Microsoft

A guide to

EMISSIONS MANAGEMENT

Digital solutions for sustainability

Welcome to our Emissions Management white paper. This is the first in our Pathfinder series, where we'll be sharing our insights, expertise, and experience on how to be more sustainable, as well as developing a set of generalized blueprints to guide your journey.

We'll also be examining the need for a robust system of record for sustainability data management. This is an essential foundation for prioritizing action areas, controlling mitigation efforts, and effectively delivering both internal and external reporting. Without it, delivering on net zero targets in a timely and cost-effective manner becomes increasingly challenging. Finally, we'll explain the Microsoft digital solutions designed to help organizations achieve their sustainability objectives.

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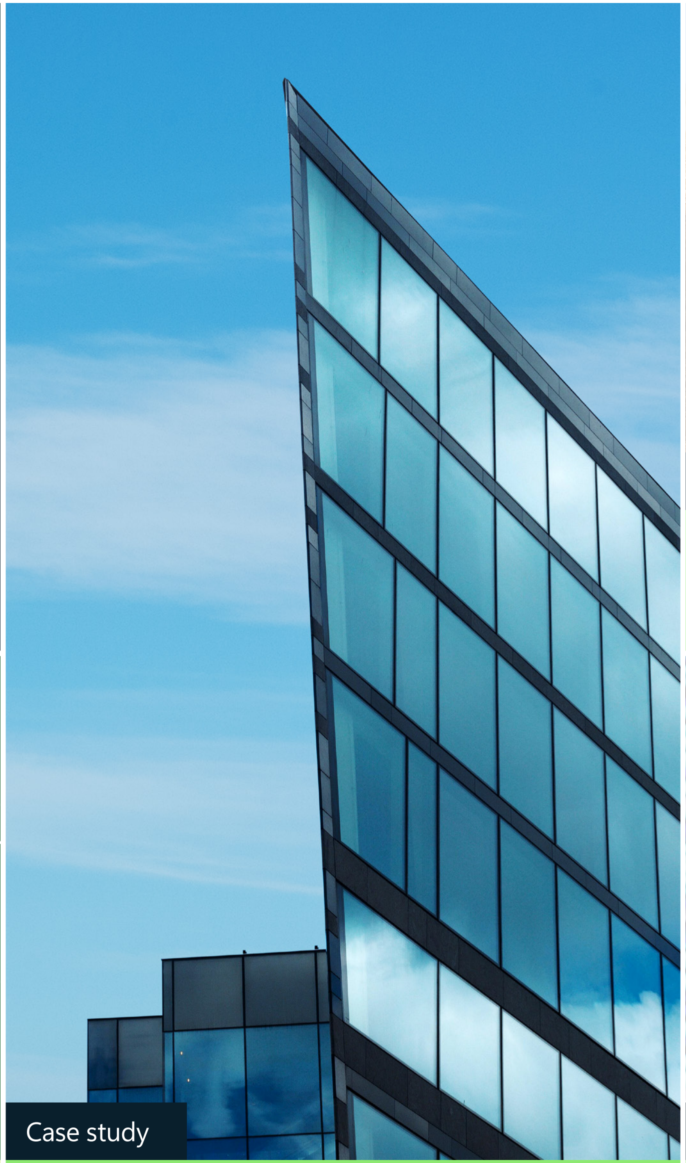
> If we're going to be serious about net zero we're going to have to focus not just on more rapid cuts in emissions, but also carbon removal… It's a massive opportunity for governments and the private sector.
>
> **Claire O'Neill,** co-chair of the WBCSD Imperatives Advisory Board

Sustainability Data Management and Insights (SDMI) Model 13



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The rationale for net zero and Microsoft's sustainability strategy

Net zero has a simple definition: halting the build-up of human-generated greenhouse gases in our atmosphere.[1] Achieving that goal, however, is both an urgent and complex challenge.

The world has already warmed by about 1.1°C. To avoid catastrophic climate change we must limit that to below 1.5°C, reaching net zero no later than 2050.

The complexity arises in the execution. Reaching net zero by 2050 requires the complete transformation of infrastructure systems to reduce CO_2 emissions from roughly 50 gigatons a year to 5-10Gt/year, emissions which then need to be removed.[2] Technology will be critical in enabling society to address this challenge, yet there is a pressing need to acquire more practical experience in deploying new technologies and developing new business strategies at scale.[3]

In line with Microsoft's goal to be carbon negative by 2030, recording, reporting, reducing and removing greenhouse gas emissions are critical activities in our sustainability journey, described in greater detail in the "Emissions Handbook" section of this paper.

Foundations for net zero

There are some constraints that need to be overcome to enable organizations to achieve net zero[4], for example:

Meaning of net zero: The IPCC's definition is simple enough at a global scale, but too broad to tell individual companies how they can reach net zero.[5] Work is necessary to improve standards and definitions.

Measurement tools for net zero: Corporations need more-accurate and automated tools – following agreed standards – for consistent measurement and accounting of carbon emissions. Work is necessary to improve existing solutions and facilitate their integration and implementation.

Markets enabling net zero: Better economic incentives to promote the effective adoption of solutions for accounting, reducing and removing carbon emissions are needed. Work is necessary to create business models enabling an ecosystem of organizations providing solutions.

To overcome these constraints, we are actively engaging with organizations to advance global knowledge[6] and developing the partnerships required – see, for example, The Carbon Call.[7]

From pledges to progress

Moving towards real progress requires an integrated, internal approach. As we work to account for, reduce, and remove emissions, Microsoft is executing a strategy that includes:

- Setting internal operational targets
- Deploying new tools
- Implementing incentives to encourage innovation
- Establishing research programs
- Investing in the development of new capabilities both internally and externally

For example, our $1-billion Climate Innovation Fund invests in projects globally to accelerate technology, development, and innovation.

Later on in the paper, we provide a blueprint for enterprise emissions management, including indirect emissions from supply chains (typically, over 80 percent of a company's emissions are indirect). Based on our experience in bringing together tools, processes, and responsibilities, this will be invaluable to all organizations working to manage their emissions.

Improved reporting

There is increasing demand for actionable data and improved reporting on climate-related risks from shareholders, customers, and regulators:

A rapid move from voluntary to mandatory reporting is already taking place across the world. In March 2022, the US Securities and Exchange Commission proposed a rule mandating that corporations disclose information on their climate-related risks. Similar rules are already present in the United Kingdom and rapidly advancing in the European Union with the adoption of the Corporate Sustainability Reporting Directive (CSRD) underway.

1 IPCC definition
2 Global Warming of 1.5°C — (ipcc.ch)
3 (REF in AI4netzero book chapter #1)
4 Microsoft's million-tonne CO_2-removal purchase — lessons for net zero (nature.com)
5 (REF in Carbon removal paper #5)
6 Make greenhouse-gas accounting reliable — build interoperable systems (nature.com)
7 Introducing the Carbon Call

Key emissions management principles

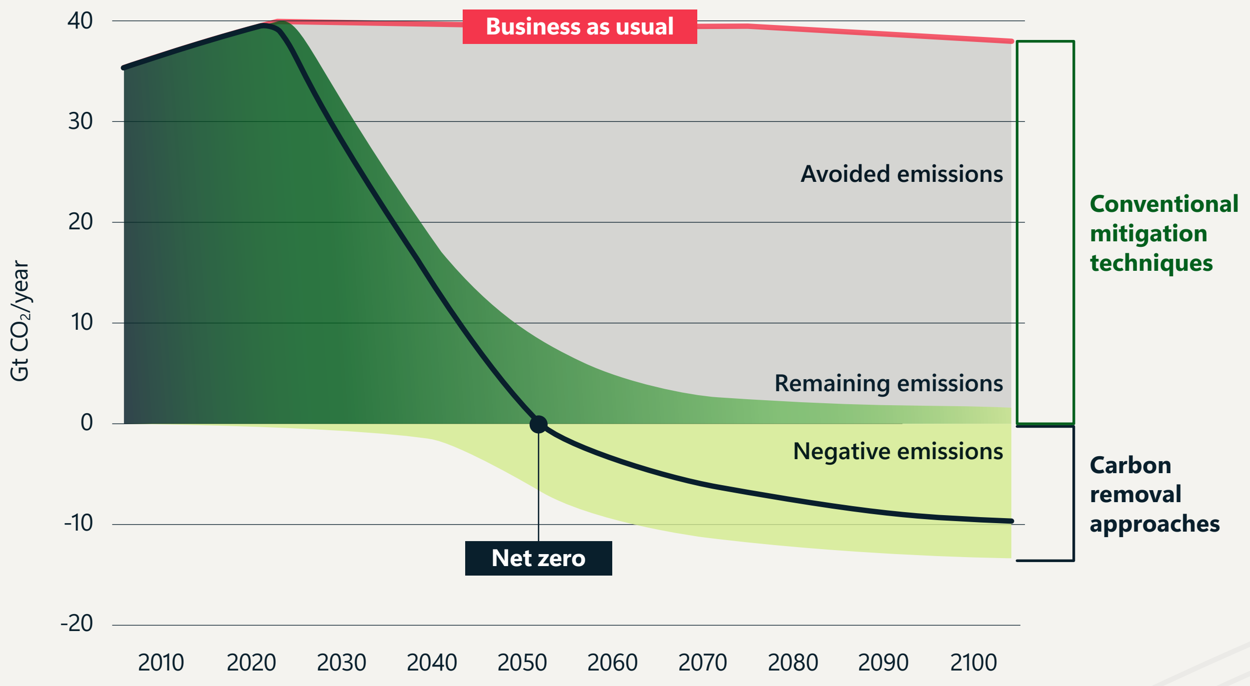
Setting science-based targets

Many corporations are setting long-term targets for emissions reduction. They aim to achieve them with science-based approaches that align with wider climate goals.

The SBTi has a useful definition of science-based targets, referring to them as: "achieving a scale of value chain emissions reductions consistent with [...] reaching global net zero in 1.5˚C pathways; and neutralizing the impact of any residual emissions by permanently removing an equivalent volume of CO_2."[8]

An organization is described as carbon negative when it removes more carbon than it emits. In January 2020, Microsoft announced a goal of being carbon negative by 2030. It's ambitious, but we'll achieve it by reducing our direct GHG emissions to nearly zero through energy efficiency, 100 percent renewable energy, reducing our value chain emissions by over 50 percent (compared to 2020) and removing the remainder of emissions. We will also remove the equivalent amount of historical carbon emissions by 2050.

Figure 1: Staying below 1.5 degrees of global warming



Source: Adapted from IPCC 2018

WORLD RESOURCES INSTITUTE

8 SBTis-Net-Zero-Standard-Corporate-Manual.pdf (sciencebasedtargets.org)

Carbon offsetting terminology and basic principles

Carbon credits: Tokens representing the avoidance or removal of GHG emissions. The difference between certified emissions avoidance and certified emissions removals is important from the perspective of atmospheric accounting.[9]

Emissions avoidance: Achieved through projects like forest protection, which reduce emissions compared to a hypothetical scenario where a higher-emissions alternative would have taken place. Most offsets refer to emissions avoidance, which are necessary but not sufficient to maintain net zero in the long run, as existing CO_2 emissions are left untouched.

Emissions removal: Also known as carbon dioxide removal (CDR), this refers to anthropogenic actions undertaken to remove GHGs from the atmosphere. This includes afforestation, actions to increase the carbon content of soils, direct air capture of CO_2, and enhanced mineral weathering. Emissions removals take carbon directly from the atmosphere which can counteract ongoing emissions after net zero is achieved, as well as create the possibility of net removal for actors who choose to remove more carbon than they emit.

Our focus on removals

Emissions removal is a major factor in our strategy to become carbon negative by 2030. Although deep carbon reduction is a priority, physically removing carbon from the atmosphere will be essential in meeting our net-negative target scale and timeframe. A focus on removals instead of avoided emissions offsets is motivated by climate science, specifically the IPCC projection the planet could need as much as 10 gigatons of CO_2 removal by mid-century, depending on the scale and pace of decarbonization.

We are among the first to do work on this topic, which is why we are committed to sharing lessons learned, as documented in our 2021 white paper[10], and publication of high-quality removal criteria.[11] For more detail, see Microsoft's million-tonne CO_2-removal purchase — lessons for net zero (nature.com).

Throughout this paper, the term "carbon offsets" is used to refer to both carbon avoidance and carbon removals. An immediate transition to 100 percent carbon removals for all organizations is not currently feasible, but organizations must commit to substantially reduce their emissions and increase the percentage of carbon removal offsets they procure with a view to exclusively sourcing carbon removals by mid-century.

Accounting for emissions across your value chain

For organizations to effectively manage emissions they must account for and quantify the emissions associated with activities across their value chain. This is broken down into three operational boundaries:

Scope 1: defined by the GHG Protocol accounting standard as "a reporting organization's direct GHG emissions (e.g., fuel combustion in boilers, furnace, and vehicles)".

Scope 2: which refers to "an organization's (indirect) emissions associated with the generation of electricity, heating/cooling, or steam purchased for own consumption."

Scope 3: which includes all "indirect emissions other than those covered in Scope 2."[12] This includes emissions associated with the organization's purchase of products from suppliers, or from its products when customers use them.

While organizations do not have direct control over most emissions in Scope 3 because they are generated by third parties, they do have control over what they buy, and who and where they buy it from. We are committed to reducing our Scope 3 emissions, which represent more than 97 percent of our total emissions, by more than half by 2030. Our carbon negative commitment includes reducing these through strategies in campuses and datacenters, rethinking the design of our devices, and engaging with our supply chain, while also removing what we cannot reduce.

Placing a price on carbon emissions

In response to shifting regulatory and market dynamics, **internal carbon pricing (ICP)** has emerged as a powerful tool to assess climate-related risks and opportunities. In this paper, we use ICP to refer to organizations using a shadow price, implicit price, or carbon fee, which can be integrated into a company's decision-making process in a variety of different ways.

Shadow pricing is a forward-looking, theoretical price used to support long-term planning and capital investment decisions. An **implicit price** calculation helps quantify the investments needed to meet climate targets. It's based on how much a company spends to mitigate GHGs or to comply with regulations.

A **carbon fee** is in effect a carbon or GHG tax. These can come in nationally or within an organization to impose a cost on what would otherwise be an externality. Carbon fees are one approach to deploying an internal carbon pricing system for a business where each business unit pays a tax based on its GHG footprint but does not provide an approach to setting the carbon price.

Microsoft has charged a company-wide price on carbon emissions since 2012. From 2023, we will increase our internal carbon fee to incentivize more aggressive measures to reduce Scope 3 emissions and match the underlying cost of carbon abatement. For example, Scope 3 business travel fees will increase to $100 per $mtCO_2e$ next fiscal year to support the purchase of sustainable aviation fuel.

We will also increase the annual fee at an accelerated rate, promoting energy efficiency and design changes that utilize low-carbon materials. That said, our approach is not a carbon pricing panacea. When referring to ICP in this paper, we are recognizing the broader spectrum of pricing mechanisms required to meet specific objectives.

9 What are carbon offsets? – Grantham Research Institute on climate change and the environment (lse.ac.uk)
10 Microsoft carbon removal: Lessons from an early corporate purchase
11 Criteria for high-quality carbon dioxide removal
12 Corporate Standard | Greenhouse Gas Protocol (ghgprotocol.org)

Introduction

NAVIGATING EMISSIONS MANAGEMENT

From net zero to internal carbon pricing, product labeling and more, we'll help guide you every step of the way.

A burning platform for change

Emissions Management is a broad term. It spans critical capabilities that underpin an organization's ability to deliver against GHG targets, brings together processes and responsibilities that may be pre-existing but dispersed across the business, and requires new ones that will evolve along with climate risks.

It is backed up by data which supports GHG program delivery, maintains access to finance, provides insight for GHG risk management and feeds both external and internal reporting.

Organizations have been bold in incorporating GHG emissions into their long-term strategies, but they have yet to tackle the true extent of the changes required. Delivering on net zero while managing broader climate change risk is much more than a reporting task. It is a transformational challenge.

To manage the operational, capital, and strategic decisions needed, a quick transition is essential. High-quality data will be critical: organizations will need to rapidly extend from corporate reporting to the provision of management data that supports targeted GHG mitigation initiatives.

[13] Decarbonization tracker: progress to net zero through the lens of investment (swissre.com)

Key trends driving investment in emissions management

Net zero targets

The scale of decarbonization required to reach ambitious net zero targets necessitates significant investment. In sectors like energy, transport, building and heavy industry, one estimate by Zurich Re estimates an investment gap of over $270 trillion between 2022 and 2050 to meet targets.[13]

Mandatory and voluntary reporting

We are witnessing a step-change in the capture and reporting of sustainability information and data. In many countries, the regulatory landscape is undergoing profound change, with tougher non-financial reporting requirements, particularly for organizations with significant GHG emissions. There is also a major push to report on business risks from the climate crisis (figure 2):

Transition risks: resulting from a global move towards low-carbon economies. These include risks associated with rapidly changing technologies, markets, policies, and social norms. For example, a manufacturer whose products fail to meet energy-efficiency standards and regulation risks losing sales opportunities. Transition risk assessment determines how well a company is positioned to survive and thrive as GHG emissions become progressively constrained.

Physical risks: from climate change, such as the impact of extreme weather on manufacturing and supply chains, as well as chronic changes like sea-level rise and reduced rainfall. Not only do physical risks need to be assessed, but an organization's resilience to withstand those risks needs to be measured.

Shareholder pressure and transparency

Several major institutional investors now demand climate-related data from the companies they invest in, seeking to include and consider climate risk as part of their investment selection process. More and more say they cannot accurately use companies' sustainability disclosures and are instead demanding value-based sustainability reporting with the following characteristics:

Financial materiality: more sustainability disclosures related to financial performance.

Consistency: the main shortcomings of current reporting practices are inconsistency, incomparability, and lack of alignment in standards.

Reliability: sustainability reports should be fully audited similar in style to financial ones.

> All of us are going to have to find new ways to innovate our way out of this mess.
>
> **Brad Smith**
> Web Summit 2022

A burning platform for change continued

Key trends driving investment in emissions management continued

Consumer demands

Customers care about who they do business with. Sustainable consciousness is on the rise. In Euromonitor International's latest sustainability survey, 54 percent of global consumers believe that ethical purchase decisions make a difference.[14] Customers really want to reduce their carbon footprint, minimize waste, buy "green" products and get services from environmentally friendly companies.

Increased focus on carbon price

Compliance markets are becoming tougher and more widespread. The EU Emission Trading Scheme prices, for example, have been well above €70 per tonne for most of 2022.[15] A new emission trading scheme in China has become the world's largest compliance market, despite only covering power generation.[16] The EU's long anticipated carbon border tax may result in a step-change in carbon pricing as companies seek to measure emissions and carbon tax exposure across supply chains.

Green finance

Green debt financing is getting more sophisticated, while green or sustainable project-specific finance instruments are growing in popularity. General debt financing at preferential rates is available for organizations with demonstrably better sustainability performance, and sustainability indices at national and industry-specific levels are guiding investment. More government and central bank funding to support climate responses is also likely as the realities of meeting the Paris targets become clearer, such as the Bank of Japan's recent special lending facility to support investments in climate change projects.[17]

Figure 2: Example targets, frameworks and standards geared towards both voluntary and mandatory reporting and compliance requirements

Global and national targets

- Sustainable Development Goals
- PARIS2015 COP21·CMP11
- 2030 Climate Target Plan
- 78% GHG cut by 2035
- Peak emissions before 2030

Legislative frameworks

- EU ETS
- Cap and trade
- CO_2 emission performance standards
- Industrial Emissions Directive
- Gasoline and diesel car sale ban – 2040

Reporting frameworks

- GRI
- PRI Principles for Responsible Investment
- TCFD Task Force on Climate-Related Financial Disclosures
- CDP Disclosure Insight Action
- ecovadis

Methodologies

- LEED
- Dow Jones Sustainability Indexes
- ACT Assessing Low Carbon Transition®

Standards

- PAS 2050, PAS 2060 (certified carbon neutral product, bptargetneutral.com)
- ISO 14064
- ISO 50001
- SASB
- Greenhouse Gas Protocol

14 https://www.euromonitor.com/article/euromonitor-international-launches-new-whitepaper-how-to-become-a-sustainable-brand
15 EU Carbon Price Tracker | Ember (ember-climate.org)
16 China's Emissions Trading Scheme – Analysis – IEA
17 Bank of Japan to boost funding to help fight climate change – MarketWatch

A blueprint for emissions management

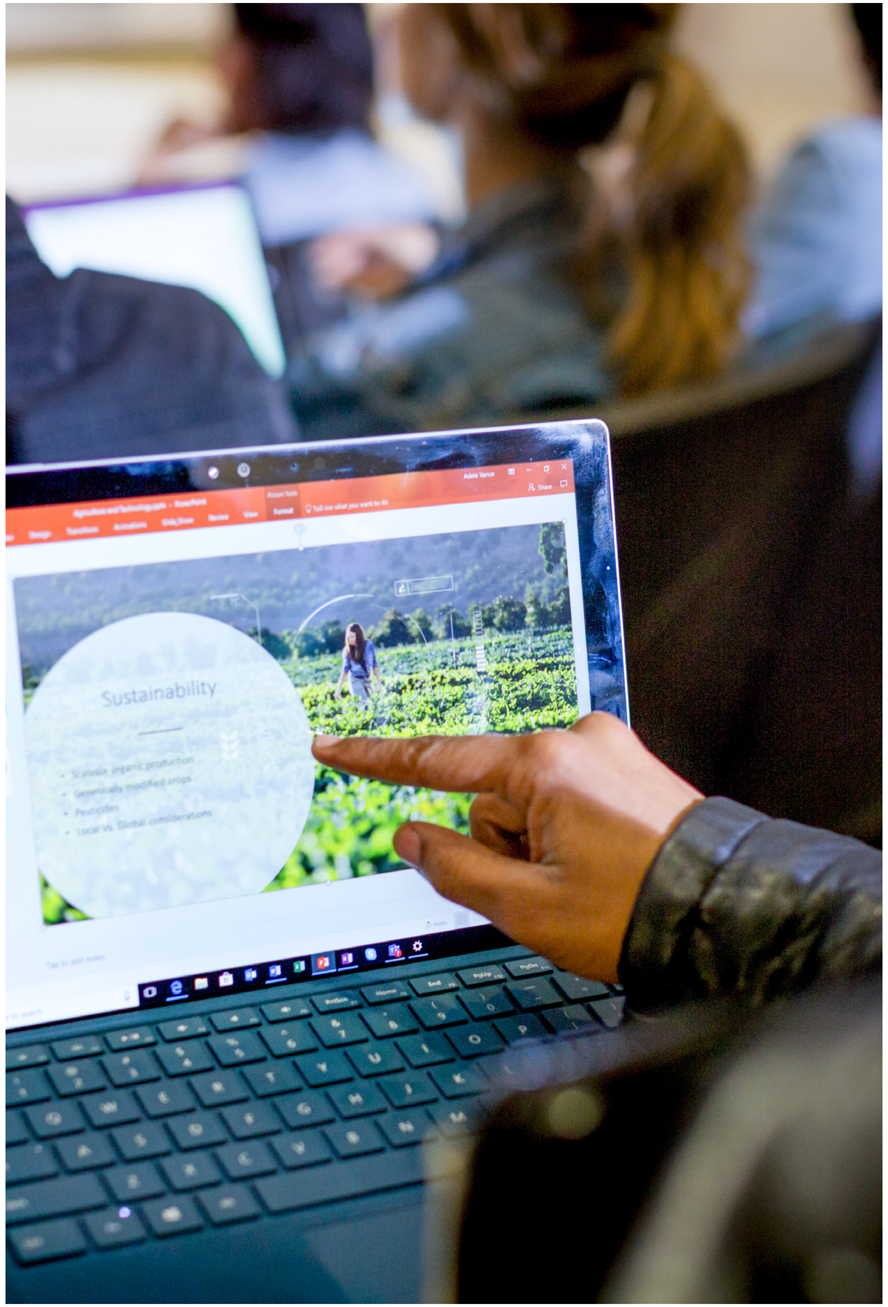
Emissions management

We've learned a lot about emissions management in our ten-plus years. This paper aims to distill those learnings into a useful, usable, universal blueprint.

At Microsoft, we see Emissions Management as a "5-R Journey." It begins with recording and reporting emissions with better data collection and automation, reducing as much as possible with a data-informed roadmap, replacing fossil fuels in our electricity consumption with renewables, and finally removing what remains.

All organizations share common goals and challenges, so think of these steps as a foundational set of capabilities to manage emissions, even if the individual routes taken to achieve net zero may be different.

The conceptual model on **page 10** represents this emissions journey in visual form



26
global corporations with $500 billion in procurement spend supported the Science Based Targets initiative (SBTi)

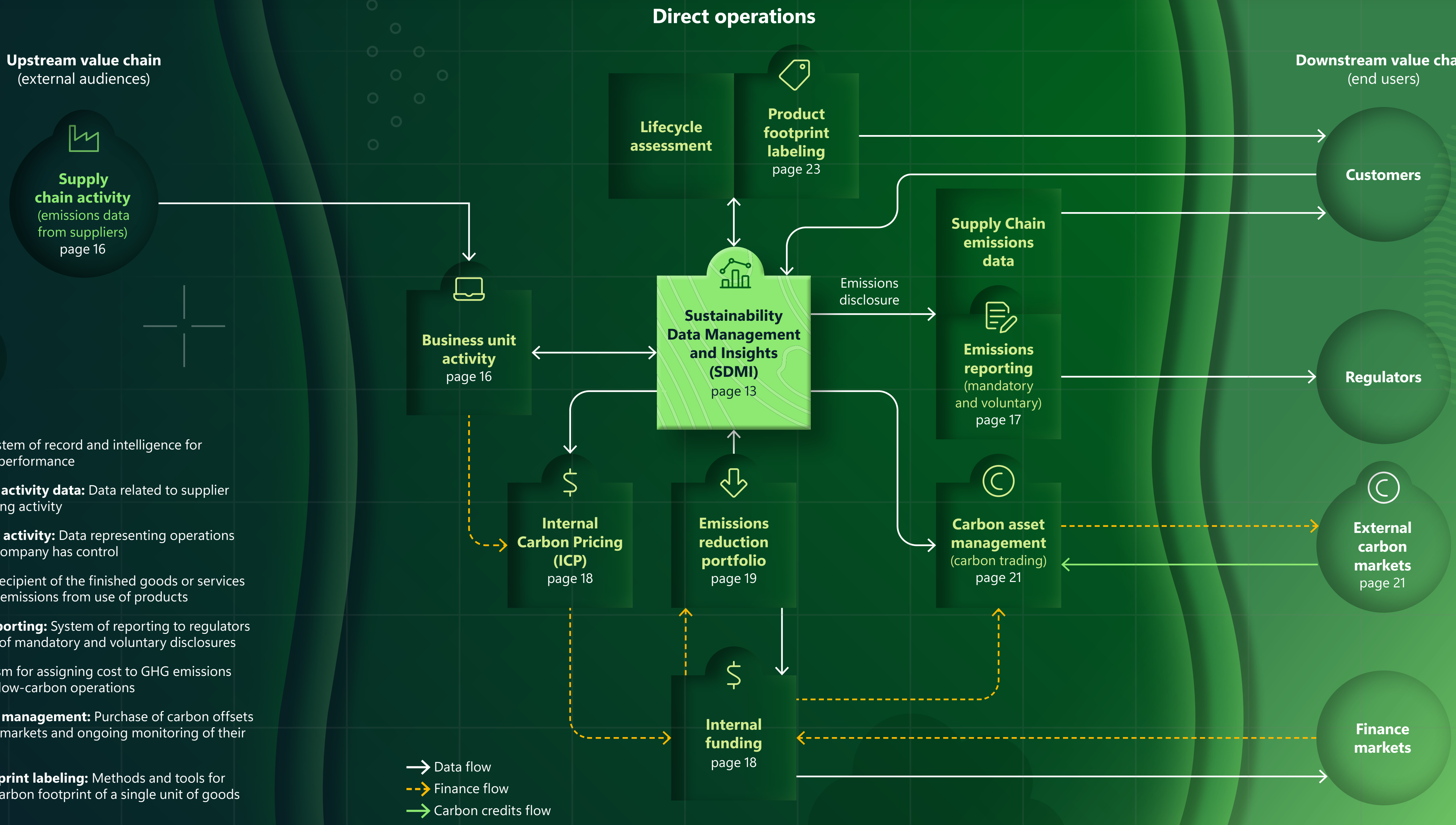
381
companies that collectively emit 1.65 $GtCO_2e$ joined the (SBTi) or had their target approved

75%
Scope 3 emissions account for three quarters of total emissions across all sectors based on CDP submissions

100 to 1,000
billion metric tons of carbon dioxide ($GtCO_2$) removal needed globally by 2100 according to the IPCC

A blueprint for emissions management continued

Figure 3: Emissions management conceptual model



- **SDMI:** The system of record and intelligence for sustainability performance
- **Supply chain activity data:** Data related to supplier GHG-generating activity
- **Business unit activity:** Data representing operations over which a company has control
- **Customers:** Recipient of the finished goods or services and source of emissions from use of products
- **Emissions reporting:** System of reporting to regulators and investors of mandatory and voluntary disclosures
- **ICP:** Mechanism for assigning cost to GHG emissions to incentivize low-carbon operations
- **Carbon asset management:** Purchase of carbon offsets from external markets and ongoing monitoring of their performance
- **Product footprint labeling:** Methods and tools for determining carbon footprint of a single unit of goods or services

Emissions conceptual model – explained

Introduction

The rest of this paper explores each component of this model in detail. To understand the model itself, imagine starting from the system of record at the center then expanding outwards, first through data capture, then emissions reporting, then the use of data to enable increasingly advanced capabilities.

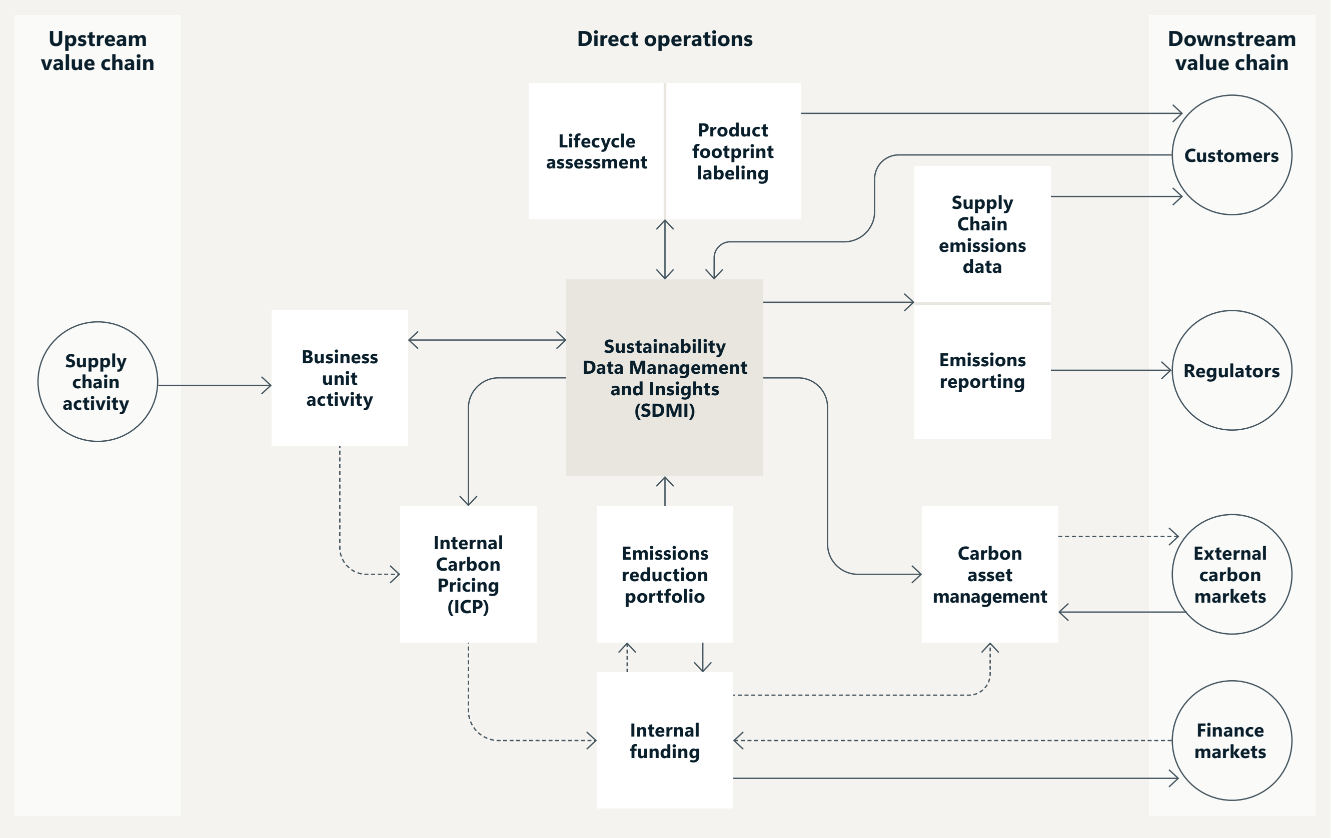
The components it displays are conceptualized capabilities, not specific Microsoft solutions, and each is implemented in iterative steps. We start with primitive approaches that allow for historical analysis of emissions, then as elements of the model advance, accelerate towards higher-fidelity, interconnected systems that enable informed decisions.

The center: system of record

Data that defines the organizational construct is held here, along with prescribed methods of calculating emissions against which to record and report emissions.

The left & right: connected systems

Activity data flows in from the left, from **business units** and their respective **supply chains**. Conversely, activity data from the **customer** use of sold products, a source of emissions that need to be accounted for, flows from the right. With data consistently and accurately recorded in the **SDMI** system, the reporting needs of a broad spectrum of internal and external audiences can be satisfied through the right-hand side of the model.



How the other components work

The data within the SDMI system can serve voluntary and mandatory disclosure needs. **Internal carbon pricing** is an increasingly common mechanism for raising capital and providing an emissions disincentive. The data flowing through the system becomes the "source of truth" to apply pricing mechanisms. The capital generated from this pricing should be managed centrally and allocated according to transition needs.

With the **SDMI** system acting as a carbon ledger, carbon offsets can balance any deficit. The need to comply with local compliance markets and purchase offsets to meet net zero targets means engaging in **external carbon markets**, which have increasing levels of complexity that span sourcing, validation, traceability, custody, and settlement. An accurate understanding of an organization's overall carbon position will depend on offsets being connected into the central **SDMI** system.

With better emissions data management and insights, organizations can be transparent about the carbon footprint of goods and services they provide to customers. **Product footprint** calculation requires complex allocation mechanisms and, in most cases, works with incomplete and imperfect data that needs to be resolved through estimations and approximations. By improving the fidelity of data across the organization and associated value chain (for instance through IoT technology or supply chain traceability solutions) it is possible to improve the accuracy and applicability of product labeling to meet demand.

Emissions management handbook

YOUR ROADMAP TO A SUSTAINABLE TRANSFORMATION

This section of the paper is a best-practice handbook designed to help you improve your approach to Emissions Management.

Sustainability data management and insights (SDMI)

Emissions management relies on a trusted baseline of data that reflects an organization's activities.

A system of record is needed to calculate the baseline against which an organization's progress can be measured. In its most primitive form, this can be manual, using Excel workbooks, or a simple database solution. While this can give an approximate view of an organization's footprint, a more strategic approach is needed to achieve true transparency.

SDMI is a data structure of an organization's accumulated emissions. Its function is to accurately record and report emissions data. By using a common data model, it can unify data from disparate sources to achieve consistent reporting and intelligence. It can also centralize and standardize calculations methods, structure emissions data so it is available for analysis and serves the needs of different audiences.

Finally, the SDMI system helps track progress towards organizational goals, meaning units, teams and even individuals can get a real insight into their contribution towards achieving strategic emissions reduction.

Emissions accounting

To record and report emissions, organizations need to establish the following and collect the relevant data:

Determine organizational and operational boundaries

– Create a clearly defined organizational structure against which emissions are recorded and reported.
– Manage master data related to facilities and assets, both directly or indirectly owned or operated by the organization, as well as a list of suppliers and customers that form the wider value chain.

Identify relevant data and develop collection procedures and tools, including

– Activity data: the ledger of activities that generate emissions. Comprised of direct emissions data from direct monitoring methods, process activity data (e.g. the kWh of electricity), and financial activity data (e.g. $100 of resources or monetary measure of a process resulting in GHG emissions).
– Metadata including details on the data sources, data collection periods and data quality.
– Estimated missing data to fill gaps.

Select method of quantifying GHG emissions

– GHG protocol prescribed methodologies that must be used for each source category. For example, for Scope 3 category 1 purchased goods and services, methods range from spend-based (least specific) using the economic value for goods and multiplying it by relevant secondary emissions factors, to supplier-specific (most specific) when product-level cradle-to-gate GHG inventory data from the supplier is used. Organizations have the flexibility to choose, can change methods used over time, and must decide which is most appropriate to achieve their business goals.
– Emissions factors. The coefficients used to calculate an estimate of GHG emissions generated for a given activity. GHGs are usually reported as carbon dioxide equivalents (CO_2e), a common unit that normalizes all GHGs in terms of their global warming potential (GWP).

How SDMI works

A truly effective SDMI system should help an organization compile and systematize its GHG Inventory, namely the list of its emissions sources and associated emissions quantified using standardized methods. This all starts with determining organizational and operational boundaries. Reference data helps these organizations to define themselves and their constituent parts consistently and to material levels of granularity. For some organizations, the granularity will be departmental or divisional. Others will drill down to individual assets and processes. Granularity should reflect strategy and ambition: it would be of little use to manage emissions at a divisional level when action is required at team or facility levels.

Emissions accounting continued

Organizations must also identify and collect activity data from business units, associated supply chains and the use of goods and services they produce. Based on this, they should be able to quantify their emissions. For reporting purposes, emissions factors [18] are used to calculate an estimated GHG emissions per unit from activity data. Often, emissions of different GHG are expressed as carbon dioxide equivalent (CO_2e). This is a common unit that normalizes all GHGs in terms of their global warming potential (GWP) values.[19]

There are a variety of emissions factor libraries in use today, for example the US EPA[20] and UK Defra.[21] As emissions management becomes more widespread and sophisticated, tailored emissions factors are making reporting more precise for specific sectors. Examples include items of industrial machinery, or the emissions generated by ships. Embedding emissions factors into a central system ensures consistency across the organization, and over time as factor libraries evolve and improve.

18 IPCC Emissions Factor Database | Greenhouse Gas Protocol (ghgprotocol.org)
19 Global Warming Potentials (IPCC Fourth Assessment Report) | UNFCCC
20 GHG Emission Factors Hub | US EPA
21 Greenhouse gas reporting: conversion factors 2021 – GOV.UK (www.gov.uk)

A digital footprint model

The SDMI system enables progress toward reduction goals and highlights the materiality of emissions across divisions. Identifying and acquiring this data can be challenging so improving the availability and fidelity of data needs an iterative approach. Often, the data relating to the activity will not exist. In these cases, an approximation method, such as a spend-based methodology, is necessary to complete the model.

Once a data source is identified, the collection interval needs to be determined. This is typically defined by the materiality of the emissions, the value gained from frequency intervals, and the feasibility of repeated data collection. In some cases annual data is enough, for example capturing data for an immaterial activity, for completeness of annual reporting. In other cases, near real-time data is necessary to generate actionable insights, or to optimize processes using artificial intelligence and machine learning to reduce emissions. The system needs to encode this library of data sources, the nature of the data provided by each source (actual, estimated, pre-calculated), and the frequency with which data should be sampled to complete the model.

Once activity data is flowing into the system, calculations performed using relevant emissions factor libraries estimate CO_2e value so it can be compared across time and activities. These calculations must be consistent and executed with integrity to allow for audit and transparency. Where organizations operate across multiple jurisdictions, emissions may need to be calculated multiple times from the same source to meet the needs of different audiences. Robust data management is essential to manage the integrity of such complex data processing models.

The importance of transparency

Given increased levels of scrutiny around emissions, it is vitally important to provide transparency around the method and inputs used in reporting. With voluntary disclosures, for example, organizations have been operating within loosely defined guidelines, which can lead to diverse interpretations of which method and inputs should be used to report emissions. Today, organizations must be able to offer similar transparency to that which is required by financial regulators. They need systems of data tracking and verification that can stand up to this scrutiny and support their own governance.

Finally, the SDMI is the engine room that serves important capabilities described elsewhere in this paper, from reporting to product footprint labeling. One example is providing the data for "what-if scenario modeling." This is a powerful tool for determining the best pathway to net zero and supporting decisions around which projects to invest in based on their emissions performance.

The SDMI system forms a digital model of an organization's footprint, enabling progress toward reduction goals and highlighting the materiality of emissions across divisions.

SDMI Model, **page 10**

How SDMI supports emissions management

Organizations with advanced SDMI systems can show that GHG protocol accounting and reporting best-practice principles have been followed, giving evidence of:

Relevance
All material GHG emissions of the organization are being recorded.

Completeness
The entire emissions of the organization are held in one location, can be clearly observed and support accurate and complete reporting.

Consistency
Centralization ensures GHG emissions are reported consistently over time so progress can be measured accurately.

Transparency
The system provides a consistent and coherent audit trail, with all data sources, calculation methodologies and assumptions documented.

Accuracy
The system ensures that the GHG emissions quantification process is systematically accurate, by minimizing human error through automation.

Case study

Integrating sustainability into strategy

Mexican company Grupo Bimbo[22] is a world leader in the baking industry. As part of its 75th anniversary in 2020, it added a new purpose: "to nourish a better world." One of its commitments is to achieve net zero carbon emissions by 2050. With the power of Microsoft Cloud for Sustainability[23] and guidance from Microsoft partners, Grupo Bimbo is on its way to fulfilling its mission of integrating sustainability with its overall business strategy and positively impacting the future.

Gaining a single view of their footprint
With Microsoft Sustainability Manager, Grupo Bimbo set up connections to capture activity data from emissions sources, utility and supply chain providers to measure and monitor their impact across all three emissions scopes.

Using calculation models
Grupo Bimbo can use recommended algorithms with verified factors and methods or bring in their own factor library.

Setting goals and reviewing progress
The data tells the story of where the company is today and gives leaders the insight to decide on next steps.

[22] Grupo Bimbo video
[23] Microsoft Cloud for Sustainability | Microsoft

Business and supply chain activity

Most organizations rely on samples and approximations as a starting point for calculating GHG emissions, for example using energy bills at a facility level or bulk fuel consumption information to make aggregate calculations.

The value of an emissions management platform is determined by the quality of data it records.

Most organizations rely on samples and approximations as a starting point for calculating GHG emissions, for example using energy bills at a facility level or bulk fuel consumption information to make aggregate calculations.

This approach is useful to start the journey towards emissions management, but an effective reduction strategy requires increasingly higher levels of data fidelity. Integrating emissions reduction into operations creates more detailed and accurate insights that drive low-carbon transformation. For organizations with advanced levels of data maturity, modern data storage and analytics capability, this is a potentially trivial step. However, for many, it needs investment in monitoring and data capture capabilities.

> It's OK to have imperfect data as long as you are transparent about that. Leveraging estimates... is perfectly fine as long as you are honest about your limitations... and have a roadmap to capture better data in the future.
>
> **World Economic Forum**
> Measuring, reporting and reducing Scope 3 emissions
> World Economic Forum (weforum.org)

How it works

Activity data is recorded across an organization via a variety of methods. At its most sophisticated, it will come from IoT devices, which provide real-time information. In some cases, this might be discrete data points about a particular asset or process. In others it may be a complete building or factory management system. Automated monitoring may not always be possible, and data may come in the form of energy bills or invoices for goods purchased. In emissions management terms, these are all valid sources of activity data that must be recorded into the SDMI platform.

To fully quantify an organizations GHG emissions, supply chains activity data is required. This is recorded as various Scope 3 emissions categories. Lack of data and consistent standards make these "embedded" emissions one of the biggest challenges. In our experience, it has been helpful to use a code of conduct to provide suppliers with clarity on what is expected of them.[24] This set of standards forms the baseline against which suppliers must operate. Once it is in place, standard interfaces should be implemented so suppliers can provide consistent, secure data.

Scope 3 emissions are a complex topic that we'll address in a later white paper. We have also previously published insights into an innovative approach that Microsoft's cloud supply chain group is using for the calculation of Scope 3 cloud emissions.[25]

[24] Microsoft Supplier Code of Conduct | Microsoft Procurement
[25] Microsoft Scope 3 Whitepaper: "A new approach to scope 3 transparency"

How this supports emissions management

Visibility

An effective inventory management plan provides a central record of emissions, their sources and the data connections that provide access to the activity data. By creating a complete inventory of emissions across their own operations and supply chain, organizations can highlight areas of emissions risk and identify underperforming elements where intervention is necessary.

Materiality

Organizations must prioritize improving the fidelity of data that represents their most material emissions. Insights from this data support management decision making and the allocation of resources to improving performance.

Timeliness

The interval at which data is collected plays a significant role in emissions management. Intervals need to be relevant to the activity's materiality and consistent to allow for trends and anomalies to be detected more easily. This enables rapid response to peaks in emission and helps to optimize processes for carbon efficiency.

Emissions reporting

Once activity data is flowing into the SDMI system and emissions have been calculated and recorded, accurate GHG reporting becomes possible.

The SDMI system should now provide all the quantitative information to support reporting.

Reporting generally falls into two categories: voluntary and mandatory. Voluntary disclosures take the form of annual corporate sustainability reports or submissions like CDP.[26]

The annual corporate sustainability report has become a core publication for most organizations, often constituting the bulk of their public reporting. While there is no universal format, each framework generally requires consistent metrics. Most of this information should be fulfilled by the SDMI system, representing a major advance for organizations that spend considerable time sourcing, correlating, and formatting information.

As regulators scrutinize sustainability performance more closely, enterprises increasingly focus on meeting mandatory disclosures. This causes challenges, particularly in organizations that operate across multiple jurisdictions, underlining the need for a unified reporting capability.

[26] Home – CDP

How the system works

The reporting system is the core mechanism for communicating activity, both internally and externally. It is also the interface through which insights from the SDMI can be derived and consumed. The relationship between these two systems is significant, and they often constitute elements of the same physical system.

The templates required for consistent reporting are designed and maintained within the reporting system. These may take the form of defined templates for specific disclosure frameworks with aggregate enterprise-level data. Or they may be internal reports and dashboards with information relevant to the operational units that are responsible for reducing emissions. Ideally, the system is a self-service platform. It should give everyone, both internal and external to the organization, controlled access to emissions data relevant to their needs, to encourage integration into strategic and operational decision making.

In its most basic form, the reporting system provides descriptive analytics, highlighting significant sources of emissions. This prompts action to be focused where emissions are most evident. At its more sophisticated, the system enables insights to be derived from deep patterns in activity data, for example identifying inefficiencies that can be optimized to avoid unnecessary emissions. The aim of the system is to provide "prescriptive analytics" – recommended actions to manage emissions.

Each organization's governance structures are organized differently, but in many cases, goals will be set that place responsibility for reducing emissions with the business units, to drive required action. These goals are recorded in the reporting system, with progress towards them measured by data from the SDMI. The system should also provide scorecards that combine goals and insights relevant to operating units or divisions, creating performance tools equivalent to financial scorecards.

How this supports emissions management

Insights

Reporting emissions data has immense value because it can reveal opportunities to accelerate emissions reduction. It presents an opportunity to use pattern recognition to identify interventions that might otherwise not have been considered.

Operational integration

The more that data is integrated into operations, the greater its value for reporting. By surfacing emissions data at control and decision points, decision makers can see the environmental impact of their choices. This can support a shift in culture within the organization.

Adoption

An engaging emissions reporting and insight interface with dashboards and scorecards will drive greater participation across the organization.

Internal carbon pricing (ICP)

Internal carbon pricing aligns decision making with GHG emissions targets.

To date, emitting GHGs has largely been free, providing limited incentives to move to low-carbon energy sources or improve efficiency. Regulations, carbon markets and taxation are changing this for the better.

Organizations are responding to this by implementing their own internal carbon pricing approaches. For example, asset-intensive companies may require GHG emissions to be incorporated into investment cases, while those with significant footprints related to business travel may focus on changing employee behavior or incentivizing remote meetings. Whichever approach is used, initial and future price levels are key. A meaningful price signal can form the basis for short-term behavioral change, investment in low-carbon technologies and longer-term transformation of the business.

How the system works

Once GHGs emissions expressed as a CO_2 equivalent value are accounted for by the SDMI, an internal carbon price can be set, and a cost assigned to each tonne or unit of CO_2e. This insight is typically surfaced through the reporting or finance system so carbon can be factored into business and investment decisions.

The system will perform different functions depending on the pricing approach. An implicit carbon price identifies the marginal cost of abatement to an organization based on actual costs a company expends to reduce emissions, such as through renewable energy purchases or energy-efficiency projects. A "shadow price," which is more forward-looking, theoretical, and usually much higher, tends to be used to support risk analysis and what-if scenario modeling for investments or new product development. When a carbon price has been set, a company may charge internal carbon fees, where each business unit pays a cost based on its GHG footprint. This approach enables the development of a mechanism through which the collected fees can be reinvested in mitigation initiatives or used to buy offsets.

No single approach supports all business requirements, so a hybrid system is likely to be most effective. It should also have the flexibility to allocate a carbon price to different business units and geographies. Internal carbon pricing has the potential to support improvements in risk management, investments, appraisal of project financing and behavioral change.

It's important to note carbon pricing must happen in concert with complementary policies, funding options, and de-risking instruments. So, it's only a piece of the puzzle – but a very important one.

How this supports emissions management

Building awareness

ICP helps to change the organizational mindset, so emissions become a material factor in decision making. ICP schemes make carbon a more central consideration to business operations and create a currency with which to understand carbon risk.

Funding the transition

Re-investment mechanisms, such as carbon fees paid by each business unit based on their GHG footprint, generate internal finance to drive immediate emission management action. This should also extend to supply chain partners.

Encourages accountability

ICP is an important foundation for new policies, most notably for carbon neutral investments within business groups. It encourages accountability and guides better-informed decision making.

Emissions reduction portfolio

Once an organization can accurately record and report its impact (and quantify carbon risk via ICP mechanisms), it can start reducing emissions.

The types of abatement projects depend on specific business and industry contexts. At Microsoft, investments include renewables projects to meet our commitment that by 2030, 100 percent of our energy supply, 100 percent of the time, will come from zero carbon resources on grids where we operate.

In 2020 and 2021 alone, we signed new purchase agreements for roughly 6GW of renewable energy across ten countries, bringing renewable energy projects to 7.8GW globally. We're also investing in low-carbon materials to achieve net zero across global campuses and datacenters. For example, at our Silicon Valley campus, we're building the largest mass timber building in the United States.

A rigorous approach to net zero requires multiple projects: from replacing energy sources with renewables to improving energy efficiency and reducing waste. This makes central coordination essential. To quantify impact, each project requires a mechanism for expected and actual emissions reduction to be integrated via the SDMI and reporting systems. This way accurate roadmaps can be developed, and shortfalls addressed. Combined with finance systems, the portfolio is where funding allocation related to transition and mitigation projects is managed. Managing emissions is also a great opportunity to engage employees, and many organizations encourage and crowdsource proposals for sustainability projects. A portfolio management system can support ideation, project justification and funding, delivery and scaling.

How the system works

What-if scenario modeling

To simulate the outcomes of proposed emissions reductions projects.

A marginal abatement cost curve for portfolio planning

Abatement cost refers to the cost of reducing GHG emissions, for example by choosing low-carbon building materials. The marginal abatement cost measures the cost of reducing one more unit of GHG emissions, typically shown on a marginal abatement curve. A robust portfolio management system should integrate the financial costs or savings expected from different projects, alongside potential reductions in emissions if implemented. This can help decide which projects represent the best ROI in terms of $/t$CO_2$e.

Cross-departmental team

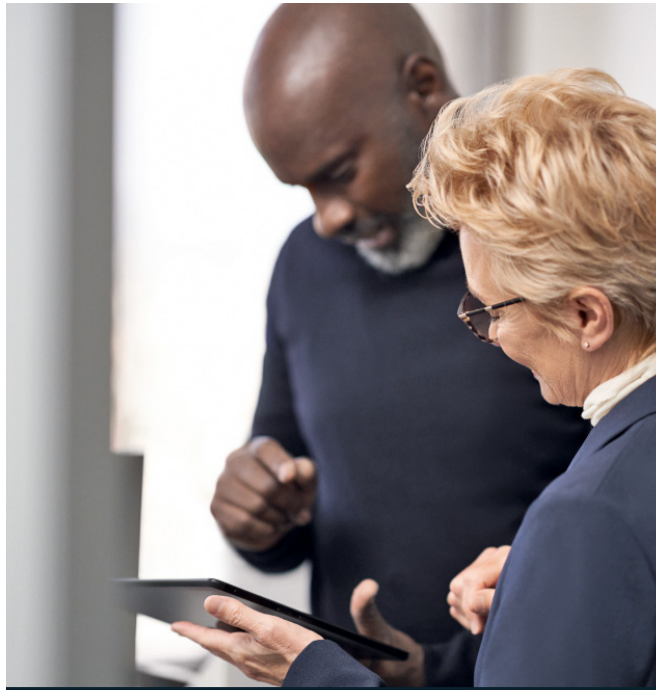
These teams select internal mitigation projects and allocates funding and oversees successful delivery.

Integration with the SDMI system

To monitor and measure performance on an ongoing basis.

Enterprise collaboration systems

To build communities and source new ideas from employees.



> Empowering our global workforce is the center of our sustainability strategy. We have employee communities who drive bottom-up sustainability initiatives to educate, inspire, and activate every employee to advance the company's sustainability goals.
>
> **Microsoft Sustainability Report**

Emissions reduction portfolio continued

How this supports emissions management

Forecasting

Forecasting likely emissions reductions and delivery times based on project timelines is critical to credible decarbonization roadmaps and decisions on carbon reduction options.

Visibility

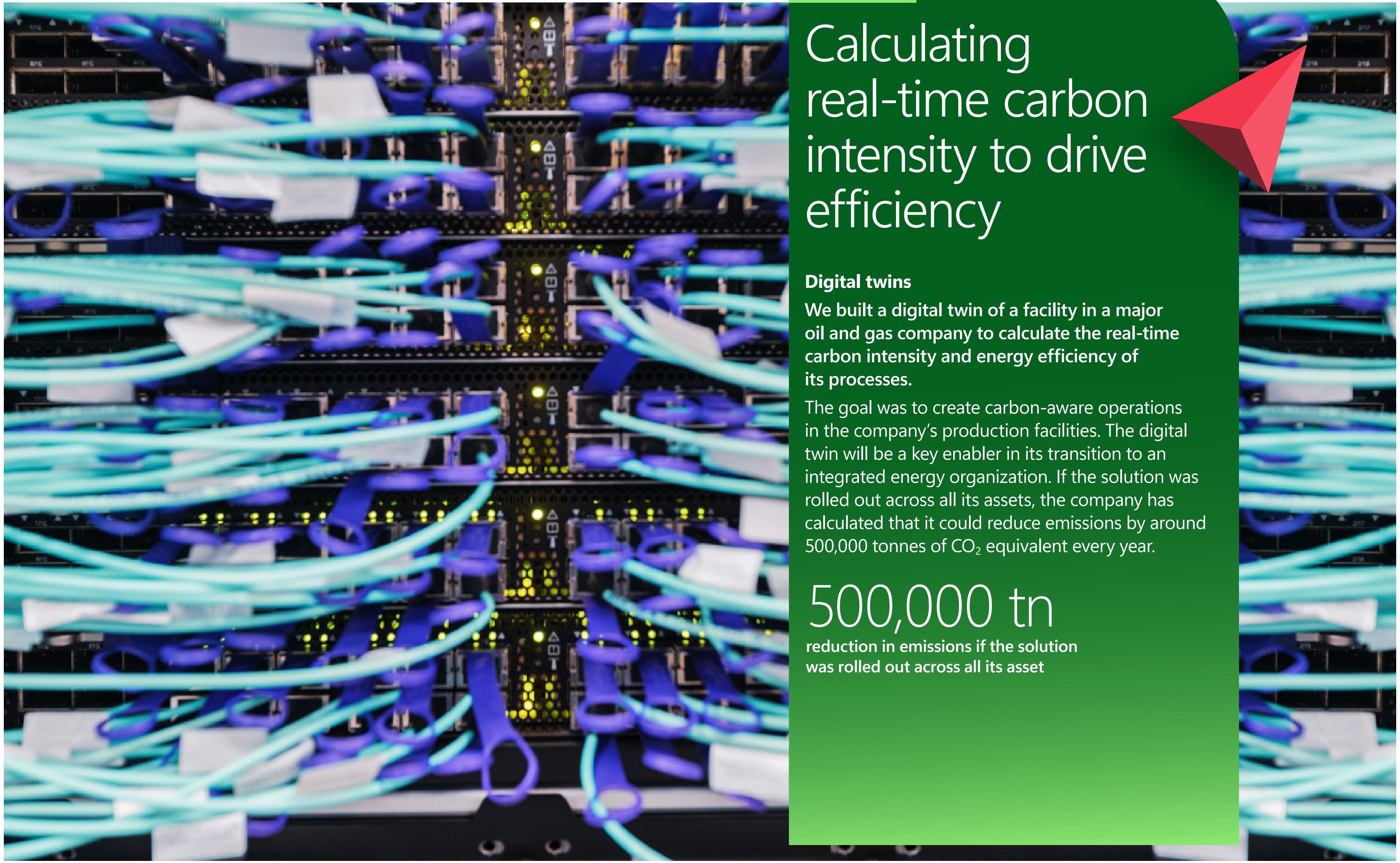
By centralizing information across a product portfolio, organizations monitor cumulative risks to achievement of net zero targets caused by project delays or roadblocks.

Access to funding

This empowers business units and employees to act. The portfolio system enables appropriate governance, enables collaboration across teams and individuals, and nurtures a culture of change. It also helps to identify opportunities to transition or mitigate emissions.

Employee engagement

Sustainability projects work best when everyone is involved. Establishing communities of interest and engaging employees in meaningful initiatives often has a real impact.



Case study

Calculating real-time carbon intensity to drive efficiency

Digital twins

We built a digital twin of a facility in a major oil and gas company to calculate the real-time carbon intensity and energy efficiency of its processes.

The goal was to create carbon-aware operations in the company's production facilities. The digital twin will be a key enabler in its transition to an integrated energy organization. If the solution was rolled out across all its assets, the company has calculated that it could reduce emissions by around 500,000 tonnes of CO_2 equivalent every year.

500,000 tn

reduction in emissions if the solution was rolled out across all its asset

Carbon asset management and external markets

To meet their aspirations, organizations can combine internal measures with external market purchases.

This can include carbon removal units, carbon allowances, supply chain insets or renewable energy certificates. In the short term, most organizations turn to external credit markets to remove GHG emissions they are unable to mitigate. In the past, the low cost of offset credits made it more economical to purchase reductions than to reduce emissions. This approach is not aligned with net zero frameworks that prioritize reducing own emissions. Nevertheless, carbon trading will be a key tool in delivering net zero for most companies, over the shorter term.

The carbon trading landscape is evolving rapidly. Most organizations have to manage exposure across multiple markets, as well as using voluntary markets and renewable energy certificates to deliver on their net zero targets. The development of carbon border taxes increases complexity further.

Mandatory (compliance) emissions trading schemes and carbon taxes are growing in coverage and increasing emissions prices. For example, the EU emissions trading scheme (EU ETS) was introduced in 2005, covering GHGs from major industrial and power generation sources. The low-carbon allowance prices seen in the early years are now gone. Prices have been climbing to levels high enough to drive transformational change rather than incremental improvements.[27]

Page 22 shows a global picture of emissions trading schemes and carbon taxes

How the system works

With the complexities involved, organizations need a system that simplifies the exchange process, along with capabilities addressing how carbon offset credits are used to deliver net zero targets.

This includes:

- Developing a clear rationale for the use of offsets vs. in-house mitigation for emissions.
- Selecting projects with attributes that link to company values and stakeholder preferences.
- Integrating with standard registries, verifiers, and marketplaces to build stakeholder confidence in purchased voluntary carbon credits.
- Ongoing monitoring of project performance, with transparent reporting.
- Tools to support carbon market analysis and trading, i.e. supply-demand analysis for carbon offsets.
- Integration of carbon credit purchases into both the SDMI and reporting systems to provide management information and feed into GHG disclosures.

How this supports emissions management

Integration of carbon offset into an overall net zero strategy

It supports organizations' path to a net zero future through participation in the carbon credits market.

Transparency

The system addresses quality and perception problems, providing clarity to investors and regulators that carbon credits are supporting progress towards net zero targets and companies are adequately managing their carbon risks.

Forecasting

Understanding the future costs of offsets can inform financial and strategic planning and help drive the right emissions reduction portfolio investment decisions (see section 7).

[27] High-Level Commission on Carbon Prices (Stiglitz and Stern, supported by the World Bank)

Carbon asset management and external markets continued

Figure 4: A global picture of emissions trading schemes and carbon taxes

1. California, USA
Began in 2013 and covers about 80 percent of GHG emissions.

Overall, 60 percent of allowances made available via auctions in 2020.

Revenue largely channeled to greenhouse gas reduction fund.

2. China
ETS operational from 2022. Only covers power generation, 12 percent of global emissions. ETS does not cap allowances and operators are incentivized to outperform a benchmark.

3. Colombia
Carbon tax covering all liquid and gaseous fuel.

4. European Union
EU ETS introduced in 2005 and covers 40 percent of GHG emissions, with a cap of 1.6bn ton CO_2 for stationary sources in 2021.

5. France
Carbon tax, introduced in 2014 to complement EU ETS.

6. Germany (+EU)
National ETS was set up in 2021 to cover transport fuels and heating areas not covered in the EU ETS.

7. Kazakhstan
Cap and trade in place since 2013.

8. Québec, Canada
Cap and trade in place since 2013.

9. Mexico
ETS pilot started in January 2020, covering 40 percent of national emissions.

10. New Zealand
Launched in 2008 but overhauled to improve capability to contribute to GHG goals. Auctions allowances reduces free allocations for industrial sector, includes agriculture from 2025.

11. Nova Scotia, Canada
Cap and trade in place since 2019.

12. Spain
Carbon tax for fluorinated GHGs.

13. South Africa
Carbon tax covering all GHG emissions from the industry, power, buildings and transport sectors irrespective of the fossil fuel used.

14. South Korea
Launched in 2015 and based on a cap-and-trade approach. Covers almost 700 of largest emitters and accounts for about 73 percent of national GHG emissions.

15. Sweden
Carbon tax for buildings and transportation.

16. Tokyo
Instigated cap-and-trade program in 2010. 1,200 large buildings, factories, heat suppliers, and other facilities required to reduce emissions below a facility-specific baseline.

17. United Kingdom
Separated from EU ETS in January 2021. Processes largely aligned with EU, but emissions cap is 5 percent lower.

Mandatory compliance emissions trading schemes and carbon taxes are growing in coverage and increasing their emissions prices

Product footprint labeling

A key challenge in emissions management is determining the carbon footprint of a single unit of goods or services, to achieve "product footprint labeling."

The methodology for developing product carbon footprints (PCFs) should be certified against an internationally recognized standard such as PAS 2050, GHG Protocol Product Standard or ISO 14067, and represent all cradle-to-grave activities. The development of robust, certified PCFs demonstrates an organization's commitment to its emissions reduction goals and enables consumers and investors to exercise their preferences. It deepens trust and strengthens customer engagement and brand loyalty.

Achieving product footprint labeling is a complex task requiring significant fidelity of data across the organization and the lifecycle of the good or service. This ranges from labeling based on Economic Input-Output (EIO) Lifecycle Assessment, using industry average data, to full variable data labeling with batch-level traceability for sustainability and provenance. This level of transparency and granular information requires effective exchange of data across value chains, from raw material supply to product end of life.

How the system works

Lifecycle assessment (LCA) is key enabler of product labeling. It analyses the total inputs into the delivery of goods and services and calculates the impact of use including disposal or decommission at end of life.

LCA often relies on hybrid methodologies. For many inputs there is quality data which can be easily attributed to the individual products. Where data doesn't exist, methods like spend-based analysis help. This approach uses a pre-defined calculation to determine an emissions value per unit of spend, allowing overall spend to be equated with emissions. For raw materials, data and pre-defined calculations provide simple methods that scale easily. For inputs purchased as components, a hybrid method may be required. The constituent materials can be calculated using a raw materials data method, while product costs require a spend-based analysis. This hybrid method also extends to disposal. As they reach end of life, materials may be reused or recycled, and the costs of these processes should be considered.

Spend-based methods are challenged when an organization decides to spend more on a material with a potentially lower footprint. While the actual emissions related to those materials have reduced, calculated emissions would increase due to higher spend. This is increasingly compensated for through dynamic spend-based calculation methods, which use frequently updated reference data taking into consideration the advances in material emissions reduction and their related costs. LCA systems also rely upon an accurate bill of materials. This is often held in resource planning systems and needs data interfaces and frequent management to accurately reflect changes in the materials of goods and services.

Product labeling requires a system which can take inputs from many sources and apply a methodology that determines an allocation of the entire emissions to a unit of consumption. This requires an accurate bill of materials, a complete, consistent, and accurate record of all emissions and a source of reference that distributes an allocation of all emissions to a single unit. This diverges significantly from the enterprise-wide recording of data held in the SDMI, which enables aggregate enterprise emissions reporting. The data in the SDMI must therefore be divided equitably across all products, arriving at the "best-effort" calculation to be provided to the consumer.

> Solving this challenge product carbon footprint calculation presents a tremendous opportunity and the potential to accelerate decarbonization significantly.
>
> **Peter Bakker**
> President & CEO,
> WBCSD Pathfinder Framework

Product footprint labeling continued

Microsoft Azure Emissions Impact Dashboard

This dashboard provides customers with information on carbon emissions from their cloud usage, making Microsoft the only provider to offer full transparency across all three scopes of emissions.

Using AI and advanced analytics, the Emissions Impact Dashboard shows reduction trends for customer cloud usage over time, providing the ability to forecast cloud emissions and simplify carbon reporting. It uses consistent and accurate carbon accounting to quantify the impact of Microsoft cloud services on a customer's environmental footprint and compiles the data into easily shared reports for voluntary or statutory reporting requirements.

Case study

Reducing the emissions footprint of built environments through IoT

IOT

To reduce operating costs for its commercial properties, Sweden's largest real estate company and a global leader in sustainability manages a real estate portfolio worth SEK170 billion (USD19.6 billion).

To reduce operating costs for its commercial properties, the company has adopted ProptechOS, an Azure IoT-based solution that unlocks the potential of connected, intelligent properties.

By adding Azure Digital Twins to this solution, in 2021 the company saved upwards of SEK6 million (USD700,000) in energy consumption alone.

By focusing on sustainability improvements, equally important to tenants, the company experienced higher incomes through increased occupancy while simultaneously driving higher asset values.

Product footprint labeling continued

How this supports emissions management

Visibility

Increases value chain visibility, driving initiatives and collaboration with supply chain partners and customers to tackle the most material emissions.

Sustainable product design

Supports the design of products with lifecycle sustainability at the forefront, such as use of low-carbon materials, efficient production techniques, and considering reuse or recycling at end of life.

Microsoft Devices

Within our devices business, we have made significant investments to expand our data-driven lifecycle assessment (LCA) and telemetry approach.

This helps better measure, inform, and prioritize top reduction opportunities to reduce our device carbon intensity across the full lifecycle of our devices. For example, the most recent iterations of the Xbox Series X|S have improved our awareness of full ecosystem energy usage from consoles, information which is critical to future energy-efficiency improvements and emissions reductions.

Efforts to reduce device carbon intensity include carbon-conscious design, reducing supply chain emissions, innovating energy-efficient hardware and software in use, and enabling product repairability, reusability, and recyclability. For example, we designed our Surface Laptop Studio to allow “stamping,” a lower-waste manufacturing technique that reduced our aluminum scrap rate for the product’s base by at least 25 percent, a key contributor to an overall product carbon reduction of 30 percent versus its predecessor, the Surface Book 3 13".

25% manufacturing technique that reduced our aluminum scrap rate for the product’s base

30% Surface Laptop has an overall product carbon reduction of 30 percent versus its predecessor

17% Total Energy consumption for the Surface Pro 8 is 17 percent smaller than Pro 7

80% Energy-saving mode can reduce Xbox power usage in standby mode by over 80 percent

Conclusion

TAKING THE NEXT STEPS

Emissions management is always going to be a journey. The path to lowering emissions may be complex, but it is vital not only for the future viability of organizations but the planet itself.

In summary

Progress isn't uniform. It happens in fits and starts. We must always be mindful that some organizations will have traveled further than others.

Our aim with this white paper is to create something beneficial for all, laying out the emissions management system components we believe are needed to successfully oversee and manage long-term GHG mitigation.

To recap, these are:

- A central system of intelligence, to record and report enterprise emissions
- Advanced GHG data acquisition across the organization and wider supply chain
- Monitoring and reporting capability for both emissions and mitigation initiatives
- Development and implementation of internal carbon pricing mechanisms
- Programme oversight on GHG mitigation projects
- Participation in external carbon markets and oversight of carbon offset risk exposure
- Transparent product footprint labeling

A proven system to navigate complexity

At Microsoft, we know what it takes to transform a business. Today, through Microsoft Pathfinder, we're sharing what we've learned, helping others navigate the sheer complexity of the change needed. We want to drive ambition and accelerate change, offering the business community a science-based approach to achieve net zero that will work.

Progress through innovation

Progress only comes through innovative products and solutions that benefit the whole planet. At Microsoft, our offerings range from providing transparency on organizations' footprints, to digital supply chains that improve business processes, to IoT sensors that stream real-time telemetry for predictive analytics.

Technology enables a new realm of possibility, one that will be a driving force in enabling ambitious, effective, and enduring sustainability outcomes.

Solution	Description
Microsoft Cloud for Sustainability[28] See more	Our first cloud designed to work across multiple industries. Solutions can be customized to specific industry needs, whether a customer is in retail, energy, manufacturing, or another industry. At its core is a data model that aligns with GHG protocols. We're also incrementally extending the data model to include other ESG categories.
Microsoft Sustainability Manager See more	Built on top of our data model, this enables organizations to input, extract, and understand data. It centralizes emissions and water data to streamline ingestion, sharing, and reporting. Customers see results quickly with prebuilt calculation models and can configure calculations to support their needs. The consistency delivered enables more accurate and reliable reporting. Unified data is the foundation of our approach to sustainability, providing self-service data integration and calculation with rich connectors to partner applications.
Microsoft Environmental Credit Service See more	Brings efficiency, trust, and transparency to voluntary ecological markets. It tokenizes and manages the lifecycle of all the assets, including projects, claims, and carbon credits that are involved in the voluntary ecological market ecosystem across participants, such as suppliers, issuing registries, validation and verification bodies, marketplaces, custodians, and buyers.

[28] Microsoft Cloud for Sustainability | Microsoft

In summary continued

Your expert partner in sustainability transformation

At Microsoft, we've been on our sustainability journey for over a decade. Despite the universal challenge, we've learned there really is no such things as a 'one-size-fits-all' solution.

Different organizations have different needs. Some want to solve immediate compliance concerns or manage operational risks. Others need to apply a sustainability lens to their business strategy and unlock new opportunities. Others still might be wondering what their strategy even is, let alone being able to select the solutions they need to put it into action.

At the Microsoft Sustainability Service Line, our solutions adapt as needed. For those with existing strategies, Accelerated Solutions are a powerful way to boost progress. For those who need something less prescriptive, we offer Tailored Solutions – developing a unique digital strategy and sustainability roadmap.

Finally, any successful transformation is an ongoing partnership, one that grows and evolves as an organization does. That's why we have sustainability experts to provide advice, as well as technical specialists to both shape and deliver the End-to-End Transformation.

01
Accelerated Solutions

Proven, powerful, enterprise-ready solutions.

Every sustainable transformation needs a data-driven approach. To record, report and reduce environmental impact, our solutions help make sense of vast amounts of data. From our SDMI solution that generates actionable insights from granular levels of information, to Internal Carbon Pricing to help put a value on emissions and more, we offer the tools to transform your organization.

Sustainability Data Management and Insights (SDMI)
Comprehensive, integrated, and automated sustainability data management using **Microsoft Cloud for Sustainability**.

Internal Carbon Pricing
Access the necessary tools to reinforce behavior change and prepare for a low-carbon future.

Emissions, Water, Waste and Ecosystems Management
Identify priority areas to reduce consumption, emissions and waste and drive target optimization.

Sustainable Supply Chain
Transform supply chains to positively impact your business, society, and the planet.

Product Footprint Labeling
Access tools to evaluate environmental impacts throughout the entire lifecycle of a product.

Climate Risk Management
Identify, adapt, and respond to climate-related risks.

02
Tailored Solutions

Working with organizations to tailor the ideal package.

By collaborating closely with an organization we can create something targeted to their needs. The approach is simple: we come in, help envision the digital solutions needed, then work together to create a bespoke roadmap to deliver it. This helps do everything from sifting vast quantities of environmental and climate-related data in granular detail, to identifying key insights and improvement areas and reducing climate risk.

03
End to End Transformation

Ongoing support that underpins your sustainability transformation journey.

Solutions are only the start. With any shift to a climate-conscious business model, the process will always involve an ongoing partnership. From analyzing huge amounts of data to implementing change management or integrating new data into existing processes, our team is here to support an organization as it evolves. We bring together sustainability experts and technical specialists to manage your transformation, assisting in everything from coordinating programs to managing stakeholders, helping build a business case, or even overseeing adoption.

Glossary of terms

Carbon allowances

Carbon allowances, or permits, are a right to emit greenhouse gases. They are issued by governments and form the basis of compliance markets such as the EU Emissions Trading Scheme and other cap-and-trade markets such as RGGI and the California emissions trading scheme. An allowance is a right to pollute and is fundamentally different to voluntary carbon markets which deal in emissions reductions/removals.

Carbon fees

A carbon fee is a carbon or GHG tax. This may be imposed at a national level or within an organization to impose a cost on what would otherwise be an externality.

Carbon fees are an approach to deploying an internal carbon pricing system for a business where each business pays a tax based on its GHG footprint. Unlike shadow pricing and implicit pricing, the carbon fee approach relates to the mechanism of taxing business units on their GHG footprint and does not provide an approach to setting the carbon price.

Carbon removals

Carbon, or GHG removals are anthropogenic actions undertaken to remove GHGs from the atmosphere. These actions include afforestation, actions to increase the carbon content of soils, direct air capture of CO_2, enhanced mineral weathering etc.

CO_2e

CO_2e is the amount of carbon dioxide (CO_2) emission that would cause the same integrated radiative forcing or temperature change, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of GHGs. Most typically, the CO_2-equivalent emission is obtained by multiplying the emission of a GHG by its global warming potential (GWP) for a 100-year time horizon. For a mix of GHGs it is obtained by summing the CO_2-equivalent emissions of each gas.

Emissions additionality

For carbon reduction or removal projects to have valid credits that can be sold, it is necessary for the project to prove additionality. Additionality means GHG reductions would not have occurred naturally in the absence of a market for the carbon. This means woodland that was not at risk of deforestation anyway would not be eligible for the development of carbon credits. Similarly, many renewable generation projects are cost-competitive without carbon credits and cannot be classed as additional.

Additionality is a key element of carbon credit quality and has a major impact on the price the credit may obtain in the market. It must be noted determining additionality is not clear-cut as much of the assessment needs to be based on future predictions such as of electricity and lumber prices.

Emissions Scopes 1, 2, 3

Scope 1 is defined by the GHG Protocol accounting standard as "a reporting organization's direct GHG emissions" (e.g. fuel combustion in boilers, furnace, and vehicles). **Scope 2** refers to "an organization's (indirect) emissions associated with the generation of electricity, heating/cooling, or steam purchased for consumption," and **Scope 3** includes all "indirect emissions other than those covered in Scope 2."

Greenhouse gas

Greenhouse gases can absorb infrared radiation (heat) emitted by the surface of the Earth. This energy is re-emitted by the gases, with a proportion directed towards the Earth's surface. The net effect is that a proportion of energy that would otherwise be lost to space is trapped, resulting in a warmer planet than if the gases were absent.

There are several greenhouse gases, the most important of which are water vapor, CO_2, methane, nitrous oxide and ozone. Anthropogenic contributions to greenhouse gases are key for CO_2, methane, nitrous oxide and a number of fluorocarbons such as SF6 and HCFCs.

Implicit carbon price

Implicit carbon pricing is an approach to setting the internal carbon price for an organization. It is calculated based on how much the organization spends to mitigate GHGs or to comply with regulations. Implicit pricing is therefore a method of determining the costs to the business overall and can be used to recover these costs from business units and provide incentives to reduce emissions.

Net zero

Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period. Net zero CO_2 emissions are also referred to as carbon neutrality.

Glossary of terms continued

Paris Agreement targets

The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC. One of the goals of the Paris Agreement is "Holding the increase in the global average temperature to well below 2˚C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5˚C above pre-industrial levels", recognizing that this would significantly reduce the risks and impacts of climate change.

Power purchase agreements

Power purchase agreements (PPAs) are long-term contracts between an electricity generator and a buyer. Traditionally, PPAs were used by generation developers to gain funding for new projects and lower the electricity price risks. Increasingly, PPAs are being used as a mechanism for organizations to gain long-term access to electricity from renewable sources. A key element of this is proof for the organization that the electricity comes from renewable sources and that they retain the exclusive rights. As such, the PPA may include renewable energy certificates or equivalent.

Removal credits

Projects that remove GHGs from the atmosphere, such as reforestation, earn credits that can then be sold as offsets. In order to be approved these projects must go through a series of approval and validation steps to ensure demonstrable, additional and permanent removal of GHGs from the atmosphere. Projects that provide removal credits may also provide significant sustainability benefits for ecosystems and communities local to the project through various co-benefits.

Renewable Energy Certificates

Renewable Energy Certificates, or RECs, are tradable market instruments that represent the property rights to the benefits of renewable generation. Note that the REC does not represent the actual MWh of electricity, which may be traded separately from the REC. Ownership of enough RECs to cover electricity demand demonstrates that an organization has utilized renewably sourced generation.

Science-based targets

Science-based targets are in-line with the latest climate science evidence on what is required to meet the targets of the Paris Agreement. Science-based targets are another way of saying Paris-aligned. The Science Based Targets Initiative provides technical expertise to support organizations in setting science-based targets by reviewing their targets and promoting best practices.

Shadow price

Shadow pricing is an approach to setting the internal carbon price for an organization. It is a forward-looking, theoretical price and is generally used to support long-term business planning and capital investment decisions. Generally, it is higher than any existing carbon price, reflecting the expectations that carbon prices will have to rise significantly to support the transition to a low-carbon economy.

Supply chain insetting

Supply chain insetting is an approach for organizations to invest in reducing the GHG footprint across their broader value chain. A key aspect of this is that the GHG reductions are externally verified against business as usual to help ensure additionality and to allocate the benefits to the investing company. Insetting can be a valuable approach where the supply chain partners do not have the capital, skills or are otherwise unable to monetize GHG reductions in their own operations.

Sustainability

Sustainability is a dynamic process guaranteeing the persistence of natural and human systems in an equitable manner. For society, sustainable development meets the needs of the present without compromising future generations' ability to meet their needs (WCED, 1987), balancing social, economic and environmental concerns.

Voluntary carbon markets

The voluntary carbon markets are based around projects that aim to produce demonstrable, additional, and permanent emissions reductions, either by removal or through reduction compared to business as usual.

Reduced emissions: from efficiency or fuel substitution (renewables) measures.

Removed emissions: from technology- or forestry/agriculture-based carbon capture.

Avoided emissions: from protection of forests.

Currently there are several organizations providing verification of project-based offsets. The prices vary significantly, reflecting different underlying project types and degrees of confidence in the offset quality.

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