

Offshore Energy Thematic Methods

Provides methodological guidance for accounting for offshore energy activities within ocean accounts.

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OUTCOME

This Circular provides methodological guidance for accounting for offshore energy activities within ocean accounts, extending [TG-3.10 Offshore Energy Accounts](#) with thematic methods for cumulative impacts, decommissioning, and energy transition.

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ABOUT THIS CIRCULAR

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DRAFT

1. Outcome

¶1 This Circular provides methodological guidance for accounting for offshore energy activities within ocean accounts, extending **TG-3.10 Offshore Energy Accounts**¹ with thematic methods for cumulative impacts, decommissioning, and energy transition.

1.1 Decision Use Cases and Policy Links

¶1 **Offshore wind site selection and spatial planning.** Marine spatial planning authorities require spatial footprint data, exclusion zone mapping, and ecosystem condition baselines to evaluate competing offshore wind proposals, feeding into **TG-1.2 Marine Spatial Planning**.

¶2 **Oil and gas decommissioning accounting.** Asset accounts for offshore energy infrastructure (Section 3.5.1) enable tracking of decommissioning liabilities. The rigs-to-reefs framework (Section 3.5.2) provides accounting treatment for partial decommissioning. Asset valuations also support **TG-1.8 OA and Project-Level Finance**.

¶3 **Energy transition and climate policy.** The energy transition accounting framework (Section 3.6) supports reporting on the shift from offshore oil and gas to marine renewables, including NDC progress and avoided-emissions tracking. Climate indicators feed into **TG-2.8 Climate Indicators**. Section 3.6.3 provides the accounting linkage.

¶4 **Renewable energy target monitoring.** Physical energy accounts (Section 3.2) record installed capacity and generation by technology type. These data support comparison against policy targets and link to **TG-2.5 Ocean Economy Structure**.

¶5 **Asset accounts integration.** Treatment of renewable energy resources and terminal costs for offshore infrastructure is governed by **TG-3.1 Asset Accounts**.

1.2 Emerging Methodological Issues

¶1 Methods for offshore renewable energy accounting and cumulative impact assessment are not yet standardised within the SEEA framework. Specific areas of emerging methodology are summarised below.

Methodological area	Description
Income attribution for floating offshore wind installations	Accounting treatment for mobile offshore installations (floating production units, floating wind turbines) without fixed seabed attachment. See Section 3.1.2.
Carbon capture and storage (CCS) accounting	Recording of carbon dioxide stored in depleted offshore reservoirs, pending resolution of whether stored carbon is negative extraction, a new asset type or an environmental protection service. See Section 3.6.3.
Infrastructure repurposing accounting	Treatment of oil and gas infrastructure converted for renewable energy use (platforms as wind turbine bases, pipelines for hydrogen transport). See Section 3.6.1.
Electromagnetic field (EMF) impact accounting	Recording of electromagnetic fields from subsea power cables and their effects on electrosensitive species. See Section 3.4.2.
Ecosystem service valuation	Valuation of artificial reef ecosystem services created by offshore structures. See Section 3.4.3.
Cumulative impact thresholds	Frameworks for assessing when combined impacts exceed ecosystem carrying capacity. See Section 3.4.
Cross-border accounting	Treatment of offshore installations in shared maritime zones or areas beyond national jurisdiction. See Section 3.1.1.

Methodological area	Description
Emerging offshore activities	Offshore hydrogen production, offshore desalination, and marine data centres represent emerging ocean uses. Record pilot installations in supplementary tables where they occur.

¶12 Reclassification to Applied may be considered once international guidance on these topics is formally adopted through the UN Statistical Commission process or the UNCEEA work programme. The spatial scope covers offshore energy activities within the Exclusive Economic Zone and on the continental shelf as defined by UNCLOS, including both fixed and floating installations. Activities within areas beyond national jurisdiction are addressed in **TG-6.6 Deep Sea and Seabed Accounting**. **TG-6.11 Coastal Infrastructure** addresses cable landfall infrastructure and onshore grid connections.

¶13 ⓘ Framework Position

¶14 This Circular specialises **TG-3.10 Offshore Energy Accounts** for cumulative impacts, decommissioning and the energy transition. TG-3.10 owns the supply and use tables, the mineral and energy resource asset accounts and the activity classification; this Circular adds what those do not reach.

¶15 It also owns, for the publication as a whole, the treatment of **submerged artificial structures (IUCN GET M4.1)** at Section 3.5.2 – the write-down, the M4.1 extent entry at footprint plus ecological halo, and its reversal. That rule applies wherever the structure sits, including inside the territorial sea (**TG-6.11**) and to structures colonised by reef-building corals (**TG-6.1**).

¶16 Spatial scope is the EEZ and continental shelf. Activity in areas beyond national jurisdiction is **TG-6.6**; cable landfall and onshore grid connection are **TG-6.11**.

2. Requirements

¶1 This Circular requires familiarity with:

- ¶2 **TG-0.1 General Introduction to Ocean Accounts** – conceptual framework for ocean accounting, including the Basic Spatial Unit framework for georeferencing offshore activities.
- ¶3 **TG-3.10 Offshore Energy Accounts** – foundational accounting structure for offshore energy, including supply and use tables, asset accounts for mineral and energy resources, and activity classification.

2.1 Related Circulars

- ¶1 **TG-3.1 Asset Accounts** – general methodology for environmental asset accounts applicable to seabed mineral resources and ecosystem condition accounting.
- ¶2 **TG-3.3 Economic Activity Relevant to the Ocean** – industry classification guidance for distinguishing offshore from onshore energy extraction.
- ¶3 **TG-4.1 Remote Sensing Data** – methods for mapping offshore energy infrastructure using satellite imagery and AIS data.
- ¶4 **TG-6.5 Pelagic and Open Ocean** – accounting for offshore renewable installations in pelagic environments.
- ¶5 **TG-6.6 Deep Sea and Seabed Accounting** – relevant for deep-water energy developments and activities beyond national jurisdiction.
- ¶6

TG-6.11 Coastal Infrastructure – export cable landfall, onshore substations, and grid connection infrastructure.

2.2 International Standards Alignment

¶1 This guidance aligns with four standards:

- ¶2 SEEA Central Framework (2012)² for mineral and energy resource treatment and decommissioning costs
- ¶3 SEEA-Energy (2019)³, ⁴ for physical and monetary supply and use tables and fossil fuel asset accounts
- ¶4 2025 SNA⁵ for renewable energy resource classification and terminal cost treatment
- ¶5 UNCLOS (1982)⁶ for the offshore installation legal framework⁷

2.3 Data Sources

Source	Data provided
National petroleum and energy regulatory authorities	Licence areas, production data, reserves estimates, and decommissioning schedules for offshore oil and gas fields.
Environmental agencies	Impact assessments, monitoring data for ecosystem condition variables, and discharge permits.
Maritime authorities	Infrastructure locations, safety zone coordinates, and vessel tracking data (AIS).
Energy companies	Financial reports, sustainability disclosures (following IFRS S2 and TNFD frameworks), and operational data.
Research institutions	Ecological studies, technology assessments, and condition monitoring results.
International sources	IEA <i>World Energy Balances</i> ⁸ for bilateral production data; IRENA for renewable energy capacity and cost data; 4C Offshore and Global Wind Energy Council for offshore wind farm registries.

¶1 Data quality should be assessed following **TG-0.7 Quality Assurance**, with particular attention to temporal consistency, spatial coverage, and measurement uncertainty.

¶2 **Readiness and sequencing.** Whether a country is positioned to compile this account at all – mandate, data architecture, capacity and the order in which to build – is assessed under **TG-0.8 Implementation Readiness Assessment**, and is not restated here.

3. Guidance Material

3.1 Energy Type Classification

3.1.1 Fossil fuel extraction (oil and gas)

¶1 Offshore oil and gas platforms extract mineral and energy resources classified within ISIC Division 06 (Extraction of crude petroleum and natural gas)⁹. ISIC Division 06 does not distinguish onshore from offshore extraction at the four-digit level, so compilers should use location-based coding or national satellite industry codes where available. See **TG-3.3 Economic Activity Relevant to the Ocean**.

¶2 **Physical asset accounts** record stocks using the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC-2009)¹⁰:

Class	Description
Class A: Commercially Recoverable Resources	Deposits where extraction and sale has been confirmed economically viable (UNFC categories E1, F1, G1-G3).
Class B: Potentially Commercially Recoverable Resources	Deposits expected to become economically viable in the foreseeable future (UNFC categories E2, F2.1/F2.2, G1-G3).
Class C: Non-Commercial and Other Known Deposits	Resources not expected to become economically viable with current technology and prices.

¶3 **Monetary asset accounts** record the net present value of commercially recoverable resources, with revaluations reflecting changes in commodity prices, extraction costs, and discount rates¹¹. For foundational supply-use and asset-account structures, see **TG-3.10 Offshore Energy Accounts**.

¶4 **Transboundary reservoirs**. Where offshore reservoirs straddle maritime boundaries, the SEEA Central Framework requires that “only the country’s share of the resource should be recorded in its asset accounts” (SEEA CF para. 5.93)¹². Share allocation rules:

- ¶5 The **primary basis** is a *unitisation agreement* specifying production shares. Where one is in force, compilers should use its production share for national asset account entries.
- ¶6 Where no unitisation agreement exists, use the most recent **bilateral production data sharing arrangement**, or IEA *World Energy Balances*⁸ as an interim basis.
- ¶7 UNFC classification should be applied **independently in each jurisdiction** using that jurisdiction’s economic parameters. Where the sum of national reserves exceeds an independently assessed reservoir total, document this divergence in a cross-boundary consistency footnote.

¶8 Transboundary reservoir methodology has been flagged as a candidate issue for future UNSD guidance development.

3.1.2 Offshore wind energy

¶1 The 2025 SNA and SEEA-Energy classify wind energy resources as a type of renewable energy resource distinct from mineral and energy resources¹³.

¶2 Key accounting considerations:

- ¶3 **Income attribution – floating wind installations**. By convention, income streams from offshore renewable energy capture are attributed to the value of underlying seabed assets¹⁴. For floating installations without fixed seabed attachment, this convention is methodologically problematic. Compilers should distinguish two treatments:
 - ¶4 *Provisional recording convention (workaround)*: Record floating installations in the spatial unit corresponding to the licence or lease area, and attribute income streams to seabed assets within that area. This is **explicitly a workaround**, not a settled method.
 - ¶5 *Preferred future treatment*: Attribute floating wind income to a distinct “offshore wind resource” asset class reflecting the wind resource and licence. This treatment is not yet standardised.

Compilers must document in account metadata which treatment has been applied. A formal issue has been submitted to the UNSD SEEA expert group. Compilers should monitor outcomes through UNSD and UNCEEA.

- ¶6 **Fixed asset accounts** – Wind turbines, foundations, and transmission infrastructure are recorded as produced fixed assets with depreciation over their operational life.
- ¶7 **Capacity factors** – Physical accounts should record both installed capacity (MW) and actual generation (MWh), as capacity factors for offshore wind typically range from 35–50%.

- ¶8

Cable infrastructure and indicative useful lives – Array cables and export cables have different asset lives and ownership structures and should be recorded as separate asset classes where data permit. Table 3.1 provides indicative useful life parameters^{5, 15}.

Table 3.1: Indicative useful life parameters for offshore wind asset classes

Asset class	Indicative useful life (years)
Wind turbine and tower	20–25
Monopile / jacket foundation	25–30
Array cable	20–25 (aligned with turbine life)
Export cable	30–40 (may serve multiple wind farm generations)
Offshore substation	25–30

(References to be confirmed – see Section 5.)

3.1.3 Wave and tidal energy (emerging)

¶1 The FDES defines renewable energy sources to include “tidal action, wave action, marine (non-tidal currents, temperature differences and salinity gradients)”¹⁶.

¶2 Two distinct tidal energy technologies should be distinguished. **Tidal range** (barrages and lagoons) creates large spatial footprints and significant estuarine ecosystem impacts. **Tidal stream** (underwater turbines) has smaller spatial footprints but potential collision and noise impacts on marine fauna. These technologies differ substantially in their spatial, ecological, and economic characteristics and should be recorded separately.

¶3 Accounting for emerging marine energy technologies should:

- ¶4 Track pilot and demonstration installations separately from commercial operations
- ¶5 Record research and development expenditure as gross fixed capital formation per SEEA-Energy guidance
- ¶6 Monitor installed capacity growth to inform energy transition scenarios

3.2 Compilation Procedure for Offshore Energy Accounts

Step 1: Data collection and source identification

¶1 Assemble the data sources catalogued in Section 2.3 to measure opening stocks, production flows, additions, reductions, and closing stocks for each energy type. Data quality should be assessed following **TG-0.7 Quality Assurance**, with particular attention to temporal consistency, spatial coverage, and measurement uncertainty.

Step 2: Classification and mapping to asset categories

¶1 Map source data to SEEA CF asset categories:

- ¶2 **Mineral and energy resources** (offshore oil and gas) – Class A (commercially recoverable), Class B (potentially commercial), and Class C (non-commercial)
- ¶3 **Renewable energy resources** (wind, wave, tidal) – classified separately from mineral resources following 2025 SNA treatment

¶4 Physical accounts record stocks in natural units (barrels, cubic metres, MW installed capacity, MWh generation). Monetary accounts record net present value of expected resource rents (for oil and gas) or income streams attributed to seabed assets (for renewable installations).

Step 3: Physical supply and use table compilation

¶1 Physical energy supply and use tables (PSUT) follow SEEA-Energy Chapter 3⁴.

¶2 **Supply table** records: (1) production from offshore oil and gas fields (by spatial unit and field), (2) production from offshore renewable installations (by technology and location), and (3) imports of offshore-produced energy where relevant for transboundary accounting.

¶3 **Use table** records: (1) intermediate consumption within offshore operations (platform electricity, flaring losses), (2) exports of offshore-produced oil, gas, and electricity, and (3) final consumption of offshore renewable electricity by domestic users.

¶4 The balanced PSUT provides the foundation for deriving energy self-sufficiency indicators, emission intensity by fuel type, and renewable energy share indicators feeding into **TG-2.8 Climate Indicators**.

Step 4: Monetary supply and use table compilation

¶1 Monetary supply and use tables enable calculation of gross value added, compensation of employees, and gross operating surplus for offshore energy industries. These measures feed into **TG-2.5 Ocean Economy Structure**.

¶2 Key valuation considerations:

- ¶3 Oil and gas production is valued at wellhead prices (excluding transport and processing margins)
- ¶4 Offshore renewable electricity is valued at wholesale market prices or feed-in tariff rates
- ¶5 Gross value added is calculated as output minus intermediate consumption
- ¶6 For non-renewable resources, **resource rent should be calculated separately** from consumption of fixed capital on produced assets, using the net price or user cost method per SEEA-Energy Chapter 6¹¹. See Section 3.7 for a worked example.

Step 5: Asset account compilation

¶1 Asset accounts track opening stocks, additions, reductions, reappraisals, and closing stocks. For offshore oil and gas, depletion of the mineral resource is recorded **separately** from consumption of fixed capital on produced assets. Conflating the two is a methodological error that SEEA-Energy Chapter 6 explicitly cautions against¹¹. For offshore renewable resources, there is no depletion, and asset value derives from the stream of future income attributed to the seabed lease or licence.

Step 6: Integration with national accounts and balance sheets

¶1 Integration ensures that:

- ¶2 **Depletion entries** in asset accounts correspond to depletion costs in production accounts and adjustments to net domestic product (see **TG-1.1 National Ocean Budgets**)
- ¶3 **Extraction entries** correspond to natural resource inputs in physical supply-use tables
- ¶4 **Investment in offshore infrastructure** is recorded as gross fixed capital formation in produced assets
- ¶5 **Environmental impact entries** in ecosystem condition accounts are consistent with offshore energy spatial footprints

3.3 Spatial Footprint Accounting

3.3.1 Seabed occupation

¶1 Spatial accounts should record:

¶2 **Direct footprint** – The physical area occupied by: (1) platform jackets and foundations (oil/gas), (2) monopile, jacket, or floating foundations (wind), (3) anchoring systems and mooring lines, and (4) subsea infrastructure (wellheads, manifolds, templates).

¶3 **Cable corridors** – Export cables require seabed rights-of-way. UNCLOS Article 79 establishes that all States are entitled to lay submarine cables on the continental shelf, subject to coastal State jurisdiction over cables connected to installations¹⁷. Cable landfall and onshore substation accounting are addressed in **TG-6.11 Coastal Infrastructure**.

3.3.2 Exclusion and safety zones

¶1 UNCLOS Article 60 permits coastal States to establish safety zones extending up to 500 metres from each point of the outer edge of offshore installations¹⁸. These zones effectively exclude commercial fishing, navigation, anchoring, and other seabed development.

¶2 Spatial accounts should record both the **statutory exclusion area** (defined by regulatory designation) and the **effective exclusion area** (observed through AIS vessel tracking data showing actual avoidance patterns). For guidance on using AIS and satellite data to delineate effective exclusion zones, see **TG-4.1 Remote Sensing Data**.

¶3 **Tier 1 fallback (no AIS processing capacity)**. Compilers may estimate the effective exclusion area by applying an empirical multiplier to the statutory 500 m safety zone area. The AIS-derived method remains preferred. Compilers must document in account metadata which method has been used and, where the multiplier is applied, the assumed value.

3.3.3 Integration with marine spatial planning

¶1 Offshore energy spatial data should be compiled as georeferenced polygon layers showing lease/licence boundaries, infrastructure locations, cable routes, safety/exclusion zones, and planned development areas, consistent with formats in **TG-1.2 Marine Spatial Planning**.

3.4 Environmental Impact Recording

¶1 The quantitative treatment below links physical impact measurements to the condition variables defined in SEEA Ecosystem Accounting, so cumulative impacts flow through to ecosystem condition assessments. For general ecosystem condition accounting methodology, see **TG-3.1 Asset Accounts**.

¶2 *Table 3.2: Offshore energy environmental impact comparison*

Impact Type	Oil & Gas	Offshore Wind	Tidal/Wave
Seabed disturbance	Platform footprint	Foundation footprint	Device anchoring
Underwater noise	Drilling, operation	Construction (piling)	Operation (low)
Collision risk	Low (platforms visible)	Bird/bat collision	Marine mammal
Pollution risk	Spills, discharges	Low (no fuel)	Low
Decommissioning	Complex, costly	Simpler	Emerging
Account treatment	Depletion of minerals	No depletion	No depletion

3.4.1 Underwater noise

¶1 Offshore energy activities generate underwater noise during construction (pile driving), operation (machinery, vessel traffic), and decommissioning¹⁹.

¶2 **Source characterisation** – Record noise source levels, frequencies, and temporal patterns by activity type and location as supplementary physical data tables linked to the relevant spatial unit and time period.

¶3 **Receptor mapping** – Identify noise-sensitive marine species, particularly marine mammals and fish. UNCLOS Article 65 requires States to cooperate for the conservation of marine mammals, with cetaceans receiving particular attention²⁰.

¶4 **Impact pathways** – Link noise exposure to ecological outcomes including behavioural disturbance, masking, temporary or permanent hearing threshold shifts, and physical injury. Document as condition indicators within ecosystem condition accounts.

¶5 **Data sources.** Use **regulatory monitoring data** (where available under national marine noise management frameworks) or **published acoustic modelling results** from environmental impact assessments. For European jurisdictions, EU Marine Strategy Framework Directive descriptor D11 (Commission Decision (EU) 2017/848²¹) provides the regulatory baseline.

¶6 TNFD metrics for noise pollution²² are designed for corporate site-level disclosure and should **not be aggregated directly across operators to derive national-level indicators**, for three reasons:

- ¶7 measurement methodologies are not standardised across companies
- ¶8 “noisiest part of day” is a peak rather than period-average metric
- ¶9 TNFD disclosures are voluntary and incomplete

3.4.2 Electromagnetic fields (EMF)

¶1 Subsea power cables generate electromagnetic fields that may affect electroreceptive marine species (sharks, rays, some crustaceans). Research remains limited. Current accounting practice should:

- ¶2 Record cable specifications (voltage, current, burial depth, shielding) as supplementary physical data
- ¶3 Map cable routes in relation to sensitive habitats using georeferenced data
- ¶4 Monitor and report any observed behavioural effects as condition indicators where monitoring data are available

3.4.3 Habitat modification

¶1 **Substrate introduction** – Hard structures create artificial reef habitat in otherwise soft-sediment environments. The IUCN Global Ecosystem Typology classifies “Submerged artificial structures” (M4.1) as a distinct ecosystem type²³. Compilers should record the introduction of hard substrate as a change in ecosystem type within extent accounts (from soft-sediment benthic to M4.1), whilst noting that the ecological value of artificial habitat may differ substantially from natural reef. For general guidance on ecosystem extent accounting, see **TG-3.1 Asset Accounts**. For coral reef regions, see **TG-6.1 Coral Reef Accounts**.

¶2 **Sediment disturbance** – Installation and cable burial activities disturb seabed sediments, potentially releasing contaminants and altering benthic communities. Record as condition changes in affected spatial units.

¶3 **Hydrodynamic changes** – Large arrays of offshore structures may alter local currents, wave patterns, and sediment transport²⁴. Compilers should record observed hydrodynamic changes in the minimum supplementary table below, drawing on satellite altimetry, HF radar, and in situ monitoring described in **TG-4.1 Remote Sensing Data**.

¶4 *Table 3.3: Minimum supplementary table for offshore wind hydrodynamic impact recording*

Field	Description
Installation ID	Unique identifier for the wind array
Monitoring period	Reporting year and reference baseline period
Current velocity change	% change from baseline at specified depth
Wave height reduction	% change in lease area
Sediment transport indicator	Qualitative: increased / reduced / unchanged
Source	Model output or in situ observation

Field	Description
Uncertainty rating	Low / medium / high

3.4.4 Collision risk

¶1 **Seabirds** – Offshore wind turbines present collision risk for migratory and foraging seabirds. Empirical evidence suggests mortality rates for offshore installations are generally lower than for onshore wind, though considerable uncertainty remains in population-level estimates. Impact assessment should adopt precautionary approaches, clearly distinguishing observed mortality from modelled estimates.

¶2 **Marine mammals** – Vessel traffic associated with offshore energy operations increases collision risk for cetaceans and pinnipeds. Record as pressure indicators in ecosystem condition accounts.

¶3 **Fish and invertebrates** – Entrainment in cooling water intakes may impact fish populations. Tidal stream devices present potential collision risk for marine mammals and large fish species.

3.5 Decommissioning Accounting

3.5.1 Asset retirement framework

¶1 The SEEA Central Framework distinguishes between terminal costs and remedial costs for fixed asset disposal²⁵:

¶2 **Terminal costs** are anticipated during production periods and should be provisioned through consumption of fixed capital allowances over the asset's life. Examples include removal of platform topsides and jackets, plugging and abandonment of wells, cable removal or burial, and site clearance surveys.

¶3 **Remedial costs** are incurred after operations cease, often by parties other than the original operator: cleanup of contaminated seabed sediments, long-term monitoring of residual structures, and rehabilitation of impacted habitats.

¶4 The 2025 SNA glossary defines terminal costs as “costs incurred on the disposal of an asset or at the end of its service life” covering “de-installation and decommissioning costs (in case of oil rigs or nuclear power stations) or rehabilitation costs of land sites”²⁶.

¶5 **Orphaned infrastructure**. For account purposes, an installation is classified as **orphaned** where:

¶6 (a) the registered operator or licence holder no longer exists as a legal entity; or (b) the operator exists but has formally disclaimed decommissioning responsibility, and a court or regulatory determination has assigned liability to the state; or (c) the installation has been abandoned without regulatory notification and the operator cannot be located.

¶7 Orphaned installations should be identified separately in supplementary tables and recorded as **government-held contingent liabilities**, consistent with the 2025 SNA treatment of contingent liabilities²⁷. Where the liability is **probable and the remediation cost can be reliably estimated**, the estimated cost should be recorded as a government provision. Where the government subsequently incurs remediation expenditure, record as gross fixed capital formation (land improvement asset) or intermediate consumption (ongoing environmental protection), as applicable.

3.5.2 Rigs-to-reefs programmes

¶1 Some jurisdictions permit partial decommissioning where platform structures are left in place as artificial reefs. Research indicates that “more than 500 oil and gas platforms were decommissioned and left as artificial reefs in US waters since 1940” with “more than 600 in the Asia-Pacific alone” as candidates for reefing²⁸.

¶2 **This Section owns the treatment of submerged artificial structures for the publication.** The rule below is written for rigs-to-reefs conversions but applies to any placed structure that acquires confirmed ecological function, wherever it sits: breakwaters, groynes and artificial reefs inside the territorial sea are recorded the same way (**TG-6.11 Coastal Infrastructure Accounting** Section 3.4.1), and a structure colonised by reef-building corals is still M4.1 and not an addition to M1.3 photic reef extent (**TG-6.1 Coral Reef Accounting** Section 3.1).

¶3 Accounting treatment follows a three-step recording sequence consistent with SEEA EA extent account transition rules²⁹:

1. ¶4 **On legal decommissioning:** Record write-down of the oil and gas infrastructure asset as an **other change in volume of produced assets**, removing the platform from the produced asset stock.
2. ¶5 **On regulatory confirmation of reef designation:** Record introduction of an **IUCN GET M4.1** ecosystem extent entry, with area equal to the **structure footprint plus a defined ecological halo** (typically 50–100 m radius from the structure). The statutory 500 m exclusion zone must not be used as the M4.1 extent area, as it substantially overstates the area of active ecological function.
3. ¶6 **In subsequent periods:** Update ecosystem condition variables (species diversity, biomass density, structural integrity) as monitoring data become available. No circular in this edition covers M4.1 condition measurement: select variables under **TG-4.8 Physical Condition Measurement** and **TG-4.9 Biological Condition Measurement**. The benthic cover and structural complexity metrics in **TG-6.1 Coral Reef Accounting** Section 3.2 are a usable analogue for the biological variables, but the reference condition for a submerged artificial structure is not a natural reef and must be set on its own terms.

¶7 If reef designation is subsequently revoked or the structure fails to develop confirmed ecological function, the M4.1 extent entry should be **reversed** as an other change in volume of ecosystem assets in the period of revocation.

¶8 In addition, compilers should:

- ¶9 record the reduction in decommissioning liability (terminal cost avoided)
- ¶10 track any payments to or from regulatory authorities
- ¶11 account for any ongoing maintenance or monitoring obligations

¶12 Note that oil and gas infrastructure left as artificial reefs “is more exposed to light/noise/chemical pollution associated with operations as well the spread of invasive species” compared to purpose-built artificial reefs³⁰. This pollution legacy should be reflected in the condition assessment of converted structures.

3.5.3 Remediation expenditure

¶1 Where decommissioning reveals contamination or environmental damage, remediation expenditure should be recorded as:

- ¶2 **Gross fixed capital formation** when creating a land improvement asset (remediated site)
- ¶3 **Intermediate consumption** when representing ongoing environmental protection activities

¶4 SEEA-Energy notes that expenditures on decommissioning represent one area where economic response to environmental issues can be highlighted³¹. The same principle applies to offshore oil and gas decommissioning, which may be recorded as environmental protection expenditure within thematic and extended accounts.

3.6 Energy Transition Accounting

3.6.1 Fossil to renewable transition

¶1 **Asset revaluation** – Declining demand for fossil fuels may reduce the economic value of oil and gas reserves, recorded as downward reappraisals in physical asset accounts and revaluations in monetary accounts.

¶2 **Infrastructure repurposing** – Some offshore oil and gas infrastructure may be converted for renewable energy use (platforms as wind turbine bases, pipelines for hydrogen transport, wellbore infrastructure for geothermal extraction). Record the reclassification as other changes in volume of assets, noting both the write-down of the original asset and the acquisition of the repurposed asset.

¶3 **Workforce transition** – Employment shifts from fossil fuel to renewable sectors should be tracked through labour accounts linked to ISIC industry classifications. See **TG-3.5 Social Accounts**.

3.6.2 Stranded asset treatment

¶1 The IFRS S2 Climate-related Disclosures standard requires disclosure of “the amount and percentage of assets or business activities vulnerable to transition risks”³². In SEEA terms, stranded assets are recorded as:

- ¶2 **Downward reappraisals** (Class A to Class B/C) for resource reclassification
- ¶3 **Other changes in volume of assets** for unexpected retirements
- ¶4 **Write-offs** for exploration expenditure on abandoned projects

¶5 **Recognition timing**. The SEEA Central Framework requires that revaluations be recorded “when the event causing the change is recognized” (para. 5.94)³³. Table 3.4 sets out recognition criteria by trigger type.

¶6 *Table 3.4: Stranded asset recognition criteria by trigger type*

Trigger type	Period of recording	Supporting documentation
Policy announcement	Period in which binding legislation or regulation is enacted (not at consultation or political announcement stage) ³⁴	Citation of enacted legislative or regulatory instrument
Market signal	Period after the commodity price has been below the cost of extraction for two consecutive annual average periods and no recovery is expected ³⁵ , ³⁶	Annual average price series and extraction cost reference
Physical event	Period of the physical event ³⁷	Incident report and reference to asset condition assessment

¶7 Documentation should follow **TG-0.7 Quality Assurance** standards.

3.6.3 Carbon and climate accounting

¶1 **Emissions** – Fossil fuel extraction generates direct emissions (flaring, venting, fugitive methane) and enables downstream emissions from combustion. For recording these flows, see **TG-3.4 Flows from Economy to Environment**.

¶2 **Carbon storage (CCS)** – Some depleted offshore reservoirs may be repurposed for carbon capture and storage. CCS accounting remains an open methodological question awaiting UNSD resolution, including whether stored carbon represents negative extraction, a new asset type, or an environmental protection service. Compilers in jurisdictions with operating offshore CCS projects (notably Norway, the UK, and Australia) should populate the provisional supplementary table below, drawing on the OSPAR CCS reporting framework³⁸ and IEA CCUS Projects Database³⁹.

¶3 *Table 3.5: Provisional supplementary table for offshore CCS recording (pending standardisation)*

Field	Unit / format
Reservoir ID	Unique identifier
Location (BSU)	Basic Spatial Unit reference
Storage capacity	Mt CO2
Cumulative injections to period start	Mt CO2
Injections during period	Mt CO2
Monitoring / verification expenditure	USD
Ownership structure	Operator, equity shares, public/private

¶4 **Avoided emissions** – Offshore renewable energy displaces fossil fuel generation, contributing to emission reductions counted in national inventories. For SDG indicator 12.c.1 compilation from offshore energy accounts, see **TG-2.10 MEA Indicators**⁴⁰.

3.7 Worked Example: Synthetic Offshore Energy Account

Scenario description

¶1 The accounting area is a coastal State's EEZ containing one mature offshore oil field and one operational offshore wind farm. The accounting period is calendar year 2025.

¶2 Offshore oil field parameters:

- ¶3 Total recoverable reserves (Class A): 200 million barrels
- ¶4 Development cost (GFCF): USD 15,000 million
- ¶5 Annual extraction rate: 20 million barrels
- ¶6 Expected production life: 10 years
- ¶7 Oil price (central case): USD 85/barrel; sensitivity range USD 70–100/barrel
- ¶8 Annual operating expenditure: USD 800 million
- ¶9 Estimated decommissioning cost: USD 2,000 million

¶10 Offshore wind farm parameters:

- ¶11 Installed capacity: 500 MW
- ¶12 Capacity factor: 0.42
- ¶13 Annual generation: 1,839,600 MWh
- ¶14 Design life: 25 years
- ¶15 Construction cost (GFCF): USD 2,500 million
- ¶16 Annual O&M expenditure: USD 50 million
- ¶17 Wholesale electricity price: USD 80/MWh

Physical asset account for oil field (stock in million barrels)

Accounting entry	Value
Opening stock (1 Jan 2025)	200
Additions to stock	
Discoveries	0
Upward reappraisals	0
<i>Total additions</i>	0
Reductions in stock	
Extraction	20
Downward reappraisals	0

Accounting entry	Value
Total reductions	20
Closing stock (31 Dec 2025)	180
Derived measures	
Depletion (extraction for non-renewable resource)	20

¶1 Table 3.6: Physical asset account for offshore oil field, 2025

Resource rent calculation (net price method, central case USD 85/barrel)

Item	Value (USD million)
Gross output (20M bbl × USD 85)	1,700
less: Intermediate consumption (operating costs)	800
less: CFC on development infrastructure (USD 15,000M / 10 yr)	1,500
less: Return to produced capital (assumed 4% of net capital stock, indicative)	300
Resource rent (net price method)	-900
Memo: Unit resource rent per barrel	-45.0

¶1 Table 3.7: Resource rent supplementary calculation, oil field 2025 (central case USD 85/barrel)

¶2 At the central case price, resource rent is negative, as the mature field's development cost is high relative to current gross output. Where resource rent is non-positive, depletion is recorded as zero and the field's monetary asset value is held under review for downward reappraisal.

Monetary account for oil field (values in million USD, annual; central case USD 85/barrel)

Monetary flow	Annual value
Gross output (20M bbl × USD 85)	1,700
Intermediate consumption (operating costs)	800
Gross value added	900
Consumption of fixed capital and depletion	
of which: CFC on development infrastructure (USD 15,000M / 10 yr)	1,500
of which: Decommissioning provision (USD 2,000M / 10 yr)	200
of which: Mineral resource depletion (per resource rent, Table 3.7)	0
Total CFC and depletion	1,700
Net value added	-800

¶1 Table 3.8: Production account for offshore oil field, 2025 (central case USD 85/barrel)

Price sensitivity for net value added

¶1 Table 3.9: Price sensitivity – net value added, oil field 2025 (USD million)

Oil price (USD/bbl)	Gross output	GVA	CFC + depletion	Net value added
70	1,400	600	1,700	-1,100
85 (central)	1,700	900	1,700	-800
100	2,000	1,200	1,700	-500

¶2 Mature offshore fields with high development cost may report negative net value added across a wide range of price assumptions. This reflects depreciation of large past development capital,

decommissioning provisioning, and a mature-life production profile. Compilers should report results alongside the resource rent calculation and price-sensitivity range.

¶3 **Decommissioning provision:** Terminal costs of USD 2,000 million are provisioned over the 10-year production life at USD 200 million per year, recorded as part of consumption of fixed capital. If actual decommissioning costs in Year 11 exceed the provision (e.g., USD 2,500 million due to unexpected contamination), the excess USD 500 million is recorded as remedial costs in the period incurred.

Physical supply account for offshore wind (energy in MWh)

Physical flow	Year 1	Year 2	...	Year 25
Installed capacity (MW)	500	500	...	500
Actual generation (MWh)	1,839,600	1,839,600	...	1,839,600
Capacity factor	0.42	0.42	...	0.42

¶1 Table 3.10: Physical supply account for offshore wind, 2025

Monetary account for offshore wind (values in million USD, annual)

Monetary flow	Annual value
Gross output (1,839,600 MWh × USD 80)	147.2
Intermediate consumption (O&M)	50.0
Gross value added	97.2
Consumption of fixed capital (USD 2,500M / 25 yr)	100.0
Net value added	-2.8

¶1 Table 3.11: Production account for offshore wind, 2025

¶2 Any subsidies received (feed-in tariffs, renewable energy certificates) should be recorded as current transfers in the distribution of income account.

¶3 **Wind wholesale price sensitivity.** The USD 80/MWh central case sits at the lower end of European 2024–25 offshore wind strike prices (USD 90–130/MWh typical). Benchmark prices should be sourced from IRENA LCOE data or published Contracts for Difference (CfD) strike prices for the relevant jurisdiction⁴¹.

¶4 Table 3.11a: Price sensitivity – net value added, offshore wind farm 2025 (USD million)

Wholesale price (USD/MWh)	Gross output	GVA	CFC	Net value added
70	128.8	78.8	100.0	-21.2
80 (central)	147.2	97.2	100.0	-2.8
90	165.6	115.6	100.0	15.6
110	202.4	152.4	100.0	52.4

¶5 At USD 90/MWh or above the wind farm reports positive net value added, and compilers should document the price source in account metadata.

Spatial footprint summary

Spatial measure	Oil field	Wind farm
Lease area	25 km ²	120 km ²
Direct seabed footprint	0.15 km ²	0.25 km ²
Statutory safety zones (500m)	0.79 km ²	62.8 km ²

Spatial measure	Oil field	Wind farm
Export cable corridor	0 km ² (subsea pipeline)	20.0 km ²
Effective exclusion area (from AIS)	1.2 km ²	140.0 km ²

¶1 *Table 3.12: Spatial footprint account for offshore energy installations, 2025. Safety-zone derivation: wind farm $\sim 80 \text{ turbines} \times \pi \times (0.5 \text{ km})^2 \approx 62.8 \text{ km}^2$; oil field 1 platform $\times \pi \times (0.5 \text{ km})^2 \approx 0.79 \text{ km}^2$.*

Environmental impact summary

Impact category	Oil field	Wind farm
Seabed disturbance	0.15 km ²	0.25 km ²
Underwater noise (construction)	180 dB re 1 μ Pa @ 1m (drilling)	190 dB re 1 μ Pa @ 1m (piling)
Pollution risk	2.5 million m ³ produced water	Low
Exclusion zone	0.79 km ²	62.8 km ²
GHG emissions (direct)	450,000 tonnes CO ₂ -eq	<5,000 tonnes CO ₂ -eq

¶1 *Table 3.13: Environmental impact account for offshore energy installations, 2025*

¶2 These impact indicators feed into the ecosystem condition accounts described in Section 3.4, and support cumulative impact assessment across multiple installations within a spatial unit.

Integration and upward connections

¶1 Upward linkages to policy:

- ¶2 **TG-1.1 National Ocean Budgets:** The USD 200 million decommissioning provision represents a fiscal liability. Monetary depletion of oil reserves (calculated via resource rent applied to the 20 million barrels extracted) represents natural capital drawdown deducted from gross income to calculate environmentally adjusted net domestic product.
- ¶3 **TG-2.8 Climate Indicators:** Direct emissions of 450,000 tonnes CO₂-eq from the oil field contribute to national greenhouse gas inventories. The 1.84 TWh of offshore wind generation displaces approximately 900,000 tonnes CO₂-eq of fossil generation (assuming grid emission factor of 0.5 kg CO₂/kWh).
- ¶4 **TG-1.8 Project Finance:** Total investment of USD 2,500 million against annual revenue of USD 147 million illustrates project finance challenges where long payback periods and policy support requirements create financing gaps addressable through blue bonds or sustainability-linked loans.

¶5 Cross-account consistency:

- ¶6 Oil extraction of 20 million barrels corresponds to extraction recorded in physical supply-use tables
- ¶7 Monetary depletion of oil reserves corresponds to adjustments in monetary asset accounts
- ¶8 Offshore wind generation of 1.84 TWh flows into national energy balance tables
- ¶9 Spatial footprints are consistent with marine spatial planning databases

4. Worked Example Cross-References

¶1 Cross-references for the worked example (Section 3.7) and integration with upstream and downstream circulars are provided in the relevant subsections of Section 3 and Section 1.2. The compilation procedure (Section 3.2) and the data sources (Section 2.3) define the practical workflow for compiling offshore energy accounts.

5. Coordination Considerations

¶1 Effective offshore energy accounting requires coordination between national statistical offices, energy ministries, environment ministries, maritime authorities, industry associations, and regional bodies (including bilateral coordination on unitisation of transboundary reservoirs as set out in Section 3.1.1).

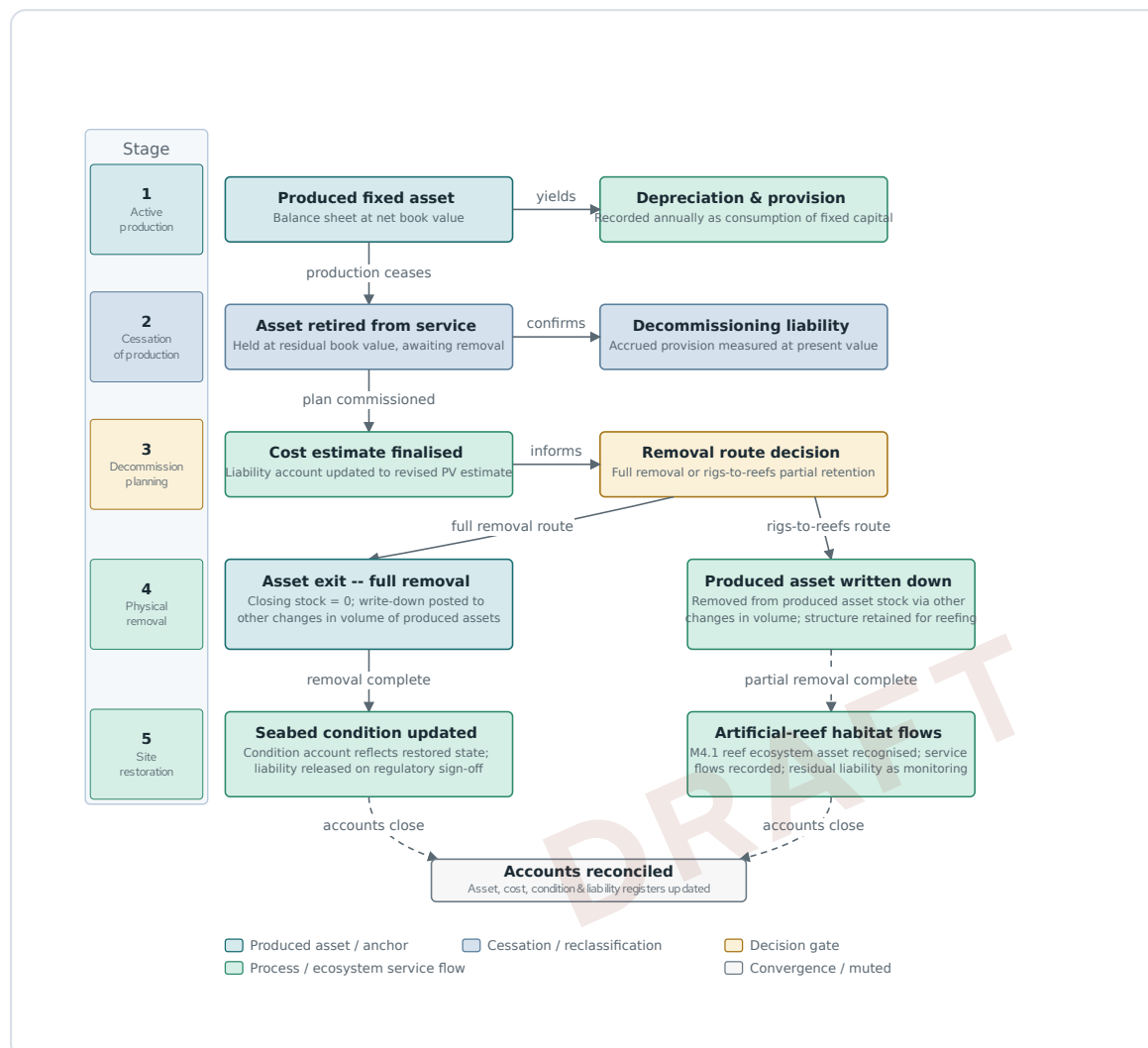


Figure 6.9.1 Five-stage offshore decommissioning sequence linking each stage to produced-asset exit, liability recognition, or artificial-reef reclassification.

Source: TG-6.9 draft, decommissioning treatment (stages, account entries, and liability provisions); 2025 SNA Glossary (definition of terminal costs); SEEA CF (2012) §4.194--4.209 (terminal vs remedial costs); IMO Resolution A.672(16) (guidelines for abandonment of offshore installations); OSPAR Decision 98/3 (disposal of disused offshore installations in the OSPAR maritime area); SEEA EA (2021) Ch. 4 (ecosystem extent transitions) and condition accounts (restoration).

6. Acknowledgements

¶1 **Authors:** [To be confirmed]

¶2 **Reviewers:** [To be confirmed]

7. References

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3. ¶3 SEEA-Energy (2019), Chapter 1, paragraphs 1.1–1.24. Introduction to SEEA-Energy, including scope, policy relevance, and relationship to IRES and SNA.
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5. ¶5 2025 SNA, paragraphs 11.199–11.202 (renewable energy resource classification) and paragraph 11.85 (other structures including offshore installations). *Paragraph numbers to be verified against the final published 2025 SNA text.*
6. ¶6 UNCLOS (1982), Articles 56, 60, 76–79. Sovereign rights over continental shelf resources and regulation of offshore installations.
7. ¶7 Additional regulatory context is provided by: IMO MARPOL Convention and London Protocol (discharge accounting and decommissioning at sea); OSPAR Convention (North-East Atlantic offshore installation management); IFRS S2 and TNFD frameworks (corporate sustainability disclosures); and IEA, IRENA, and UNSD/UNCEEA work programmes.
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0. ¶10 SEEA Central Framework (2012), paragraphs 5.170–5.185 (application of UNFC-2009 for categorizing mineral and energy resources) and paras 5.170–5.195 on monetary valuation of mineral and energy resources. *Upper bound of paragraph range to be verified against the published SEEA CF PDF.*
1. ¶11 SEEA-Energy (2019), Chapter 6. Monetary asset accounts for mineral and energy resources using net present value approaches; net price and user cost methods for resource rent; distinction between consumption of fixed capital on produced development infrastructure and depletion of the mineral resource.
2. ¶12 SEEA Central Framework (2012), paragraph 5.93. Treatment of shared mineral and energy resources in national asset accounts.
3. ¶13 2025 SNA, paragraph 11.202. “For renewable energy resources, the following breakdown is recommended: (i) wind energy resources; (ii) solar energy resources; (iii) water energy resources; (iv) geothermal energy resources; and (v) other renewable energy resources.”
4. ¶14 SEEA Central Framework (2012), paragraph 5.231. “By convention, the value of income streams from these sources are attributed to the value of land.” *Paragraph number to be verified against the published SEEA CF PDF.*
5. ¶15 IRENA offshore wind asset-life data. *Document title and section/annex reference to be confirmed – IRENA (2023) “Offshore Wind Energy: Technology Overview” was not verified by websearch; correct IRENA source to be identified before final publication.*
6. ¶16 FDES (2013), paragraph 3.95. “Renewable energy includes solar, hydroelectric, geothermal, tidal action, wave action, marine (non-tidal currents, temperature differences and salinity gradients), wind and biomass energy.”
7. ¶17 UNCLOS (1982), Article 79. “Submarine cables and pipelines on the continental shelf.”
8. ¶18 UNCLOS (1982), Article 60. Safety zones “shall not exceed a distance of 500 metres around them, measured from each point of their outer edge.”
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