Service Carbon Footprints: A Methodology Guide

Calculating, Reporting and Using SCF Data in the Green Project Ecosystem

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Executive Summary

For companies in financial services, technology, professional services, and life sciences, purchased services often represent the majority of indirect spend. Spend-based estimates cannot track genuine performance: they respond to changes in spend, not emissions, and reflect sector averages rather than any specific supplier's operations. A supplier's corporate carbon footprint moves closer to primary data but remains at an aggregate level, not the emissions of the specific service being purchased. For companies with decarbonisation commitments, science-based targets, or regulatory obligations, both limitations are increasingly untenable.

ISO 14067, the Greenhouse Gas (GHG) Protocol Product Standard, and the Partnership for Carbon Transparency (PACT) Methodology all specify that services should be included in product-level carbon reporting, but none provides sufficient practical guidance to do so consistently. This methodology addresses that gap, setting out how to calculate, report, and use Service Carbon Footprints (SCFs): a per-unit emissions figure for a service, structured the same way as a product carbon footprint.

What an SCF measures. An SCF quantifies the greenhouse gas emissions associated with delivering one unit of a service: one consulting day, one room-night, one terabyte processed. The unit must specify what is delivered, in what quantity, at what quality level, and over what time period. A consulting hour delivered remotely carries a different footprint from one requiring international travel; without that context, the figure cannot be correctly interpreted or compared.

Setting the boundary. Three boundary options are set out: gate-to-gate (direct operations only), cradle-to-service-delivery (upstream inputs and capital goods included), and cradle-to-grave (full lifecycle). Boundary choices directly drive result uncertainty: different scope decisions produce incomparable SCFs even when the declared unit is identical. The draft European Union (EU) Product Environmental Footprint Category Rules (PEFCR) for hotel accommodation shows this clearly. The Product Category Rules (PCR) define one overnight stay as the declared unit and explicitly exclude food and beverage, spa, conference, and guest transport as separate services. Without that sector-level normalisation, two hotels could produce figures covering entirely different activities. Sector-specific alignment on what is in and out of scope is what makes SCFs interpretable, supplier-comparable, and credible to buyers. Capital assets, including buildings, IT infrastructure, and vehicles, require particular attention: their embodied footprint is typically material for service providers and cannot be excluded without explicit materiality testing.

Calculating the footprint. Two methods are presented. The **top-down corporate inventory approach** disaggregates an existing corporate GHG inventory to service level using a defined allocation hierarchy. It is faster and builds on data already held, making it appropriate as a first estimate. Its limitations are material: allocation is largely unavoidable, results are sensitive to driver selection, and SCF quality is capped by the parent inventory. The **bottom-up service inventory approach** builds the emissions ledger from operational activity data, replacing allocation with direct attribution wherever possible. It is more demanding but produces results that are auditable, lower in uncertainty, and suitable as primary data in a buyer's Scope 3 inventory. The two approaches are not mutually exclusive: top-down is the practical starting point, bottom-up is the target state.

Allocation. Shared infrastructure and overheads must be allocated across services using drivers that reflect physical causation: compute load for data centre energy, floor area for building energy, full-time equivalent (FTE) headcount for commuting and people-driven overheads. Economic proxies are a last resort. Allocation driver selection is one of the largest sources of SCF uncertainty: different defensible choices can produce materially different per-service results, and sensitivity analysis across plausible drivers is a required step, with assumptions disclosed.

Using SCFs. The PACT three-level framework, applied to services, ties calculation rigour to fitness for purpose. Level 1 (Indicative) SCFs are appropriate for identifying priority categories and informing supplier engagement. Level 2 (Robust) SCFs support supplier tendering, Scope 3 inventory reporting, and decarbonisation planning. Level 3 (SCF+) is required for formal supplier comparison, commercial claims, and external certification. SCFs can incorporate verified emissions reductions through certified instruments such as renewable energy certificates, provided each attribute is retired once and disclosed alongside the unadjusted figure. Level 1 SCFs should be refreshed annually; Level 2 and 3 are valid for up to three years, subject to recalculation if a material change shifts the figure by 10% or more.

Introduction

Services are the largest unmeasured category based on primary emissions data in most organizations' Scope 3 inventories. For companies in financial services, professional services, technology, and life sciences, service procurement frequently accounts for the majority of indirect spend. Yet the emissions embedded in those purchases remain largely estimated from spend-based proxies that cannot track performance, support supplier selection, or satisfy growing disclosure and decarbonization requirements.

The three most widely adopted product carbon footprint (PCF) standards (ISO 14067:2018 [ISO, 2018], the Greenhouse Gas Protocol (GHGP) Product Standard [GHGP, 2011a], and the Partnership for Carbon Transparency (PACT) Methodology v3.0 [PACT, 2024]) all recognize services as within scope. None provides the operational guidance needed to calculate them consistently. ISO 14067 establishes the legal and conceptual basis for service carbon footprints (SCFs) but does not resolve how to define functional units for heterogeneous services or allocate shared infrastructure. The GHGP Product Standard is similarly inclusive in principle; in practice, its worked examples and data quality guidance were built around physical goods. PACT v3.0 goes furthest: it introduces declared units for desk-based services (hours) and IT-related services (megabyte-seconds), and explicitly acknowledges that service spend represents a large and growing share of Scope 3 emissions. PACT itself describes this as a starting point, noting that sector-specific guidance will be needed to develop it further.

Three forces are making that development urgent. Regulatory requirements are expanding: the Corporate Sustainability Reporting Directive (CSRD), the Science Based Targets initiative (SBTi) Corporate Net-Zero Standard, and CDP all create accountability for value chain emissions, including purchased services. Supplier engagement programs that have matured around physical goods are now reaching service categories, and the methodology gap is increasingly visible. And spend-based emission factors, the current default for service emissions, are not credible as data quality expectations rise across Scope 3.

This paper builds on the foundation the three standards have established. It does not replace them. It develops the practical guidance they have not yet provided: how to define system boundaries and functional units for services, how to construct a service inventory from first principles or from a corporate greenhouse gas (GHG) inventory, how to apply allocation consistently across scope categories, and how to produce an SCF that can be verified, exchanged, and used as primary data in a buyer's Scope 3 calculation.

Functional Units and Service Carbon Footprints

Defining the Functional Unit

The functional unit (FU) is the quantified performance of a product system used as a reference unit [ISO, 2018; GHGP, 2011a]. A complete functional unit definition specifies four elements:

- **Function**: the service delivered (what)
- **Magnitude**: the volume or intensity of that service (how much)
- **Quality level**: the service-level specification (how well)
- **Duration or service life**: the time period over which the function is delivered (how long)

Services vary by quality, time, and context in ways physical goods typically do not, and this variation can dominate the carbon footprint result. An SCF for "one consulting day" means something very different depending on whether delivery is in-person (with associated travel) or remote, at a senior or junior level, on a client site or at the supplier's premises.

Standards Context

PACT (a project of the World Business Council for Sustainable Development (WBCSD), and developer of the Pathfinder Framework) has taken a first step toward normalizing SCF declared units for two broad service categories [PACT, 2024]:

- *Desk-based services* (consulting, legal, marketing): declared unit is time in hours (hr)
- *IT-related services* (software, SaaS): declared unit is usage in megabyte-seconds (Mb·s)

These two units provide a valuable interoperability baseline. In practice, the SCF result for a given unit will depend strongly on the quality and delivery context in which the service is provided, and reporting the unit alongside this context helps buyers interpret the result correctly.

This is particularly relevant for **desk-based services**, where the same nominal hour can be delivered in very different ways. A consulting hour delivered remotely from a low-carbon-grid office will typically have a different footprint to a consulting hour delivered on-site following a long-haul flight, with travel and on-site logistics often making up a significant share of the engagement's footprint. Reporting the hour together with delivery mode, seniority mix, and location helps the buyer understand which case they are purchasing.

Unfortunately many parts of the service economy: logistics, accommodation, manufacturing services, facilities management, and financial services sit outside these two declared units published by PACT, and would benefit from sector-appropriate functional units that reflect how customers actually consume the service.

Green Project's Approach

Service PCFs are interpretable only when the functional unit reflects how the customer actually consumes the service. Green Project proposes that a defensible SCF functional unit must specify all four of the following:

1. **Service outcome**: what is delivered (e.g., "one transaction processed", "one room-night occupied at defined service tier")
2. **Volume or intensity**: how much (e.g., number of transactions, room-nights per reporting period)
3. **Service level**: how well (e.g., SLA tier, occupancy class, quality standard)
4. **Time period**: how long or over what window (e.g., per month, per year, per event). A yearly average of a delivered unit of service is usually suitable in most instances.

The declared unit must be both trackable by the service provider in their operational data and recognizable to the downstream customer as the thing they purchased. This dual requirement eliminates units that are internally convenient but externally opaque, and units that are externally clear but operationally untraceable.

The Environmental Product Declaration (EPD) International Product Category Rules (PCR) for professional building cleaning services (PCR 2011:03 v4.0.1) illustrates all four elements in practice [EPD International, 2026]. The declared unit is **1 m² of surface kept cleaned over one year**. Cleaning frequency varies by contract but is excluded from the unit; the customer purchases maintained cleanliness over a fixed period, regardless of visit frequency. Non-floor surfaces (windows, doors) below 20% of total area are absorbed into the floor-area unit; above that threshold they are declared separately. Results must be reported by building type (schools, offices, hospitals) since emissions profiles differ materially between them. Together, these choices fully specify outcome (cleaned surface), volume (m²), quality tier (building type and surface type), and time period (one year), making the result comparable across providers and usable in a buyer's Scope 3 Category 1 inventory.

Candidate Functional Units by Service Category

Within the Green Project SCF calculator, the quality level, delivery mode, and reference period are defined alongside the functional unit. The shareable SCF data model includes a compulsory free-text **service level** field and a non-compulsory **delivery mode** field if applicable. In future updates to the PACT data model specification we propose that both metadata fields are included when the footprint export is for a service. This helps clarify functional units and ensures correct interpretation downstream. The table below presents indicative functional units reflecting how customers consume across the service economy. Alongside each unit, the table lists potential **quality / grade tiers** and **delivery modes** that can materially affect the SCF result.

Service Category	Functional Unit	Unit Symbol	Quality / Grade	Delivery Mode
Financial Services	Transaction	transaction		
Financial Services	Billable Hour	hr	Analyst / Associate / Senior / Partner	On-site / Remote / Hybrid
Financial Services	Person-day	person·day	Junior / Mid / Senior consultant	On-site at client / Remote / Hybrid
Financial Services	Service Hour	hr	Standard / Premium / Private-client	
Financial Services	Account–Year	account·yr	Basic / Premium / Private-wealth	
Digital Financial Services	Transaction	transaction		
Digital Financial Services	API Call	API call		
Digital Financial Services	Gigabyte Stored	GB_stored	Hot / Warm / Cold / Archive	
Digital Financial Services	Gigabyte Transferred	GB_transferred		
Digital Financial Services	vCPU-Hour	vCPU·hr		
IT / Cloud / SaaS / Digital	API Call	API call		
IT / Cloud / SaaS / Digital	Gigabyte Stored	GB_stored	Hot / Warm / Cold / Archive	
IT / Cloud / SaaS / Digital	Gigabyte Transferred	GB_transferred		
IT / Cloud / SaaS / Digital	vCPU-Hour	vCPU·hr		

Service Category	Functional Unit	Unit Symbol	Quality / Grade	Delivery Mode
Professional Services	Billable Hour	hr	Analyst / Consultant / Manager / Partner	On-site / Remote / Hybrid
Professional Services	Person-day	person·day	Junior / Senior / Principal	On-site / Remote / Hybrid
Accommodation	Room-night	room·night	Economy (≤3 star) / Mid-scale (4 star) / Luxury (5 star)	Limited-service / Full-service / All-inclusive
Hospitality	Meeting Space–Hour	m^2·hr		
Hospitality	Meal Served	meal	Casual / Fine dining	Dine-in / Takeaway / Delivery / Buffet / Banquet
Hospitality	Guest	guest	Standard / VIP	In-person / Self-service / Concierge
Logistics / Transport	Tonne-kilometre	t·km	Standard / Refrigerated / Load Type	Road (FTL/LTL) / Rail / Air / Sea / Multimodal
Logistics / Transport	Passenger-kilometre	pax·km	Economy / Premium economy / Business / First	Road / Rail / Air / Sea
Logistics / Transport	Vehicle-kilometre	veh·km	ICE diesel / ICE petrol / Hybrid / BEV	Owned fleet / Contracted / Last-mile / Long-haul
Facilities Management	m^2 Serviced–Year	m^2·yr	Basic / Standard / Premium / Critical-environment	On-site staffed / Mobile teams / Outsourced

Service Category	Functional Unit	Unit Symbol	Quality / Grade	Delivery Mode
Facilities Management	Service Hour	hr	Standard / Skilled trade / Specialist	On-site / On-call / Remote monitoring
Facilities Management	Equipment Serviced / Maintained	equipment	Preventive / Corrective / Predictive	On-site / Remote diagnostics / Hybrid
Manufacturing Services	Unit Output	units	Standard / Precision / Medical- or aerospace-grade	Make-to-stock / Make-to-order / Engineer-to-order
Manufacturing Services	Production Weight	kg	Commercial / Industrial / Critical-spec	In-house / Contract manufacturing / Toll processing
Manufacturing Services	Service Hour	hr	Operator / Skilled technician / Engineer	On-site / Job-shop / Customer-site
Construction Services	m² Constructed	m²		
Construction Services	Service Hour	hr		
Construction Services	Tonnes of Material Handled	tonne		
Other Services	Transaction	transaction		
Other Services	Person-day	person·day		
Other Services	m² Serviced / Managed	m²·yr	Basic / Standard / Premium	
Other Services	Unit Output	units		
Other Services	Service Hour	hr	Standard / Specialist	On-site / Remote / Hybrid

Service Carbon Footprints: System Boundaries

Boundary Patterns for Service Carbon Footprints

ISO 14067 permits carbon footprint studies designed for different applications; boundaries must match the study goal and be reported transparently [ISO, 2018]. The GHGP Product Standard similarly requires that boundary choices be documented and justified against the study's declared purpose [GHGP, 2011a]. For services, three boundary patterns are in common use:

- **Cradle-to-grave**: includes all upstream and downstream emissions related to service delivery, including end-of-life processes such as waste management, dismantling, and landfilling, both for the materials consumed in delivery and for the capital assets used to deliver it.
- **Cradle-to-service-delivery**: (labelled cradle-to-gate in product contexts) includes all upstream emissions related to service delivery: upstream purchased goods and services, capital assets, energy used during delivery, business travel, employee commuting, and upstream transportation and distribution. For services, this label is more precise than "cradle-to-gate" because service production and consumption are inseparable. Services are consumed as they are produced. The GHGP Product Standard makes this explicit: for a service, production and use may be combined into a single service delivery stage encompassing all operations required to complete the service, including materials, energy, and end-of-life considerations for any wastes and replaced parts [GHGP, 2011a]. The Scope 3 emissions associated with the end-of-life of capital assets can be excluded from scope and captured instead in a cradle-to-grave assessment.
- **Gate-to-gate**: focuses on the direct operations of service delivery (energy, fuels, refrigerants, waste, and business and service-related travel) and excludes both upstream purchased capital and non-capital goods and services and downstream customer emissions arising from use of the service. This boundary encapsulates emissions from the production and delivery of the service under the direct operational control of the service provider.

Worked Example: Hotel Accommodation Service

The draft EU Product Environmental Footprint Category Rules (PEFCR) for hotel accommodation (declared unit: one overnight stay) illustrates boundary scoping in practice [adelphi, 2026]. Activities excluded as outside the scope of the accommodation service include:

- *Other hotel services*: food and beverage, parking, laundry, pools, conference facilities (separate services with their own declared units)
- *Guest transport*: belongs in the guest's own Scope 3 inventory
- *Staff housing and transport; longer-stay or temporary accommodation; hotel grounds*

Under the cut-off rules, the boundary also excludes packaging waste from room set-up, common-area equipment, transport packaging for refill amenities, and fuel transport for on-site heat generation.

The PEFCR boundary spans the full cradle-to-grave lifecycle of the accommodation service across four stages:

Stage	In-scope processes
Capital goods supply	Building assembly (frame, systems, external elements, interiors); room equipment (furniture, textiles, electrical appliances); supply and transport of raw materials for both
Hotel room set-up	Room set-up operations; transport of goods to hotel; energy consumed during set-up
Hotel operation	Energy consumption; water withdrawal; wastewater discharge; solid waste; land occupation; refrigerant gases; consumables (single-use and refill items, transport to site); room and common-areas cleaning; laundry (in-house and external, including transport); wastes transport and recovery/disposal
End-of-life	End-of-life of building; end-of-life of room equipment; wastes transport and recovery/disposal

Each exclusion listed above is either a separate service, a guest-side emission, or below the materiality threshold; all exclusions must be documented with justification.

Worked Example: ICT Service

Where the hotel PEFCR draws a tight ring around a single facility, Information and Communications Technology (ICT) services demand a different scoping approach because the service is delivered through a network of interdependent goods rather than from one location. The International Telecommunication Union (ITU) Recommendation ITU-T L.1410 sets out the corresponding rules [ITU, 2024]. An ICT service boundary is built up from the boundary of the underlying ICT network (itself the sum of impacts from constituent ICT goods, support goods, and site infrastructure) with service-specific additions layered on top.

For an ICT service, in addition to the network goods and their supporting infrastructure, the boundary includes:

- *Application software development* and the impact of running the primary subscription service software

- *Data centres* where the service is operated: number of servers, storage, and network units; their energy consumption; and data centre overhead for cooling, power, and back-up systems (data centre **building construction** is optional)
- *Consumables and supportive products*, sales and logistics infrastructure
- *Associated travel and transport* beyond what is already captured in the underlying goods and networks
- *Service provider support activities*: offices, business travel, working environments

ITU-T L.1410 provides an **eight-item checklist** to structure data collection and avoid both gaps and double-counting:

#	Checklist item	What it covers
1	**ICT hardware**	Life cycle of ICT goods and networks (PCs, printers, base stations, core nodes); materials and energy
2	**ICT software**	Design, development, and use of individual software, packages, middleware, OS
3	**Consumables and supportive products**	Printouts, media, cartridges, and other items needed to use the ICT system
4	**Site infrastructure**	Energy consumption and building life-cycle emissions for ICT sites (base station sites, data centres) and associated cooling and power supply
5	**Transport (goods)**	Movement of non-ICT goods within the boundary (courier, deliveries); fuel and supply chains
6	**Travel (people)**	Commuting, professional travel, customer travel, depending on study scope
7	**Storage of goods**	Energy for cooling and lighting at storage sites for non-ICT items

#	Checklist item	What it covers
8	**Working environment**	Office buildings used by personnel: cooling, heating, lighting, equipment

Defining what is in scope

In both examples, in-scope boundaries are prescriptive. Having a sector-specific, normalized boundary scope is preferable because defining where the service boundary ends for a service can be opaque. In the hotel example above, one could very easily argue for the inclusion of ancillary services such as parking, spa, conference, food & beverage. But the function being performed here is strictly providing an overnight stay in a hotel room. Without a coalesced set of standards, practitioners would seek to include and exclude different business activities based on their own set of preferences. This reduces interoperability and transparency of disclosures within a sector.

In Green Project, our system boundary formation rules look as follows:

> ***Figure placeholder.*** *Turn below steps into chart. (diagram to be drawn)*

1. Is there a published Product Category Rule for this service? [YES/NO]
    - If [YES], align system boundary process scope with the published guidance
    - If [NO], proceed to step 2.
2. Construct a process map of your service and include all inputs including any ancillary services inputs that are used in the delivery of the service. Map all shared inputs and infrastructure if shared with other service products.
3. Calculate a screening SCF based via a spend based assessment to ascertain what inputs/processes can be cut from scope due to immateriality (aggregate exclusions capped at less than 3% of total cradle-to-gate emissions)
4. Refine system boundary based on screening results. Document system boundary, transparently outline inclusions and exclusions and the reasons for any exclusions.

A Note on Capital Goods

Capital goods are a consequential boundary decision specific to services. PACT states that manufacturing of production equipment, buildings, other capital goods, business travel, commuting, and R&D activities should generally be excluded from a PCF unless materially significant, with aggregate exclusions capped at less than 3% of total cradle-to-gate emissions [PACT, 2024]. For manufactured goods this exclusion is usually defensible: capital equipment contributes a small share of per-unit emissions when amortized across large production volumes.

For service providers the picture is different. Buildings, fit-out, vehicles, and ICT infrastructure typically can carry a large footprint relative to operational emissions. Applying the 3% exclusion rule without testing materiality would routinely produce an understated SCF. Capital goods must therefore be evaluated against the cut-off rule explicitly, and in most service SCF calculations they will need to be included.

When they are included, the accounting level determines the treatment. For corporate-level Scope 3 reporting, the GHGP Scope 3 Standard requires companies to account for the total cradle-to-gate emissions of purchased capital goods in the year of acquisition [GHGP, 2011b]. For product-level (per-service-unit) accounting, capital goods emissions should be amortised across the expected lifetime of the asset and allocated in proportion to the service's share of actual usage; otherwise the per-unit SCF becomes unstable and unrepresentative.

Service-Level vs Service-Client-Level System Boundaries

Two practical levels exist:

- **Service level**: a single SCF representing the average emissions per functional unit of the service across the full customer base. Appropriate for catalog services delivered to many customers under broadly comparable conditions (a SaaS product, a transactional banking service, a logistics route).
- **Service-client level**: a separate SCF per customer or per contract where delivery conditions vary materially between clients. Relevant for bespoke services such as professional engagements with client-specific travel, on-site staffing, or dedicated infrastructure.

Green Project's default position is service-level reporting. Three reasons drive this:

1. **Operational scope is contained.** Producing and maintaining a separate SCF for every customer multiplies the calculation, allocation, and disclosure workload at a point in the field's development where the underlying frameworks are still nascent.
2. **Audit and assurance requirements are proportionate.** A single service-level SCF is one verifiable record per service; a client-level approach creates a verifiable record per contract, with the associated documentation and review burden.
3. **Industry comparability is preserved.** SCF methodology is still consolidating. Reporting at the service level keeps results aligned with emerging PCRs and cross-sectoral standards, supports comparison between providers, and avoids fragmenting disclosures before the underlying conventions are settled.

Service-client-level reporting remains the right answer for genuinely bespoke services and the calculation infrastructure described in this paper supports it directly. As PCR coverage broadens and assurance practice for service-level SCFs matures, expect a move to more client and context specific calculations.

Allocation Methodology for Service Carbon Footprints

PCF standards require companies to avoid allocation wherever possible, through subdivision, redefinition of the unit of analysis, or system expansion. And when unavoidable, to allocate using underlying physical relationships. If physical relationships cannot be established, economic allocation or another justified basis may be used. Allocation methods must be applied consistently within the product life cycle and all choices disclosed with justification [ISO, 2018; GHGP, 2011a]. The PACT Methodology goes further, defining a rule-based mechanism for choosing between physical and economic allocation [PACT, 2024].

Allocation Unit Types

The choice of allocation unit is one of the most consequential decisions in an SCF calculation. Different allocation keys can produce substantially different footprint results. The unit(s) chosen must reflect a genuine causal relationship between the shared input and the services that consume it.

Four types of general allocation units are available for service carbon footprints:

- **Compute / Throughput**: captures physical processing activity: the work a service performs. Examples vary across sectors: tonne-kilometres for logistics, machine runtime or output mass for manufacturing, kilometres travelled or seat-kilometres for transport, vCPU-hours or data volume for IT and cloud services. Where it applies, compute/throughput is the strongest allocation driver because it links directly to the energy and resources consumed in delivering the service.
- **Space**: captures building use and the energy tied to it. Floor area and occupied room-nights are the natural drivers for accommodation, hospitality, and facilities management. Sectors where heating, cooling, lighting, and maintenance costs scale with physical footprint rather than activity volume. Space-based allocation is preferred over labor or economic drivers whenever the shared input is primarily a property or facility cost.
- **Labor**: captures human effort and the overhead it generates. For professional services, consulting, and financial services, worked hours or FTE headcount are the most causally grounded drivers. Labor-based allocation is also appropriate for Scope 3 Category 7 (employee commuting) across all service types, since commuting emissions scale with workforce size.
- **Economic**: allocation uses revenue or operating expenditure as a proxy when no physical relationship can be established. It reflects commercial scale, not physical causation, and should be treated as a last resort. Economic drivers distort results by attributing more emissions to high-margin services regardless of their actual resource consumption.

Allocation type	Examples	What it represents	Apply when...
Compute / Throughput	vCPU-hours, machine-hours, tonne-kilometres, API calls, mass of goods produced, tonnes of material handled	Physical processing activity	Input is process-intensive: vehicle fleet operation, manufacturing equipment, data centre energy, warehouse handling
Space	m², room-nights, floor area occupied, m² constructed	Building use and associated energy	Input is facility-related: facilities management
Labor	Hours worked, FTE headcount	Human effort and associated activities	Input is people-intensive: business travel, commuting, HR services, management overheads
Economic	Revenue, operating expenditure	Proxy relationship; use as fallback only	No physical causal relationship can be established. Flag explicitly and include in sensitivity analysis

Mixing allocation units within a single SCF inventory is acceptable and often necessary. What matters is consistency: the same driver must be applied to all line items within the same input category. Input categories can be defined by product classification (Green Project classifies all materials and services to the UNSPSC taxonomy), by internal spend account, or by scope category.

Input category approach	Example input	Classification / Code	Allocation driver
Product classification (UNSPSC)	Building cleaning services	76111500	m² floor area (Space)
Product classification (UNSPSC)	Cloud data processing	81112200	vCPU-hours (Compute)
Product classification (UNSPSC)	Air freight transport	78102200	t·km (Throughput)
Spend account (GL)	Office rent, utilities, cleaning	6100 – Facilities	m² floor area (Space)

Input category approach	Example input	Classification / Code	Allocation driver
Spend account (GL)	Cloud hosting, hardware leases	6200 – IT infrastructure	vCPU-hours / GB (Compute)
Spend account (GL)	Flights, rail, accommodation	6300 – Travel and subsistence	km by mode (Throughput)
Scope category	Upstream purchased services	S3.1 Purchased goods and services	Mass or units (Compute)
Scope category	Staff home-to-office travel	S3.7 Employee commuting	FTE headcount (Labor)
Scope category	Leased office buildings	S3.8 Upstream leased assets	m² occupied (Space)

The Green Project Allocation Prioritization Matrix

Cross-sectoral PCF standards (ISO 14067, GHGP Product Standard, PACT) prescribe *how* to allocate, not *which driver* to use for a given service-input pairing. Sector PCRs would close that gap; for most service categories they do not yet exist (see *The Case for Sector-Specific Category Rules* below), leaving practitioners conducting comparable studies to make different but equally defensible choices.

Green Project codifies its allocation choices to close this gap. The **internal allocation prioritization matrix** standardizes driver selection across studies, harmonizes approaches between comparable services, and provides an auditable reference for every allocation decision in an SCF. It resolves the allocation choice along three axes:

- **Service category**: the industry the SCF is being calculated for (Hospitality, Logistics, Professional Services, Manufacturing Services, etc.)
- **Product category**: the classification of the shared **input** requiring allocation (a purchased material, asset, or service), anchored to a structured taxonomy. Green Project uses the UNSPSC for materials and purchased services
- **Scope category**: the emission scope or sub-category being allocated (operations, S3.1 purchased goods, S3.6 business travel, S3.7 commuting, and so on)

Each cell of the matrix carries a ranked list of allocation units, from the most direct physical driver down to economic fallbacks. The same scope category can require different drivers depending on which input is being allocated and the service category receiving it. Conversely, some drivers are universal across service categories: Scope 3 Category 6 (business travel) takes distance travelled or mass.distance as the Rank 1 driver regardless of sector, and Scope 3 Category 7 (employee commuting) takes FTE headcount in the same way.

Where a sector PCR has been published, its allocation rules supersede the matrix and are applied directly. Where none exists, the matrix is used to select the highest-ranked allocation unit for which reliable operational data is available, applied consistently across comparable studies and product categories.

Example: IT / Cloud Services / SaaS Allocation Unit Rankings

Ranked allocation units for IT / Cloud Services: data centre and compute-driven inputs:

Rank	Allocation unit	Symbol	Driver type	Rationale
1	vCPU-hours provisioned	vCPU·hr	Direct	Data centre electricity scales directly with provisioned compute load.
2	Data processed / stored	GB	Direct	Storage and processing workload drives infrastructure energy; measurable from cloud provider dashboards.
3	Active users	users	Proxy	Approximates digital workload when compute or storage data are unavailable.
4	Revenue	$	Proxy	Reflects scale, not physical causation. Use when no operational data is available.
5	Operating expenditure	$ OpEx	Proxy	No causal relationship to compute load.

vCPU-hours and data volume correlate directly with energy consumed. Revenue and OpEx tell you nothing about which service actually ran the servers. A high-margin SaaS product could generate ten times more revenue per compute hour than a low-margin data pipeline, yet the two would receive equal emission attribution under economic allocation.

Worked illustration: two inputs, two drivers, three co-product services

A SaaS provider with three co-product services (an Authentication API, Managed PostgreSQL, and Enterprise Analytics Suite) shares both compute infrastructure and employee commuting emissions. The two inputs need different drivers, and the resulting service shares differ:

Service	Compute (vCPU·hr)	Compute share	Employee commuting (FTE)	FTE share
Authentication API	1,800,000	15%	40	20%
Managed PostgreSQL	6,000,000	50%	20	10%
Enterprise Analytics Suite	4,200,000	35%	140	70%
Total	**12,000,000**	**100%**	**200**	**100%**

Data centre energy (4,800 tCO_2e), allocated by vCPU-hours:

- Authentication API: 4,800 × 15% = **720 tCO_2e**
- Managed PostgreSQL: 4,800 × 50% = **2,400 tCO_2e**
- Enterprise Analytics Suite: 4,800 × 35% = **1,680 tCO_2e**

Employee commuting, Scope 3 Category 7 (200 tCO_2e), allocated by FTE count:

- Authentication API: 200 × 20% = **40 tCO_2e**
- Managed PostgreSQL: 200 × 10% = **20 tCO_2e**
- Enterprise Analytics Suite: 200 × 70% = **140 tCO_2e**

Enterprise Analytics Suite consumes 35% of compute but accounts for 70% of commuting emissions because the two inputs respond to different physical causes: compute to workload, commuting to headcount, which in this company is concentrated in the Enterprise Analytics Suite team. If commuting were allocated by compute share, Enterprise Analytics Suite would receive 200 × 35% = 70 tCO_2e, half the correct figure.

The Case for Sector-Specific Category Rules

Without a published PCR, practitioners must make allocation choices without sector guidance. Two companies in the same service category can produce incomparable SCFs by making different but equally defensible decisions. ISO 14067 defines a PCR as "a set of specific rules, requirements and guidelines for carbon footprint quantification and communication for one or more product categories" [ISO, 2018]. PCRs provide auditable allocation rules, a shared life-cycle model structure, and the industry alignment needed to make SCF exchange routine.

Service-specific PCR coverage is uneven but growing, led by sectors with clear per-unit metrics:

- **Hotel accommodation**: draft EU PEFCR with declared unit of one overnight stay; explicit inclusions and exclusions for ancillary services, guest transport, and capital goods [adelphi, 2026]
- **Transport services**: EPD program PCRs for passenger, freight, and courier services with standardized reference flows [EPD International, 2023]
- **ICT networks and services**: European Telecommunications Standards Institute (ETSI) and ITU specifications provide the boundary and allocation framework for ICT service carbon accounting [ETSI, 2015; ITU, 2024; ITU, 2012]

From Inventory to SCF: Two Calculation Approaches

Calculation Method 1: Top-Down SCF Calculation

This method starts from an existing corporate GHG inventory, disaggregating it down to individual services. Most service companies have already compiled this data; the primary advantages are speed and completeness: corporate inventories already capture shared overheads (facilities, IT, central procurement, travel) that are difficult to measure directly and easy to omit entirely. The approach maps corporate inventory line items to service processes, replaces aggregated figures with activity-specific data where material, and applies a disciplined allocation hierarchy.

Calculation Steps

1. Identify the service origin

Determine the region, business unit, or facility where the service is produced and delivered. This is the geographic and organizational boundary for all subsequent steps.

2. Define the functional unit and service level

Specify the declared unit for the service, the **service level** (quality tier, SLA, or grade), and, where it materially affects the emissions profile, the **delivery mode**. Record the total quantity of the service delivered during the reference period.

3. Set the reference period

The reference period must match the period covered by the corporate GHG inventory, typically one full calendar year or one full financial year. Using the same period ensures the service emissions and the service volume denominator (step 10) are directly comparable and avoids seasonal distortion in the per-unit result.

4. Subdivide the corporate inventory and set scope boundaries

Disaggregate the corporate inventory to the lowest subdivision matching the service origin (entity, facility, or business unit level), as far as the data allows. For a cradle-to-service-delivery boundary, Scope 1, Scope 2, and upstream Scope 3 (Categories 1–8) are in scope; downstream Scope 3 categories (9–15) are excluded.

5. Directly attribute emission sources

Within the subdivided inventory, identify activity data attributable solely to the service in question and exclude line items attributable to other goods or services. For overly aggregated procurement data, split into more detailed categories from your spend cube so line items can be attributed without requiring allocation.

6. Apply allocation to shared inputs

For activities that cannot be directly attributed (shared services, corporate overheads, multi-service facilities, aggregated procurement data), select allocation drivers based on causal relationships. Use the allocation hierarchy defined for the service category and the specific scope category involved (e.g. labor for business travel and commuting; throughput or space for electricity, depending on service type). Document every allocation decision. Allocation units should make sense across all products and services that are receiving attributed emissions.

7. Amortise capital goods emissions

Apply class-based amortisation to the S3.2 emissions data rather than using it unadjusted. Classify capital goods data in the S3.2 ledger by asset type and divide each class by its default assumed lifetime to produce an annualised charge:

Asset class	Default assumed life
IT hardware, servers, network equipment	4 years
Office equipment, furniture	5 years
Vehicles and fleet	5 years
Leasehold improvements and fit-out	10 years
Buildings and real estate	30 years
Unclassified	5 years

Sum the annualised charges across all asset classes to produce the total annual capital goods figure, then allocate this to the service using the same shared driver applied to other overhead inputs (floor area, compute share, headcount, or equivalent).

8. Calculate the service inventory total

Sum directly attributed and allocated emissions across all upstream scope categories to produce a total service inventory for the reference period.

9. Run sensitivity and uncertainty analysis

Test the sensitivity of the service footprint results against different allocation decisions selected in steps 6 and 7. Results that are stable across plausible alternative drivers carry lower uncertainty; significant divergence signals a material assumption that must be disclosed. Attach a qualitative uncertainty rating to the result and document the analysis transparently.

10. Calculate the SCF per functional unit

Divide the service inventory total by the declared service volume to produce the SCF at the functional unit level.

Requirements for a Useful Result

This approach produces credible SCF results only when the underlying inventory meets the following conditions:

Requirement	What is needed
Granular activity data	Material energy, fuel, and raw material flows quantity-based; spend categories specific enough to map to individual services.
Sub-divisible inventory structure	Inventory divisible to entity, facility, or business unit level. Subdivision directly reduces the scope of allocation required [ISO, 2018; GHGP, 2011a].
Tagged procurement data	Procurement line items tagged to specific services wherever possible, enabling direct attribution rather than allocation.
Complete upstream Scope 3 coverage	All upstream Scope 3 categories included at the highest feasible data quality [GHGP, 2011b].
Causal allocation unit for shared inputs	A physically meaningful allocation unit defined and applied consistently across services sharing the same input. Physical units (compute, space, labor) preferred over revenue or spend.
Allocation at the most granular level possible	Allocate at inventory line level first, then scope category level, and only as a last resort at the whole-inventory level.

Structural Limitations

The hybrid approach carries four material limitations that careful methodology cannot fully eliminate.

Limitation	Description	Mitigation
Allocation driver sensitivity	The choice of allocation driver (revenue, headcount, floor area, compute hours, etc.) can materially shift SCF results and reverse the emissions ranking of services.	Sensitivity test across plausible drivers; disclose assumptions explicitly.

Limitation	Description	Mitigation
Procurement data aggregation	Invoices routinely bundle multiple service categories into a single line item, forcing allocation where direct attribution would be preferable.	Tag procurement lines to specific services wherever possible by ensuring a detailed spend cube is leveraged in your coporate inventory.
Capital goods coverage	S3.2 only captures assets purchased in the reporting year. Assets acquired in prior years are absent, likely understating capital goods emissions for asset-heavy businesses.	Use a rolling three-year average of S3.2 spend. When capital goods are material in overall SCF footprint, move to calcualtion approach 2.
Service portfolio heterogeneity	Top-down allocation requires a single physical driver that is causally meaningful across all services sharing the same overhead inputs. Where a service company's portfolio spans fundamentally different service types, no single physical driver (compute hours, labor time, floor area) is valid across all of them. Revenue becomes the de facto fallback, reflecting pricing power rather than emissions intensity. Allocation carries low methodological confidence.	Treat results as a screening estimate for heterogeneous portfolios. Move to calcualtion approach 2.

When to Use This Approach

Method 1 produces a Level 1: Indicative SCF (defined in later chapter). Subject to the requirements introduced in this chapter being met and the known limitations minimized or avoided, this is fit for identifying priority service categories for decarbonisation, prioritising supplier engagement, and integrating into buyer Scope 3.1 inventory calculations as a primary data substitute for spend-based emission factors. It is not fit for carbon-informed tendering, formal supplier comparisons, EPD inputs, or marketing and certification claims. For those applications, Method 2 is required.

Calculation Method 2: Process-Based SCF Calculation

The most rigorous path to an SCF is to treat it as a standard PCF calculation, built from first principles in accordance with ISO 14067, the GHGP Product Standard, and PAS 2050 [ISO, 2018; GHGP, 2011a; BSI, 2011]. This approach does not start from a corporate GHG inventory. Instead, it constructs a dedicated service inventory from scratch: a bill of materials (BOM) and services representing every input required to deliver one functional unit of the service within a defined system boundary. Because inputs are identified and measured at the service level, direct attribution replaces allocation for all inputs unique to the service; allocation is only required for genuinely shared inputs.

Labor-intensive services may not have a readily available bill of materials, and input data may not be tagged to service level in a company's ERP or ERM system, requiring the inventory to be built manually. The payoff is a more accurate, defensible result with clearly characterised uncertainty.

Calculation Steps

1. Define goal and scope

Establish the purpose of the calculation, the intended audience, and how the result will be used. Define where the service is produced and the service lifecycles to be included.

2. Define the functional unit

Specify the declared unit of the service, including quality tier and delivery mode where relevant. It is acceptable to calculate an SCF for an "average" service level, but this must be transparently documented. The functional unit must be meaningful in a downstream customer context (not just internally legible) to enable supply chain data sharing and interoperability.

3. Define the system boundary and build a process map

Map all processes involved in delivering the service. Document explicitly which processes are included and which are excluded, with a stated justification for each exclusion. System boundaries for services can be opaque; a rigorous process map is what makes results trustworthy and makes clear under what conditions comparisons with other services are valid. For a cradle-to-service-delivery boundary, Scope 1, Scope 2, and upstream Scope 3 (Categories 1–8) are in scope; downstream Scope 3 categories (9–15) are excluded. If a PCR is available, adhere to the system boundary requirements for the product category. In aggregate, excluded attributable processes shall represent less than 3% of the total cradle-to-service-delivery SCF emissions.

4. Define the reference period and assign product metadata

Set the reference period to the date range for which inventory data will be collected, typically one full calendar or financial year. A one-year reference period is acceptable in most cases. Where possible, a three-year period is preferable: it smooths variability in process inputs and labor demand over time, producing a more representative average. This is particularly valuable for intangible, labor-intensive services where delivery inputs vary meaningfully year to year.

Assign a service SKU or service ID and key product metadata: classify the service against a recognised product and services taxonomy such as the UN Standard Products and Services Code (UNSPSC), and write clear, unambiguous product and process descriptions. This metadata is critical for downstream SCF consumers and ensures interoperability across buyer systems.

5. Build the upstream goods and services inventory

Construct the inventory of non-capital-good inputs required to deliver one functional unit of the service, organised in two parts:

- **Direct inputs**: materials and outsourced services attributable solely to this service, with no sharing across other services. No allocation is required. Build this from the bottom up using quantity-based activity data wherever possible; the result should resemble a traditional bill of materials with clearly defined, service-unique input requirements.
- **Shared inputs**: non-capital inputs shared across multiple services (e.g., facility overheads, shared outsourced services). Drawing this from the corporate inventory is recommended: a complete corporate inventory minimises inadvertent cut-off. Shared inputs must be allocated across the services that consume them.

6. Build the capital assets inventory

Identify all capital assets required to deliver the service: for example, servers, network equipment, and data centres for IT services; vehicles and plant for construction; fit-out and equipment for hospitality. For each asset, define its useful service lifespan, its expected annual throughput or utilisation, and its total cradle-to-gate lifecycle emissions. Amortise embodied emissions linearly across the asset's useful life and allocate the annual amount to the service in proportion to the service's share of total annual usage of that asset.

For each capital asset *i*, the annual share of its embodied emissions attributed to the service is:

$$E_{service,i} = (E_{embodied,i} / Life_i) \times (U_{service,i} / U_{total,i})$$

The first factor amortises the asset's embodied emissions over its useful life. The second factor allocates the annual amount to the service in proportion to the service's share of total annual usage of that asset.

Summing across all capital assets gives total capital-goods emissions for the reference year:

$$E_{service,capital} = \text{sum of } (E_{embodied,i} / Life_i) \times (U_{service,i} / U_{total,i}) \quad \textit{(for all assets i = 1 to n)}$$

Where:

- **$E_{embodied,i}$** = total cradle-to-gate embodied emissions of capital asset *i* (kgCO2e)
- **$Life_i$** = expected useful life of asset *i* (years)

- **U_service,i** = annual usage of asset *i* by the service (e.g., operating hours, vCPU-hours, m2 occupied)
- **U_total,i** = total annual usage of asset *i* across all services sharing it (same units)
- **E_service,i** = annual emissions of asset *i* attributed to the service (kgCO2e/year)
- **E_service,capital** = total annual capital-goods emissions attributed to the service (kgCO2e/year)

7. Build the transport inventory

Three categories of transport should be in scope:

- **Materials transport**: transport and distribution of material inputs to the point of service delivery. Physical activity data (tonne-kilometres by mode) or fuel consumption data produces the highest data quality [ISO, 2023]. Delivery of capital goods to the service facility can also be included.
- **Business travel**: typically a dominant transport source for labor-intensive services; likely immaterial for compute- or throughput-intensive services. Collect passenger-kilometres by mode or fuel consumption records where available.
- **Employee commuting**: material for services with significant on-site labor. Typically estimated from commuting surveys or workforce location data.

To prevent inadvertent omissions, ensure that all shared inputs, capital assets, and travel are assessed at minimum at screening stage. No input that may exceed the 3% individual or aggregate materiality cut-off threshold should be excluded without explicit justification [ISO, 2018; PACT, 2024].

8. Collect direct energy consumption data

Gather consumption data for:

- Electricity: apply both location-based and market-based calculations [GHGP, 2015]
- Mobile and stationary combustion of fuels
- Purchased heat, steam, and cooling

Where energy is metered at a shared facility level, allocate to the service using a causal driver.

9. Select emission factors

Primary emission factors (sourced directly from suppliers or derived from measured activity data) should be preferred over secondary background databases, particularly for hotspot emission sources. For cloud and AI infrastructure, major cloud service providers publish product-level carbon footprints and per-customer consumption reports; these should be used in preference to generic database values where available [Google Cloud, 2024; AWS, 2024].

For all inputs, the emission factor selection criteria defined in ISO 14067 and the PACT Methodology apply in full [ISO, 2018; PACT, 2024]. For spend-based inputs where no primary or physical-activity data exists, multi-regional input-output (EEMRIO) databases (such as EXIOBASE or CEDA) are acceptable secondary sources.

10. Run sensitivity and uncertainty analysis

Test the sensitivity of the SCF result to the key methodological choices made in steps 3, 5, and 6: system boundary decisions, allocation drivers for shared inputs, and capital asset amortisation assumptions. Even in a bottom-up calculation, these choices introduce uncertainty. Results that are stable across plausible alternative assumptions carry lower uncertainty; significant divergence signals a material assumption that must be disclosed. Attach a qualitative uncertainty rating to the result and document the analysis in the disclosure metadata.

11. Calculate the SCF per functional unit

Sum the total emissions across all inventory components (direct inputs, shared inputs, capital assets, transport, and energy) to produce the service inventory total for the reference period. Divide by the total quantity of the service delivered during that period to produce the SCF at the functional unit level.

When to Use This Approach

The detailed bottom-up method returns the most accurate SCF results available. Because it is built from actual activity data rather than apportioned estimates from a corporate ledger, it avoids the "garbage in, garbage out" risk that the corporate-inventory approach inherits: errors and omissions in the parent inventory would otherwise propagate into every SCF it generates. Critically, the bottom-up structure is what enables auditability. Minimizing allocation through direct attribution and subdivision is precisely what a third-party verifier will look for. This makes the detailed approach the right choice for service providers whose SCFs need to withstand external scrutiny, support CDP disclosure, or serve as primary data in a buyer's audited Scope 3 inventory.

The method is demanding. Building a service inventory from first principles requires structured, service-level data: activity records, capital asset registers, energy sub-metering, and tagged procurement. Companies without this infrastructure, or those making their first attempt at service-level carbon accounting, will face a significant data collection burden. For them, the corporate-inventory approach described in the preceding section is a more practical starting point. The detailed method is best suited to larger service providers and organizations with mature sustainability data practices who are ready to move beyond screening-level estimates.

Using SCF Data: Fitness for Purpose and Decision Support

PACT's recent contribution to the practical application of PCF data has been useful for the industry. Where earlier guidance focused on how to calculate a PCF, PACT's usability framework addresses the equally important question of what that PCF can and cannot be used for [PACT, 2026]. This is a meaningful step forward for the field: it shifts the conversation from calculation mechanics to decision quality, and gives both suppliers and buyers a shared vocabulary for assessing whether a given PCF is fit for its intended purpose.

The framework introduces a set of PCF calculation levels and a Fit-for-Purpose Matrix linking each level to specific business decisions. Green Project has adopted this framework and extended it for SCFs, mapping it to the SCF tools we provide and the service-specific calculation considerations discussed in this paper.

An SCF is only as useful as the decisions it can support. Methodological maturity matters: a light-touch, top-down estimate as discussed in the simplified SCF approach will answer some questions well and others not at all. Using an under-specified SCF to justify a commercial claim or a direct supplier comparison introduces risk for the buyer, the supplier, and the integrity of the broader market.

Green Project SCF Calculation Levels

The table below, adopted from [PACT, 2026], describes three SCF calculation levels, the Green Project tools that produce each, and the equivalent PACT PCF disclosure level. Moving from Level 1 to Level 3 reflects increasing methodological rigor, data quality, and disclosure completeness.

Level 1: Indicative SCF

Green Project Level	PACT Level	Green Project Tools & Services
Level 1: Indicative SCF	Level 1: Indicative SCF	Free Supplier SCF tool (Calculation method 1)

What the received SCF is	Attributes	Where the received SCF has limitations
A light-touch SCF calculation, with a functional unit without service level tier or delivery mode specification	• Top-down corporate inventory disaggregation to an SCF inventory	• Allocation is not avoided in most cases unless data of significant granularity and

What the received SCF is	Attributes	Where the received SCF has limitations
	• Functional unit defined without service level and delivery mode • Functional unit defined from predefined accepted unit list • Capital goods included via class-based amortisation of S3.2 spend using default asset lives • Hybrid activity units and primarily secondary emission factor data sources • Allocation of attributable and non-attributable emissions unavoidable due to input data granularity (aggregated corporate inventory data) • Sensitivity analysis of allocation approaches alludes to significant uncertainty • All Level 1 PACT attributes	specificity is provided in the corporate inventory • System boundary decisions not clearly explained or transparently shared with user. Boundary conflicts with corporate inventory possible • A functional unit without service type and mode is classified as weak by GHGP Product Standard and PEF methodology • Capital goods treatment uses class-based amortisation defaults rather than a per-asset register; approximation error should be disclosed • Data gaps potentially present in the corporate inventory and potential reliance on spend-based calculation methods

Level 2: Robust SCF

Green Project Level	PACT Level	Green Project Tools & Services
Level 2: Robust SCF	Level 2: Consistent PCF + Level 3: Methodologically Complete SCF	Premium Supplier SCF tool (Calculation method 2)

What the received SCF is	Attributes	Where the received SCF has limitations
A methodologically complete SCF with the majority of PACT data attributes populated, clear transparency on data sources, choices and exclusions, and data reliability indicators, demonstrating greater calculation integrity	• Process data collection (bottom-up approach) • Process-based activity data for material inputs • Inclusion of capital assets amortized over full useful lifetime • Avoidance of allocation because of bottom-up data granularity for attributable emissions • Allocation hierarchy clearly applied and transparently shared for non-attributable emissions • Description of boundary processes and documenting of included and excluded business activities within the boundary • Description of cut-off processes, reasoning and assumptions • All Level 2 PACT attributes • Relevant PCR rule followed • Complete functional unit definition with service level and delivery mode attributes defined • Use of supplier-specific data and calculation of the Primary Data Share	• Current climate of SCF landscape means that it is likely that emission factors remain secondary data • Lack of PCR guidelines for service categories introduces uncertainties around practitioner assumptions around system boundary setting, functional unit choices and allocation

Level 3: SCF+

Green Project Level	PACT Level	Green Project Tools & Services
Level 3: SCF+	Level +: Conditional SCF	Premium Supplier SCF tool + consultancy

What the received SCF is	Attributes	Where the received SCF has limitations
An SCF at any level where the SCF alone is insufficient to satisfy the application or decision. Additional use-case-specific alignment conditions and supplementary metadata must also be met, for example, to support a formal comparison, commercial decision, certification or external claim. The specific conditions required are defined by the relevant use case and will be developed through the PACT Product-level Data Use-Case Forum	• All required use-case-specific alignment attributes populated • Explicit confirmation of functional equivalence • System boundary consistency • Allocation approach consistency • Declared unit consistency • Primary Data Share (PDS) consistency • Consistency on LCA database used • Consistency on LCA software used • SCF shared alongside supplementary documentation required for the specific decision	• Level+ status is not achieved if required alignment conditions for the specific use case are missing • Comparability or claim validity breaks if assumptions differ or are insufficiently documented • Alignment requirements differ depending on the application context (e.g., tendering vs. marketing claim vs. certification)

The Fit-for-Purpose Matrix

The matrix below links types of business decisions to the minimum SCF calculation level required to support them reliably. It is based on the PACT Fit-for-Purpose framework, adapted for services and applied to Green Project's SCF calculation levels.

Key:

Symbol	Meaning
☑	Fit for purpose
☑*	Fit for purpose with caveats (see note below table)
〰	Directional insight only; use with caution
✕	Not fit for purpose
🔒	Required: SCF+ conditions must be met

Supplier Engagement and Procurement

Business Decision	Indicative SCF	Robust SCF	SCF+
Identify priority product categories for decarbonization planning	☑	☑	—
Refine / prioritize supplier engagement	☑	☑	—
Decide whether to invite a supplier into a joint decarbonization or capability-building program	☑	☑	—
Cluster suppliers (services or homogeneous portfolios) by relative carbon intensity	〰	☑	—

Business Decision	Indicative SCF	Robust SCF	SCF+
Use SCF data as a criterion in carbon-informed tendering processes	✕	☑	—
Decide to pay / refuse a green premium based on SCF comparison for the same material	✕	✕	🔒

Internal Portfolio and Intervention Planning

Business Decision	Indicative SCF	Robust SCF	SCF+
Prioritize internal decarbonization interventions across products or portfolios	~	☑	—
Evaluate the credibility and potential impact of a Supplier SCF Reduction Plan	~	☑	—
Identify specific SKUs or part numbers for decarbonization efforts	✕	☑	—
Refine Scope 3.1 hotspot analysis using supplier-specific SCF data	✕	☑	—

Reporting and Disclosure

Business Decision	Indicative SCF	Robust SCF	SCF+
Integrate supplier-specific SCF data into Scope 3.1 inventory calculations	☑*	☑	—
Track and report year-on-year Scope 3.1 emissions performance, incorporating supplier SCF data	☑*	☑	—
Use SCF data as an input for EU Battery Regulation / EU Digital Product Passport reporting requirements	✕	☑	—

Product and Engineering

Business Decision	Indicative SCF	Robust SCF	SCF+
Analyze carbon performance trends across material classes	✕	☑	—
Use supplier SCF data as an input to publishing or certifying your own product-level SCF or EPD	✕	☑	—
Use SCF data as an informational input for marketing / launching a "lower-carbon" product variant	✕	✕	🔒

Comparison

Business Decision	Indicative SCF	Robust SCF	SCF+
Compare a service from Supplier A against the same service from Supplier B	✕	✕	🔒

> **Note on Fit for purpose: For Scope 3.1 inventory integration and year-on-year tracking, a Level 1 Indicative SCF can be used as a primary data substitute for spend-based emission factors when the quality, granularity and specificity of the corporate inventory data is high. This means the inventory can be clearly attributed to services without requiring allocation, there are no data gaps in the inventory and a large proportion of material emissions are covered by primary data and or process based secondary emission factor databases.*

Market-Based Instruments and Environmental Attributes

SCFs can incorporate emissions reductions delivered through certificate-based instruments, provided the underlying claim is robust, the attributes are accounted for once and only once, and the treatment follows the prevailing guidance for the scope category in question.

Where Market-Based Instruments Are Permissible

The GHGP and SBTi are progressively widening the scope of value-chain emissions that can be addressed through market-based instruments, while tightening the quality criteria attached to them.

- **Scope 1**: certificate-based instruments for direct fuels (biomethane certificates, sustainable aviation fuel attributes, low-carbon hydrogen guarantees of origin) are not yet accepted across the main cross-sectoral standards (GHGP, PACT, Together for Sustainability (TfS), SBTi). Chain-of-custody and additionality methodologies are maturing [ISCC, 2025], and a Scope 1 market-based framework is expected as part of the GHGP's forthcoming multi-statement reporting structure, which will set out how actions and market instruments can be transparently reflected in a corporate GHG report [GHGP, 2026].
- **Scope 2**: the GHGP Scope 2 Guidance establishes a dual reporting requirement (location-based and market-based) and defines the quality criteria that contractual instruments (EACs, supplier-specific contracts, green tariffs) must meet to be reflected in the market-based total [GHGP, 2015].
- **Scope 3**: the GHGP Land Sector and Removals Guidance, the ongoing Scope 3 Standard revision, and SBTi consultations are extending the use of market-based instruments to upstream and downstream value-chain emissions. Market-based SCFs are therefore expected to become permissible inputs to Scope 3 accounting in the near future. Expect renewable-energy procurement to move from a Scope 2 reporting concern into a supply-chain expectation, surfacing in supplier engagement programs, contractual targets, and compliance frameworks.

The conservative position for an SCF is to follow the latest published guidance for the scope category being addressed and to disclose the instrument used, the standard it complies with, and the volume retired against the SCF in the disclosure metadata. Where guidance is silent or in transition, the SCF should default to a location-based or unadjusted result and present the market-based adjustment alongside it.

Avoiding Double Counting

The single largest risk in market-based accounting is double counting: the same environmental attribute being claimed by more than one party, or being claimed both by the certificate buyer and by another actor in the value chain. The market-based total is only credible if every attribute is attributed to exactly one entity for exactly one reporting period. The accepted controls are:

1. **Certified instruments only**: certificates issued under recognized standards (e.g., I-REC, REGO, Guarantee of Origin schemes; ISCC, RSB, or equivalent for fuels; verified carbon market standards for value-chain interventions) with documented chain of custody.
2. **Single retirement and cancellation**: each certificate retired against a specific reporting period, in a registry that prevents reuse.
3. **Geographic and temporal matching**: the instrument must correspond to the consumption it offsets in market and vintage.
4. **Disclosure of residual emissions**: the unadjusted, location-based or pre-instrument figure must be reported alongside the market-based result so that buyers can see what was achieved through real reductions and what through certificate purchase.

A Digital Ledger for Environmental Attributes

Spreadsheets and PDF certificates cannot prevent double counting at scale, particularly when SCFs flow between supplier and buyer systems and certificates are split across multiple scope categories or services within the same organization. A **digital ledger** that records issuance, ownership, and retirement of every environmental attribute, with cryptographic or registry-backed proof of cancellation, is rapidly becoming the practical baseline. Holding the ledger and the carbon calculation engine in a **single system** is what makes this work in practice: the same allocation logic that distributes emissions across services also distributes retired attributes across them, certificates are tied directly to the inventory line items they offset, and SCF, PCF, and CCF disclosures remain mutually consistent and audit-ready, with a verifiable trail spanning attribute issuance, retirement, allocation, and disclosure.

SCF Data Quality and the Granularity of Certificate Matching

The level at which an SCF can credibly carry a market-based adjustment is bounded by the data quality of the underlying calculation. The more granular and primary-data-driven the SCF, the more granular the certificate match it can support without introducing allocation error.

- **Indicative SCF (top-down from a corporate inventory)**: the underlying activity data is aggregated and shared inputs are allocated across services using rules rather than direct measurement. Matching certificates at the service level under these conditions risks over- or under-attributing reductions to individual services, because the allocation itself carries material uncertainty. The defensible position is to retire certificates at the **full-facility (or full-entity) level** for the reference period, then let the SCF's allocation logic distribute the resulting market-based reduction across services in the same way it distributes the underlying location-based emissions.
- **Robust SCF (bottom-up, primary activity data)**: where the inventory is built from metered consumption and direct attribution, the calculation can support **service-specific**

and even **client-specific** certificate retirement: a service running on dedicated, sub-metered infrastructure can be matched to a discrete tranche of EACs; a service under a contracted green-energy clause can be matched to certificates retired against that contract. This flexibility lets certificates be deployed where they create the most commercial value (a client demanding zero-Scope-2 delivery or a service line targeting a specific decarbonization claim).

Amending and Maintaining Service Carbon Footprints

Recalculation and Validity Periods

How often an SCF should be recalculated depends on its calculation level (see *Using SCF Data: Fitness for Purpose and Decision Support*). Two events can also trigger an interim review at any level:

1. **Material change in delivery**: a change in service design, fulfilment infrastructure, supplier mix, or delivery mode that is reasonably expected to shift the SCF by more than the materiality threshold.
2. **Material change in data**: improved activity data, a switch from secondary to primary emission factors, updated secondary factor datasets, a correction to the corporate inventory, or a methodology or PCR update.

SCF level	Validity period	Recalculation cadence
Level 1: Indicative SCF	1 year	Annual, in step with the corporate inventory
Level 2: Robust SCF	Up to 3 years	At least every 3 years; sooner if a material change is triggered
Level 3: SCF+	Up to 3 years	At least every 3 years; sooner if alignment conditions or underlying data change
Any level with EAC or other market-based retirements	1 year (overrides the period above for the affected scope)	Annual: refresh the Scope 2 (or relevant) calculation and retire instruments of the current vintage; the SCF is deprecated if this is not completed

The three-year ceiling for Level 2 and Level 3 SCFs is consistent with PACT guidance, which permits PCFs (and by extension SCFs at this maturity) a maximum validity of three years provided no change of 10% or more occurs in the intervening period [PACT, 2024]. Extending validity beyond a single year for robust SCFs reduces supplier fatigue and the data-sharing burden on both producers and buyers, while preserving methodological integrity.

The annual override for SCFs carrying market-based instruments is a vintage-matching safeguard. Energy Attribute Certificates (EACs) and equivalent instruments are retired against a specific reporting period; allowing a market-based SCF to remain valid for multiple years would implicitly reuse the same retirement across periods it was never intended to cover. Re-running the Scope 2 (or relevant scope) calculation each year and retiring instruments of the current vintage keeps the market-based adjustment time-correct and prevents double counting across reference periods. An SCF that fails this annual refresh is deprecated and reverts to its location-based or unadjusted equivalent until the refresh is completed.

The 10% Materiality Threshold

Green Project applies a **10% materiality threshold** for issuing a new SCF version, aligned with the PACT convention. Where a change in process, data, or methodology moves the SCF by 10% or more relative to the prior published value, a new SCF version is issued and the previous version is **deprecated**. Below 10%, the change is logged in the SCF's revision history but the published version remains current until the end of its validity period or the next scheduled recalculation, whichever is sooner.

When a new version is issued, prior periods should be restated where the change is methodological (to preserve year-on-year comparability) but not where the change reflects genuine operational improvement (which should appear as a real reduction). Thus, it is key for software providers to have robust methodology versioning tracking and update features. It enables companies to properly track performance over time and identify decarbonization trends in normalized year on year data.

Benefit of a Single Data Environment for SCFs, PCFs, and Corporate Carbon Footprints (CCFs)

In most companies, the data needed for SCFs, PCFs, and the CCF already exists; it just sits in different systems. Procurement runs in an SRM (SAP Ariba, Coupa, etc.), production data flows through an ERP (SAP S/4HANA, Oracle, etc.), product specifications live in a PLM (Siemens Teamcenter, PTC Windchill, etc.), and operational telemetry lands in a data warehouse (Snowflake, Databricks, etc.).

Maintaining service, product, and corporate footprints in **one carbon platform that integrates natively with these systems** turns those scattered inputs into a connected graph: product-level records are matched to the procurement invoices that bought them, those invoices to the supplier locations that fulfilled them, and supplier locations to the energy mix and emission factors that apply at each site. Each node carries the activity data and metadata needed to calculate emissions; each edge expresses a relationship the calculation depends on. A change in any one node (a new supplier, a refreshed emission factor, a corrected invoice line, an updated product BOM) propagates through the graph automatically, recalculating the SCFs, PCFs, and corporate footprint that depend on it.

A unified environment removes duplicate activity-data uploads, retains a single source of truth for emission factors, allocation rules, and methodology versions, and makes reconciliation between SCFs, PCFs, and the CCF an easier task. Suppliers submit primary data once and that data flows into every footprint that depends on it.

Once activity, financial, and operational metadata are connected at this level of fidelity, the same dataset that produces a compliant footprint also supports **carbon intelligence**: hotspot identification across services, products, and supplier categories; year-on-year performance tracking on normalized data; scenario modelling for procurement substitutions and design changes; and benchmarking across business units. Sustainability, finance, procurement, product, and ESG reporting teams operate from the same source data while pursuing different decisions, which removes the data-quality inconsistencies that often arise between teams running separate calculations.

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