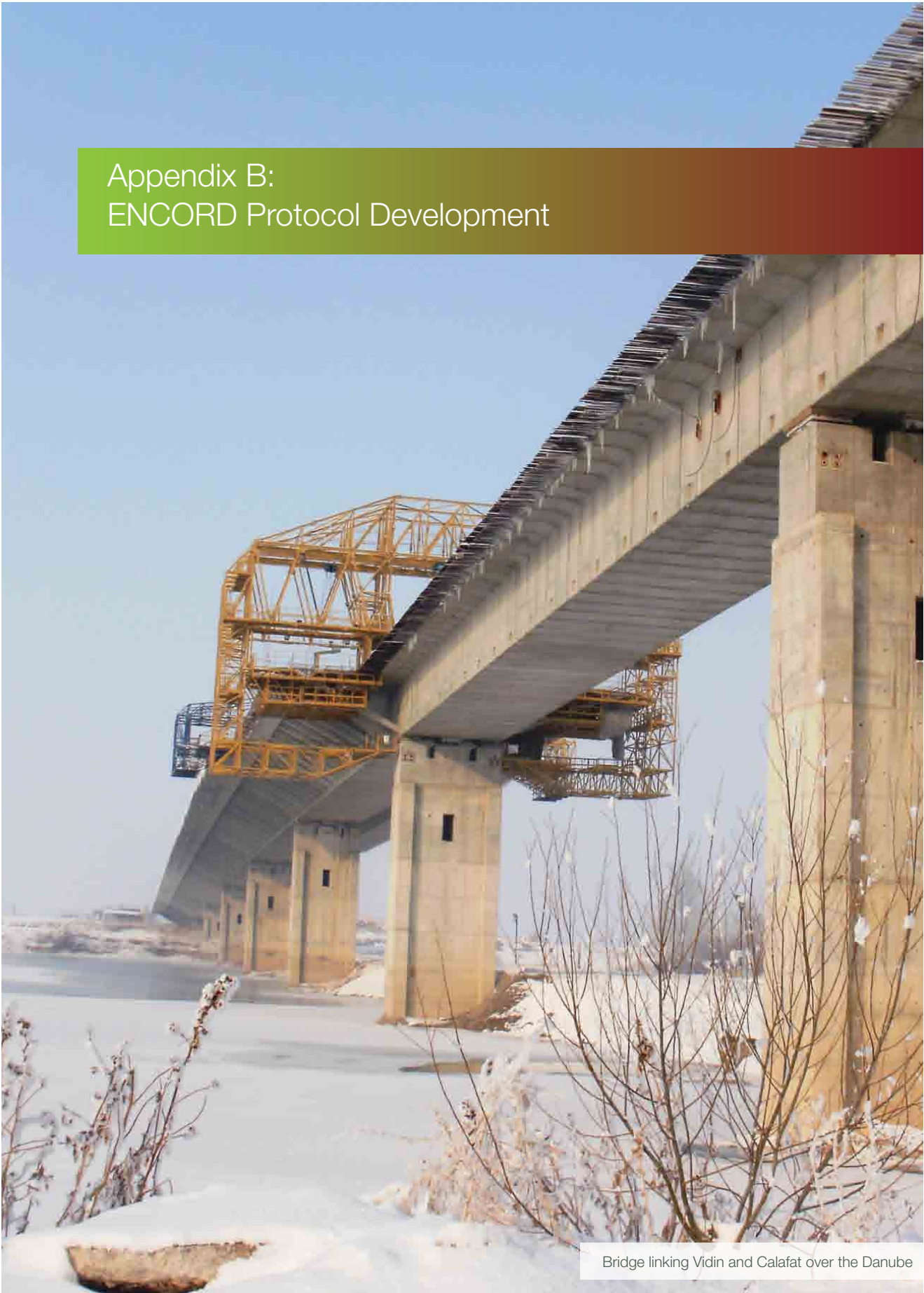
Wadi Dayqah Dam, Oman

Appendix A

The table sets out construction emission sources and how this relates to the GHG Protocol scopes.

	GHG Protocol Scope 1	GHG Protocol Scope 2	GHG Protocol Scope 3	ENCORD emissions sources
Buildings / depots and other fixed facilities including off-site manufacture and assembly	<p>Fuel used in all buildings/ facilities owned, leased or rented by the company eg:</p> <ul style="list-style-type: none"> • Gas Oil • Diesel • Petrol • Fuel Oil • Heating Oil • Natural Gas • Liquefied Petroleum Gas (LPG) • Compressed Natural Gas (CNG) • Coal • Etc. <p>Process and fugitive emissions eg:</p> <ul style="list-style-type: none"> • Air conditioning equipment 	<p>Electricity used in all buildings/ facilities owned, leased or rented by the company:</p> <ul style="list-style-type: none"> • Electricity 		ENCORD emissions sources 1, 2, 3, 4, 5, 6
Projects / Sites	<p>Fuel purchased for all plant and equipment owned, leased or hired by the company eg:</p> <ul style="list-style-type: none"> • Gas Oil • Diesel • Petrol • Fuel Oil • Heating Oil • Natural Gas • Liquefied Petroleum Gas (LPG) 	<p>Electricity used in site accommodation etc.:</p> <ul style="list-style-type: none"> • Electricity 	<p>Fuel purchased for all plant and equipment by others eg. sub-contractors or clients eg:</p> <ul style="list-style-type: none"> • Gas Oil • Diesel • Petrol • Fuel Oil • Heating Oil • Natural Gas • Liquefied Petroleum Gas (LPG) • Electricity 	<p>ENCORD emissions sources 1, 2, 4, 5, 6</p> <p>ENCORD emissions source 9</p>
Travel in cars and vans (Vehicle Fuel)	<p>Fuel purchased/paid for by the company for the purpose of business travel in vehicles owned, leased or hired by the company or in privately owned vehicles eg:</p> <ul style="list-style-type: none"> • Petrol • Diesel • LPG • Km / miles travelled 	<p>Electricity purchased/paid for by the company to power electric vehicles for the purpose business travel in vehicles owned, leased or hired by the company or in privately owned vehicles eg:</p> <ul style="list-style-type: none"> • kWh • km / miles travelled 	<p>Fuel and electricity used for the purpose of commuting in vehicles owned leased or hired by the company or in privately owned vehicles eg:</p> <ul style="list-style-type: none"> • Petrol • Diesel • LPG • kWh electricity • km / miles travelled 	ENCORD emissions source 7
Business Travel in addition to road miles including rail and air travel			<p>Miles travelled for relevant mode of transport eg:</p> <ul style="list-style-type: none"> • Rail • Long haul flights • Short haul flights • Taxi • etc 	ENCORD emissions source 8
HGV Vehicles	<p>Fuel purchased for use in HGVs owned, leased or hired by the company eg:</p> <ul style="list-style-type: none"> • Petrol • Diesel • LPG 		<p>Fuel purchased by sub-contractor / supplier for use in HGVs eg:</p> <ul style="list-style-type: none"> • Petrol • Diesel • LPG 	<p>ENCORD emissions source 7</p> <p>ENCORD emissions source 9</p>

Appendix B: ENCORD Protocol Development



Bridge linking Vidin and Calafat over the Danube

Appendix B

This Protocol has been developed by experts in the field of environment and sustainability within the construction sector from the member companies of ENCORD and its partners in this project. The development process took place between November 2008 and December 2010.

In January 2011 ENCORD engaged with WBCSD and WRI to further develop the protocol for use by the wider construction sector. A brief description of the development process is provided below.

Overview

The protocol has been developed by companies working within the construction sector with support from key stakeholders. Individuals involved are from sustainability and research and development functions of each participating organisation and are experts in their field.

The development process has consisted of a series of workshops and a systematic review process following each development and / or update made. The draft protocol document has been circulated to ENCORD members and their partners within the sector and all feedback has been taken into account. Following each workshop revisions were made to the protocol and updated versions circulated for comment. In total, 12 revised versions were created (A – L) over the review process.

Members of ENCORD acknowledged that external advice was required to further develop the protocol and to ensure it was compliant with recognised, global standards such as the Green House Gas Protocol Corporate Standard. As such, ENCORD engaged WBCSD and WRI to carry out a formal review of the protocol.

This sector guidance has been reviewed by the GHG Protocol and is in conformance with the GHG Protocol Corporate Accounting and Reporting Standard.

Workshops

November 2008 – Surrey, UK - Carbon Disclosure Project (represented by Andrea Smith) presented to the ENCORD membership outlining the importance of common measurement and reporting of GHG emissions and the work of the CDP. Members presented their work on GHG emissions measurement and reporting. It was concluded that a number of different approaches were being used and that measurement was not consistent. A series of breakout sessions were held with smaller groups to scope out how ENCORD could address these issues. It was agreed that a working group would be established to develop a draft protocol / guidance document.

April 2009 – London, UK - Working group members met on April 16th. A draft protocol was presented and an overview of the carbon emissions monitoring and reporting drivers for construction were introduced and discussed. Revisions were agreed during the meeting.

October 2009 – London, UK - Working group members met on 5th October. The workshop was called to review the latest draft of the protocol and to discuss and agree remaining concerns and issues. A revised protocol (rev F) was produced and circulated to members following the meeting. This day long workshop involved detailed discussion of the guidance including on;

- Introduction and Background
- Construction Areas of Operation,
- Scope of Measurement,
- Identifying emissions from Transport, Subcontractors, Materials, Waste and 'Products' (eg buildings in use).
- Suitability of KPIs

Mar 2010 – Hertfordshire, UK - Working group members met on 29th and 30th March. The aim of the meeting was to secure agreement on the final draft of the protocol. Members agreed to measure and report GHG emissions sources 1 to 7 at a minimum going forward and to present the protocol for approval by the ENCORD Council. It was also agreed to engage with external organisations to further develop the protocol beyond ENCORD, for use by the wider sector (WBCSD and WRI involvement had already been requested at this point and contact made with GRI regarding their construction and real estate sector supplement).

June 2010 – Copenhagen – Work of the CO₂ protocol group formally presented to the ENCORD Council members. Revision K of the protocol issued on the ENCORD website.

July 2010 – Madrid, Spain - Working group members met on 5 and 6 as part of a wider ENCORD council and sustainability meeting. An update was provided to council on the work to engage external organisations to further develop the protocol.

Nov 2010, London - Working group members met with GRI CRESS team to outline integration of guidance within the protocol to the GHG emissions indicators within CRESS. It was agreed that the approach for indicator CRESS 4 would mirror that of the ENCORD protocol and that further references would be made to the protocol document to assist reporters.

Additional support for the protocol

The Global Reporting Initiative through its construction and real estate sector supplement (CRESS) has worked with ENCORD to ensure that indicators relating to GHG emissions from construction align with the ENCORD protocol. The ENCORD protocol is now referenced in the CRESS .

The Carbon Disclosure Project has supported ENCORD in the development of the protocol since 2008 and supports the on-going work to extend the scope of measurement to include wider scope 3 emissions sources.

“We support the development of sector-specific protocols for the additional clarity that they can give to GHG profile of companies by giving more detailed guidance to companies on how to calculate their direct and indirect GHG emissions. This in turn benefits users of the data who are better able to compare companies. We support your attempts to get broader stakeholder review of the methodology...I would like to encourage your work on developing a sector-specific methodology covering Scopes 1 and 2 and commend your intention to extend this work into the use phase.”

Paul Simpson, CEO, Carbon Disclosure Project.

The World Green Building Council has expressed support for the protocol.

“The WorldGBC supports in principle the work that ENCORD are doing to develop a GHG accounting protocol specifically for the construction sector... The WorldGBC Rating Tools committee understands that ENCORD is complementary to our work on carbon from operations, focusing on the construction phase only and would welcome exploring how best to align the two initiatives further.”

Romilly Madew, Chair WorldGBC Rating Tools Committee and Jane Henley, CEO, WorldGBC.

ENCORD members



This protocol is built on the GHG Protocol Corporate Accounting and Reporting Standard.