

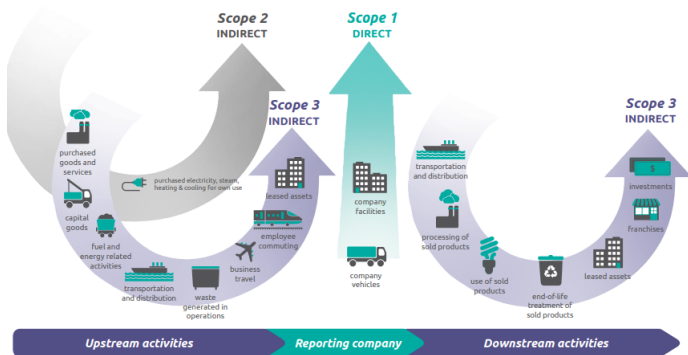
Can Financial Accounting Serve as a Template for Effective Corporate Carbon Accounting?

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Greenhouse Gas (GHG) Protocol



Source: WRD

Frequently Voiced Issues:

Implementation **uneven** and **incomplete** in practice

No proper distinction between **stock** and **flow** variables

Reliance on **secondary** rather than **primary** data reflecting actual measurement

Mandatory Carbon Disclosures

- **Carbon pricing regulations** require Scope 1 reporting under
 - European ETS system
 - Cap-and-Trade systems in California, China (?)
- Some jurisdictions **mandate CO₂ reporting** for publicly listed companies in their annual reports:
 - **UK mandate** for Scope 1&2 since 2013
 - In early 2024, **U.S. SEC** issued final guidelines for publicly listed companies → Report Scope 1&2 emissions
 - Recent **EU Sustainability Reporting Standards (ESRS)** → Report Scope 1-3 emissions

Voluntary Carbon Disclosures

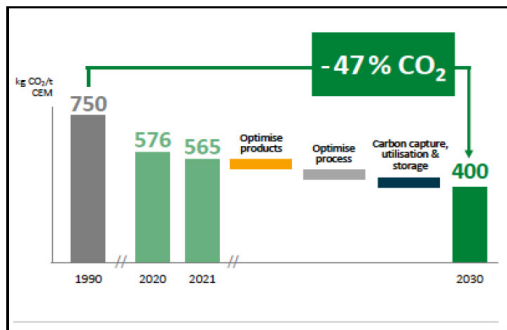
- Nearly half of the largest 2,000 corporations, and more than 70% of Fortune 500 companies, have by now issued **Net-Zero Pledges**
- Common **Net-zero Ambition**:
"XYZ will be carbon-neutral (net-zero) by 2050"
- Voluntary disclosures at the corporate and product level:
 - **Corporate Carbon Footprints (CCFs)**
 - **Product Carbon Footprints (PCFs)**
- Consumer product firms advertise **select products** as **carbon neutral**
→ Shell, Nestle, Total...
Public reaction appears **skeptical** → Reliance on **Carbon Offsets**

Still Missing:

Generally Accepted Carbon Accounting Principles (GACAP)

Net-Zero Pledge Example: Heidelberg Materials

- 2030 Carbon Intensity Goal: ≤ 400 kg CO₂ /t cement



Source: Stanford GSB case study

- 2050 Goal: Carbon Neutral Concrete

Net-Zero Pledge Example: Google

- Scope 3 covers employee travel and commuting
- **Claim:** Carbon Neutral since 2007
- **Claim:** Has already eliminated all legacy emissions
→ Did so by 2020!

Google's carbon accounting logic....

Carbon Emission (CE) Statements

- "Mirrors" historical cost accounting for operating assets
- **CE Balance Sheet**
 - **Key Carbon Performance Indicators**
 - A company's *past, current and future* emissions performance
- **CE Flow Statement**
 - **Carbon Emissions in Goods Sold (CEGS)**
 - Measure of the *current damage* that the firm's sales products have contributed to the global climate
 - Fundamental identity equating *aggregate CEGS* with *aggregate "cash flows" (direct emissions)* in the economy

CE Balance Sheets

CE in Assets		CE in Liabilities and Equity	
Buildings	BB_{BLD}	BB_{ETI}	Emissions Transferred In
Machinery & Equipment	BB_{MAC}	BB_{DE}	Direct Emissions
Raw Materials	BB_{MAT}	(BB_{DR})	Direct Removals
Work-in Process	BB_{WIP}	BB_{EQ}	Equity
Finished Goods	BB_{FG}		

- All entries represent stock variables → Cumulative emissions
- Additional diagnostic information with line-item reporting
 Example: Show annual increments for Direct Emissions (DE)
 → For 2024, break BB_{DE} into $(y_{DE}^{2023}, y_{DE}^{2022}, \dots, y_{DE}^{20xx}, EB_{DE}^{prior\ 20xx})$
- Direct Removals (DR) as a contra-liability (with a negative sign)
- Balance in Equity (EQ) account shows the firm's Legacy Emissions

Bookkeeping

	CE in Assets								=	CE in Liabilities			
Accounts	PPE	MAT	WIP ₁	...	WIP _m	FG ₁	...	FG _n		ETI	DE	DR	EQ
Beginning Balance	BB_{PPE}	BB_{PPE}	BB_{WIP_1}	...	BB_{WIP_m}	BB_{FG_1}	...	BB_{FG_n}		BB_{ETI}	BB_{DE}	BB_{DR}	BB_{EQ}
Transactions:													
T ₁		u_1							=	u_1			
T ₂		$-u_2$	u_{21}	...	u_{2m}				=				
T ₃	$-u_3$		u_{31}	...	u_{3m}				=				
T ₄			u_{41}	...	u_{4m}				=		u_4		
T ₅			$-u_{51}$...	$-u_{5m}$				=			$-u_5$	
T ₆			$-v_{61}$		$-v_{6m}$	w_{61}	...	w_{6n}	=				
T ₇						$-u_{71}$		$-u_{7n}$					$-u_7$
Ending Balance	EB_{PPE}	EB_{PPE}	EB_{WIP_1}	...	EB_{WIP_m}	EB_{FG_1}	...	EB_{FG_n}		EB_{ETI}	EB_{DE}	EB_{DR}	EB_{EQ}

Cradle-to-Gate PCFs

- Transactions T2-T6 require a **PCF Measurement System**
Assign current i) **Direct Emissions (DE)**, ii) **Direct Removals (DR)**
iii) **Emissions in Acquired Inputs** → Work-in-Process and Finished Goods
- Analogous to an inventory costing system

$$f : (\text{Current DE}, \text{Current DR}, \text{CE Inputs}) \rightarrow \text{CE Outputs}$$

- CE of acquired parts (materials) generally like "direct costs"
Scope 1&2 Emissions generally "overhead", subject to allocations

Accounting Issues:

Restrict companies' discretion in designing their own
PCF Measurement System? → Catena-X (2023), TfS (2022)

- **Recursive and decentralized** measurement of "**Upstream Scope 3**" CE
- **No double-counting** for CE in products
- **Real incentives** to reduce direct and indirect emissions

Accounting for Carbon Offsets

- Accounting framework described here precludes the recognition of **Avoidance Offsets** → Google's claim of being "climate positive"
- Record eligible removals in **Direct Removals** on the CE balance sheet → On the liability side with negative sign
- Corresponding credit to the **Work-in-Process** accounts → On the asset side with negative sign

Accounting Issues:

- i) Recognize only carbon **removals** with assurance of permanence?
- ii) Full discretion for companies in applying removal credits to select sales products? Enable Greenwashing?

CE Flow Statement

u_{71}	=	$PCF_1 \cdot s_1$ (CE in Sales of Product 1)
u_{72}	=	$PCF_2 \cdot s_2$ (CE in Sales of Product 2)
.	=	.
.	=	.
.	=	.
u_{7n}	=	$PCF_n \cdot s_n$ (CE in Sales of Product n)
u_7	=	CEGS

- $CEGS = \sum_{i=1}^n PCF_i \cdot s_i$, where s_i denotes sales quantity of product i
- PCF_i is product i 's PCF including applicable CDR credits

Interpretation

CEGS as a **Corporate Carbon Footprint (CCF)** measure:

Current damage done to global climate by the firm's sales products

- "Losses" in $CEGS$ are absorbed in Equity $\rightarrow \Delta \text{Equity} = -CEGS$

Assessing Corporate Decarbonization Efforts

CE in Assets		CE in Liabilities and Equity	
Buildings	EB_{PPE}	EB_{ETI}	Emissions Transferred In
Machinery & Equipment		EB_{DE}	Direct Emissions
Raw Materials	EB_{MAT}	(EB_{DR})	Direct Removals
Work-in Process	EB_{WIP}	EB_{EQ}	Equity
Finished Goods	EB_{FG}		

Key CE Performance Indicators

- **Direct Net Emissions:** $EB_{DE} - BB_{DE} - (EB_{DR} - BB_{DR})$
- **CE Flow:** $CEGS = EB_{EQ} - BB_{EQ}$
 - The ratio $\frac{CEGS}{COGS}$ as a measure of the firm's carbon intensity
- **CE in Assets** → Lower bound on future CEGS
- **Legacy Emissions:** EB_{EQ}

The Closing Bell

- Need for CCF and PCF measures based on **Generally Accepted Carbon Accounting Principles (GACAP)**
- Two immediate advantages of **Carbon Emission Statements** based on financial accounting principles:
 - Low conceptual barriers for auditors in certifying CE statements
 - Adapt existing ERP software systems
- Adoption of such CE statements promises to
 - yield added **transparency** and **accountability** on firms' decarbonization pathways
 - create stronger **corporate incentives for decarbonization** than currently provided by the GHG Protocol!