


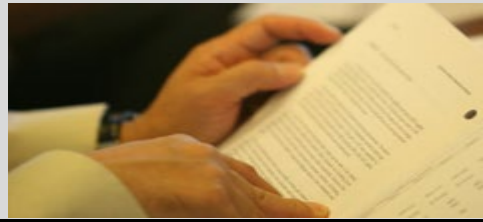

HARVARD | BUSINESS | SCHOOL

Accounting for Greenhouse Gas Emissions and Removals

Robert S. Kaplan, Harvard Business School
Karthik Ramanna, Blavatnik School of Government, Oxford

E-Liability Institute

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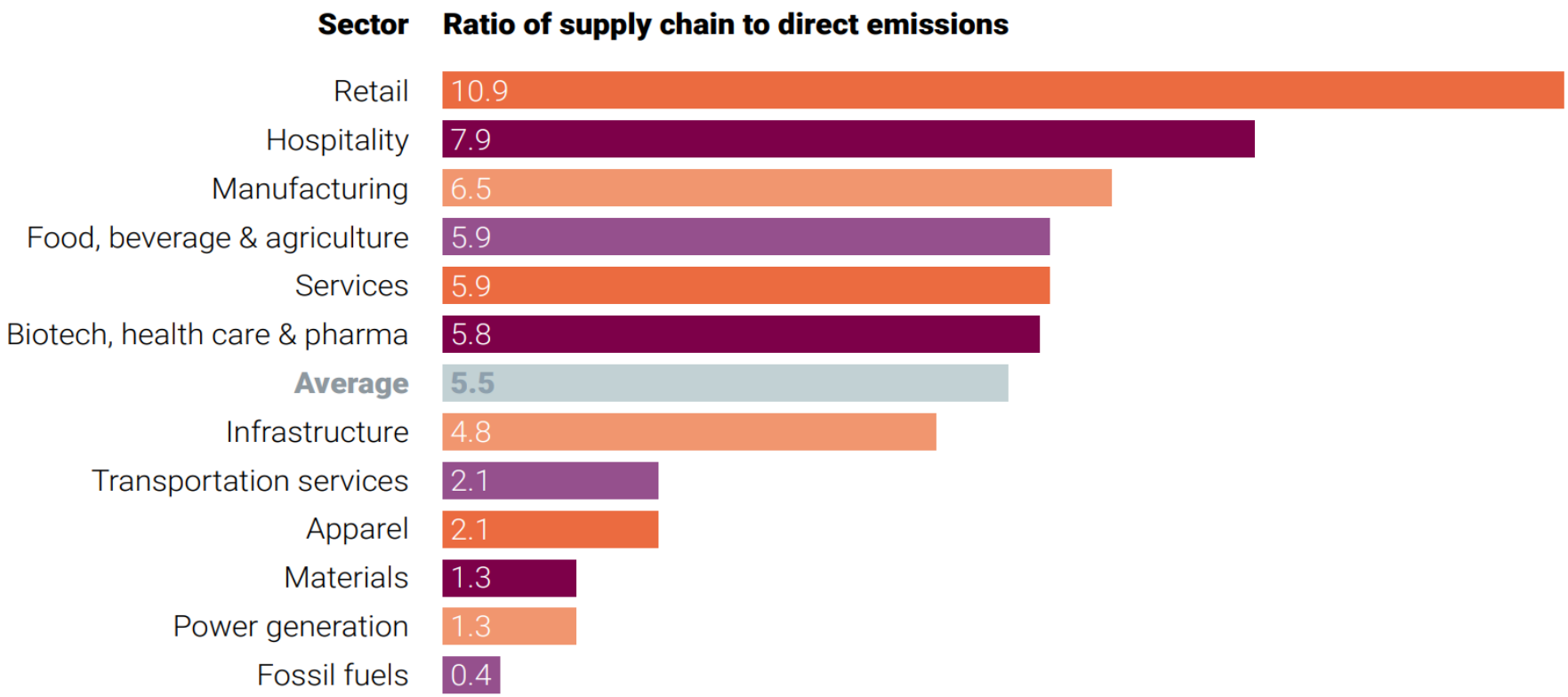
For most companies, supply-chain emissions far exceed their own (direct) emissions



Source: Carbon Disclosure Project, Supply Chain Report 2019

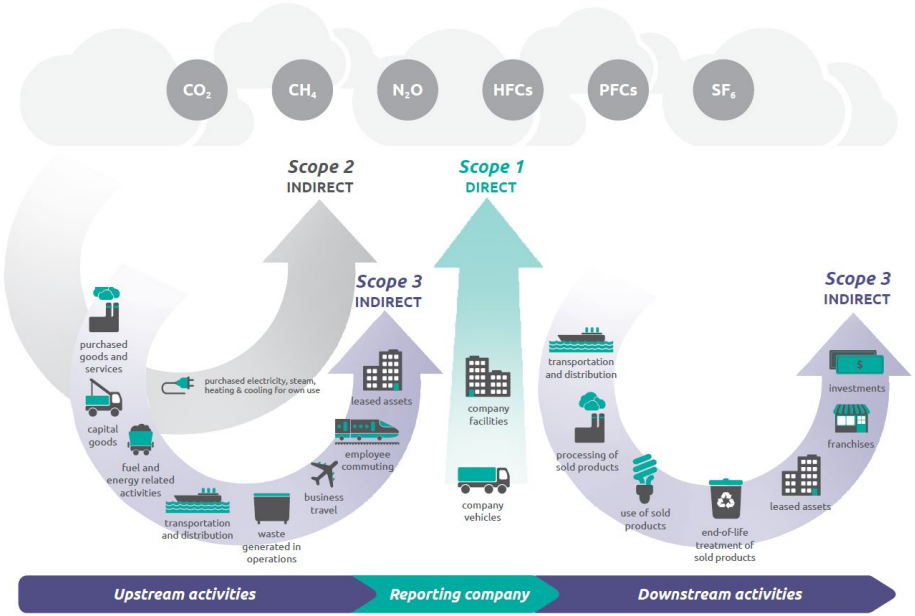
Measuring Corporate Greenhouse Gas (GHG) Emissions

UN-sponsored working group published the **GHG Protocol** in 2001.

Scope 1: Direct GHG emissions from sources owned or controlled by a company; e.g., production equipment and fleet of company vehicles.

Scope 2: GHG emissions that occur at non-company owned facilities that generate electricity purchased and consumed by the company.

Scope 3: Upstream GHG emissions from a company's supply chain, and downstream emissions by corporate customers and end-use consumers



Source: Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard

A downstream company cannot possibly calculate all its upstream (supply chain) emissions. And upstream companies cannot control the emissions their downstream customers produce.

Mining

Transport

Steel

Transport

Car Door Manufacturer

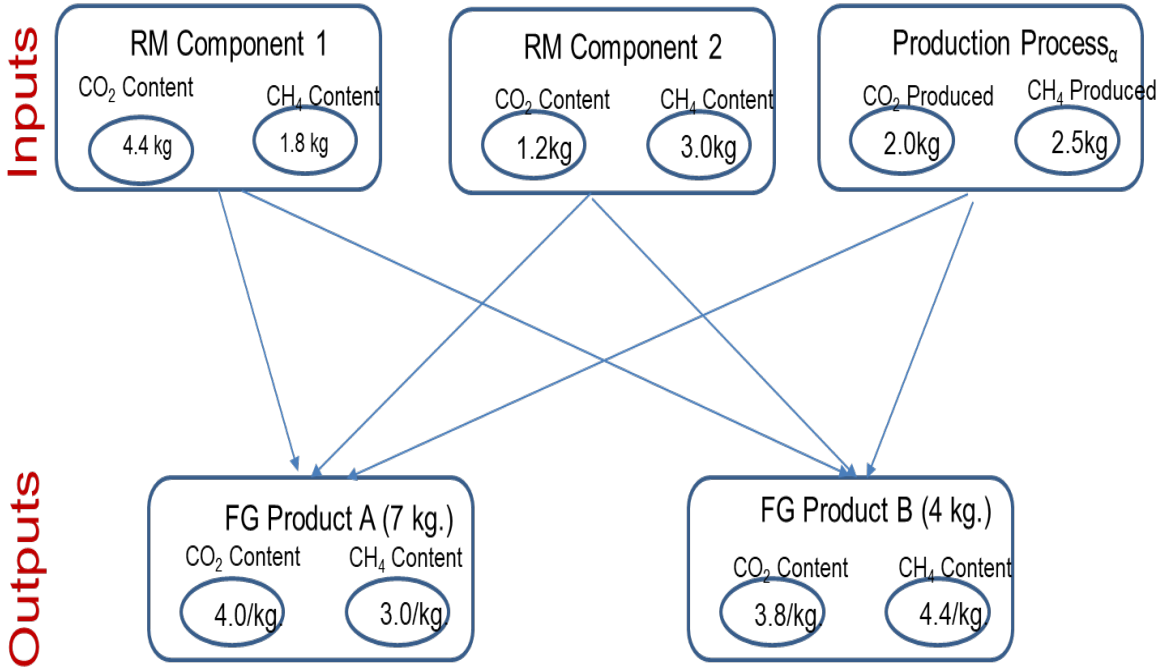
Toyota/BMW
(with 15,000 Tier-1 suppliers)

E-liability Carbon Accounting Solution: Start with upstream company and transmit emissions information via products sold to immediate customers.

Mining → Transport → Steel → Transport → Car Door Manufacturer → Auto Factory (with 10K-15K suppliers) → 

The E-Liability carbon accounting solution: companies calculate and send emissions information downstream via products.

- Each period, **starting with the original raw materials producer**, each company obtains the GHG emissions in its purchased products from its immediate (Tier-1) suppliers. It also calculates its own (Scope 1) GHG emissions.
- The company assigns its purchased and produced GHG emissions to its outputs, similar to how Activity-Based Costing assigns shared expenses to products and services,



Source: "Accounting for Climate Change" *Harvard Business Review* (Nov. 2021) by Robert S. Kaplan and Karthik Ramanna.

One Company's Dual Financial-Carbon Statement for a Typical Product

Product Cost and Margin	Product A (€/unit)	Cost % of Sales	Carbon Emissions	Product A ($kgCO_{2eq}$/unit)	CO_{2e} % of Total
Materials Cost	**3.0**	35%	**Embedded Emissions in Materials**	**6.0**	84%
+ Production Cost	2.0	24%	+ Produced emissions (Scope 1)	1.0	14%
Product Cost	**5.0**	59%	**Product emissions**	**7.0**	98%
+ Distribution Cost	0.5	6%	+ Distribution Emissions	0.1	1%
+ Product Specific Costs	0.2	2%	+ Product Specific Emissions	0.1	1%
Total Product Cost	5.7	67%	**Total Product Emissions**	7.2	100%
+ Profit contribution	2.8	33%			
Customer Price	**8.5**	100%			

This product has materials and conversion **costs** that are **59% of selling price** and **98% of the product's carbon footprint**.

E-liability Accounting and Transfers

Shipping Company CO_2 Account

E-Liability (Start-of-Period) +
Purchased emissions +
Produced (Scope 1) emissions+

= E-Liability (End-of-Period)

- Transferred emissions to customers

Mining Company CO_2 Account

- Transferred emissions to customers

E-Liability (Start-of-Period) +
Purchased emissions +
Produced (Scope 1) emissions+

= E-Liability (End-of-Period)

Car Door Company CO_2 Account

Product emissions transferred to customers

E-Liability (Start-of-Period)
Purchased and produced during period
E-Liability (End-of-Period)

Steel Company CO_2 Account

Product emissions transferred to customers

E-Liability (Start-of-Period)
Purchased and produced emissions during period
E-Liability (End-of-Period)

End-use Consumer CO_2 Account

Purchased emissions during period

Post the embedded carbon content on the car's purchase sticker, along with price

Product emissions to customers

OEM Auto Company CO_2 Account

E-Liability (Start-of-Period)
Purchased and produced emissions during period
E-Liability (End-of-Period)

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The E-Liability Carbon Inventory Equation

E-Liability balance EOY =

E-Liability balance SOY

\+ Emissions (Scope 1) our company produced this year

\+ Embedded emissions (suppliers' Scope 1) in our purchased products

− Emissions embedded in outputs sold to customers this year

Every Company Reports its Own and Supplier's Emissions with a Single Page E-liability Statement (analogous to a financial statement's inventory footnote)

	Tons of CO_2	
GHG Scope 1 Emissions from own operations (production processes and transportation)	2,600	
GHG in products and services purchased from tier-1 suppliers (replaces inaccurate, incomplete Scope 3 report)	33,800	
• Electricity		5,600
• Steel		10,600
• Components and other raw materials		5,400
• Equipment		12,200
GHG transferrable to customers	36,400	
GHG reductions from purchased carbon offsets	**(8,000)**	
Net GHG transferrable to customers	28,400	

Summary of E-liability carbon accounting method

- No matter how complex the value chain, each entity need only know its **direct emissions** and the emissions embedded in the products and services (e.g., electricity) purchased from ***immediate* suppliers**. The entity transmits the embedded emissions with the products sold to its ***immediate customers***, removing the E-liability from its E-ledger.

- Emissions are **calculated** and **audited** once and ***only once***, at the place where they occur, improving accuracy and lowering compliance costs.

- Accurate, transparent and auditable information enables companies to reduce global Scope 1 emissions by **continuous improvements** – **re-designing** products, **re-engineering** processes, and **purchasing** low-carbon-content products and services.

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Pilots are a key enabler for scaling E-liability principles

In-process or completed pilots

Software and assurance enablers

E-liability Institute

Provides pro-bono advice to organizations interested in deploying the E-liability principles in pilot studies.

Disseminates the findings from these studies to encourage other organisations and regulators to embrace E-liability principles.

The Market for Carbon Offsets

The Guardian

18 January 2023

Based on a new analysis at least 90% of Verra's rainforest carbon credits do not represent real emission reductions

Each credit is equal to one metric tonne of CO_2 equivalent

94.9m
carbon credits claimed

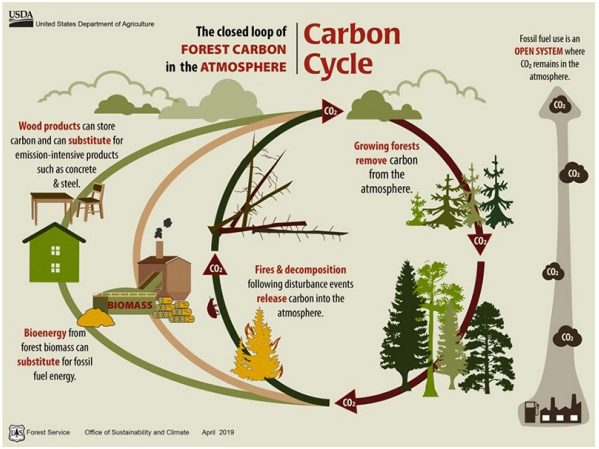
5.5m
real emissions reductions

Buying many carbon removal certificates today is equivalent to purchasing an NFT. The buyer purchases rights to an image without any new carbon having been removed from the atmosphere.

Two Types of Carbon Offsets

- **Removal offsets** are created by activities such as photosynthesis in forests, direct air capture, mineralization, and ocean-storage technologies. Removal offsets are measured by the *quantity* of gas actually removed from the atmosphere and the *duration* for which it remains captured.

- **Avoidance offsets** arise from preventing some *prospective* quantity of GHG from entering the atmosphere. An avoidance offset is measured against a hypothetical counterfactual of actions.



Two Offset Accounting Principles

1. Only removal offsets can be used to reduce an organization's E-liabilities.

- Avoidance offsets cannot be used to reduce an organization's E-liability balance. Otherwise, you are doing bookkeeping with speculative, not verifiably performed, actions. Good intentions are not a foundation for good accounting.

2. Removal offsets are tradeable

- Trading of carbon offsets enables capital to flow to most efficient offset producers, including indigenous communities, with, traditionally, limited access to capital.

Robert Kaplan, Karthik Ramanna, and Marc Roston, "**Accounting for Carbon Offsets**," *Harvard Business Review* (July 2023).

Offset Accounting Principle 3

Rights to carbon removals, such as nature based removals, are recognized as an E-asset, and tradable as a removal offset, when the timing and magnitude of the offsets are both estimable and probable.

- Likelihood and measurability of the captured quantity is based on the project's financial resources, historical performance, scientific models, and data analytics.
- Carbon removals are not reasonably estimable or probable when management is weak, funding inadequate, or considerable likelihood of natural or human-caused risks remains.

Offset Accounting Principle 4

A company can use a purchased offset to net against its E-liability account only when that quantity of GHG has been removed from the atmosphere and indefinitely sequestered.

- Analog to “earned” criterion for revenue recognition

Offset Accounting Principle 5

An offset asset shall be impaired or accreted based on the discovery of new information about the quantity and duration of actual carbon sequestration.

- Need regular audits to validate any new information on the duration and quantity of sequestered carbon
- Impairment precipitates a write-down of the offset asset.
- Accretion increases the offset asset, which enables more E-liabilities in current and future periods to be offset.

Disclosure of Downstream Emissions

- Only for B2C companies
- where product use requires customers to consume energy **AND**
- a causal link exists between product-design decisions and consumer emissions
- For example:
  - Consumer packaged foods that require heating
  - Washing machines and laundry detergent
  - Automobiles, gasoline and diesel fuel, tires
  - Gaming consoles

Robert S. Kaplan and Karthik Ramanna, "Disclosing Downstream Emissions," *Harvard Business Review* July-Aug 2024

Disclose rate of CO_{2e} emissions per unit of use, but not total consumer emissions

Fundamental cost equation: Cost = Price per unit × Quantity (in units).

- Cost of steel used in a car equals the quantity (in kg) of steel in the car multiplied by the price/kg of the steel in the car.

Equation for consumer-generated emissions:

Consumers' total CO_{2e} emissions = CO_{2e} per unit of use × Units used.

"Units used" is measured by minutes of cooking time, number of washing machine cycles, kilometers driven, or hours of game-console playing.

B2C Companies can **disclose** and be **accountable** for 1st RHS term in above equation, but not the 2nd .

- This is **disclosure** information, separate from the E-ledger **accounting** system.

Downstream Disclosure often involves multiple counting

- A consumer driving an ICE vehicle => auto company, petroleum company, and the tire company may each disclose estimated emissions/km. driven.