Learning from the Experts Webinar Series

Carbon Footprinting for Offshore Wind

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May 14, 2025

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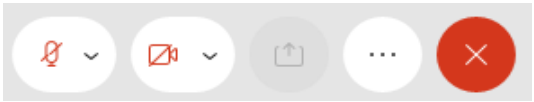

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Learning from the Experts

This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

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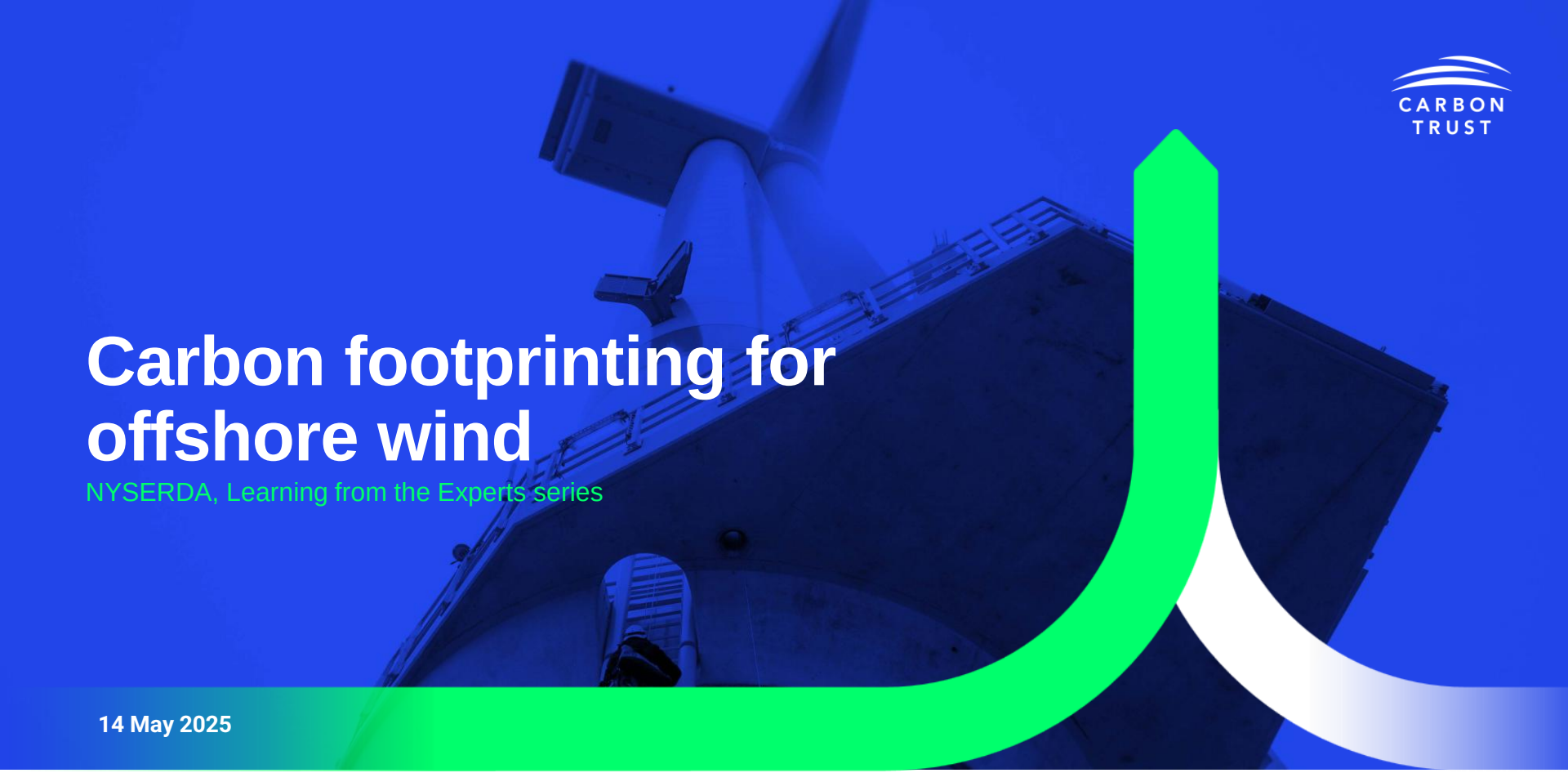


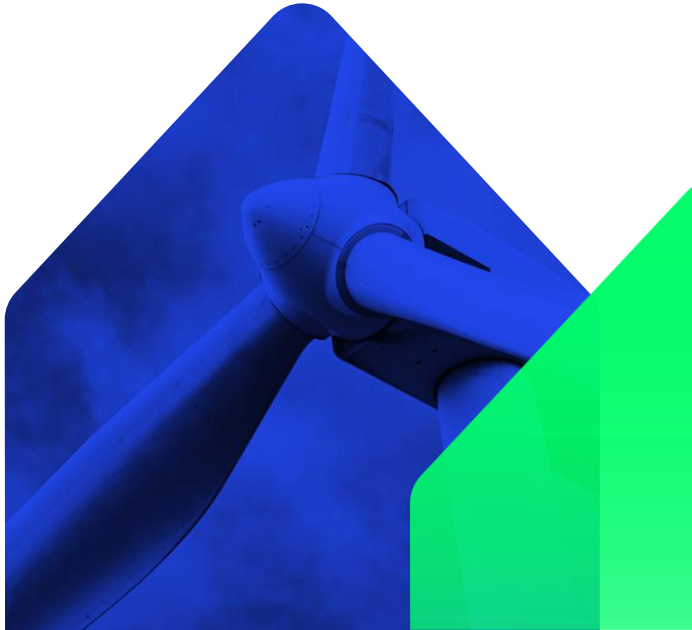
Carbon footprinting for offshore wind

NYSERDA, Learning from the Experts series

14 May 2025

Agenda

1. About the Carbon Trust
2. Carbon emissions in offshore wind
3. Sustainability JIP industry guidance
4. Emission factors – data quality
5. The OSW decarbonisation pathway



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The Carbon Trust

Our mission is to accelerate the move to a decarbonised future.

5

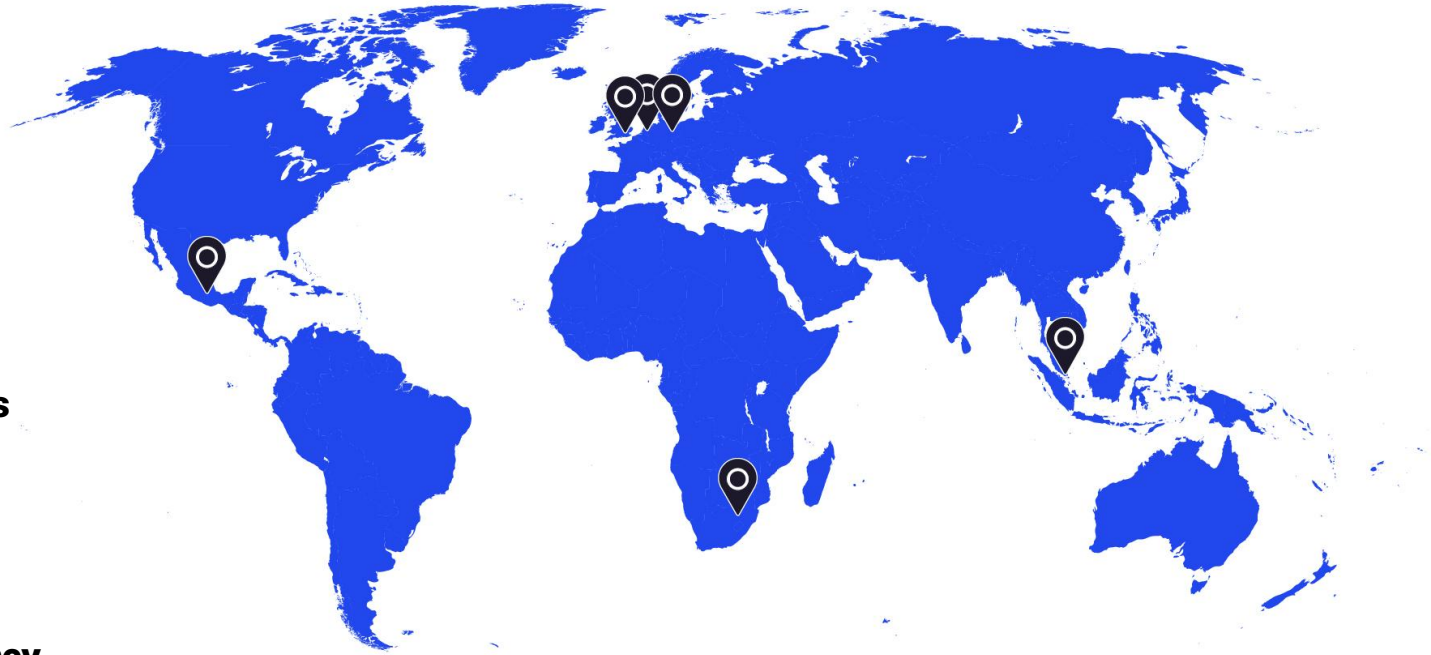
supporting clients across 5 continents

400+

experts and consultants

20

years of experience in sustainability consultancy



What we do

Net Zero transition planning and delivery

We advise companies, financial institutions, and public sector organisations on their Net Zero transition, supporting them on each step of their journey – from footprinting and risk analysis through to target setting, strategy, financing and implementation.

- Target setting
- Footprinting and reporting
- Route to Net Zero Standard

Product carbon footprint labelling

Our label verifies that a product or brand has reduced its product's carbon footprint, or has a comparatively lower footprint than other products. This informs more sustainable purchasing choices.

- Product carbon footprint label

Market transformation

We help design, implement and evaluate policies, business models and large-scale projects to meet ambitious carbon reduction targets.

- Offshore wind
- Climate policy
- Energy transition

Offshore wind

Joint Industry Programmes (JIP) Accelerators

- **Pre-competitive space to tackle industry-wide challenges**
- **Standard setting (e.g. Cable Burial Risk Assessment, 66kV/132kV)**
- **Technology demonstration (e.g. bird collision avoidance campaign)**
- **Competition and innovator support**

Market agnostic

Generic solution for OSW

The Offshore Wind Accelerator (OWA) — 2008

Carbon Trust's flagship collaborative RD&D programme for bottom-fixed offshore wind.

The Floating Wind JIP (FLW JIP) — 2016

The Floating Wind JIP Overcomes challenges and advance opportunities for commercial scale floating wind

The Offshore Renewables JIP (ORJIP) — 2011

Offshore Renewables JIP aims to reduce consenting and environmental risks for offshore projects.

The Integrator — 2020

The Integrator is designed to examine the interplay between offshore wind, existing infrastructure, and other technologies to highlight opportunities for innovation investment.

Sustainability JIP (SUSJIP) — 2023

The Sustainability joint industry programme aims to decarbonise offshore wind farm developments and support developers to achieve net zero targets.

Market Specific

Addressing specific market challenges

Philippines Joint Industry Programme — 2021

A public-private collaboration initiative set up to accelerate offshore wind development in Philippines by conducting impactful research that resolves barriers to offshore wind

National Offshore Wind R&D Consortium (NOWRDC) — 2018

Prioritize, support, and promote research and development activities that reduce cost and risk of offshore wind development projects throughout the U.S.

State of Maine: Offshore Wind Research Consortium — 2023

Aims to create a common understanding of the local and regional impacts (negative and positive) of floating offshore wind in the Gulf of Maine

Advisory

Specialist advice for governments and industry:

- **New market opportunities**
- **Domestic economic benefits**
- **Sustainable accelerated OSW development**

The Sustainability Joint Industry Programme

Objective and structure

- **A developer-funded and developer-led collaborative programme to accelerate decarbonisation action across future fixed and floating projects for a net-zero OSW industry.**
- **Drive for industry alignment of measuring carbon footprints using the OSW Product Carbon Footprinting Industry Guidance. Interface with relevant initiatives and parties to enable an industry-wide shift.**
- **Drive industry change by implementing key decarbonisation activities through collaboration.**
- **A united developer voice on decarbonisation action will help influence the wider industry on targets and decarbonisation ambitions in the OSW sector.**

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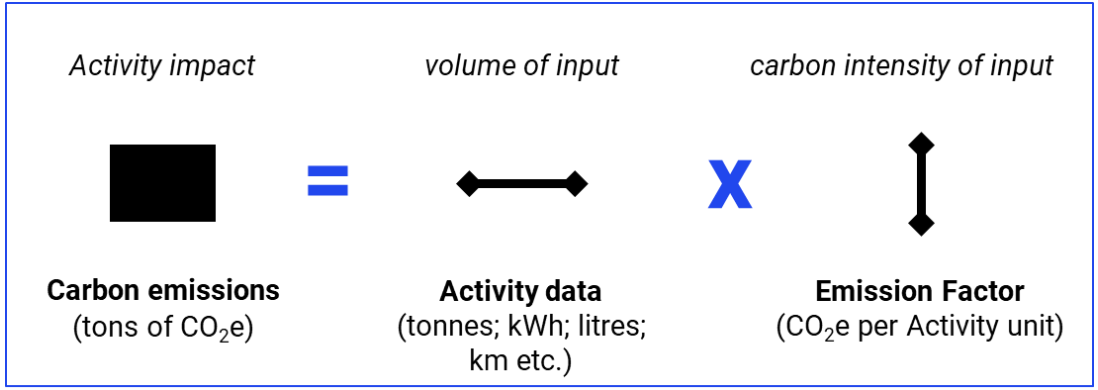
Carbon emissions in offshore wind

What is carbon footprinting?

A carbon footprint is the total greenhouse gas (GHG) emissions caused directly or indirectly by an individual, product, system or organisation across its full life cycle.

The climate impact from emissions of different GHGs are expressed in the same unit, carbon dioxide equivalents (CO2e) for ease of calculation and interpretation.

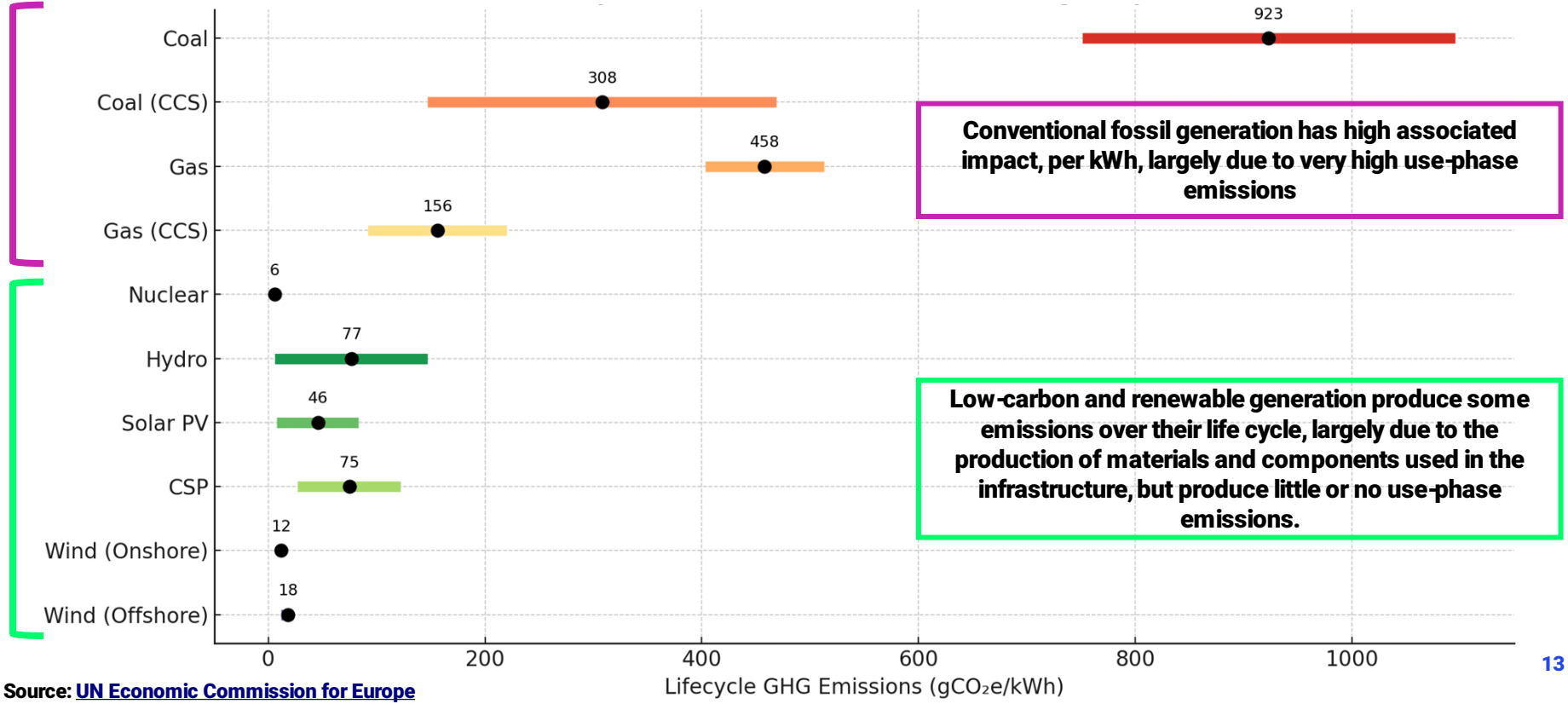
Carbon footprint = Sum of offshore wind development activities that produce carbon emissions multiplied by relevant emission factors to represent intensity of the activity



Overview of relevant stages in a life cycle carbon footprint for offshore wind energy:

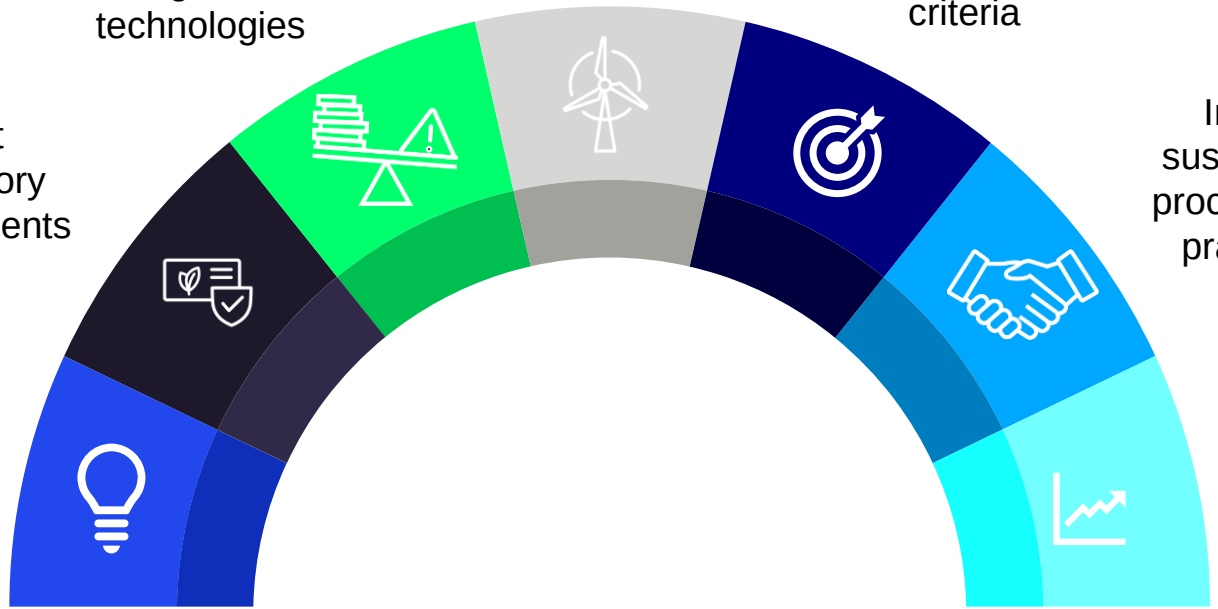
Life cycle carbon footprint of different generation technologies

All electricity generation technologies have a carbon footprint when considered over the full life cycle. This includes emissions from manufacturing of components, construction of plant, use-phase or operational emissions, and finally decommissioning and end-of-life.



Source: UN Economic Commission for Europe

Why measure carbon footprints for Offshore Wind developments?



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Sustainability JIP industry guidance

Measuring the carbon footprint of an offshore wind farm

- **There is currently no industry guidance on calculating a full life cycle carbon footprint for an offshore wind farm. This leaves the industry open to interpret cross-sectoral standards which results in different interpretations for Offshore Wind and reduces comparability.**
- **SUS JIP is tackling the lack of industry guidance by developing the 'Offshore Wind Industry Product Carbon Footprinting Guidance'.**
- **The aims of the Product Carbon Footprinting guidance are to provide:**

1. **Sector specific rules for the application of the relevant standards for Product Carbon Footprints (PCFs) to an Offshore Wind development (ISO 14067, GHG Protocol Product Standard).**
2. **Standard assessment criteria to harmonise the calculation approach within the industry.**
3. **A framework for developers to calculate and report different emissions metrics.**
4. **A framework to improve data quality and data exchange.**

Output:

A freely available OSW product carbon footprinting guidance document, and calculator tool published on 25 September 2024

Compliance to standards

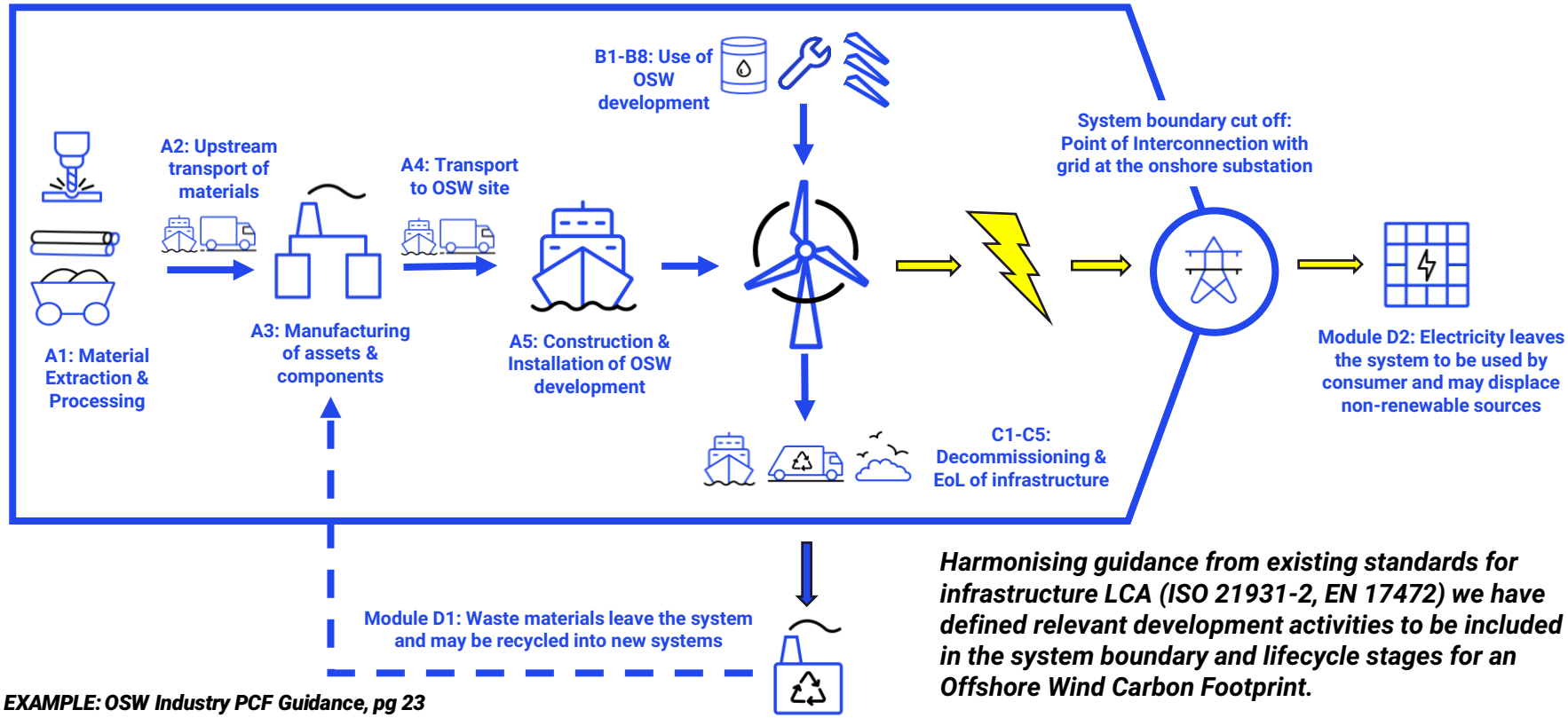
The guidance document is intended to provide a sector-specific guidance for the application of the following core standards for product-level assessment of carbon footprints:

- ISO 14067: Carbon footprint of products. Requirements and guidelines for quantification
- GHGP Product Life Cycle Accounting and Reporting standard
- ISO 14040 - Environmental management — Life Cycle assessment — Principles and framework
- ISO 14044 Environmental management — Life Cycle assessment — Requirements and guidelines

This guidance also draws on additional requirements and terminology outlined in the following supplementary standards and guidance documents:

- ISO 21931-2: Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment — Part 2: Civil engineering works
- ISO 21930:2017: Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
- EN 15978: Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method
- EN 15804: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
- EN 17472:2022: Sustainability of construction works. Sustainability assessment of civil engineering works. Calculation methods.
- ISO 14025 Environmental labels and declarations — Type III environmental declarations — Principles and procedures
- International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment
- WBCSD PACT Pathfinder Framework v2
- PAS 2080:2023 Carbon management in buildings and infrastructure
- RICS: Whole Life Carbon assessment for the built environment
- Carbon Trust: Product carbon footprints requirements for assurance – Part 1: Technical, v3.0

Scope & system boundary for a carbon footprint



EXAMPLE: OSW Industry PCF Guidance, pg 23

Harmonising guidance from existing standards for infrastructure LCA (ISO 21931-2, EN 17472) we have defined relevant development activities to be included in the system boundary and lifecycle stages for an Offshore Wind Carbon Footprint.

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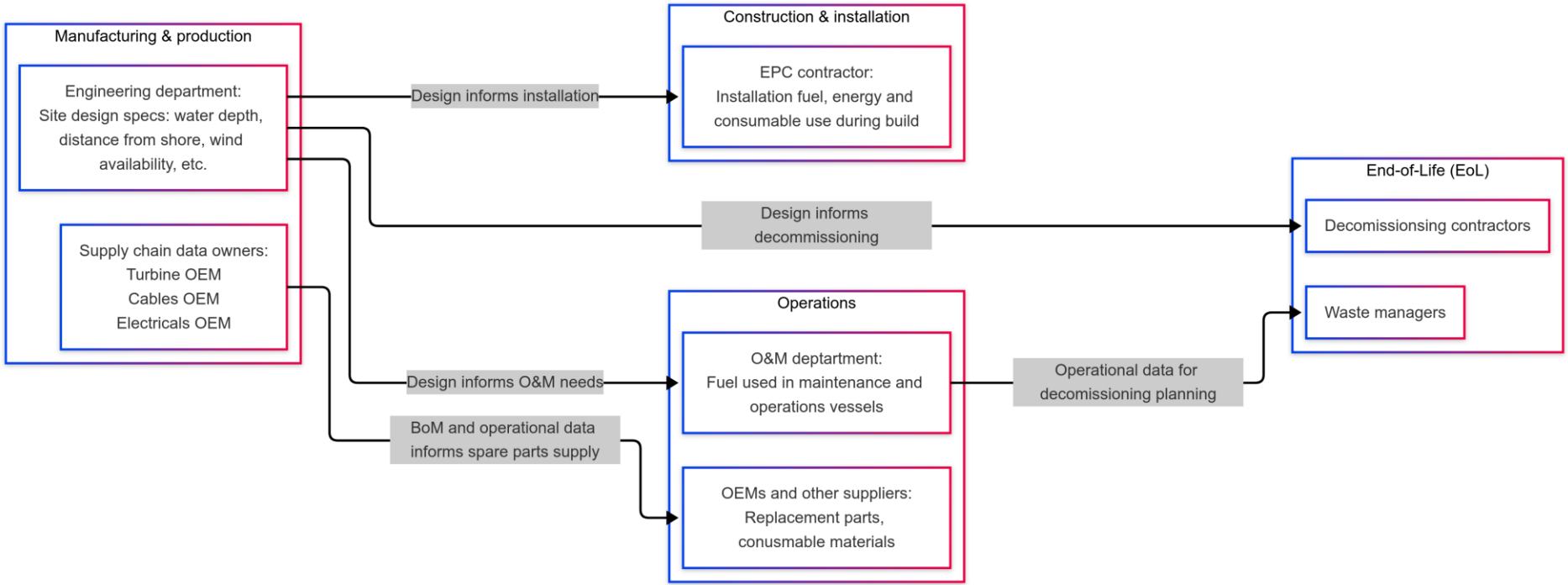
Emission data

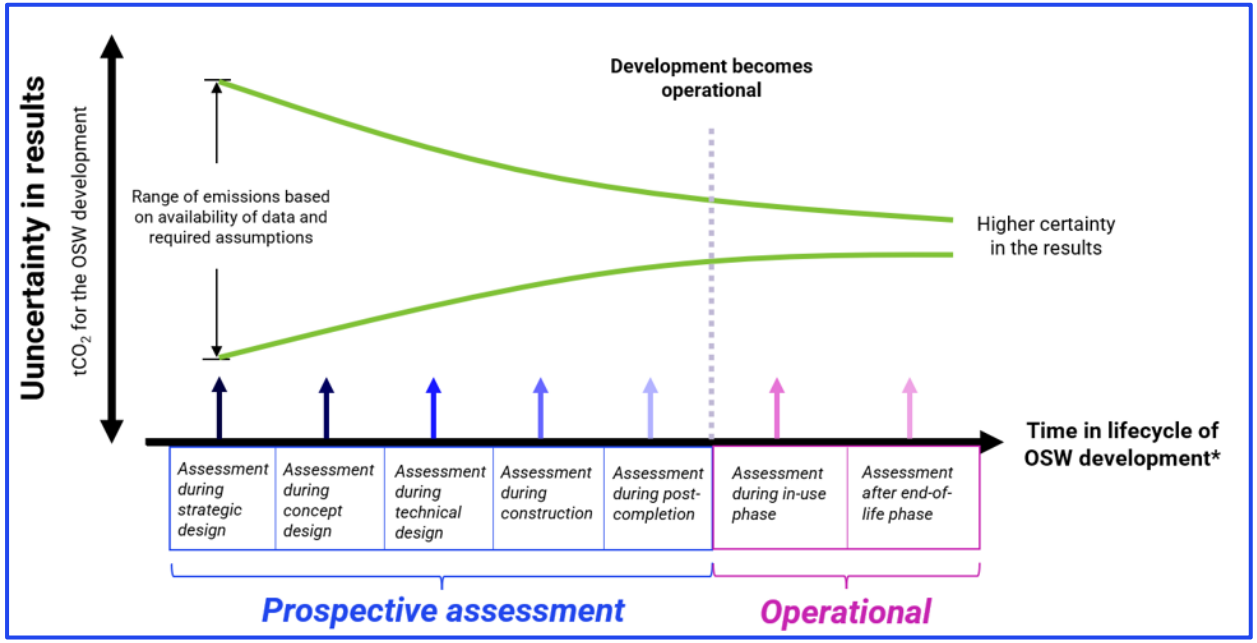
Calculating an accurate carbon impact requires complex data from across the entire value chain

There are many data owners and data types required for a carbon footprint, including bills of materials for major assets and components, carbon data (LCA, EPD) and operational data such as fuel consumption in vessels. Data collection requires collaboration between internal teams and value chain partners.



Emission factors - data quality

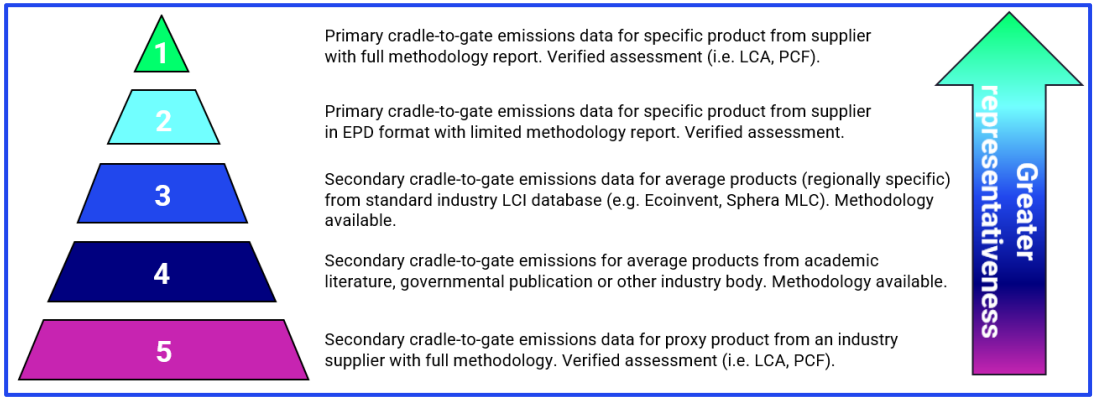
Currently, most emissions data is based on industry averages. While a good starting point, we promote the use of supplier-specific data by advising on how to collaboratively seek primary data with appropriate timings.



This timeline is not proportional to the full lifecycle of an OSW development

Emission factors – data requirements

- **For improved decision-making, the industry must work together to increase confidence and accuracy on how to decarbonise by using supplier-specific data.**



- **Primary emission factors come directly from the supplier and are produced using measured or observed data. The quality can vary depending on the methodology used.**
- **Secondary emission factors come from a variety of sources including industry databases.**

- **The process to improving data quality and realising carbon reductions will be both collaborative and iterative and should trickle up the full supply chain.**

OSW Industry PCF Guidance, Section 3.8, Data quality & uncertainty

SUSJIP Phase 2 (2025 – 2026) objectives

Phase 1

Measurement

To refine the OSW Industry Product Carbon Footprint methodology to provide additional clarity through and expert working group.

Seek international adoption and recognition.

Data

Improve carbon emission data and monitoring practices by addressing common challenges with developers and suppliers in data gathering.

Create a supplier guidance annex to the methodology focused on components.

Decarbonisation action

To focus on steel decarbonisation.

Use open industry dialogue and economic assessment to develop recommendations and next steps for the OSW industry to drive forward a Green Steel Action Plan (GSAP).

Phase 1

Supply chain data engagement

Supplier-specific footprinting data challenges

Understand the carbon footprinting approaches and challenges facing OSW supplier asset classes.

Supplier-specific guidance

Create a supplier-focused guidance document to support the provision of supplier data into OSW carbon footprints

Understand current challenges

Build consensus on the approach of supply chain engagement to collect accurate data and drive decarbonisation.

Supplier strategy commitment plan

Create a developer-led supplier strategy commitment to determine common expectations of suppliers regarding emission data.

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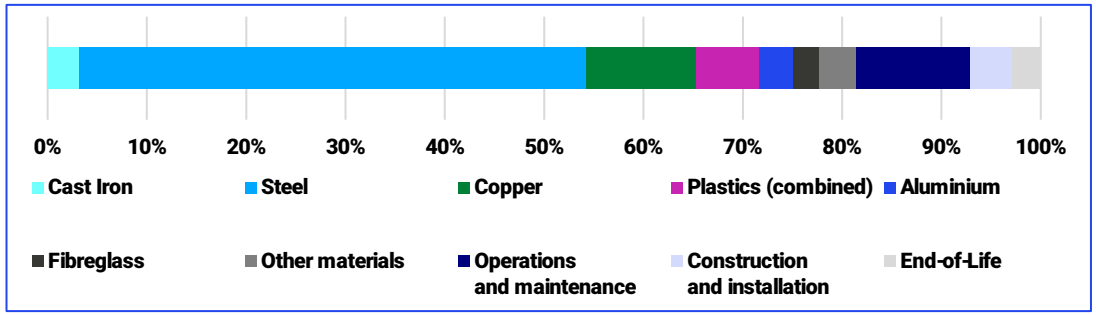
The offshore wind decarbonisation pathway

Emission sources for an average OSW farm

The emissions profile of an OSW farm can vary based on factors such as project size, distance from shore, the choice of foundation material and design.

- **Steel contributes over 50% of life cycle carbon emissions for an average OSW development. This represents the area where the most significant reductions are required to achieve Net Zero.**
- **Embodied emissions from other materials (copper, plastics, cast iron, and aluminium) contribute 24% to a development's total footprint.**
- **15-20% of emissions are produced by construction, installation and operation and maintenance activities throughout an OSW development's lifetime. This reflects the emissions associated with the vessel fuels required for these offshore activities.**

Baseline composition of emission sources for an average OSW development



Source: Offshore wind decarbonisation pathway with data from Siemens SGD 14-222 and Vestas V236-15 studies.

Industry actions to support decarbonisation

Short-term

- The low carbon materials market is enhanced through demand signaling, renewables deployment, use case development, and advancing circular economy practices
- Demand for alternative fuel-capable vessels grows
- Infrastructure to support vessel-charging begins development
- Quantification of the carbon reduction and risk mitigation benefits of OSW decarbonisation attracts green capital, which supports the move towards Net Zero

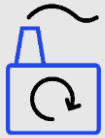
Medium-term

- Low carbon materials are regularly used in OSW developments, and commercialisation of alternative production processes occurs
- Alternative fuel-capable vessels become fully commercialised, and supporting infrastructure is fully developed
- Net Zero fuels begin to be deployed
- Electrified CTVs and SOVs become commonplace, making O&M Net Zero ready
- Enhanced condition monitoring leads to life extension and repowering to becoming viable
- Carbon pricing mechanisms (e.g., CBAM type regulation) lead to the availability of low carbon materials growing internationally

Long-term

- Developers regularly use Net Zero materials due to the further commercialisation of alternative technology production processes
- Hard-to-abate sectors (e.g. concrete) begin providing Net Zero aligned offerings
- Net Zero fuels become available
- Global grids decarbonise, achieving Net Zero in fully electrified vessels

Industry decarbonisation actions

Category	Objectives	Examples
 Materials and supply chain	Actions related to driving decarbonisation in the OSW supply chain and associated material inputs	• Set 'green' material use targets independently or through organising bodies to stimulate demand for low-carbon materials. • Increase OSW and other renewable energy capacity to facilitate green hydrogen production and the deployment of electric arc furnaces required to decarbonise the steel sector. • Aggregate demand for green materials and communicate future commitments and expectations regarding material use to support supply chain planning.
 Maritime activities	Actions to decarbonise vessel activities and fuels used during construction & installation and operations & maintenance	• Support vessel electrification infrastructure by ensuring new OSW developments are equipped with vessel charging capabilities and developing grid infrastructure at key ports. • Skills and training development across vessel operators and key ports on safe and effective low/zero carbon fuel handling.
 Market interventions	Funding, incentives and taxation interventions to facilitate the shift to low carbon developments	• Apply sustainable finance frameworks with eligible assets related to OSW ecosystem decarbonisation to enhance access to capital for supply chain decarbonisation. • Enhance the weighting of carbon-related criteria in incentive mechanisms and tendering frameworks (PQQ or NPC) • Government supply chain support mechanisms to help the development of sustainable manufacturing infrastructure.
 Business model innovations	Innovations and changes to OSW development business models	• Incentivise investments for repowering by lengthening seabed leases. Issue 50-year OSW leases to encourage life extension and repowering. • Investigate decommissioning processes for foundations that could enhance the availability of material for recovery and recycling.

Achieving OSW decarbonisation action

- **The emissions from OSW represent a small fraction of the total emissions associated with electricity generation.**
- **To achieve Net Zero alignment, every industry must take accountability for exploring pathways to Net Zero and adopting economic models that account for environmental and social impacts beyond financial costs.**
- **Achieving Net Zero alignment will require fully integrating low carbon materials and practices into OSW designs and development processes. This will be a gradual, collaborative process.**
- **Deeper cooperation and action are required between stakeholders, including governments and regulators, developers, financial institutions, supply chain companies and vessel operators.**

Significant cross-sector collaboration is required to unlock the decarbonisation potential of the offshore wind industry. A holistic view of the value chain is essential.

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Thank you for listening

Contact us

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June 11, 1:00 p.m. ET

Offshore Wind Vessels – Constraints and Opportunities

Clarksons

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