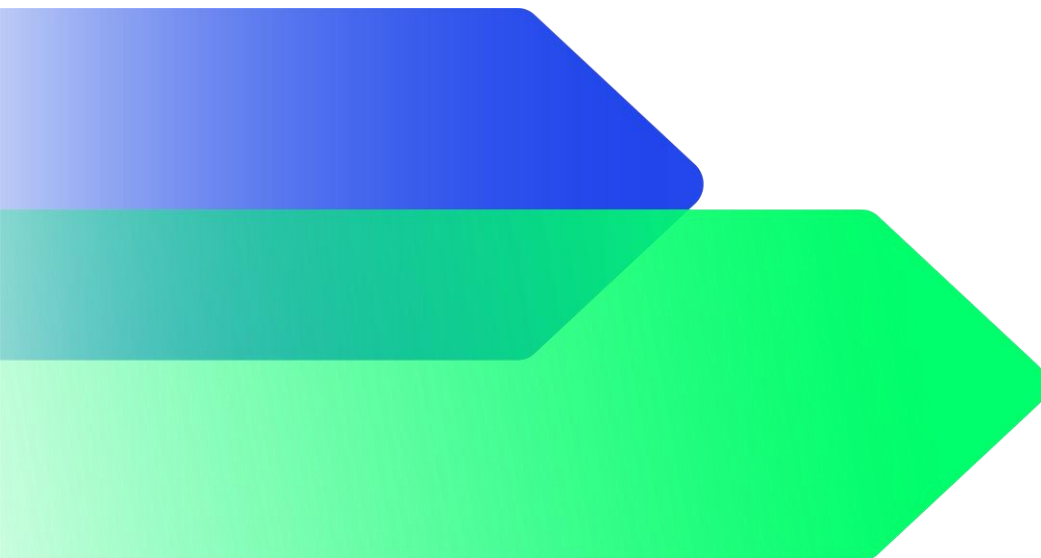


GUIDANCE

Offshore Wind Supplier data guidance

Supplier Guidance for Providing Data into Product Carbon Footprints (PCFs)

2026



Executive summary

USES OF THIS DOCUMENT

Different sections of this document are intended for different audiences. It is recommended to focus on the sections relevant to your organisation's current stage.



Sections 1 and 2 cover the basics for those newer to carbon data.



Section 3 offers more advanced guidance and methodology for suppliers more mature in carbon calculation.

This guidance helps you, as a supplier to the offshore wind industry, provide high-quality, consistent, and transparent data for carbon footprint assessments of offshore wind farms. It is a companion to the *OSW Industry Product Carbon Footprinting (PCF) Guidance* produced by the SUS-JIP programme at the Carbon Trust, translating its methodological requirements into clear, practical steps you can act on.

Offshore wind supply chains are diverse and technically complex, with significant variation in manufacturing processes, design specifications, and data-collection practices. Through workshops, one-to-one interviews, and reviews of existing carbon data, we have identified the most common challenges suppliers face, including limited primary emission-factor availability, inconsistent methodological choices, confidentiality constraints, and the absence of reference products for bespoke components. This guidance has been shaped by those insights, and it reflects what is feasible for suppliers today while signalling the direction of travel for higher-quality, more comparable data in the future.

Inside, you will find:

- Minimum data-quality standards and the types of activity and emission-factor data you are expected to provide.
- Guidance on documentation, transparency, and verification practices that underpin credible carbon reporting.
- Asset-specific data requirements for turbines, cables, foundations, substations, construction and installation, and operations and maintenance, each acknowledging the unique data characteristics, methodological considerations, and typical sources of uncertainty for that category.

By following this guidance, you will be better equipped to understand how your data feeds into offshore wind farm carbon measurements, identify opportunities to improve accuracy and consistency, and engage more effectively with project developers. In turn, this supports a more transparent and

comparable industry dataset, enabling decarbonisation decisions grounded in robust, supplier-specific information aligned with ISO 14040/44, ISO 14067, and the *Offshore wind industry PCF guidance*.

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1. Introduction

1.1. Background to the *Offshore wind supplier data guidance*

The global transition to a decarbonised energy system is central to achieving the goals of the Paris Agreement and avoiding the worst impacts of climate change. Offshore wind (OSW) is at the heart of this transition, delivering large-scale, low-carbon electricity to power a Net Zero future.

The Sustainability Joint Industry Programme (SUS-JIP), operated by the Carbon Trust, has developed a standardised approach for calculating the Product Carbon Footprint (PCF) of an offshore wind development. The *OSW industry PCF guidance* helps Offshore Wind farm developers help quantify the life cycle greenhouse gas (GHG) emissions associated with OSW projects, enabling developers to identify carbon hotspots and take targeted action to reduce them.

However, developing an offshore wind farm depends on a complex and diverse supply chain: raw material suppliers, component manufacturers, construction contractors, and operational service providers. To accurately measure the carbon impact of a wind farm, developers need to collect high-quality primary data from key supply-chain partners.

This companion document, the *Offshore wind supplier data guidance*, has been developed to support the implementation of the *OSW industry PCF guidance* by translating its methodological rules into practical steps for you as a supplier. As the industry standardises how carbon footprints are calculated, you may face increasing requests for detailed Product Carbon Footprint (PCF), Life Cycle Assessment (LCA) or Environmental Product Declaration (EPD) data. Without a unified approach, reporting remains inconsistent, administratively burdensome, and dominated by generic assumptions, limiting both credibility and the industry's ability to decarbonise effectively. This guidance addresses those challenges by providing standardised, and asset-specific guidance to data collection that aligns with industry requirements.

Aims of the Offshore wind supplier data guidance:

- To provide supplier-focused guidance that supports the provision of consistent, high-quality data aligned with the *OSW industry PCF guidance*.
- To define minimum data quality expectations and offer practical direction to help suppliers understand what data is needed and why.
- Set out detailed recommendations at the asset-category level (WTG, cables, foundations, substations, construction & installation).
- Improve the consistency and accuracy of supplier carbon data to support decarbonisation decisions.

1.2. Scope and intended audience

Intended audience

This guidance is for you if you supply materials, components, assets, construction services, or operational services to the offshore wind sector. It is designed to support you in calculating and exchanging accurate, consistent, and standardised GHG emissions data, which is essential for calculating the full GHG impact of OSW developments. In doing so, it can also help strengthen your position in invitations to tender and tender processes, support inclusion in supplier databases, and reinforce your reputation as a credible supplier.

What is in it for you?

High-quality carbon data is quickly emerging as prerequisite for Offshore Wind tenders. By establishing robust data-collection and carbon measurement processes, you can:

- **Improve your understanding of carbon impacts:** Identify decarbonisation opportunities within your own operations and communicate with non-expert stakeholders.
- **Prepare for tenders:** Reduce the administrative burden of managing multiple, contradictory data requests from different developers and OEMs at tender stage, and reduce the tender risk by positioning your products as verifiable lower carbon options.
- **Improve data quality:** Gain clarity on data requirements and quality expectations and guide the transition from generic industry averages (secondary data) to supplier-specific primary data.

Life cycle activities in scope for offshore wind farms

OSW Industry PCF Guidance covers all activities necessary for development of an offshore wind farm. The relevant life cycle stages [Figure 1] include:

- 1) **Raw materials and manufacturing:** extraction, processing, component/asset manufacturing.
- 2) **Transportation and logistics:** delivery of components to offshore wind sites.
- 3) **Construction and installation (C&I):** use of vessels, cranes, and supporting infrastructure.
- 4) **Operation and maintenance (O&M):** use of vessels and replacement of components over the life cycle of the wind farm.
- 5) **End-of-life stages:** including decommissioning, recycling, and final disposal of assets.

Life cycle activities in scope for suppliers

While developers are responsible for compiling the full carbon footprint across these stages, you, as a key data provider, are responsible for compiling carbon data specifically for the goods and services you supply. Your focus is on the specific "cradle-to-gate" impact of the goods or services you provide - that is, the emissions from raw-material extraction through to the point the product leaves your facility, or the service is delivered. Your reporting responsibility generally falls into one of two categories:

- **Material and asset manufacturing:** If you supply components like turbines, cables, or foundations, your primary activities include raw material acquisition, upstream transport to your site, and the energy consumed during your manufacturing processes (e.g., welding, casting, or extrusion).

- **Service and installation provision:** If you provide services like construction, installation, or maintenance, your activities are driven by logistics and operations. Your focus is on the fuel consumption of specialised vessels (e.g., jack-up or cable-laying vessels), the transport of personnel, and the use of temporary on-site infrastructure.



Figure 1 Life cycle stages, activities and likely data sources for an OSW farm carbon footprint as defined by the OSW industry PCF guidance

How to navigate this document?

This guidance is designed as a reference manual, not a rigid rulebook. We recognise that suppliers operate at different levels of maturity in measuring and reporting carbon data. As shown by Figure 2 below:

- If you are providing carbon data for the first time, we recommend starting with Section 2, which covers the fundamentals of how supplier data feeds into a PCF, the key reporting standards, and baseline quality expectations.
- If you already have significant experience producing and transferring carbon data, you may wish to go directly to Section 3 to validate that your data aligns with the specific methodological criteria for your asset class (e.g., turbines, cables, foundations, substations and electrical equipment, or construction and installation services).



Figure 2 Supplier carbon data maturity ladder

The table below summarises the key supplier categories relevant to offshore wind carbon footprinting. It describes how your activities contribute to life cycle emissions for an offshore wind farm and highlights the data typically needed, so you can quickly identify where your own role fits and what is expected of you.

Table 1 Suppliers categories and their relevance to the OSW carbon footprinting

Supplier category	Relevance to Offshore Wind carbon footprinting
Wind Turbine Generator (WTG) manufacturers	WTG materials and manufacturing contribute a significant share of overall emissions. Key data includes material composition (by mass and grade) and manufacturing energy consumption. Relevant life-cycle stages, as defined in the PCF methodology, are production (A1–A3), repair and refurbishment (B1–B8), and end-of-life (C1–C5).
Cable manufacturers	Cable manufacturing is a significant source of OSW emissions. Where multiple cable types are produced from shared processes, emissions should be allocated using physical criteria (e.g. length, mass); economic allocation may be applied where physical allocation is not feasible. Key data includes energy use, material inputs, and allocation methods. Relevant life-cycle stages: production (A1–A3), shared O&M activities (B1–B8), and end-of-life (C1–C5).
Foundations manufacturers	Foundations contribute a significant share of overall emissions owing to high material mass, particularly related to steel, which is an emissions intensive material. Key data includes material composition (steel grades, concrete volumes, coatings) and manufacturing energy consumption. Relevant life-cycle stages: production (A1–A3), shared O&M activities (B1–B8), and end-of-life (C1–C5).
Substations and electrical equipment manufacturers	Substations and electrical equipment contribute to OSW emissions through the high material and energy demands of structural and electrical components. Key data includes material inputs (electrical steel, electrical equipment, structures), energy use, and installation logistics. Relevant life-cycle stages: production (A1–A3), construction and installation (A4–A5), use-stage emissions such as SF ₆ leakage and maintenance (B1–B8), and end-of-life (C1–C5).
Construction and Installation services	C&I activities contribute to emissions through the use of specialised vessels (jack-up, cable-laying, heavy-lift crane vessels), heavy machinery, and temporary infrastructure. Key data includes vessel types, fuel type and quantity, transport distances, and equipment usage profiles. Relevant life-cycle stage: construction and installation (A4–A5).
Operations and maintenance services	O&M activities generate emissions throughout the operational life of the wind farm through vessel use, service trips, spare-part replacements, and energy consumption during maintenance. Key data includes vessel fuel use, frequency of maintenance visits, and replacement-part logistics. Relevant life-cycle stage: use of OSW development (B1–B8).

2. Overview of carbon data requirements

Your goods and services directly shape the life-cycle emissions of offshore wind farm. Therefore, developers rely on you to provide clear, consistent, and high-quality carbon data, typically in the form of Product Carbon Footprints (PCF), Life Cycle Assessments (LCA) or Environmental Product Declarations (EPD) that describe the specific greenhouse gas emissions associated with your goods and services. This section explains the general concepts and data requirements you should be aware of when preparing your carbon data.

Table 2 Types of carbon data you can provide

Data type	What it is
Product Carbon Footprint (PCF)	A calculation of the total greenhouse gas emissions associated with specific products or services across their life cycle, typically expressed in kg CO ₂ e or t CO ₂ e. A PCF may cover cradle-to-gate (raw materials through to the product leaving your facility) or cradle-to-grave (through to end of life), depending on the scope agreed with the data recipient. PCFs are usually prepared following ISO 14067 and may also align with the GHG Protocol Product Standard or the PACT framework.
Life Cycle Assessment (LCA)	A comprehensive environmental assessment of a product, process, or service across its full life cycle, covering multiple impact categories (e.g. climate change, resource depletion, acidification) including the greenhouse gas emissions. LCAs are conducted in accordance with ISO 14040 and ISO 14044. The LCA method underpins the PCF standards, which were derived to provide more detail for people specifically seeking to measure carbon impacts.
Environmental Product Declaration (EPD)	A standardised, independently verified document that reports the environmental performance of a product based on an underlying LCA. EPDs are prepared in accordance with ISO 14025 and follow Product Category Rules (PCRs) that define the methodology for a specific product type, ensuring comparability across suppliers. EPDs are typically published through a programme operator (e.g. EPD International, IBU, PEP ecopassport) and are valid for a defined period.
Environmentally Extended Input-Output (EEIO) data	A top-down modelling approach that estimates emissions based on economic transaction data rather than physical process data. EEIO models use national economic input-output tables linked to environmental satellite accounts to derive emission intensities per unit of economic output (e.g. kg CO ₂ e per £ of expenditure) for broad industry sectors. Common EEIO databases include EXIOBASE and the OECD Inter-Country Input-Output tables.

Regardless of whether you provide a PCF, LCA or EPD, your data must meet a consistent set of methodological requirements. These include clear system boundaries, a defined declared unit, transparent documentation of data sources, and high-quality activity data for the processes you control. The sections below summarise the minimum expectations that apply to all suppliers before the asset-specific requirements in Section 3.

Table 3 Terminology that underpins carbon data

Terms and concepts	What this means for you
Activity data	The quantitative inputs to your processes: quantities of raw materials consumed, energy use by type and amount (e.g. kWh of electricity, m ³ of natural gas), fuel usage, transport distances, and transport modes. Activity data is the foundation of any emissions calculation.
Emissions factors	Conversion factors that translate your activity data into greenhouse gas emissions (e.g. kg CO ₂ e per kWh of grid electricity, or kg CO ₂ e per tonne of steel). When you use emission factors, you should disclose the source, publication year, and methodology. Factors should be traceable to recognised databases or supported by internal documentation.
Process emissions	Greenhouse gas emissions arising directly from your manufacturing or operational processes, rather than from energy consumption. Examples include CO ₂ released during cement calcination, SF ₆ leakage from switchgear, or emissions from chemical curing processes. Where relevant, these should be reported separately from energy-related emissions.
System boundaries	The defined scope of what is included in and excluded from your carbon data. For most OSW suppliers, the standard boundary is cradle-to-gate: from raw-material extraction through to the point your product leaves your facility. Subcontracted or outsourced processes within this boundary should also be included. Service providers should capture all emissions directly associated with delivering the service.
Functional unit	The reference unit to which your emissions data is expressed, for example, one wind turbine generator, one kilometre of cable, one tonne of steel, or one foundation installed. Your functional unit should be agreed with the data recipient to ensure consistency across the supply chain.
Allocation methods	The approach used to divide emissions between multiple products from a shared process or facility. This is particularly important where you operate manufacturing facilities which produce multiple products.
Verification	Any independent verification or audit of your data should be indicated, with verification reports or certificates available upon request. Verification may be first-party (internal review), second-party (review by your customer), or third-party (independent assessment against a recognised standard).

2.1. How to provide carbon data

To calculate your carbon impacts reliably, you should be guided by established international standards, ISO 14040/44, ISO 14067, and the Greenhouse Gas Protocol, as well as the *OSW Industry PCF Guidance* developed by the Carbon Trust. This guidance builds on those frameworks and gives you sector-specific direction that reflects the unique characteristics of offshore wind supply chains. For your results to be comparable with those of other suppliers and projects, it is important that you align with harmonised system boundaries, categorisation rules, and allocation methods.

In practice, this means your data contributions should follow common definitions and units, so that they are consistent across the supply chain. We also recommend that you clearly document all data you provide. This transparency enables traceability, builds more robust carbon reporting for the sector, and gives you valuable insight into opportunities for continuous improvement.

Data security and confidentiality

We recognise that detailed Bills of Materials (BOM) often contain sensitive intellectual property. To balance transparency with confidentiality, you can:

- **Aggregate data:** Group minor components into material categories (e.g., "Specialty Polymers") provided the total mass and emission factors remain verifiable.
- **Use Third-Party Verification:** An independent verification statement can confirm the accuracy of the product carbon footprint (PCF) results, or other submitted carbon-data results such as LCA or EPD climate-change results, without requiring the disclosure of proprietary formulas to the developer.

What kind of carbon data is acceptable?

A supplier-specific PCF is the preferred format, as it integrates directly into project-level assessments. However, a full LCA or a current, independently verified EPD can also be used, provided the methodology aligns with best practices. If you already hold an LCA or EPD, you do not necessarily need to prepare a separate PCF from scratch; the climate-change results can often serve as your submission basis, as long as they use the correct impact methodology (IPCC, Global Warming Potential, 100 years). Where gaps exist (such as different system boundaries), these should be clearly documented for the developer.

Typical supplier carbon data journey

If you are new to carbon accounting,

1. **Define scope:** Confirm your cradle-to-gate boundary and functional unit with the developer.
2. **Map the system:** Identify major material inputs and energy-intensive manufacturing steps.
3. **Collect activity data:** Gather primary records for energy use, material mass, and fuel logs.
4. **Apply emission factors:** Select appropriate emission factors using the database hierarchy.
5. **Document and share:** Prepare your submission using the transparency criteria in Table 4.

Why a full life cycle perspective matters

Developers rely on comprehensive data across all life-cycle stages. Upstream stages, such as raw material extraction and asset and component manufacture, can contribute over 75% of a development's

total carbon impact. Providing detailed data on these processes helps identify "hotspots," enabling targeted emissions reductions where they have the greatest impact.

Primary vs secondary data

- **Primary data:** data collected directly from your own operations, actual measurements or records from your production facilities, or fuel use in your vehicles and vessels. It reflects the specific materials, energy inputs, and processes unique to your products and services and should be used wherever possible.
- **Secondary data:** data collected from publicly available life-cycle inventory databases, government reports, or academic studies. While it enables measurement in the absence of direct supplier input, it is not specific to your activities and therefore carries more uncertainty. It generally reflects industry averages and may not represent your innovative technologies or process efficiencies.

When you do use secondary data, you should:

- Collect it from reputable, up-to-date sources that are regionally and technologically representative of your activities.
- Clearly describe it in your PCF or LCA report and replace it with primary data as it becomes available.
- Accompany it with metadata stating the source, year of publication, assumptions, and any limitations.

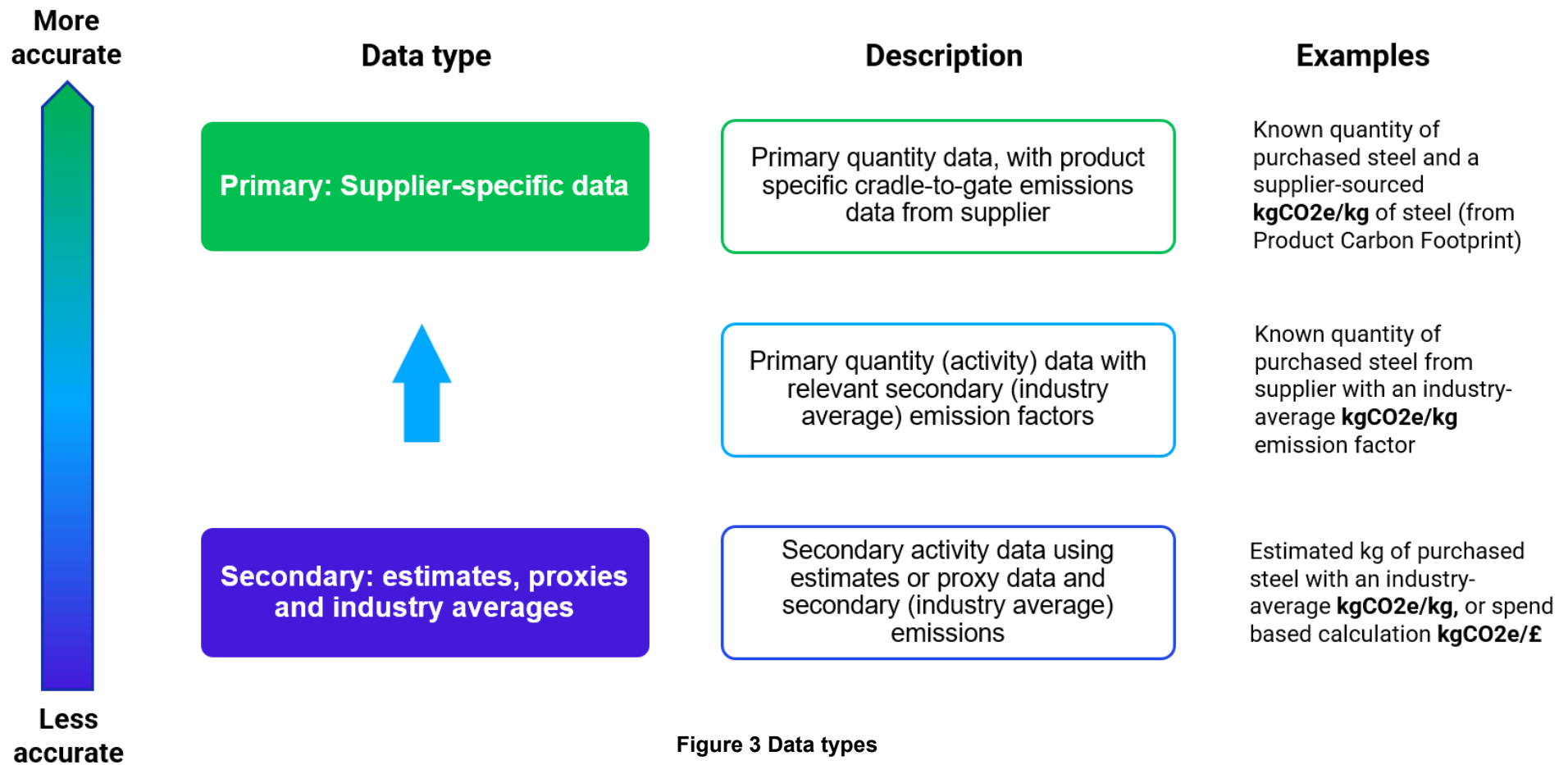
What the key standards say about primary data

ISO 14067 recommends primary data for all processes under your control or those contributing significantly to the footprint. The GHG Protocol Product Standard requires primary data for processes you control and encourages it for critical upstream inputs. Additionally, the PACT Methodology (WBCSD) requires you to disclose your Primary Data Share (PDS) and score data quality across dimensions like technological and geographic relevance.

Over time, the goal is for you to increase the share of primary data you provide [Figure 3], reduce reliance on generic assumptions, and improve the accuracy and comparability of PCF results across the sector.

What the key standards say about primary data

ISO 14067 recommends primary data for all processes under your control or those that contribute significantly to the overall footprint. The GHG Protocol Product Standard requires primary data for processes you control and encourages it for critical upstream processes. The PACT Methodology (WBCSD) additionally requires you to disclose your Primary Data Share (PDS) and score data quality across five dimensions: technological relevance, temporal relevance, geographic relevance, completeness, and reliability.



2.2. Methodological expectations for carbon data

Reporting standards

To support consistency, comparability, and transparency, you are encouraged to follow a core set of methodological principles when collecting and reporting your carbon data. The primary standards you should align with are:

- ISO 14067 – Carbon footprint of products: requirements and guidelines for quantification.
- ISO 14040/14044 – Life Cycle Assessment: principles, framework, requirements, and guidelines.
- GHG Protocol Product Life Cycle Accounting and Reporting Standard.

In addition to these overarching standards, Product Category Rules (PCRs) provide more specific methodological requirements tailored to product types. PCRs define specific methodologies for a given product category, covering aspects such as system boundaries, allocation rules, and data quality expectations. Where a relevant PCR exists for your product, you are encouraged to follow it alongside the standards listed above. We discuss the PCRs most relevant to each asset class in Section 3.

System boundaries and functional units

When calculating your carbon data, it is essential that you apply system boundaries and functional units that align with the overall project PCF. For offshore wind supply chains, the standard boundary is cradle-to-gate.

This means your footprint should cover all upstream activities, from raw-material extraction through to the point your product leaves your facility, without extending into operational use or end-of-life stages, which are handled by developers and other downstream stakeholders.

Your functional unit should reflect a clear, measurable output of your product, for example, one tonne of steel, one foundation structure, or one kilometre of cable. We recommend checking with the PCF recipient (developer, or supply-chain partner) to confirm the expected functional unit.

You should also clearly document the system boundaries applied. If any exclusions are made (e.g. packaging materials or auxiliary inputs), justify why these exclusions are appropriate and describe how they affect the overall footprint.

If you are a service provider rather than a product manufacturer, for example, providing transport, installation, construction and installation, or operations and maintenance services, the cradle-to-gate concept applies differently. Your system boundary should capture all emissions directly associated with delivering the service, including vessel and vehicle fuel consumption, equipment energy use, and any consumable materials. Your functional unit should reflect a measurable unit of service output, such as emissions per foundation installed, per hour in an operational mode, per kilometre of cable laid, or per maintenance visit. As with product suppliers, you should clearly document which activities are included and excluded and confirm the expected functional unit with the developer.

Allocation and modelling

When your processes generate multiple co-products or outputs, it is essential to allocate emissions to these products using a clear method. Standards such as ISO 14067 and the GHG Protocol define a hierarchy for allocation methods that you should follow:

1. **Physical allocation** — Use physical relationships (such as mass, volume, or energy content) wherever possible. This approach provides a direct and transparent link between your inputs and outputs.
2. **Economic allocation** — Where physical allocation is not feasible, emissions can be allocated based on the economic value of each co-product. Ensure that the market prices used are transparent, stable, and well-documented to maintain credibility.
3. **System expansion or substitution (avoided allocation)** — This method, which avoids allocation by expanding the system boundary or considering substituted products, should be used cautiously. A strong justification is required, and transparency is key to ensure the approach is understood and accepted.

It is important that you document the allocation method you apply, explain your reasoning, and ensure consistency with the chosen standards. Clear documentation and alignment with these principles are essential for your data to be accepted and trusted throughout the value chain. If you are unsure which allocation approach is most suitable, engaging early with your customer or the project developer will help align expectations and streamline reporting efforts.

Data quality requirements

Carbon data can be of varying detail and accuracy and typically improves as suppliers mature in their sustainability journey. While there is no minimum quantitative threshold for data quality, you should aim to provide high quality data wherever possible, especially for that contribute significantly to your product's overall emissions. According to the standards framework, data quality should be assessed across five key criteria, and data is considered high quality data where it meets the thresholds for each:

1. **Technological representativeness**: Does the data reflect the actual technologies and processes you use?
2. **Temporal representativeness**: Is the data current, typically no older than 3 years?
3. **Geographic representativeness**: Does the data correspond to the specific geographical region where your product is manufactured or your services are delivered?
4. **Completeness**: Are all relevant GHG emissions sources and life-cycle stages included in the data?
5. **Reliability** — Does the data come from trustworthy sources (direct measurements, verified reports, established databases)?

If you are just starting to produce carbon data, you may identify weaknesses in data. This is acceptable if they are clearly documented and communicated. It is important that you establish a clear plan for progressively improving your data quality over time, which focuses in improving your data quality by addressing weaknesses across these key data quality criteria. Continuous improvement and transparency in how you manage data quality will build trust and ensure your PCF contributions remain valuable across the supply chain.

Key methodological information to document

Whether you are providing a PCF, LCA or EPD based on primary data (measured directly from your operations) or secondary data (from databases or literature), it is essential that every data submission is accompanied by clear and thorough background information. This level of transparency is critical for ensuring that your data can be properly evaluated for reliability and comparability. At a minimum, you should document or comment your approach for the following criteria related to the quality of the carbon data.

Table 4 Key information to include alongside any carbon data

Data category	What information to include
Data source and type	Clearly state where the data underpinning your study comes from and the type of data you are using. For example, specify whether it is based on internal measurements (e.g. metered energy consumption, weigh-bridge records), third-party reports (e.g. supplier EPDs, test certificates), or life-cycle inventory databases (e.g. ecoinvent, Sphera). Where you use a mix of primary and secondary data, indicate which data points fall into each category.
System boundaries and functional units	You should clearly state the defined scope of what is included in and excluded from your footprint and confirm the functional unit to which your results are normalised. The functional unit should be clearly stated in your assessment so that results can be interpreted and compared correctly. For most OSW suppliers, the standard system boundary is cradle-to-gate: from raw-material extraction through to the point your product leaves your facility. Subcontracted or outsourced processes within this boundary should also be described. Service providers describe all activities required for delivering the service. This should include the period during which the activities in your system occur (temporal boundary) and the regions or locations where your activities take place, for example manufacturing site locations (geographical boundary). Where your supply chain spans multiple countries, identify the geography for each major input (e.g. steel sourced from Country X, assembly in Country Y).
Allocation methods	Describe how you allocate emissions when your facility produces multiple products or when a process yields co-products. Physical allocation based on mass, volume, or energy content is generally preferred. Economic allocation based on product revenue may be applied where physical allocation is not feasible but should be justified with transparent market data. For recycling allocation, state whether you follow the cut-off method (which accounts only for recycled content in your inputs, with no credit for future recycling) or the avoided-impacts method (which credits your footprint for displacing virgin material through end-of-life recycling). If you apply recycling credits, document the assumed recycling rate, the displaced material, and supporting evidence such as recycling certificates. Clearly state which methods you have applied, the basis for your choices, and any standards or PCRs followed.

Exclusions	Document any processes, materials, or emissions sources that have been excluded from your footprint. For each exclusion, state what has been excluded, why the exclusion is justified (e.g. falls below cut-off thresholds, data unavailable), and the estimated impact on the overall footprint. You should still provide estimations for excluded flows, even if of lower data quality, to demonstrate they fall below the relevant cut-off criteria. As a general rule, at least 99% of all material and energy flows should be included; excluded flows should account for less than 1% of total mass and less than 1% of total energy use.
Assumptions	Document all assumptions made during data collection or modelling. Common examples include assumed transport distances where exact routes are unknown, default grid emission factors where site-specific data is unavailable, assumed material compositions for sub-components sourced from third parties, and assumed end-of-life recycling rates. For each assumption, state what was assumed, the rationale or source (e.g. based on PCR default values, industry averages, engineering estimates), and the sensitivity of the overall footprint to that assumption where known.
Data quality and uncertainty	Report the overall quality of the data underpinning your footprint and, where possible, quantify the uncertainty associated with your results. For each major input, assess data quality using a recognised framework such as the PACT framework, which scores data across five indicators: technological representativeness, temporal representativeness, geographical representativeness, completeness and reliability. Where pedigree scoring is not applied, provide a qualitative assessment distinguishing between high-quality primary data (e.g. metered inputs, verified supplier data) and lower-quality secondary or proxy data.

Assurance of your carbon data

Verification is an important step to enhance the credibility and quality of your carbon data. There are different levels of verification you can pursue. First-party verification involves an internal review by a knowledgeable expert within your organisation. Second-party verification can be conducted by an expert at the company receiving your PCF data. The most impartial option is third-party verification, where an independent verifier assesses your data against recognized standards such as ISO 14067 or the PACT framework.

While third-party external verification provides the highest level of assurance, it is important to begin this journey in a practical way. As suppliers, taking initial steps to validate your data internally or with your customers will help build confidence and readiness for future third-party assessments.

2.3. Activity data that underpins supplier carbon data

To support consistency and ease of reporting, we strongly recommend that project developers provide you with standardised data-collection templates or questionnaires, aligned to international data exchange formats like the PACT data format. These tools should outline exactly what information is needed, data points, units, relevant time periods, and emission factors, to reduce ambiguity and streamline data integration.

You are expected to provide specific, high-quality data related to your goods and services, ideally in the form of a verified PCF or LCA. The type and level of detail of the data will depend on the asset, component or service you supply, its emission intensity, and the life-cycle stages covered. However, the following core activities and sources of emissions underpin PCF and LCA assessments for most offshore wind assets, components and services.

Key activities and sources of emissions for materials, assets and component suppliers

Material composition and mass

You should include a detailed breakdown of the materials used in your products, including:

- Total mass of each component and sub-component (e.g. monopile, nacelle frame, cable core, cable sheathing, transformer windings).
- Material types and specifications (e.g. steel grade S355, epoxy resin, copper purity, XLPE insulation grade).
- Recycled content, where known (e.g. percentage of recycled steel or copper).
- Source and origin of materials, where known (e.g. country of extraction or production).

Upstream transportation

You should include data on the transport of raw materials and sub-components to your manufacturing site. For example, the transportation of structural steel to a turbine tower fabrication facility or copper rod to a cable extrusion plant. Key data includes:

- Transport modes for each leg of the journey (e.g. road, rail, sea).
- Vehicle and vessel types and fuel consumption (e.g. litres of diesel, tonnes of bunker fuel).
- Distances travelled for each leg (e.g. km for road/rail, nautical miles for sea).
- Packaging materials and any returnable transport systems.

Energy consumption during manufacturing

Energy use is a major driver of embodied emissions, particularly in heavy industrial processes such as steel fabrication, cable extrusion, and casting. You should provide:

- Total energy consumed during the manufacture of the footprinted product (e.g. kWh of electricity, m³ of natural gas, litres of diesel).
- Energy-source breakdown (e.g. grid electricity, on-site renewable generation, fossil fuels).
- Location-specific grid emission factors, if known, or the grid mix of the manufacturing location.

Where possible, you should disaggregate energy data by process step (e.g. welding, casting, coating, assembly), as this helps identify carbon hotspots within your operations.

Manufacturing processes

In some manufacturing processes, direct emissions occur due to chemical reactions or the release of process greenhouse gasses, for example iron ore reduction or clinker production. Process efficiency and material losses also impact the carbon intensity of materials. Carbon data should include:

- A description production steps
- Yield rates or material losses during production (e.g. steel scrap rates, cable off-cuts).
- On-site direct process emissions (e.g. from chemical reactions, curing, heat treatment, or use of process gases).

Waste management and recycling

Understanding waste flows from your manufacturing processes and the end-of-life fate of your products is important for a comprehensive footprint. Carbon data should include:

- Types and quantities of waste generated during production (e.g. steel offcuts, resin waste, cable insulation scrap, packaging).
- Waste treatment methods for each waste stream (e.g. recycling, incineration with energy recovery, landfill).
- Recycling rates and any circularity measures in place (e.g. closed-loop scrap recovery, reuse of process water).

Key activities and emissions sources for service suppliers, including transportation, logistics, construction, installation and operations

Transport and logistics from manufacturing site to development site

This covers the movement of components and materials from manufacturing sites to the marshalling port and onward to the offshore wind development site. Carbon data should include:

- Transport modes used for each leg of the journey (e.g. road, rail, sea).
- Vehicle and vessel types (e.g. heavy-goods vehicles, ferries, heavy-lift vessels, barges).
- Fuel type and consumption for each mode (e.g. litres of diesel, tonnes of bunker fuel, kWh of electricity for rail).
- Distances travelled for each leg (e.g. km for road/rail, nautical miles for sea).
- Number of trips or shipments, including any return legs where relevant.
- Loading and utilisation rates where available (e.g. percentage of vessel capacity used).
- Packaging materials and any returnable transport systems.

Construction and installation services

This covers all on-site activities required to install the offshore wind development, including seabed preparation, foundation installation, turbine erection, and cable laying. Carbon data should include:

- Vessel types deployed and their role (e.g. jack-up vessels for turbine installation, cable-laying vessels, heavy-lift crane vessels, crew transfer vessels, guard vessels).
- Fuel type and consumption per vessel (e.g. litres of marine gas oil, tonnes of bunker fuel), ideally disaggregated by activity (transit, standby, installation operations).
- Duration of operations (e.g. days at sea, installation time per unit).
- Transport of personnel and equipment to and from the installation site, including crew transfer vessel or helicopter fuel use.
- On-site energy consumption from temporary infrastructure (e.g. generators, lighting).
- Any weather-related standby time and associated fuel consumption, where recorded.

Operations and maintenance services

This covers all activities over the operational lifetime of the wind farm, including scheduled inspections, corrective maintenance, and major component replacements. Carbon data should include:

- Vessel types used for service visits (e.g. crew transfer vessels, service operation vessels, jack-up vessels for major repairs).
- Fuel type and consumption per vessel or visit.
- Frequency and duration of maintenance visits (e.g. visits per turbine per year, average hours on site).
- Spare-part and replacement-component logistics, including transport modes, distances, and fuel consumption for delivery.
- Consumable materials used during servicing (e.g. lubricants, hydraulic fluids, cleaning agents).
- Any helicopter transfers and associated fuel use.

3. Supplier specific data requirements

The general requirements in Sections 1 and 2 apply across all suppliers and asset classes. This section builds on that foundation with data requirements tailored to your specific product or service category.

Each sub-section below covers a single asset class, Wind Turbine Generators (WTGs), cables, foundations, substations and electrical equipment, and construction and installation services. Within each, you will find a summary table of the data categories and expectations specific to that asset class, followed by a discussion of the common PCF challenges that suppliers in your category have raised during our engagement process.

These challenges, and the practical guidance that accompanies them, are drawn directly from workshops, one-to-one interviews, and reviews of existing LCAs and EPDs conducted with suppliers across the offshore wind industry as part of the SUS-JIP programme. They reflect real methodological questions and data gaps that your peers have encountered, so you can learn from their experience and avoid common pitfalls.

You do not need to read every sub-section. We recommend navigating directly to the asset class most relevant to your products or services. However, if you supply across multiple categories (for example, a manufacturer that produces both foundations and towers), you should review each relevant sub-section to ensure your data meets the specific expectations for each.

How to get the most from this section?

1. Start by identifying your asset class in sections 3.1-3.5
2. Review the summary table for your category, it sets out the specific data expectations across all key data categories (e.g. functional unit, allocation method, system boundary, emission factors).
3. Read the key insights and challenges section that follows, it highlights the most common issues raised by suppliers in your asset category during our supplier engagement process and offers practical guidance on how to address them.
4. Cross-reference with the general requirements in Section 2, the asset-specific requirements in this section are complementary, not a replacement. Both should inform your data submission.

3.1. Wind Turbine Generators (WTGs)

Key data requirements

Data Category	Description
Standards and PCRs	Clearly define which standards have been applied. There are currently no turbine-specific PCRs. Electricity-generation PCRs such as EPD international PCR 2007:08 and EPD Italy 013 may be used, but the turbine-specific results should be reported separately from any electricity-based functional unit.
Scope & asset definition	Clearly define the turbine model, key rated characteristics (capacity, hub height, rotor diameter), and distinguish between major sub-components in your methodology and assessment (tower, nacelle, blades, hub, drivetrain).
Material composition & mass	Provide a high-level breakdown of all significant materials by mass (steel grades, castings, composites, resins, copper, electronics). State recycled content where known and disclose whether mass-balance or book-and-claim approaches are applied for any materials.
Energy & processes	Report energy consumption units (kWh, MJ) for manufacturing, with process-level breakdown where possible (e.g. welding, machining, blade curing). For electricity, provide the electricity source (grid, certificate-backed renewables, residual mix) and accounting method (location-based or market-based).
Functional/declared unit	Provide cradle-to-gate emissions per turbine. If following electricity-based PCRs, continue to report the PCR functional unit (for example, emissions per kWh delivered) but supply a declared unit separately to support OSW PCFs.
System boundary	Apply cradle-to-gate as the minimum boundary. If cradle-to-grave results are reported, provide results relevant lifecycle stages or information modules separately.
Allocation	Apply physical allocation where processes serve multiple products (e.g. shared manufacturing lines). Avoid economic allocation unless physical allocation is not feasible.

Emission factors	Use recognised, up-to-date databases (Ecoinvent, Sphera) and provide the version number. Where primary emission factors are used (e.g. steel EPDs).
End-of-life	Provide assumptions by material group (steel, aluminium, composites, copper). State recovery rates transparently; do not include non-PCR-consistent credits within A1–A3.
Recycling methodology	Apply cut-off (recycled-content) method where possible. If modelling avoided burdens or recycling credits, we recommend that these be reported separately (Module D) from cradle-to-gate impacts as end-of-life recycling and recovery rates are uncertain and very dependent on the location and other physical characteristics of the wind farm.
Assumptions & exclusions	State all exclusions and justify them using cut-off rules (<1% mass and <1% energy as baseline). Document assumptions on grid factors, transport distances, material content, or missing sub-supplier data.
Lifetime	State lifetime assumptions used for PCR-aligned reporting (typically 20–30 years). Lifetime does not affect cradle-to-gate values but is needed for clarity.
Location of manufacture	Provide country-level locations for major components to ensure use of geographically relevant emission factors.
Data period	Use data no more than 3 years old, ideally aligned to the most recent full-year production cycle.

Key insights and challenges for WTG carbon data

1. Methodological alignment and functional-unit issues

WTG carbon data currently relies on electricity-generation PCRs (PCR 2007:08, EPD Italy 013), which require electricity-based functional units tied to kWh delivered. These do not align with product-based declared units needed for offshore wind PCFs, and cradle-to-gate turbine results are not always reported separately. Variation also exists in life-cycle boundaries, inclusion of optional modules, and treatment of preventive and corrective maintenance across these PCRs, but also in supplier-specific methodologies, which creates difficulties in comparing assessments across

2. Sensitivity to primary and secondary data

Turbine results are highly sensitive to background datasets for steel, castings, composites, magnets and electronic components. Different versions of Ecoinvent (3.6–3.10), Sphera MLC and other datasets produce materially different outcomes. Primary data for steel, composite materials and other upstream EPDs is inconsistently available, leading to reliance on secondary datasets that may not align with the manufacturing region or technology. Where primary data is available for key materials, we have observed significant variability in reported impacts and study quality, which creates uncertainty in WTG assessments. Electricity modelling also varies significantly, with some assessments using regional grid averages, others using certificate-backed renewable electricity or residual-mix factors. These choices materially affect the results for high-impact upstream processes.

3. Variability in recycling, end-of-life and material assumptions

Recycling methodologies differ widely, including cut-off approaches and avoided-burden methods, with some studies reporting negative upstream impacts due to recycling credits. End-of-life scenarios vary by assessment, with different assumptions for landfill, recovery and treatment of steel, aluminium, composites and copper. Recovery rates are often optimistic and not aligned to offshore decommissioning evidence. Material-specific assumptions, especially for steel production routes, composite chemistry and rare-earth magnets, contribute further uncertainty.

4. Data availability, transparency and supply-chain complexity

Only a limited set of turbine models have publicly available PCFs, LCAs or EPDs, and the granularity and methodological clarity vary significantly. Documentation of cut-off criteria, allocation rules, background dataset versions and mass inclusion thresholds is not always consistent. Turbine manufacturing involves global, multi-tiered supply chains with differing electricity mixes, upstream processes and regional datasets, reducing traceability and complicating the production of harmonised cradle-to-gate results.

3.2. Cables

Key data requirements

Data Category	Description
Standards and PCRs	Clearly define which standards have been applied. Commonly used cable PCRs include NPCR 027 (EPD Norge), PEP Ecopassport PSR-0001, EN 50693 and EN 15804+A2. These may be used, but cable-specific results should be reported separately from any performance-based functional units.
Scope & asset definition	Clearly define the cable type (inter-array or export), voltage class, conductor material, armouring type, insulation (e.g. XLPE), sheathing and protective layers. Define the configuration the footprint applies to (e.g. 3-core 66 kV cable with copper conductor).
Material composition & mass	Provide a high-level breakdown of all significant materials by mass, including conductor (Cu/Al), insulation, bedding, armouring, sheathing and fillers. State purity levels (e.g. aluminium or copper grades), recycled content where known, and disclose whether mass-balance or book-and-claim approaches are applied for any polymers or metals.
Energy & processes	Report energy consumption (kWh, MJ) for conductor production, extrusion, armouring, sheathing and testing. Provide electricity source (grid, certificate-backed renewables, residual mix) and state whether the accounting follows location-based or market-based rules.
Functional/declared unit	Provide cradle-to-gate emissions per metre of finished cable. If following electricity-based or current-carrying PCRs, continue to report the required functional unit (e.g. 1 m transmitting 1 A over 40 years) but supply a declared unit separately to support OSW PCFs.
System boundary	Apply cradle-to-gate as the minimum boundary. If A4 transport or A5 installation losses are reported, provide life-cycle stages separately.
Allocation	Apply physical allocation where production lines serve multiple cable types (e.g. mass, length, or cross-section). Avoid economic allocation unless physical allocation is not feasible.

Emission factors	Use recognised, up-to-date databases (Ecoinvent, Sphera) and provide the version number. State where primary emission factors are used for key materials such as copper, aluminium, or steel armouring.
End of life	Provide assumptions by material group (e.g. copper/aluminium recovery, steel armouring recycling, polymer incineration with energy recovery). State recovery rates transparently; do not include non-PCR-consistent credits within A1–A3.
Recycling methodology	Apply cut-off (recycled content) method where possible. If modelling avoided burdens or recycling credits, report these separately (Module D), as end-of-life recycling and recovery rates are uncertain and context-specific.
Assumptions & exclusions	State all exclusions and justify them using cut-off rules (<1% mass and <1% energy). Document assumptions on conductor purity, insulation grade, installation depth, mass of protection layers, or missing sub-supplier data.
Lifetime	State lifetime assumptions used (typically 20–40 years). Lifetime does not affect cradle-to-gate values but is needed for clarity.
Location of manufacture	Provide country-level locations for conductor manufacture and cable assembly to ensure geographically relevant emission factors.
Data period	Use data no more than 3 years old, ideally aligned to the most recent full-year production cycle.

Key insights and challenges for cables carbon data

1. Methodological alignment and functional-unit issues

Cable carbon data use multiple product PCRs (NPCR 027, PEP Ecopassport PSR-0001, EN 15804+A2, EN 50693) with differing functional-unit definitions. Declared units per metre coexist with performance-based functional units that depend on current, resistivity and assumed lifetime. These differing conventions limit comparability across assessments. Cradle-to-gate results are sometimes embedded within cradle-to-grave datasets and not consistently reported separately.

2. Sensitivity to primary and secondary data

Cable footprints are highly sensitive to upstream datasets for aluminium, copper, armouring steel and XLPE insulation. Background dataset versions (Ecoinvent 3.6–3.10, Sphera MLC) produce materially different results, particularly for conductor metals and region-specific smelting pathways. Primary data for metal production, polymer grades and additives is inconsistently available, leading to heavy reliance on secondary data. Electricity modelling for conductor production and extrusion processes varies between regional grid mixes, certificate-backed renewables and residual mixes, creating further divergence.

3. Recycling, end-of-life and material-specific variability

EoL scenarios for cables vary across LCAs, including different assumptions for copper/aluminium recovery, steel armouring recycling and polymer incineration. Recycling methodologies range from cut-off approaches to avoided-burden crediting, with inconsistent treatment of Module D. Assumptions regarding conductor purity, recycled-content rates, cross-section size, water depth and protection layers have a significant impact on results and are not consistently disclosed.

4. Data availability, transparency and supply-chain complexity

Subsea cables are bespoke, project-specific products with complex multi-layer structures. Publicly available LCAs and EPDs often reflect onshore or generic cable variants and provide limited relevance for offshore wind. Detailed Bills of Materials are seldom disclosed due to confidentiality, resulting in aggregated cradle-to-gate intensities rather than detailed inventories. Differences in software tools, dataset versions, cut-off criteria and mass-inclusion thresholds further reduce comparability.

3.3. Substations and electrical equipment

Key data requirements

Data Category	Description
Standards and PCRs	Clearly define which standards have been applied. Relevant PCRs include EPD Italy 007 (electrical/electronic products), EPD Italy 015 (switchboards), and transformer-specific PCRs such as EPD Italy 018 or International EPD System PCR 2019:12. EN 50693 is widely used for electronic and electrical products.
Scope & asset definition	Clearly define the equipment type and configuration (transformers, switchgear, control/protection components). Distinguish between sub-systems in your methodology and assessment.
Material composition & mass	Provide a high-level breakdown of all significant materials by mass (electrical steel, copper/aluminium windings, oils/fluids, steel frames, polymers, auxiliary equipment). State recycled content where known and disclose whether mass-balance approaches are applied.
Energy & processes	Report energy consumption (kWh, MJ) for core manufacturing, winding, assembly, filling, vacuum/oil processing and testing. Provide electricity source and accounting method (location-based or market-based).
Functional/declared unit	Provide cradle-to-gate emissions per unit of equipment (e.g. per transformer, per switchgear panel). If a performance-based functional unit is required by the PCR, report a declared unit separately for OSW PCFs.
System boundary	Apply cradle-to-gate as the minimum boundary. If cradle-to-grave, provide relevant modules separately, including use-phase emissions such as transformer losses or insulating-gas leakage.
Allocation	Apply physical allocation where facilities produce multiple models. Avoid economic allocation unless physical allocation is not feasible.
Emission factors	Use recognised, recent databases (Ecoinvent, Sphera) and provide version numbers. State where primary emission factors are used (e.g. electrical steel EPDs, oil/insulating fluid datasets).

End of life	Provide assumptions by material group (electrical steel recovery, conductor metals recycling, treatment of oils/fluids, polymer incineration or disposal). Do not include non-PCR-consistent credits within A1–A3.
Recycling methodology	Apply cut-off method for cradle-to-gate. If modelling avoided burdens (e.g. metal recovery), report separately as Module D.
Assumptions & exclusions	State all exclusions and justify them using cut-off rules. Document assumptions for losses, filling quantities, auxiliary materials, SF ₆ -free alternatives, or missing upstream data.
Lifetime	State lifetime assumptions used (typically 20 years for switchgear, 35 years for transformers). Lifetime does not affect cradle-to-gate results but is needed for clarity.
Location of manufacture	Provide country-level locations for major manufacturing stages, including electrical steel and core production.
Data period	Use data no more than 3 years old, aligned with current production and database versions.

Key insights and challenges for substations and electrical equipment carbon data

1. Methodological alignment and functional-unit issues

Substation carbon data is produced under multiple PCRs (EPD Italy 007/015/018, EN 50693, EN 15804+A2) with differing expectations for declared and functional units. Some use product-based units per transformer or switchgear panel, while others use performance-based functional units linked to electricity distribution. Treatment of lifecycle modules varies, and cradle-to-gate results are not always clearly separated from use-phase losses or end-of-life impacts.

2. Sensitivity to primary and secondary data

Results are highly sensitive to datasets for electrical steel, copper/aluminium conductors, transformer oils and structural steel. Dataset versions (Ecoinvent 3.6–3.9.1, Sphera MLC) drive significant variation, and primary EPD-level data for these materials is inconsistently available. Electricity modelling across manufacturing and upstream material production varies between grid-average, renewable-certificate and residual-mix approaches, materially influencing reported impacts.

3. Variability in recycling, end-of-life and material assumptions

Recycling rates for metals, treatment of insulating oils and disposal routes for polymers vary substantially across assessments. Some LCAs apply cut-off methods, while others use avoided-burden crediting. End-of-life data quality varies, with incomplete disclosure of recovery rates and scenario assumptions. Upstream supply-chain variation in electrical steel production routes and polymer chemistries further increases uncertainty.

4. Data availability, transparency and supply-chain complexity

Substation systems are materially diverse and incorporate numerous sub-assemblies. Publicly available LCAs provide varying levels of detail, and documentation of assumptions, dataset versions, allocation rules and cut-off criteria is inconsistent. Supply chains span multiple manufacturing regions with differing background data quality and energy mixes, complicating the development of harmonised cradle-to-gate results.

3.4. Foundations

Key data requirements

Data Category	Description
Standards and PCRs	Clearly define which standards have been applied. Relevant PCRs include EN 15804+A2, steel construction PCRs under IBU, EPD Norge or International EPD System.
Scope & asset definition	Define foundation type (monopile, jacket, suction bucket) and key design parameters (diameter, water depth, wall thickness, steel grade, coating system).
Material composition & mass	Provide a breakdown of all significant materials (steel grades, plate thicknesses, coatings, grout if applicable). State recycled content and corrosion-allowance assumptions.
Energy & processes	Report energy consumption (kWh, MJ) for rolling, welding, cutting, coating and assembly. Provide electricity source and whether a market-based or location-based method is used.
Functional/declared unit	Provide cradle-to-gate emissions per foundation unit, and optionally per tonne of finished steel structure.
System boundary	Apply cradle-to-gate as the minimum boundary. A4 transport and A5 installation may be supplied separately.
Allocation	Apply physical allocation for facilities that produce multiple steel structures. Avoid economic allocation unless physical allocation is not feasible.
Emission factors	Use recognised, up-to-date datasets for steel production, coatings and auxiliary materials. State dataset versions and note where primary EPDs are used.
End of life	Provide assumptions for steel recycling rates, coating removal, and disposal routes. Do not include non-PCR-consistent credits within A1–A3.

Recycling methodology	Apply cut-off method; if avoided burdens for recycling are modelled, report these separately as Module D.
Assumptions & exclusions	State all exclusions and justify using cut-off rules. Document assumptions for coating thickness, corrosion allowances, fabrication scrap and transport distances.
Lifetime	State design life assumptions (typically 30–35 years) consistent with OSW farm assumptions.
Location of manufacture	Provide country-level locations for both steel mill production and fabrication yards.
Data period	Use recent (3 year) production cycle data, aligned to up-to-date background databases.

Key insights and challenges for foundations carbon data

1. Methodological alignment and functional-unit issues

Foundations carbon data relies primarily on EN 15804+A2 and various steel-product PCRs, but reporting formats differ. Declared units per tonne and per foundation are both used, with inconsistent treatment of optional modules and installation-related impacts. Lack of foundation-specific PCRs limits alignment.

2. Sensitivity to primary and secondary data

Foundation impacts are dominated by steel production. Results vary widely due to regional and technological differences in steelmaking (EAF vs BF/BOF), background dataset choice (Ecoinvent vs Sphera), and availability of primary steel EPDs. Electricity modelling for rolling, welding and coating processes varies between regional grid mixes, certificate-backed renewables and residual mixes, leading to significant variability in A1–A3 impacts.

3. Recycling, end-of-life, coating systems and design assumptions

Recycling approaches vary across studies, including cut-off and avoided-burden methods. End-of-life scenarios differ widely, particularly regarding whether monopiles or jackets are removed, partially removed or left in situ, and commercial data on end-of-life pathways is not expected to be available until large scale developments reach end-of-life. Coating systems, corrosion allowances, design safety factors, and fabrication scrap rates are often inconsistently documented and can materially influence results.

4. Data availability, transparency and supply-chain complexity

Limited public foundation EPDs exist, and methodological detail varies. Foundations are highly design-specific, with mass driven by water depth, soil conditions, turbine size and structural configuration. As a result, generic or proxy datasets provide poor representativeness. Lack of consistent disclosure on steel grades, coating systems and upstream EPD sources reduces transparency and comparability.

3.5. Construction and installation services providers

Key data requirements for construction

Data Category	Description
Standards and PCRs	There are no specific PCRs for C&I services. Follow relevant LCA/PCF standards (ISO 14067, ISO 14040/44). Ensure alignment with OSW industry PCF boundary definitions (A4–A5).
Scope & asset definition	Clearly define the service provided (e.g. turbine installation, monopile installation, cable laying, transport). Identify vessel types used and project scope.
Material composition & mass	Typically, not applicable. If consumables or temporary materials are significant, provide mass and composition.
Energy & processes	Provide detailed fuel consumption (litres or tonnes) and energy use for each vessel and activity (transit, installation, standby). State fuel type and renewable/dropped-in fuel usage.
Functional/declared unit	Provide emissions per relevant activity unit (e.g. tCO ₂ e per turbine installed, per monopile installed, or per km of cable laid, per day on site).
System boundary	Report activities related to the offshore wind development only, vessel construction emissions are not expected to be included as vessels will be used on many different projects and allocation is expected to be insignificant. State clearly whether personnel transfers, towage, weather delays or multi-vessel operations are included.
Allocation	Where vessels serve multiple projects at the same time and it is difficult to separate fuel consumption, allocate emissions based on time, distance or activity share. Avoid revenue-based allocation which is subject to uncertain commercial considerations.
Emission factors	Use verified fuel emission factors and disclose source and year. State if biogenic content or renewable fuel certificates are included.

End of life	Not typically relevant. Any material consumption should follow foundational PCR rules.
Recycling methodology	Not typically applicable. If applied, report consistently with cut-off method and document separately.
Assumptions & exclusions	Document assumptions on weather delays, standby time, engine loads, transit distances, and vessel utilisation. Apply <1% cut-off rules.
Lifetime	Not relevant to cradle-to-gate activity-based modelling.
Location of manufacture	Provide operational region (e.g. North Sea) to support appropriate fuel factors and weather assumptions.
Data period	Use data from the relevant installation campaign year; operational data should be recent and vessel-log-derived.

Key insights and challenges for construction and installation carbon data

1. Methodological alignment and functional-unit issues

There are no PCRs specific to C&I services. Reporting boundaries differ across assessments, and functional units (e.g. per turbine installed, per monopile installed, per km of cable laid) are not standardised. Treatment of sailing to site, standby time, weather delays, crew transfer and subcontracted vessels varies widely.

2. Sensitivity to primary and secondary data

C&I emissions are overwhelmingly driven by marine fuel consumption. Data quality depends on vessel-log accuracy, availability of fuel-use records and the choice of fuel-emission factors. Differences in emission-factor sources and treatment of drop-in renewable fuels (e.g. HVO, methanol) create further variability.

3. Operational variability and installation uncertainty

Transit distances, weather downtime, vessel utilisation and multi-vessel campaigns create large differences in emissions across projects. Lack of standard assumptions for engine loads, operational modes and installation sequences significantly limits comparability.

4. Data availability, transparency and supply-chain complexity

C&I providers typically do not publish PCFs or LCAs, and available data is sourced from sustainability reports or high-level emissions disclosures. Organisational structures vary (pure-play installers vs diversified marine contractors), and emissions from non-OSW activities can make it difficult to isolate offshore-specific intensities. Limited transparency on vessel-specific data, allocation rules and temporal boundaries further constrains data quality.

4. Glossary of carbon data terminology

Term	Definition
Activity data	Quantitative information describing your operations, including material quantities, fuel use, electricity consumption, process emissions, transport distances and logistics data. Forms the basis of all emissions calculations.
Allocation	The method used to divide emissions between multiple products from a shared process or facility. Physical allocation (mass, volume, energy content) is preferred; economic allocation may be used where physical relationships are not feasible.
Avoided burden/ Recycling credit	An optional modelling approach providing credits for potential benefits of recycling at end-of-life. Must not be included within upstream emissions. If used, it must be reported separately.
Background dataset	Secondary data sourced from life-cycle inventory databases (e.g., Ecoinvent, Sphera). Must be up-to-date, regionally relevant and documented with dataset version and publication year.
Book-and-claim accounting	A market-based method for attributing renewable electricity or recycled content via certificates rather than physical traceability. Must be transparently disclosed.
Carbon footprint	Total greenhouse gas emissions associated with a product or service, expressed in kgCO ₂ e. Used here specifically to refer to life-cycle GHG emissions.
Construction and installation (C&I)	Offshore installation activities including transport to site, turbine erection, foundation installation and cable laying, typically involving specialist vessels.
Cradle-to-gate	System boundary covering all emissions from raw-material extraction to the point the product leaves your facility. This is the standard boundary for most suppliers.
Cradle-to-grave	Full life-cycle boundary including upstream, use phase and end-of-life. Developers will model the use and end-of -
Declared unit	A product-based unit for reporting cradle-to-gate results (e.g., per turbine, per metre of cable, per foundation). Required for offshore wind PCFs.

Environmentally Extended Input–Output (EEIO)	A top-down modelling approach estimating emissions based on economic expenditure rather than process data. Used only where product-specific data is not available.
Electricity accounting method	The basis used to calculate emissions from electricity consumption: location-based (regional grid average), market-based (reflecting contractual instruments), or residual mix (grid mix excluding renewable certificates).
Emission factor (EF)	A value that converts activity data into GHG emissions (e.g., kg CO ₂ e per kWh of electricity, per tonne of steel). Must be from a recognised, up-to-date source.
Environmental Product Declaration (EPD)	A third-party-verified document reporting environmental impacts in accordance with ISO 14025 and a specific Product Category Rule (PCR). Based on an underlying LCA.
Functional unit	A performance-based unit required by some PCRs (e.g., 1 kWh delivered, 1 m transmitting 1 A). Used alongside declared units but not interchangeable with them.
GHG Protocol Product Standard	A standard for quantifying and reporting product-level GHG emissions. Requires primary data for processes you control and transparency in methodological choices.
ISO 14040 / 14044	International standards defining the principles, framework, requirements and guidelines for conducting Life Cycle Assessments (LCAs).
ISO 14067	International standard defining requirements for quantifying and reporting the carbon footprint of products (CFPs). Foundation standard for PCFs.
Life Cycle Assessment (LCA)	A detailed assessment of environmental impacts across the full life cycle of a product or service, conducted under ISO 14040/44. Includes climate-change impacts typically assessed using GWP100 impact.
Material composition	Detailed breakdown of materials in your product by type, grade and mass (e.g., steel grades, copper purity, composite resin type).
Mass-balance approach	A chain-of-custody model used to attribute recycled or bio-based content when materials are physically mixed. Must be disclosed clearly.
Module D	Reporting module for beyond-system-boundary impacts, such as potential benefits from recycling. Reported separately from other lifecycle stages.

O&M (Operations and Maintenance)	Activities occurring during the operational life of an offshore wind farm, including vessel use, inspections, corrective maintenance and component replacements.
PACT / Primary Data Share (PDS)	WBCSD framework for exchanging product carbon data. Requires disclosure of the share of primary data used and qualitative scoring of data quality across five dimensions.
PCR (Product Category Rule)	A rule set defining how LCAs and EPDs must be conducted for a specific product category, including system boundaries, allocation rules and functional units.
Primary data	Data measured directly from your operations (e.g., metered energy use, fuel logs, weighbridge records). Required for processes under your control.
Process emissions	Greenhouse gas emissions released directly from manufacturing or chemical processes (e.g., SF ₆ leakage, resin curing, clinker production).
Recycled content	Proportion of recycled input material in your product. Should be reported by material type where known.
Recycling methodology	The approach used to model recycling in LCAs. Suppliers should use the cut-off method for cradle-to-gate reporting.
Residual mix	A grid electricity factor excluding renewable certificates, used alongside market-based accounting.
Scope (product system)	The set of processes, activities and assumptions included within your carbon footprint. Must be clearly documented.
Secondary data	Data from LCI databases, literature or industry averages used where primary data is not available. Must be traceable and up-to-date.
Service unit	The declared or functional unit for service activities (e.g., per turbine installed, per km of cable laid, per hour in operational mode).
System boundary	Defines what is included in your carbon footprint. For most suppliers, this should be is cradle-to-gate at a minimum.
Upstream emissions	Emissions from raw-material extraction, processing and logistics prior to your manufacturing activities.
Verification	Independent review of your carbon data. May be internal (first-party), customer-led (second-party) or by an accredited verifier (third-party).

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