Decarbonization Playbook for the Pharmaceutical Industry

Actionable emissions reduction initiatives for a net zero transition

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accenture | PSCI

This document is ‘solutions-first’

Its intent is to provide an actionable playbook to guide the pharmaceutical community on the road to net zero.

There have been several whitepapers published on the topic of health sector decarbonization. This Playbook builds on that work to provide 24 detailed interventions that have been assessed in terms of addressability, emission reduction potential, implementation timeline, upfront cost, regulatory complexity, and intervention adoption timeframe. This deep analysis of interventions will support pharmaceutical companies to drive action as they navigate their decarbonization journey.

It provides the key elements for progress on the net-zero journey for pharmaceutical companies

Outlines the emissions impact on industry

Providing the pharmaceutical industry context with respect to carbon emissions, outlining the climate risks, the stakes of inaction, and the sector’s emission contributions.

Flags common pain points and pitfalls

Highlighting common challenges organizations face when mobilizing towards net-zero, showcasing the need to prepare the organization by building key capabilities necessary to successfully execute a net-zero plan.

Identifies the net-zero value creation opportunities

Outlining the value creation opportunities, highlighting the shared value in addressing negative externalities including becoming more efficient and innovative.

Defines substantive decarbonization interventions

Presenting a repository of decarbonization initiatives for pharmaceutical organizations, organizing initiatives by level of reduction potential categorized by key drug lifecycle impact areas.

Highlights key capabilities to execute and set-up for success

Defining the organizational capabilities pharmaceutical organizations need to build and/or strengthen to enable enterprise-wide change, adoption and scale initiatives on their path to net-zero.

What's in the Playbook?

The playbook is organized into three sections and is intended to be read sequentially but can also be used modularly with links to each section below.

Section 01

Pressures and unique challenges for decarbonization in the pharmaceutical industry.

Section 02

24 emissions reduction initiatives across **seven impact areas** spanning the drug life cycle.

Section 03

Organizational capabilities needed to enable and accelerate impact within and outside the organization.

Contents

How has this playbook been prepared?

Collection & Research

Collected data on **GHG emission sources and potential decarbonization initiatives** through external and Accenture internal resources.

- Published GHG emissions inventories of pharmaceutical companies.
- External publications on sustainability in the pharmaceutical industry.
- Internal Accenture research on pharmaceutical decarbonization based on project experience.

Evaluation

Evaluated each initiative on its **addressability, GHG reduction potential, implementation timeline, upfront cost, regulatory complexity, and intervention adoption timeframe.**

- Decarbonization initiatives aligned with emission sources.
- Financial and emissions estimates for each initiative.

Validation

Validated the list of initiatives through a combination of review and input from **Accenture subject matter advisors (SMA)** and **Pharmaceutical Supply Chain Initiative (PSCI)* industry members.**

- Accenture SMA inputs and refinement of initiatives.
- Consultation with external industry partners through the PSCI Decarbonization Team.

*PSCI is the leading nonprofit membership organization driving responsible supply chain practices in the pharmaceutical and healthcare industry

Section 01

Understanding the Stakes

Climate change is causing devastating impacts on health

In January 2022, UN Secretary General António Gutierres sounded the alarm about the dire state of Earth's climate: *"The world has no choice but to enter 'emergency mode," because without 'an avalanche of action,' humanity has no hope of meeting the Paris Climate Accord goal of limiting global temperature rise to 1.5 degrees Celsius above preindustrial levels."*

In March 2023, the 6th Assessment IPCC report painted an even starker picture. The report asserts that the impacts of global warming are already more severe than expected and we are hurtling towards increasingly dangerous and irreversible consequences.

5x fold increase in weather related disasters[1.1]

Floods, heatwaves, natural disasters, and other extreme events are expected to increase and occur with more intensity. Climate change is a key driver of fivefold increase in the number of weather-related disasters in the last 50 years.

80% of global population at risk of food insecurity[1.2]

About 80% of the global population most at risk from crop failures and hunger from climate change are in Sub-Saharan Africa, South Asia, and Southeast Asia, where farming families are disproportionally poor and vulnerable.

250M people at risk of mass poverty & displacement[1.3]

Over 97 percent of disaster-induced displacement in 2022 was weather-related. Countries of the Global South are experiencing increasing displacement—estimates say the numbers could go as high as 250 million people by 2050.

Sources :1.1. World Meteorological Organization Disasters Report (2022); 1.2. World Bank Analysis (2021); 1.3. T20 Climate Displacement & Migration Report (2023);

Public health consequences of inaction

Climate change affects the **social and environmental determinants of health** – clean air, safe drinking water, sufficient food and secure shelter.

Between 2030 and 2050, climate change is expected to cause approximately **250,000 additional deaths per year**, from malnutrition, malaria, diarrhea and heat stress.

A 2021 study indicated that across the Western United States, there were ~150,000 asthma events resulting from wildfires. These smoke-induced asthma exacerbation cases contributed to over **$1.5 billion in excess healthcare costs.**

Climate change induced health challenges

- Injury and mortality from extreme weather events
- Water-borne diseases and other water-related health impacts
- Heat-related illnesses and long-term impacts of such exposure
- Nutrition issues and food-borne illnesses
- Mental and psycho-social health as well as noncommunicable disease
- Higher zoonoses (disease transmitted between from animals to humans) incidence

Sources: 1.4. World Health Organization - Climate Change & Health (2021)

The pharmaceutical industry is a key contributor to global emissions due to complex product lifecycles and an energy-intensive value chain

More than

10 to 15 years

for drug developement[1.5]

In that time, an average pharmaceutical company releases

14M MTCO2e

across scope 1, 2 and 3 carbon emissions[1.6]

Only about

12%

of drugs entering clinical trials are approved by the FDA[1.5]

4.5%

of total annual emissions **globally** are emitted by the health sector[1.8]

If the global health care sector were a country, it would be the **5th largest GHG emitter** on the planet.

55%

more Scope 1+2 emissions per $1M of revenue released by pharmaceutical companies than automotive companies[1.7]

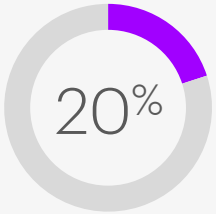
48.55 tonnes of CO2 per $1M

31.4 tonnes per $1M

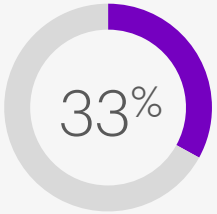
Sources: 1.5. Research and Development | PhRMA(2022) ; 1.6. Accenture Research; 1.7. World Economic Forum (weforum.org) (2022) ; 1.8. smi-hstf-supply-chains-whitepaper.pdf (storyblok.com)

However, advancing decarbonization is slow as life sciences (LS) companies wrestle with various pain points preventing more progress

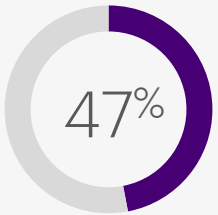
Emissions need to be reduced by 45% by 2030, and be net zero by 2050, to avoid the worst impacts of climate change.



of LS companies are **on track to achieve net-zero by 2050.**



of LS companies are **off track but reducing emissions.**



of LS companies are **off track, and still growing emissions.**

Companies must identify and contend with **critical pain points** to kickstart progress towards targets. They must also build capabilities that counteract these pain points and set the stage for activation (more in section 3).

- Lack of capable technology and reliable, accurate, and specific data.
- Nascent, changing, and uncertain measurement methodologies.
- Intricate, far-reaching, and opaque supply chains that require robust coordination.
- Energy-intensive equipment and procedures in pharmaceutical manufacturing and biotech research.
- Long, inflexible product development cycles that make it hard to implement rapid changes or re-design processes.
- Difficult balance between maximizing for sustainability while ensuring a high level of patient safety and product efficacy.
- Cultural and organizational inertia to change required to build net-zero mindset.
- High R&D costs to develop and implement sustainable tech and practices.
- Uncertain and rigorous regulatory environment across borders.

Non-exhaustive

Sources: 1.10. Content on this slide sourced from Accenture Research: Accenture Net Zero Report (2023)

Inaction or delay on decarbonization exposes pharmaceutical companies to material risk factors across the stakeholder landscape

Regulation is requiring more disclosure, accuracy and verification; and carbon taxes are proliferating

...non-compliance will lead to **penalties, fines, or suspension of trading, increasing exposure to carbon tax and related regimes.**

Patients are joining advocacy groups, researching eco-practices, and wielding social media to force a greener drug industry

...inadequate engagement with patients and significant patient groups could impact **reputation and competitive position.**

Investors view climate risk as financial risk, and require it be managed as such

...inadequate risk management and lack of transparent disclosure could lead to **reduced shareholder value and higher cost of capital.**

Employees prefer companies with strong sustainability programs, and it impacts whether they stay

...inability to retain talent could lead to **high turnover, lost sales, and reduced productivity.**

Customers are including mandatory net-zero requirements as a means of doing business

...inability to meet customer contractual requirements could lead to **loss of revenue and diminished brand reputation.**

Peers in the pharmaceutical industry are setting ambitious targets

...inability to meet customer contractual requirements could lead to **loss of revenue and diminished brand reputation.**

The case for decarbonization is strong, as it offers direct, material benefits from new enterprise and patient value creation opportunities

Tangible

Increase Positives

Drive Growth

Addressing sustainability throughout product lifecycle can lead to innovations in new products and services that broaden and **differentiate the product portfolio** and can appeal to **patient preferences in sustainability.**

Drive Efficiency

Optimizing equipment for **low energy use and durability** in manufacturing and transport reduces costs and may be eligible for government incentives.

Redesigning processes for **reduced waste generation** and enhanced recovery of products and packaging.

Reduce Negatives

Improve Trust And Reputation

Strengthening relationships with customers and patients based on credible claims of being a **responsible brand.**

Facilitating a culture of experimentation, and **enhancing talent recruiting, employee engagement and reducing turnover.**

Reduce Risks

Mitigating **supply chain risk and increase resiliency** through designing for sustainability and enhanced recovery of products and packaging.

Managing **regulatory risk from emerging policies** on emissions reduction such as carbon taxes and other climate and transition risks.

Intangible

Section 02

Taking Action

Emissions across the product lifecycle are found in three scopes of emissions as defined by the GHG Protocol, with most emissions in the value chain (Scope 3)

Percentage share of normalized GHG emissions derived from the analysis of 10 top pharmaceutical companies

Scope 3

- 55% Purchased Goods & Services
- 6% Upstream Transportation & Distribution
- 3.5% Capital Goods
- 2% Business Travel
- 1% Employee Commuting
- <1% Waste Generated in Operations

Scope 1 & Scope 2

Scope 1 5%

- Combustion of Fossil Fuels
- Company Operated Vehicles

Scope 2 3%

- Purchased Energy in Company Owned Facilities

Scope 3

- 1% Downstream Transportation and Distribution
- 1% End of Life Treatment of Sold Products
- 20% Use of Sold Products
- <1% Processing of Sold Products
- 2% Fuel & Energy Related Activities
- <1% Investments

Value-Chain Emissions Breakdown View

Inbound 3rd Party Emissions →

Tier n | Tier 3 | Tier 2 | Tier 1

Company Operations →

R&D/ Product Development | Manufacturer/ Distribution

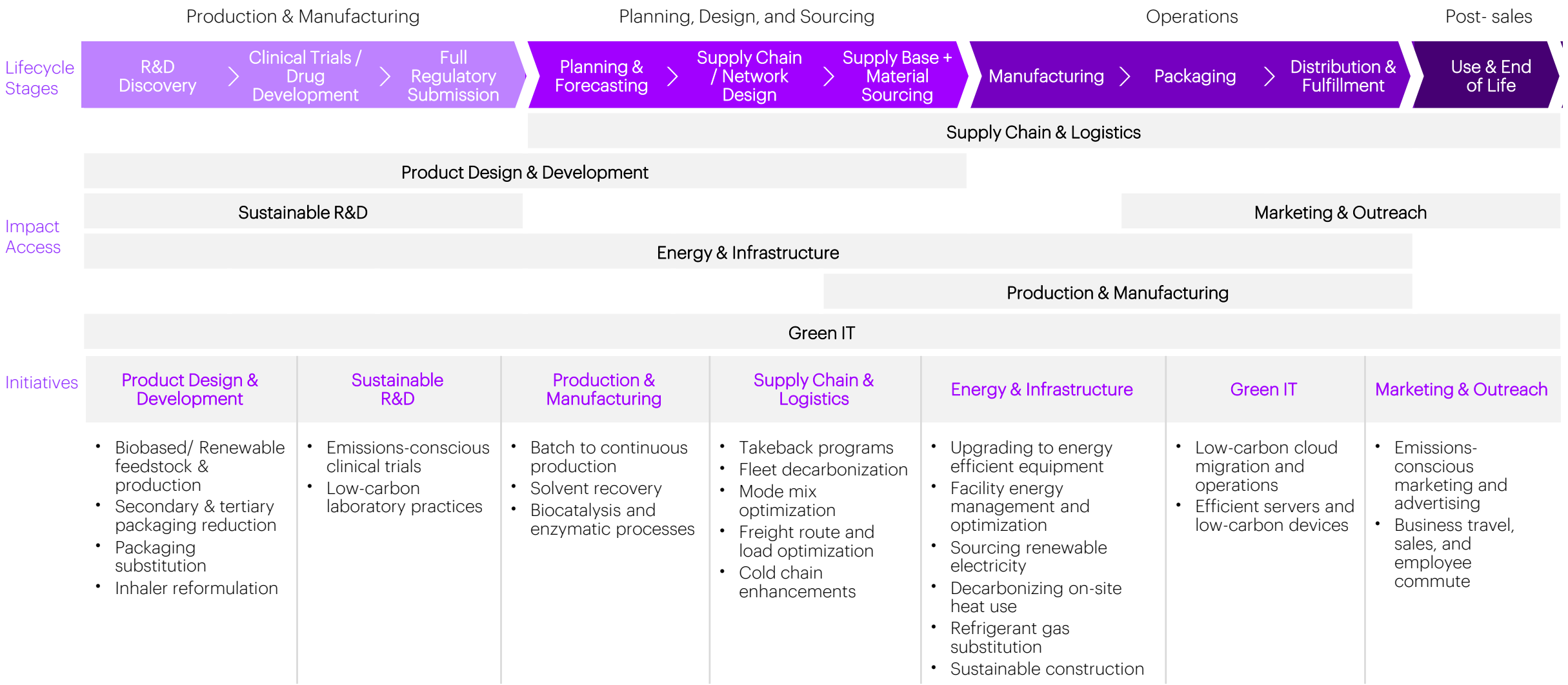
Outbound 3rd Party Emissions →

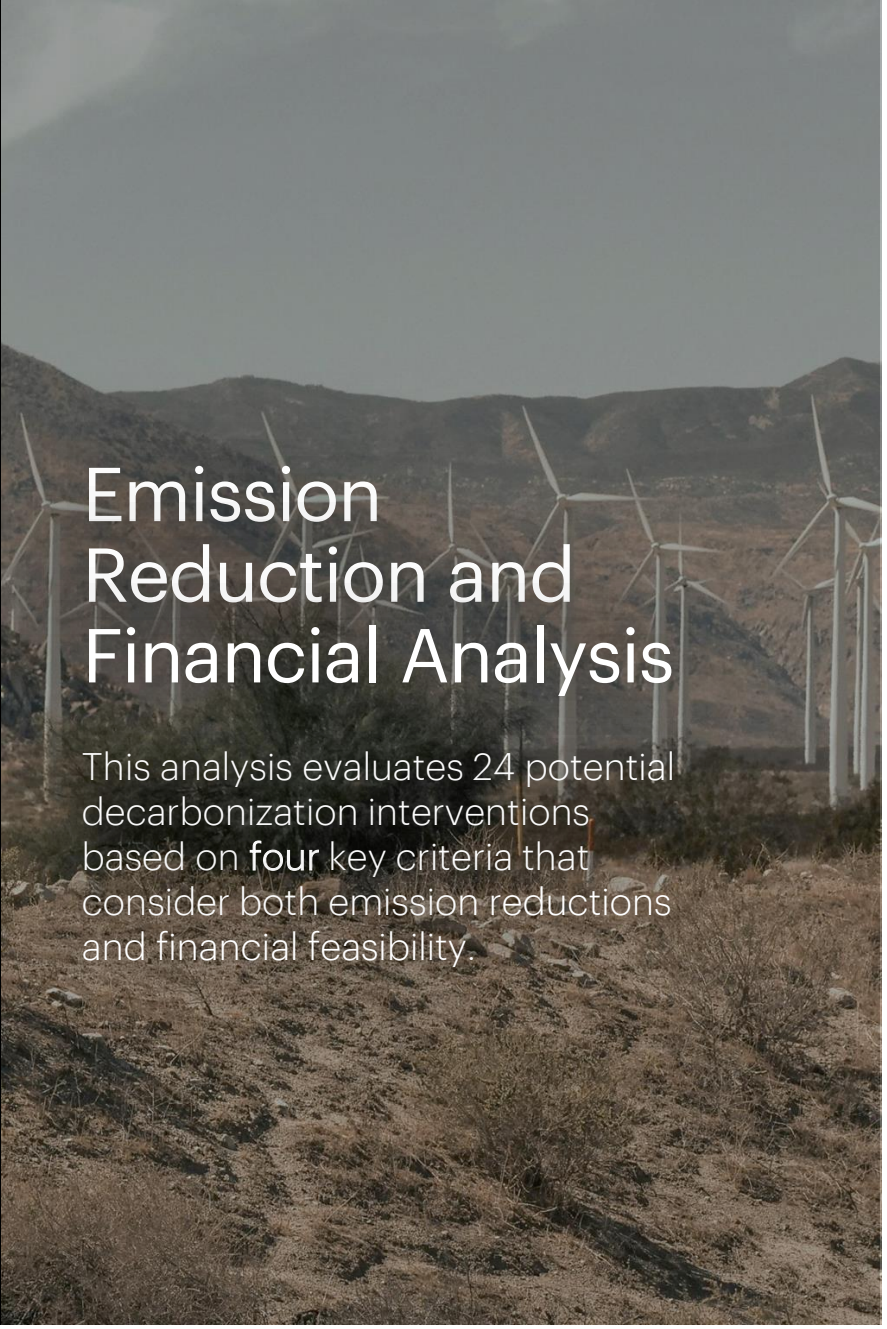
Retailer/HCP | Patients | Reverse Logistics

Source: 2.1.1. Accenture/SAP Analysis 2023, | 2.1.2. PSCI Scope 3 Greenhouse Gas Emissions Calculation (2020); *Emissions categories defined in accordance with the 2.1.3.GHG Protocol

Note: Three Scope 3 categories (Upstream leased assets, Downstream leased assets and Franchises) have been excluded from this analysis for the top 10 pharmaceutical companies due to their immateriality based on our assessment. The specific exclusions may vary across different businesses.

To guide pharmaceutical companies to achieve net zero, we identified 24 emission reduction initiatives across 7 impact areas that map to the drug development lifecycle





Emission Reduction and Financial Analysis

This analysis evaluates 24 potential decarbonization interventions based on **four** key criteria that consider both emission reductions and financial feasibility.

Addressability

(% of total Scope 1, 2, and 3 emissions)

This metric points to **the potential coverage** of the initiative. A higher percentage indicates that the initiative targets a larger portion of company's carbon footprint, leading to potentially greater overall emission reductions.

Emission Reduction Potential

(% reduction in emissions with respect to the addressed emissions):

This focuses on **the effectiveness** of the initiative. A higher percentage signifies the initiative's ability to significantly reduce emissions within the scope it addresses.

Upfront Cost

(Typical upfront investment required to design and operationalize the initiative):

Understanding the upfront cost allows for **financial planning and prioritization**. Initiatives with lower upfront costs could be implemented more quickly, while high-cost options might require securing additional funding or phased implementation.

Implementation Timeline

(% of total Scope 1, 2, and 3 emissions):

Initiatives with shorter implementation timelines allow quicker rollout which may lead to faster emission reductions, potentially contributing to achieving sustainability goals sooner.

1. Note: A combination of Accenture's project data and secondary research was employed to estimate the addressability, emission reduction potential, upfront costs, and implementation timelines.
2. Addressability, emission reduction potential, implementation timeline, and upfront cost ratings are based on Accenture's past internal project data, subject matter expert input and secondary research.
3. Upfront cost figures are based on scale of initiatives rolled out by large pharmaceutical companies with annual revenues between US$30 billion and US$100 billion.

These initiatives were evaluated on emissions and financial considerations to facilitate prioritization and planning

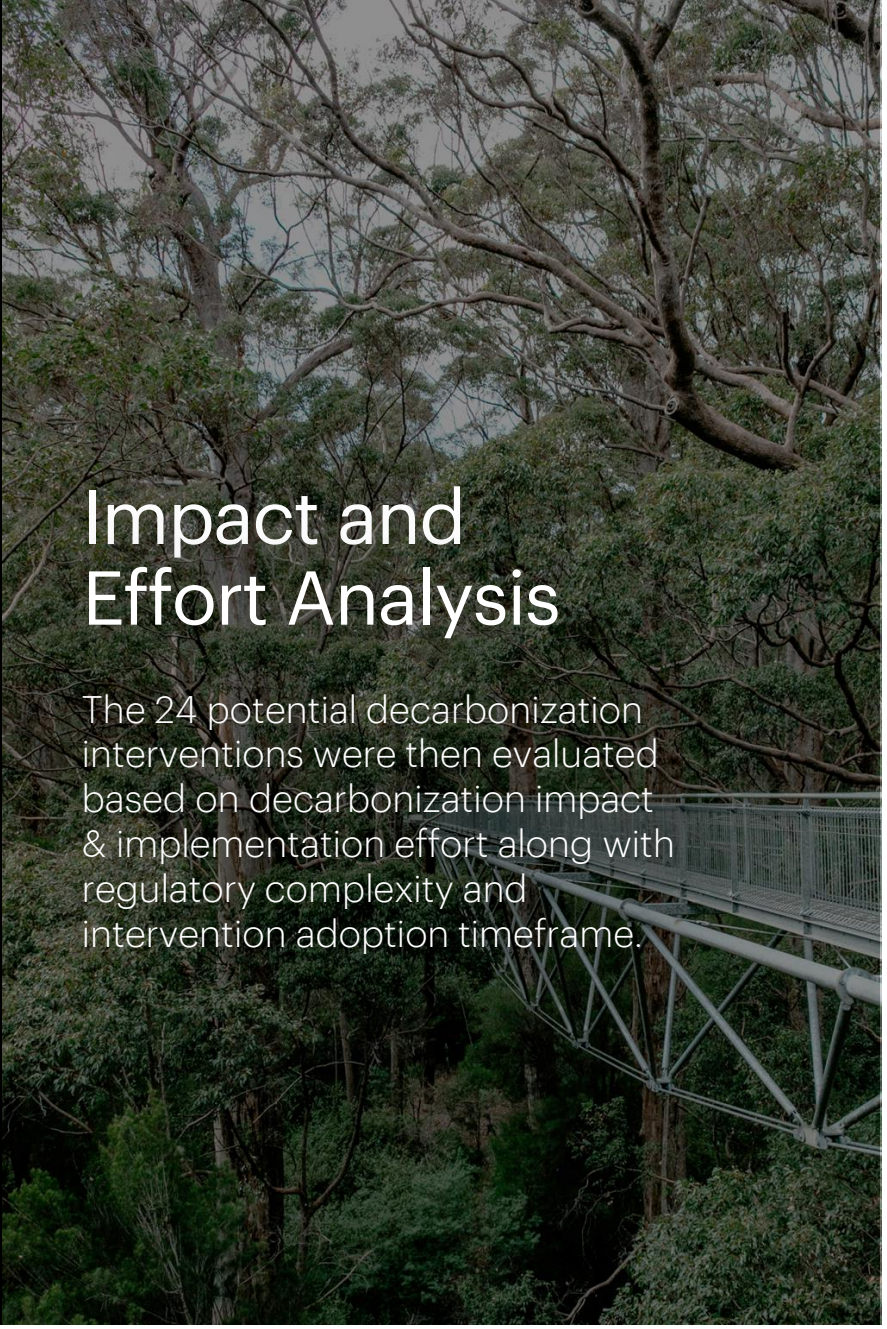
		Emission Considerations			Financial Considerations	
Impact Area	Initiatives	Applicable Scope Categories	Addressability	Emission Reduction Potential	Implementation Timeline	Upfront Cost [1]
Product Design & Development	• Bio-based/ Renewable feedstock and production	S1, S3 Cat 1, 5	● ●	● ●	● ● ●	● ● ●
	• Secondary and tertiary packaging reduction	S3 Cat 1, 4, 5, 9, 12	● ● ●	● ●	●	●
	• Packaging substitution	S3 Cat 1, 4, 5, 9, 12	● ●	● ●	● ●	● ●
	• Inhaler reformulation	S3 Cat 11	●	● ● ●	● ● ●	● ● ●
Sustainable R&D	• Emissions-conscious clinical trials	S1, S2, S3 Cat 1, 3, 5	●	● ●	● ● ●	●
	• Low-carbon laboratory practices	S1, S3 Cat 1, 5	● ●	● ●	● ● ●	● ●
Production & Manufacturing	• Batch to continuous production	S1, S2, S3 Cat 1, 3	● ●	● ● ●	● ● ●	● ● ●
	• Solvent recovery	S2, S3 Cat 1, 5	●	● ●	● ● ●	● ● ●
	• Biocatalysis and enzymatic processes	S3 Cat 1, 5	● ●	● ●	● ●	● ● ●
Supply Chain & Logistics	• Takeback programs	S3 Cat 1, 5, 11, 12	●	●	● ●	● ●
	• Fleet decarbonization	S1, S3 Cat 4, 9	● ● ●	● ● ●	● ● ●	● ● ●
	• Mode mix optimization	S1, S3 Cat 4, 9	● ●	● ● ●	● ●	● ● ●
	• Freight route and load optimization	S1, S3 Cat 4, 9	● ● ●	● ● ●	●	●
	• Cold chain enhancements	S1, S3 Cat 4, 9	●	● ●	● ●	● ●
Energy & Infrastructure	• Upgrading to energy efficient equipment[2]	S1, S2, S3 Cat 3	● ●	● ●	● ●	●
	• Facility energy management and optimization	S1, S2, S3 Cat 1, 2, 3, 5	●	●	●	●
	• Sourcing renewable electricity[3]	S2	● ●	● ● ●	●	●
	• Decarbonizing on-site heat use	S1, S2	●	● ●	● ● ●	● ● ●
	• Refrigerant gas substitution	S1	●	● ● ●	● ● ●	● ●
	• Sustainable construction	S2, S3 Cat 1, 2, 5	● ● ●	● ●	● ● ●	● ● ●
Green IT	• Low-carbon cloud migration and operations	S2, S3 Cat 1	●	● ● ●	● ●	● ●
	• Efficient servers and low carbon devices	S2, S3 Cat 1, 3, 5	● ●	● ●	● ●	● ●
Marketing & Outreach	• Emissions-conscious marketing and advertising	S3 Cat 1	● ●	● ●	● ● ●	● ●
	• Business travel, sales, and employee commute	S3 Cat 6, 7	● ●	●	● ● ●	● ●

Scope 3 Emissions Categories: Category 1: Purchased Goods and Services; Category 2: Capital Goods; Category 3: Fuel- and Energy-Related Activities; Category 4: Upstream Transportation and Distribution; Category 5: Waste Generated in Operations; Category 6: Business Travel; Category 7: Employee Commuting; Category 8: Upstream Leased Assets; Category 9: Downstream Transportation and Distribution; Category 10: Processing of Sold Products; Category 11: Use of Sold Products; Category 12: End-of-Life Treatment of Sold Products; Category 13: Downstream Leased Assets; Category 14: Franchises; Category 15: Investments.

For further details on emissions organization refer: Source 2.1.3.GHG Protocol

	● Low	● ● Medium	● ● ● High
Adressability	< 5%	5-10%	>10%
Emission Reduct. Pot.	<35%	35-70%	>70%
Timeline	<1 yr.	1-5 yrs.	>5 yrs.
Upfront Cost	< $1 Mn	$1-10 Mn	>$10 Mn

1. Upfront cost figures are based on scale of initiatives rolled out by large pharmaceutical companies with annual revenues between US$30 billion and US$100 billion.
2. Upfront costs for RE infrastructure typically reflect own investment. However, certificates can be acquired without upfront costs.
3. For upgrading to energy efficient equipment intervention ESCO model is considered for implementation.
4. For Sourcing Renewable Energy intervention OpEx model is considered for implementation.



Impact and Effort Analysis

The 24 potential decarbonization interventions were then evaluated based on decarbonization impact & implementation effort along with regulatory complexity and intervention adoption timeframe.

Decarbonization Impact

This metric is calculated as a 60/40 weighted average of Addressability and Carbon emission reduction potential ratings, reflecting the assumption that higher addressability leads to greater impact.

Implementation Effort

This metric is calculated as 50/50 weighted average of Implementation timeline and Upfront cost.

Regulatory Complexity

(Difficulty of navigating and complying with laws, standards, guidelines by regulatory bodies)

Higher regulatory complexity can create significant challenges for organizations, requiring them to invest resources in legal counsel, compliance specialists, and training to ensure adherence.

Intervention Adoption Timeframe

(Outlines the expected timeframe for organizations to implement the intervention)

Adoption timeframes are categorized as:

- **Short-term adoption (0-2 year):** implementation leading to quick wins for early decarbonization progress;
- **Medium-term adoption (2-5 years):** Begin planning & development of these intervention now;
- **Long term adoption (5+ years onwards):** Transformative interventions requiring significant investment and change.

As part of initiative planning, it is important to consider impact, effort, regulatory complexity and adoption timeframe

Impact Area	Initiatives	Decarbonization Impact [1]	Implementation Effort [2]	Regulatory Complexity [3]	Intervention Adoption Timeframe[4]		
					Near term adoption[4.a] 2024-2026	Medium adoption[4.b] 2026-2030	Long-term adoption[4.c] 2030+
Product Design & Development	• Bio-based/ Renewable feedstock and production	Medium	High	High			✓
	• Secondary and tertiary packaging reduction	High	Low	Low	✓		
	• Packaging substitution	Medium	Medium	Medium		✓	
	• Inhaler reformulation	Medium	High	High		✓	
Sustainable R&D	• Emissions-conscious clinical trials	Low	Medium	Medium		✓	
	• Low-carbon laboratory practices	Medium	High	Low	✓		
Production & Manufacturing	• Batch to continuous production	Medium	High	High		✓	
	• Solvent recovery	Low	High	High		✓	
	• Biocatalysis and enzymatic processes	Medium	High	High		✓	
Supply Chain & Logistics	• Takeback programs	Low	Medium	High		✓	
	• Fleet decarbonization	High	High	Low	✓		
	• Mode mix optimization	Medium	High	Low	✓		
	• Freight route and load optimization	High	Low	Low	✓		
	• Cold chain enhancements	Low	Medium	Low		✓	
Energy & Infrastructure	• Upgrading to energy efficient equipment 3	Medium	Medium	Medium	✓		
	• Facility energy management and optimization	Low	Low	Low	✓		
	• Sourcing renewable electricity 4	Medium	Low	Medium	✓		
	• Decarbonizing on-site heat use	Medium	High	Low			✓
	• Refrigerant gas substitution	Medium	High	Medium			✓
	• Sustainable construction	High	High	Medium			✓
Green IT	• Low-carbon cloud migration and operations	Medium	Medium	Low	✓		
	• Efficient servers and low carbon devices	Medium	Medium	Low	✓		
Marketing & Outreach	• Emissions-conscious marketing and advertising	Medium	High	Low		✓	
	• Business travel, sales, and employee commute	Medium	High	Low	✓		

1. Decarbonization impact is calculated as a 60/40 weighted average of Addressability and Carbon emission reduction potential ratings, reflecting the assumption that higher addressability leads to greater impact.
2. Implementation effort is calculated as a 50/50 weighted average of Timeline and Upfront cost ratings for each intervention
3. Regulatory complexity refers to the difficulty of navigating and complying with laws, standards, guidelines and necessary approvals.
4. The intervention adoption timeframe outlines the expected timeframe for interventions to be well-established and available for widespread adoption.
   a. Short-term adoption (0-2 year): implementation leading to quick wins for early decarbonization progress;
   b. Medium-term adoption (2-5 years): Begin planning & development of these intervention now;
   c. Long term adoption (5+ years onwards): Transformative interventions requiring significant investment and change.

7 impact areas that map to the drug development lifecycle

*Click on the boxes to navigate to each section

The following pages offer deep dives into each reduction initiative, providing an overview of the opportunity along with the potential sustainability and non-sustainability benefits

How to Read the Reduction Initiatives "Deep Dives"

Each slide consists of the same components:

Initiative scoring

Scoring against key criteria defined in our methodology (See Slides 16 and 17 for additional context)

Addressable emissions category: _____
Addressability: _____ Emissions reduction potential: _____ Timeline: _____ Upfront cost: _____

What is it?

A description of the reduction initiative and a high-level overview of where in the lifecycle it applies.

Value Potential

An overview of the sustainability and non-sustainability benefits that can be derived from implementing the opportunity.

Key Challenges

An outline of common implementation, technical, or financial challenges involved in activating the opportunity.

What do you need to get started?

A high-level list of recommended activities organizations should consider to kickoff initiative activation.

Enablers:

A breakdown of technology with relevant applications and potential to accelerate activation and increase success of initiative implementation.

Case Studies:

A highlight of select case studies from the pharmaceutical industry (and other industries) who are activating a particular initiative.

On the Horizon (trends)

List of emerging trends within the field that have the potential to significantly impact future decarbonization efforts.

Section 02

Taking Action

Product Design & Development

- Bio-based Feedstock and Production
- Secondary and Tertiary Packaging Reduction
- Packaging Substitution
- Inhaler Reformulation

Product Design & Development

Bio-based/ Renewable Feedstock & Production

Addressable emissions category: **Scope1, Scope 3- Cat 1, 5**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **High**

What is it?

Bio-based feedstock and production entails use of renewable biological materials (e.g. sugar cane, algae, starch crops) as raw materials or input for production of pharmaceutical ingredients or medications. The use of biobased feedstocks in pharmaceutical production can contribute to sustainability by reducing reliance on finite fossil-fuel based resources, promoting the use of renewable materials, and potentially reducing the environmental impact associated with traditional synthetic processes.

Value Potential

Nearly 99% of pharmaceutical feedstocks are derived from petrochemicals[2.2.1]. The use of bio-based feedstocks mitigates GHG emissions. Utilizing biological sources can also provide access to a diverse range of chemical structures and compounds that may not be easily accessible through traditional synthetic routes offering innovation opportunities. Additionally, switching to organic chemical raw materials of non-fossil origin as feedstock can mitigate supply chain risk by reducing dependence on the volatile oil market.[2.2.2, 2.2.3]

Key Challenges

Switching to bio-based feedstock may require process changes and regulatory approvals. Ensuring consistent purity and scalability of biological sources is challenging. Establishing reliable, sustainable supply chains is complex, especially with geographically dispersed or environmentally sensitive sources which can increase production costs, potentially impacting drug affordability for patients. Switching enzymes could potentially impact reaction yields or product quality. Additionally, the chemical technology that enables conversion from biomass into bio-based chemicals into final products people use is not yet as well developed24,25. Biobased production for chiral drugs might be less selective, requiring complex separation methods to ensure the correct, effective form.[2.2.4]

What do you need to get started?

- Assess current feedstock portfolio and identify potential bio-based alternatives.
- Conduct a lifecycle assessment to determine footprint for current feedstocks portfolio and prioritize more sustainable alternatives.
- Invest in R&D and experiment with various feedstocks to refine requirements and identify suitable options.
- Collaborate with biotechnology firms, academic research institutions, or industry consortia to access cutting-edge bioprocessing expertise.
- Collaborate with supply chain partners to design needed feedstocks network and sourcing strategy.
- Create a feedstock decarbonization roadmap organized by ease of substitution and investment requirements.

Enablers:

- **Lifecycle Assessment**
  Assesses environmental impacts, guiding prioritization and sustainable choices.

Case Studies

Cradle-to-Grave Life Cycle Study of Bio-Based Feedstock

The chemicals companies decarbonizing with bio-feedstocks - World Bio Market Insights

On the Horizon (Trends)

- Bio-naphtha, derived from hydrotreated vegetable oil or biogas can replace naphtha derived from oil and gas, but remains expensive today (2-3x that of naphtha). [1.8]
- Green H2 could also play a significant role as a feedstock, where used as a direct input (e.g., for ammonia), or where, used to generate complex hydrocarbons. [1.8]

Sources: 2.2.1. nih.gov; 2.2.2. Defossilization of pharmaceutical manufacturing (2022) ; 2.2.3. Modern Approaches of Plant-Based Natural Products (2022); 2.2.4. Biocatalysis:- Rossino (2022); 1.8. smi-hstf-supply-chains-whitepaper (2022)

Product Design & Development

Secondary & Tertiary Packaging Reduction

Addressable emissions category: **Scope 3- Cat 1, 4, 5, 12**
Addressability: **High** | Emissions reduction potential: **Medium** | Timeline: **Low** | Upfront cost: **Low**

What is it?

Packaging reduction involves both minimizing the amount of material used in packaging and implementing systems for the reuse or recycling of packaging. Alternative delivery methods such as concentrated formulations allow for smaller containers while maintaining efficacy. This can involve unit-dose blister packs, concentrated liquids with specific dispensers, or switching to dry inhalers and for certain medications, potentially improving adherence as well.

Value Potential

Reduction in packaging will reduce not only the GHG emissions associated with the manufacturing and transportation of the packaging material, but also emissions from the solid waste footprint of the packaging waste. Redesigning primary (e.g., plastic bottle size), secondary (e.g., cardboard box size), and tertiary (e.g., pallet design) packaging to reduce volume and weight while still maintaining safety, hygiene and acceptability standards has the potential to reduce baseline emissions by 15%.[2.2.5] Increasing the use of fully recycled content in packaging and/or increase the proportion of recycled materials in packaging instead of using virgin materials has the potential to reduce baseline emissions from packaging by 25%.[2.2.5] These packaging reductions also have the potential to reduce costs from reduced raw material needs and / or reuse of materials.

Key Challenges

Packaging material innovation sometimes requires redesign of the packaging product, which can necessitate significant expenses. Sustainable alternatives sometimes lack the same level of durability and protection as conventional materials, raising concerns about product damage and spoilage. Consumers might resist unfamiliar or less visually appealing sustainable packaging. Lack of robust infrastructure for collection, sorting, and recycling hinders wider adoption.

What do you need to get started?

- Identify packaging that could be easily reused, recycled, composted, or biodegraded.
- Engage with packaging and materials suppliers on options for adopting sustainable packaging.
- Partner with healthcare customers to explore opportunities for takeback programs.
- Assess the financial implications of incorporating recycled or post-consumer recycled materials, keeping healthcare providers, retail, and patient sentiment, and regulatory compliance, in mind.
- Partner with suppliers across the packaging supply chain networks to adopt reused and recycled packaging.
- Offer clear, on-pack labeling with post-use instructions for consumers
- Advocate for stringent packaging regulations to encourage mass adoption and exchange of best practices.

Enablers:

- **Additive manufacturing (e.g.. 3D printing)**- Allows on-demand production of customized packaging, reducing excess material usage.
- **Digital packaging inserts**- Replaces traditional paper inserts with digital versions accessible via QR codes or websites, reducing paper usage and allowing for real-time updates of product information.
- **Sustainable material sourcing marketplace platforms**- Provide access to eco-friendly materials, promoting the use of recyclable and renewable resources in packaging.
- **CAD Generative Design** - Develop design alternatives using generative design to support lightweighting and therefore less

Case Studies

Astellas x Eisai x Daiichi x Takeda: Reducing Packaging Burden

Colbert Packaging Custom Solutions for Sustainability

Generative Design Opens New Paths to a Sustainable Future

Insulet-2023-Sustainability-Report.pdf

Sources: 2.2.5. Accenture Scope 3 Analysis (2023); 1.8. smi-hstf-supply-chains-whitepaper (2022)

Product Design & Development

Packaging Substitution

Addressable emissions category: **Scope 3- Cat 1, 4, 5, 12**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **Medium**| Upfront cost: **Medium**

What is it?

Packaging substitution involves exploring sustainable material alternatives; for example, replacing non-recyclable plastics with recyclable counterparts, using renewable feedstocks and bio-derived materials, and increasing post-consumer recycled plastic content in the packaging material. In a nutshell, the goal is to switch to a more sustainable packaging option that achieves the same function and results in a lower carbon footprint.

Value Potential

Substituting fossil-fuel-based materials with renewable and bio-derived materials lowers energy consumption and greenhouse gas emissions associated with packaging throughout its lifecycle. Traditional packaging often uses non-biodegradable materials, so substituting recyclable, compostable, or biodegradable materials can significantly reduce the environmental footprint. Transitioning from traditional plastic primary and secondary packaging material to a bio-based plastic alternative has the potential to reduce baseline emissions by 21%.[2.2.5]

Key Challenges

Like reduction initiatives, innovation in substitution is risky and can require substantial investment. Additionally, new packaging materials need to comply with stringent pharmaceutical regulations for sterility, tamper-evidence, and proper labeling. The substitute material needs to ensure product safety, stability, and efficacy throughout its shelf life. Ensuring a consistent and reliable supply of substitutes materials is also critical as disruptions can create considerable risks.

What do you need to get started?

- Conduct a lifecycle assessment of current product portfolio with a focus on packaging waste.
- Analyze current product portfolio to gauge substitution viability.
- Shortlist substitution options for top product candidates and experiment to test for packaging requirements.
- Work with suppliers to innovate on necessary packaging or explore biobased or biodegradable versions of traditional plastic materials.
- Identify products that can be transitioned.
- Select products that might be suitable for reusable formats.
- Work with packaging partners to identify and implement biodegradable packaging solutions.
- Conduct packaging substitution pilots with select product(s).

Enablers:

- **Sustainable material sourcing marketplace platforms**- Provide access to eco-friendly materials, promoting the use of recyclable resources in packaging.
- **Agreement between key stakeholders**- on what packaging is acceptable and safe to remove.
- **Ready-made supply chain networks**- to enable packaging substitutions.

Case Studies

Astellas Pharma Plant-Derived Blister Package

Colbert Packaging Custom Solutions for Sustainability

We launch our bio-based polyolefins to reduce the medical sector's carbon footprint (repsol.com)

On the Horizon (trends)

- Safely Dissolvable and Healable Active Packaging Films (Bio-polyamide) for Pharmaceutical products. [2.2.6]
- Nanoscience and nanotechnology for biobased materials and packaging. [2.2.7]
- Ocean-based feedstocks for biobased packaging.[2.2.8]

Sources: 2.2.5. Accenture Scope 3 Analysis (2023); 2.2.6. Water-soluble packaging (2023) ; 2.2.7. PMI | Bio-Polyamide Market (2024); 2.2.8. ScienceDirect | Marine-derived biopolymers as potential bioplastics (2023); 1.8. smi-hstf-supply-chains-whitepaper (2022);

Product Design & Development

Inhaler Reformulation

Addressable emissions category: **Scope 3- Cat 11**
Addressability: **Low** | Emissions reduction potential: **High** | Timeline: **High** | Upfront cost: **High**

What is it?

Replacing the propellants in Metered Dose Inhalers (MDIs) with propellants that have lower global warming potential will require reformulation of inhalers. The impact of this initiative will be felt in the use-phase of the product.

Value Potential

Current propellants in MDIs have high global warming potentials. Use of sold products accounts (inhalers) for roughly half the GHG emissions of major global inhaler manufacturers. A global analysis of inhaler emissions has calculated that substituting 2–5% of MDIs with Dry Powdered Inhalers (DPIs) annually would result in inhaler GHG emission reductions by 38–58% over 50 years.[2.2.9] Clinical trials are underway actively investigating the efficacy and safety of alternatives that can reduce impact.

Key Challenges

Switching to low-carbon inhalers requires a longer timeline for: regulatory approval of new formulations and proof of clinical efficacy, changes in sourcing, potential manufacturing modifications, clinician and patient education and acceptance, and cost considerations. Switching from MDIs to DPIs may not be possible as the MDIs may still be medically necessary in some cases of asthma and chronic obstructive pulmonary disease (COPD).

What do you need to get started?

- Assess emissions impact for current state inhaler propellants.
- Shortlist propellant replacement candidates based on performance, emissions savings, patient needs, and regulatory requirements.
- Calculate potential emissions reductions from adopting each propellant replacement candidate, balancing footprint reduction with reformulation cost outlay.
- Engage with supply chain partners to blueprint for sustainable raw materials sourcing needed to facilitate reformulation process.
- Assess current state manufacturing process and identify any changes that may need to occur to facilitate reformulation.
- Design reformulation clinical trials.
- Interface with relevant regulatory bodies to ensure compliance.
- Educate clinicians and patients on the newly reformulated inhaler.

Enablers:

- **Educate Regulators and Lawmakers-** Educating regulators and policymakers can expedite the approval process and bring these advancements to patients faster.
- **Equivalence Demonstration-** between the reformulated product and the original inhaler supports regulatory approval in addition to patient and clinician adoption.

Case Studies

Kindeva Green Inhaler Initiative

Honeywell & AstraZeneca Inhaler Sustainability Partnership

On the Horizon (trends)

- Latest low-GWP propellant product approvals (pressurized metered-dose inhalers (pMDIs), breath-actuated pMDIs (BA-pMDIs), and smart inhalers incorporating digital technology).

Sources: 2.2.9. Impact of choice of inhalers (nih.gov) (2022) ; 2.2.10. Pharmaceuticals | DPIs (mdpi.com)(2023)

Section 02

Taking Action

Sustainable Research & Development

- Emissions-conscious Clinical Trials
- Low-carbon Laboratory Practices

Sustainable R&D

Emissions-conscious Clinical Trials

Addressable emissions category: **Scope 1, Scope 2, Scope 3- Cat 1, 3, 5**
Addressability: **Low** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **Low**

What is it?

Clinical trials contribute to GHG emissions through energy use and waste in research premises and transportation. The carbon footprint needs to be considered for both the design and delivery of clinical trials, looking at ways to reduce those footprints without affecting trial quality or integrity. Actions include leveraging digital health solutions like digitizing records and documentation, conducting virtual trials, remote sample collection kits, digital patient diaries, automated drug dispensing systems, using digital biomarkers, utilizing digital twins to reduce participant numbers, return of unused materials, leveraging data, and AI for screening and logistics.

Value Potential

In 2021, ClinicalTrials.gov had about 350,000 national and international trials registered, which, using the average calculated by the Sustainable Clinical Trials Group, would generate an estimated 27·5 million tons of carbon dioxide equivalent (CO_2e).[2.3.2] Implementing emission-conscious practices, such as optimizing travel logistics, utilizing remote monitoring technologies, and reducing energy consumption, can lead to operational efficiencies and cost savings in the long run. Digital Twins can support up to a 25% reduction in the number of clinical trials.[2.3.1] Remote trials can also enable participation from a more diverse patient population, including patients from more rural areas and patients from lower-income communities that lack resources to participate in person, helping to address health inequities.

Key Challenges

Extensive engagement and change management with partners who administer clinical trials is required to transform current practices to sustainable processes. Any change may also be subject to regulatory scrutiny and uncertainty.

What do you need to get started?

- Determine a baseline impact for current state clinical trials process.
- Determine areas of opportunities for decarbonizing clinical trials that maintains a high-level of fidelity and efficacy.
- Pinpoint areas in the trials process to integrate technology to reduce costs and emissions impact.
- Procure materials and equipment from sustainable sources, such as those with a low carbon footprint or those made from recycled materials.
- Implement recycle/reuse programs to reduce waste
- Use telemedicine to conduct patient visits and reduce travel-based emissions.

Enablers:

- Data analytics and Digital Twin- Analyze vast datasets to optimize trial protocols, reducing travel and resource consumption, thus lowering emissions.
- Digital Biomarkers- Enable remote monitoring of patient health data, reducing the need for frequent clinic visits and associated emissions.

Case Studies

CRASH 1 and CRASH 2 Trials

Thermo Fisher: Using Digitization and Decentralization to Decarbonize Clinical Trials

The Sustainable Trials Study Group

On the Horizon (trends)

- Technology advancement in digital biomarkers and novel blood biomarkers.

Sources: 2.3.1. BMJ Open | Quantifying the carbon footprint of clinical trials 2.3.2. Forbes (2021) 1.9. smi-hstf-digital-health-whitepaper (2022)

Sustainable R&D

Low-carbon Laboratory Practices

Addressable emissions category: **Scope 1, Scope 3- Cat 1, 5**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **Medium**

What is it?

Shifting to low-carbon laboratory practices involves adopting sustainable and environmentally-friendly approaches in research and development (R&D) laboratories, aimed at reducing the carbon footprint and environmental impact associated with laboratory operations. Sustainable practices such as replacing traditional plastics with washable pipettes and using green resins and biopolymers in labware can be adopted throughout the laboratory lifecycle.

Value Potential

Labs can significantly reduce their carbon footprint through strategies like reducing energy use, using eco-friendly solvents, minimizing hazardous waste, and maximizing efficiency in chemical reactions. Furthermore, computational modeling and automation tools can streamline processes and reduce physical experimentation, minimizing resource consumption. This not only benefits the environment, but also translates to cost savings and a more sustainable future for pharmaceutical research. Ultimately, low-carbon lab practices represent a powerful approach for the industry to minimize its environmental impact while fostering innovation and efficiency.

Key Challenges

Implementing low-carbon technologies may require upfront capital investment. Other challenges include the availability and reliable supply of more-sustainable chemicals, solvents, and laboratory supplies; developing metrics and systems to track and measure the environmental impact, resource consumption, and waste generation; and ensuring compliance with relevant environmental regulations and industry standards.

What do you need to get started?

- Develop a green chemistry policy and set targets for reducing hazardous materials, energy consumption, and waste generation.
- Substitute hazardous chemicals with more sustainable alternatives whenever possible and implement solvent recycling and recovery systems.
- Optimize reaction conditions and processes to minimize energy use, waste, and the need for purification steps.
- Encourage microscale synthesis, computational modeling, and automation to reduce physical experimentation and resource consumption.
- Establish comprehensive waste management protocols, including segregation, minimization, and proper disposal of hazardous waste streams.
- Implement training programs on green chemistry principles, sustainable practices, and safe handling of chemicals for all lab personnel.

Enablers:

- Solvent recycling systems- Enable pharmaceutical labs to reuse solvents, minimizing waste generation and reducing environmental impact.
- Green Lab Certification- is a worldwide standard for laboratory sustainability best practices that helps organizations achieve their sustainability goals.[2.3.3]
- International Laboratory Freezer Challenge (Freezer Challenge)- Innovate, invest & win for the best practices for cold storage management. [2.3.3]

Case Studies

Green Chemistry: A More Sustainable Approach to Medicine Development | Pfizer

How AstraZeneca is making drug discovery sustainable

Adopting 'Green Approach' in Drug Discovery (biospectrumindia.com)

Sources: 2.2.5 Accenture Scope 3 Analysis (2023) ; 2.3.3: My Green Lab

Section 02

Taking Action

Production & Manufacturing

- Batch to Continuous Production
- Solvent Recovery
- Biocatalysis and Enzymatic Processes

Production & Manufacturing

Batch to Continuous Production

Addressable emissions category: **Scope 1, Scope 2, Scope 3- Cat 1, 3**
Addressability: **Medium** | Emissions reduction potential: **High** | Timeline: **High** | Upfront cost: **High**

What is it?

As opposed to batch production, where products are made in discrete batches following predetermined parameters, continuous production relies on automation to manufacture products in a constant flow. The purpose is to improve product quality while reducing the amount of waste produced, the consumption of energy and solvents, the scale of process equipment required and the level of costs.

Value Potential

Compared to batch processes, continuous production optimizes resources, cuts costs by eliminating downtime, and offers tighter control for lower energy consumption and waste generation. This translates to significant reductions in energy use and emissions, as continuous processes typically require less heating and cooling cycles and use raw materials more efficiently. The use of flow chemistry for the continuous production of pharmaceuticals, leading to faster development times, improved product quality, and potentially safer production of potent drugs. Continuous production helps organizations reduce the amount of manual interventions, achieve cost reductions of up to 20% compared to batch production, reduce waste generated, accelerate process optimization, shorten release times up to 90 days, and reduce operating costs up to 30%.[2.4.1]

Key Challenges

Changes in production processes may require reevaluation of regulatory compliance and upskilling employees for new equipment, impacting operational continuity. The shift to continuous production can further disrupt continuity by requiring adjustments to scheduling, inventory, and quality control. Disruptions may occur during implementation as employees adapt. Overall challenges include development costs for large-scale continuous operation and navigating regulatory hurdles with the FDA during the transformation.

What do you need to get started?

- Map out the current batch process and analyze each for pain points and potential pitfalls.
- Conduct a feasibility study for continuous production with current process, product portfolio, and commercialization needs.
- Perform thorough risk assessment to identify potential challenges.
- Engage with OEMs on leading practices for transformation from batch to continuous.
- Develop and optimize future state manufacturing process.
- Identify data needs and establish requirements for future state continuous production data management platform.
- Integrate life cycle principles such as the ISO 14040 to ensure that there are no factors leading to a suboptimal situation from an environmental perspective.

Enablers:

- **Process Analytical Technology (PAT)**- Facilitates real-time monitoring and control of manufacturing processes, enabling seamless transition.
- **Predictive analytics and machine learning**- Predicts process behavior and identifies process optimization opportunities.

Case Studies

Pharma companies: embrace continuous manufacturing

Siemens and GEA partner in delivering continuous manufacturing to Pharmaceutical Industry

Continuous Processing, Flow Chemistry, (sterlingpharmasolutions.com)

Sources: 2.4.1. White Paper – Options for Sustainable Production in Pharma, Umlaut (2021)

Production & Manufacturing

Solvent Recovery

Addressable emissions category: **Scope 2, Scope 3- Cat 1, 5**
Addressability: **Low** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **High**

What is it?

Solvent recovery is the process of recovering solvents used during stages of drug synthesis and manufacturing. 80-90% of pharma processes involve the use of solvent, and they are responsible for around 60% of the energy consumption in the manufacture of active ingredients[1]. Incineration of these waste streams and replacement with virgin solvents generate significant emissions which can be reduced by enhancing their recovery.

Value Potential

Since solvents are essential in pharmaceutical production, being able to recover solvents allows reuse and reduces the need for new solvent production. New solvent production is very energy-intensive, so solvent recovery can lead to substantial per-product emissions reductions while saving on solvent production costs. Additionally, solvent recovery reduces waste generation by utilizing a circular economy approach along with reducing emissions by 49%.

Key Challenges

Solvent recovery methods are yet to achieve widescale adoption because of the complexity and inconsistency of solvent properties and purity. Not all solvents are suitable for recovery. Additionally, identifying the most suitable recovery measures for a given process can involve large upfront costs.[2.4.1]

What do you need to get started?

- Assess the types and volumes of solvents used in various processes, including emissions impact in the current state.
- Engage with suppliers on recoverability potential of solvents and explore opportunities for more sustainable alternatives.
- Identify solvent recovery methodologies and/or new solvent production processes to establish feasibility and shortlist solution candidates.
- Determine the feasibility of implementing solvent recovery based on factors like solvent properties, process requirements, and regulatory considerations.
- Publish a reagent/solvent guide to educate suppliers about 'more sustainable' solvents to reduce hazardous waste and improve disposal of toxic solvents.
- Interface with regulators to ensure compliance in solvent switch.

Enablers:

- **Green chemistry principles**- Guide the selection of solvents and reaction conditions to minimize solvent use from the outset. This reduces the overall volume of solvent recovery and can sometimes eliminate the need for recovery altogether.
- **Process simulation software**- Model solvent recovery processes, optimizing operating conditions and equipment design to enhance solvent recovery efficiency.

Case Studies

Lonza Small Molecules Leading in Solvent Recovery

Sanofi published a sustainable solvent guide to demonstrate how the company is minimizing carbon footprints in API R&D and production.

Sources: 2.4.1. White Paper – Options for Sustainable Production in Pharma, Umlaut (2021); 2.2.5. Accenture Scope 3 Analysis (2023); 2.4.2: Solvent recovery and reuse in industries - PMC (nih.gov)(2021);

Production & Manufacturing

Biocatalysis and Enzymatic Processes

Addressable emissions category: **Scope 3- Cat 1, 5**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **Medium** | Upfront cost: **High**

What is it?

Biocatalysis and enzymatic processes involve adopting sustainable manufacturing processes that utilize enzymes or whole-cell biocatalysts derived from biological sources to catalyze chemical reactions. Biocatalytic processes use enzymes or microorganisms to facilitate chemical transformations in the synthesis of pharmaceutical compounds or intermediates. Enzymatic processes employ isolated enzymes to catalyze specific reactions in a controlled manner. These processes can replace traditional chemical synthesis methods, which often involve harsh conditions, hazardous reagents, and generate significant waste and emissions.

Value Potential

Biocatalysis offers a double win for sustainable manufacturing. These enzymes act as natural catalysts, able to operate under mild conditions and in water-based solvents, compared to traditional methods that require harsh chemicals and high heat. This translates to dramatically reduced energy consumption, and significant cost savings on energy, materials, and equipment. Furthermore, enzymes are incredibly selective, minimizing waste generation and the need for extensive purification steps. This translates to higher product yields, less environmental impact, and a carbon reduction potential of up to 20%, making biocatalysis a powerful tool for creating a cleaner and more efficient future for manufacturing.[2.2.5]

Key Challenges

Implementation requires significant research and development efforts, collaboration with academic and industrial partners, employee training, and a strategic approach within the existing manufacturing frameworks. Additionally, navigating regulatory approvals for switching to enzymatic processes and a lack of awareness within the industry about the benefits of biocatalysis present further challenges.

What do you need to get started?

- Conduct a thorough analysis to identify suitable reactions and targets for biocatalysis or enzymatic processes.
- Optimize biocatalytic processes at lab scale, perform pilot studies, address scale-up challenges like reactor design and enzyme stability.
- Ensure regulatory compliance, validate analytical methods, establish quality control protocols, and conduct necessary toxicology studies.
- Assess specialized equipment needs, modify facilities accordingly, and establish reliable supply chains for biocatalysts, enzymes, and specialized materials.
- Implement comprehensive employee training programs, foster knowledge transfer, continuously monitor processes, and drive continuous improvement based on feedback and emerging technologies.

Enablers:

- **Enzyme discovery programs or collaborations with biotech companies**- Facilitate the identification and development of novel enzymes.
- **Economical enzyme production**- Improves cost-effectiveness through optimized fermentation processes or recombinant DNA technology, making enzymes more accessible.

Case Studies

Specialty enzymes - Novo Nordisk Pharmatech

Biocatalysis, Biocatalysts, Biocatalysis Pharma (sterlingpharmasolutions.com)

On the Horizon (trends)

- New catalytic materials discovery such as chiral macrocyclic di-lithium(I) salt and enzymatic technology innovation.[2.4.3]

Sources: 2.4.1. White Paper – Options for Sustainable Production in Pharma, Umlaut (2021); 2.2.5. Accenture Scope 3 Analysis (2023); 2.4.3: NU Research Information - Nagoya University (nagoya-u.ac.jp))(2024);

Section 02

Taking Action

Supply Chain & Logistics

- Takeback Programs
- Fleet Decarbonization
- Mode Mix Optimization
- Freight Route and Load Optimization
- Cold Chain Enhancements

Supply Chain & Logistics

Takeback Programs

Addressable emissions category: **Scope 3- Cat 5, 11, 12**
Addressability: **Low** | Emissions reduction potential: **Low** | Timeline: **Medium** | Upfront cost: **Medium**

What is it?

Takeback programs tackle end-of-life product parts and packaging. These programs facilitate collection and repurposing of reusable or recyclable packaging or products. Takeback programs may require engaging downstream partners, patients, healthcare providers, and Producer Responsibility Organizations (PROs) in the process. Collected materials may be downcycled into new products but ideally are sorted, reprocessed, and reintroduced into the company's manufacturing supply chain. This "closed-loop" system minimizes waste, promotes sustainability, and prepares companies for potential regulations.

Value Potential

Establishing a program that encourages the return of materials to be used in remanufacturing has the potential to reduce baseline emissions by 5%.[2.2.5] The current take-make-waste model is unsustainable, energy intensive, and takes up critical space in landfills. Takeback programs can support supply chain resilience by reducing the quantity of raw material needed. Takeback programs both strengthen a company's sustainability brand recognition by solving a patient pain point of product disposal and prepares the company for potential regulations mandating takeback programs.

Key Challenges

Building a takeback program presents significant logistical challenges and added complexity in this industry given the complex waste streams and regulatory environment. Establishing convenient collection points and reverse logistics requires collaboration across the value chain, including partnerships with pharmacies and healthcare providers, and possibly participating in a PRO. Participation by patients and healthcare professionals remains another hurdle.

What do you need to get started?

- Assess your current state operating model to ensure it is built to deliver a competent takeback program.
- Define secure collection and handling practices in line with Producer Responsibility Organizations P(RO) and regulatory guidelines.
- Design collection infrastructure and secure reverse logistics scheme.
- Develop communication and outreach approach, emphasizing culture change and incentives to ensure internal alignment.
- Design packaging supply chain to adopt reused and recycled product parts and packaging.
- Pilot recycling collection stations for the most waste-generating product and packaging in the largest opportunity locations.
- Advocate for public infrastructure required for more specialized collection and for new materials.

Enablers:

- Partnerships with industry coalitions- Leverage their expertise, resources, and established networks to develop best practices, navigate regulatory complexities, create economies of scale and advocate for policy changes that support takeback programs.
- Integration with pharmacy systems- Incorporate takeback processes into pharmacy workflows, facilitating the return of products by customers.

Case Studies

Sensitech Device Takeback Program

Novo Nordisk Insulin Pen Takeback Program

Corning Packaging Takeback Program

Sources: 2.2.5. Accenture Scope 3 Analysis (2023)

Supply Chain & Logistics

Fleet Decarbonization

Addressable emissions category: **Scope 1, Scope 3- Cat 4**
Addressability: **High** | Emissions reduction potential: **High** | Timeline: **High** | Upfront cost: **High**

What is it?

Decarbonizing a company's owned fleet and engaging transportation partners to make the same transition can support the net-zero transition. Fleet decarbonization involves the transition of owned fleet vehicles towards low-emissions alternatives, adopting use of sustainable fuels, replacing internal combustion engine vehicles with electric and hybrid vehicles, and incentivizing third-party logistics providers to decarbonize their fleets.

Value Potential

Globally, transportation accounts for approximately 21% of global greenhouse gas emissions.[2.5.1] These emissions are the result of burning fossil fuels—primarily gasoline and diesel fuels—in vehicles equipped with internal combustion engines. Life-cycle comparisons of battery-powered electric vehicle (EV) fleets to a gas-powered one, using real-world rideshare data have found up to a 45% reduction in greenhouse gas emissions from full electrification. The analysis indicated that electrified fleets had 40-45% lower greenhouse gas costs per trip compared to the gasoline-powered version.[2.5.2] On the fuels side, organizations have various options: (1) bio-ethanol as a gasoline substitute with the potential to reduce emissions up to 70%, (2) bio-diesel (FAME) as a diesel substitute with potential to lower lifecycle emissions by 70%, (3) renewable diesel, (4) sustainable aviation fuel as a kerosene substitute with up to 80% carbon emissions reductions for aviation lifecycle, and (5) biomethane as a natural gas substitute which avoids direct release of potent GHG gases into the atmosphere.[2.5.3]

Key Challenges

Challenges include EV and alternate-fuel vehicle availability for different needs (e.g. heavy-duty trucks) and infrastructure constraints such as the distribution and availability of EV chargers and biofuels. There is also continued controversy on the emissions impact and competing land-use for biofuels. EVs also currently have higher upfront costs, and environmental and social issues related to battery production and disposal should be considered.

What do you need to get started?

- Identify all forms of transportation used throughout the organization's value chain and build use cases where low-emission vehicles and use of alternate fuels make economic and operational sense
- Conduct a cost-benefit analysis that includes upfront costs of fleet decarbonization, infrastructure installation, and other factors.
- Establish a maintenance and management strategy to ensure low-emission vehicles are meeting performance standards and are adequately maintained for longevity.
- Engage with third-party logistics providers early and often, creating compelling incentive structures to incentivize move towards decarbonized fuels and fleets.

Enablers:

- Economic and Financial Policies- Carbon credits and government EV incentives drive adoption, promoting sustainable mobility solutions.
- Industry Coalition- An industry coalition accelerates sustainability by pooling resources, driving innovation, and advocating for technology.

Case Studies

Consortium of Pharmas, Novartis, AstraZeneca and more, electrify their vehicle fleets for sustainability gains

Delta Airlines set a goal for sustainable aviation fuel (SAF) to make up 95% of its fuel consumption by 20501

UPS has purchased 155 million gallon-equivalents of renewable natural gas (RNG) since 2014, becoming one of the largest consumers in the transportation industry

On the Horizon (Trends)

- FaaS- Fleet-as-a-Service model: supplies the vehicles the business needs and the data needed to manage them.

Sources: 2.5.1. Transportation emissions worldwide - statistics & facts | Statista 2.5.2 Transport and Climate Change Global Status Report (unfccc.int) 2.5.3. IPCC Working Group Report, Transport Analysis (2020)

Supply Chain & Logistics

Mode-mix Optimization

Addressable emissions category: **Scope 3- Cat 5, 11, 12**
Addressability: **Low** | Emissions reduction potential: **Low** | Timeline: **Medium** | Upfront cost: **Medium**

What is it?

Optimize freight transport and logistics to transition from energy-intensive transport modes (e.g. air freight) to other modes (e.g. road, rail, and ocean). This reduces a company's Scope 1 and Scope 3 emissions.

Value Potential

Mode mix optimization has proven to be an efficient way to achieve multiple benefits in logistics like reduced fuel consumption, lower operational costs, increased efficiency, enhanced customer satisfaction, improved on-time performance, reduced vehicle wear and tear, enhanced resource utilization, and minimized carbon footprint. The optimal mode mix is determined by volume shipped, transit time, distance, lead time, material properties, and carbon intensity. In general, ocean and rail freight are the most carbon-optimal modes of transport per volume shipped. For intercontinental deliveries, ocean transport is least expensive and has the lowest emissions, while air being the fastest mode. Emission factors for different modes of transport (gCO2/ton-mile): Air (905), Road: Medium and heavy-duty truck (168), Ocean (82) and Rail (22).[2.5.4] Mode mix optimization has the potential to reduce baseline emissions by 24%[2.2.5]. These network adjustments also usually translate into cost savings due to reduced mileage or the shifting of transportation modes whenever possible.

Key Challenges

Ensuring that fulfillment functions perform against lead-time and speed-to-market considerations make it difficult to phase out energy-intensive air freight entirely and typically requires greater analytics and scenario evaluation capabilities within supply chain planning and fulfillment. Poor real-time visibility over multimodal movements and greater required coordination among fulfillment stakeholders pose additional challenges.

What do you need to get started?

- Identify all forms of transportation used throughout the organization's value chain and build use cases to develop a comprehensive understanding of the current state.
- Gather data on emissions profiles for different modes in current state
- Conduct a network assessment, designing a blueprint a for future state. transportation network that is optimized for emissions and cost savings
- Based on this blueprint, begin engaging with third parties and logistics partners to build a tailored network, suited to needs and goals.

Enablers:

- Transportation Management Systems- Analyze data to optimize mode selection based on cost, time, and environmental impact, facilitating mode mix optimization.
- AI and automation enabled tools to assess mode network performance- Analyze historical data and predict future demand to optimize mode selection, improving mode mix efficiency.

Case Studies

Novo Nordisk reduced emissions by 24% by switching from air to sea freight

Pfizer cut emissions by 31% by shifting product shipments from air to ocean

Sources: 2.5.4. ghg-emission-factors-hub-2024 (epa.gov); 2.2.5. Accenture Scope 3 Analysis (2023)

Supply Chain & Logistics

Freight Route and Load Optimization

Addressable emissions category: **Scope 1, Scope 3- Cat 4**
Addressability: **High** | Emissions reduction potential: **High** | Timeline: **Low** | Upfront cost: **Low**

What is it?

Freight route optimization involves planning and selecting the most efficient and environmentally friendly routes for transporting goods. Load optimization focuses on maximizing the efficiency of cargo transportation by optimizing the loading and utilization of transportation assets (trucks, ships, containers).

Value Potential

By optimizing transportation routes and loads, companies can reduce fuel consumption and associated greenhouse gas emissions, contributing to decarbonization efforts. Additionally, these practices can lead to cost savings through improved operational efficiency, lower fuel expenses, and reduced carbon taxes or regulatory penalties. Furthermore, optimized logistics operations can enhance delivery reliability, improve customer satisfaction, and strengthen the company's reputation as an environmentally responsible corporate citizen. Freight route and load optimization have the potential to reduce baseline emissions by 9%.[2.2.5] Optimizing shipments also reduces the potential risks to the products being shipped because when there is unused space around packages, it leaves room for packages to move and potentially damage contents. Optimized routes and loads can also lead to better vehicle utilization, shorter transit times, and reduced congestion, improving overall operational efficiency by up to 30%. [2.5.5]

Key Challenges

Customer expectations, speed of delivery, and delivery costs must be considered when designing last-mile delivery programs. Route optimization also requires that organizations have the right technology and processes in place to unlock promised gains. The recent pandemic exposed vulnerabilities in just-in-time (JIT) supply chains, leading to a desire for redundancies to mitigate future disruptions. This creates a tension between efficiency and building resilience. Beyond optimization, companies can also explore more fundamental ways to reduce the overall movement of goods, such as developing local supply chains. While such strategies could have a significant long-term impact on emissions reduction, they often require extended timelines and substantial upfront investments.

What do you need to get started?

- Assess packaging practices to identify opportunities for maximizing space utilization and minimizing packaged-product weight.
- Work with internal data and/or engage partners to determine trip volumes by product, creating a shortlist of inefficiencies and opportunities areas to optimize routes
- Analyze repeated delivery attempts or returns to identify pain points and craft solutions (e.g. poor address quality, poor customer communication, etc.)
- Engage with third-party logistics partners to co-develop a sustainable last-mile and route optimization strategy that advances internal sustainability goals.
- Explore alternative fulfillment methods that meet customer needs, meet compliance needs, and reduce emission impact.

Enablers:

- **Advanced logistics management systems**- Utilize algorithms to optimize freight routes and loads, maximizing efficiency and reducing costs.
- **Virtual twin to plan low-carbon shipping routes**- Simulate various shipping scenarios to identify optimal routes that minimize carbon emissions while optimizing other logistical parameters.

Case Studies

Optimization of the COVID-19 Vaccine Distribution Route Using the Vehicle Routing Problem with Time Windows Model and Capacity Constraint

How does load planning software helps to solve the "empty space problem" in logistics? (amconsoft.com)

On the Horizon (Trends)

- Autonomous Vehicles and Drone Delivery for new possibilities of last mile delivery, increased flexibility and lower operational costs. [2.5.6]

Source: 2.5.5 Intelligent route optimization - FreightWaves (2022) 2.5.6: Human drone interaction in delivery of medical supplies: A scoping review of experimental studies | PLOS ONE (2022); 2.2.5. Accenture Scope 3 Analysis (2023)

Supply Chain & Logistics

Cold Chain Enhancements

Addressable emissions category: **Scope 1, Scope 3- Cat 4**
Addressability: **Low** | Emissions reduction potential: **Medium** | Timeline: **Medium** | Upfront cost: **Medium**

What is it?

The pharmaceutical cold chain management process involves various tasks aimed at controlling the temperature and related environmental conditions for medications and other products through the entire supply chain, from manufacturing and storage to transportation and distribution. Cold chain management involves management, monitoring, and control of temperature-sensitive products along with ensuring use of fit-for-purpose packaging. This can include deploying a variety of cooling solutions, such as dry ice for short-haul, high-value, or extremely temperature-sensitive shipments.

Value Potential

Cold chain enhancements ensure that temperature-sensitive products are maintained, preserving quality, efficacy, and therapeutic value that could otherwise result in reduced product recalls, wastage, and potential harm to patients. Streamlined cold chain logistics and improved visibility lead to better planning and management of inventory, reducing risk of stockouts and ensuring timely deliveries. Of course, optimized cold chain processes also promise reduced energy consumption, emissions, and waste. Some advanced technologies to consider are IoT sensors and controls to monitor temperature, eutectic refrigeration (instead of standard vapor compression refrigeration) and replacing traditional refrigeration systems that use toxic chemicals with more sustainable refrigeration systems. Cold chain enhancements have the potential to reduce baseline emissions by 10%.[2.2.5]

Key Challenges

Integrating and managing various temperature-monitoring technologies, sensors, and data systems can be technically complex, requiring expertise in both IT and cold chain logistics as well as cross supply chain collaboration. Upgrading or retrofitting existing cold chain infrastructure to integrate new technologies can cause temporary disruptionss in storage capacity and workflows, potentially impacting throughput and efficiency.

What do you need to get started?

- Gather comprehensive data on temperature-sensitive product requirements, distribution routes, storage conditions, and historical temperature monitoring.
- Collaborate with suppliers, carriers, and third-party logistics providers to align on requirements and expectations.
- Assess current suite of technology and tools to establish a baseline around suitability and determine future state requirements to enable cold chain enhancements.
- Ensure supply chain partners are technology-enabled to help organization achieve enhancement goals.
- Consider availability and feasibility of switching to alternative cooling options to minimize emissions and toxicity.

Enablers:

- **Temperature Monitoring and Control Systems-** Ensure that temperatures remain within specified ranges during transportation and storage, maintaining product integrity in the cold chain.
- **Eutectic Refrigeration-** Utilize phase-change materials with precise freezing/melting points to maintain stable temperatures, enhancing the reliability and efficiency of cold chain systems.

Case Studies

National Cooling Action Plan Methodology for efficient and sustainable cooling

Transforming Pharma logistics for a sustainable future | Maersk

On the Horizon (Trends)

- Use of automated storage and retrieval system (AS/RS) for automatically depositing, inventorying and retrieving loads in cold storage warehouse for efficiency improvement.

Sources: 2.2.5. Accenture Scope 3 Analysis (2023)

Section 02

Taking Action

Energy & Infrastructure

- Upgrading to Energy Efficient Equipment
- Facility Energy Management and Optimization
- Sourcing Renewable Electricity
- Decarbonizing On-site Heath Use
- Refrigerant Gas Substitution
- Sustainable Construction

Energy & Infrastructure

Upgrading to Energy Efficient Equipment

Addressable emissions category: **Scope 1,2, Scope 3- Cat 3**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **Medium** | Upfront cost: **Low**

What is it?

This initiative corresponds to energy use in manufacturing, which cause emissions through consumption of electricity, fuel, and loss of refrigerants due to leakage. Implementing monitoring, retrofitting, and resource recovery systems to enhance energy efficiency involves upgrades to HVAC systems, compressed air, cleanrooms, sterilization, refrigeration, and lighting.

Value Potential

Energy efficiency measures have the dual benefit of reducing operational energy costs and GHG emissions. The payback period, however, will vary based on the operating conditions, size, and technology maturity. Organizations can also consider modular upgrades to extend the life of equipment and enhance reusability of parts. A study of energy efficiency initiatives for the pharmaceutical sector has found a potential for energy reduction by over 20% of the total consumption.[2.6.1]

Key Challenges

Retrofitting equipment and systems may require equipment downtime at facilities, extensive planning, and large upfront investment despite high ROI. It can also require extensive engagement with vendors and capacity building of on-site personnel.

What do you need to get started?

- Carry out an energy audit to determine total resource usage across equipment and facilities.
- Isolate the biggest sources of energy use and emissions and define paths of action to upgrade for resource efficiency.
- Interview equipment and facilities stakeholders to identify current state processes pain points and needed tech upgrades.
- Define emissions and cost savings for each path of action.
- Engage with vendors and carry out techno-commercial evaluation of energy efficiency upgrades and financing options, prioritizing quick wins and big reduction opportunities.
- Implement upgrades onsite with proper change management procedures.

Enablers:

- **Advanced building automation systems-** Control and optimize energy usage in facilities through automated processes, facilitating the transition to energy-efficient equipment.
- **Energy efficiency Financing options-** These include tax credits, green loans, and partnering with Energy Service Companies (ESCOs). ESCOs are the companies that help businesses save energy and money by designing and implementing energy-efficient improvements.
- **Digital twin-** can be used to analyze manufacturing equipment performance, identify opportunities for energy efficiency and waste reduction

Case Studies

45 acres of efficient heating and cooling while reducing emissions for Johnson and Johnson

Merck optimizes space efficiency to drastically reduce emissions

****For Upgrading to energy efficient equipment intervention ESCO model is considered for implementation and upfront cost estimation

Sources: 2.6.1. Pharma Companies Cutting Energy Consumption | Centrica (2022)

Energy & Infrastructure

Facility Energy Management and Optimization

Addressable emissions category: **Scope 1, 2 Scope 3 Cat 1, 2, 5**
Addressability: **Low** | Emissions reduction potential: **Low** | Timeline: **Low** | Upfront cost: **Low**

What is it?

A digitally-enabled smart energy management platform can optimize energy consumption. The typical elements under such a platform cover energy monitoring and control, and smart metering supported by data analytics and machine learning layers for predictive maintenance. For effective implementation, maintenance, and monitoring, building organizational capabilities and awareness is required.

Value Potential

Energy management can enable identification of hotspots and proactive decision making to manage both energy use and costs. It can also enable energy performance benchmarking across multiple facilities. Additional capabilities can be embedded that allow for GHG emissions calculations and reporting. Energy management systems can also integrate predictive maintenance, enhance equipment reliability, reduce downtime, and further optimize energy use.

Key Challenges

Awareness and training of on-site personnel is critical for successful implementation. Legacy systems may be unable to be fully integrated with a different energy management platform, impacting operations and data flow. Cybersecurity must also be addressed, requiring robust measures to safeguard data and infrastructure from potential threats. Additionally, for geographically dispersed companies, implementing and integrating an umbrella management system for global remote control poses a significant challenge.

*For Facility energy management and optimization, integrating a facility management system is considered for upfront cost and timeline calculations

Sources: 1.8. smi-hstf-supply-chains-whitepaper (2022); 2.6.2. Energy integration and grid decarbonization - ScienceDirect (2022); 2.6.3. usgbc.org/leed; 2.6.4. Homepage | ENERGY STAR

What do you need to get started?

- Carry out an energy assessment to identify gaps in the current system and develop energy reduction targets.
- Understand functional and technical requirements and choose the right platform from the market/develop in-house.
- Identify best building management systems fit for purpose
- Install, configure, and integrate with existing energy management and process control systems.
- Train users on technical and management skills to use the platform.
- Test and go-live.
- Develop energy usage profiles to monitor consumption against leading benchmarks.

Enablers:

- **Advanced building automation systems** - Monitor and control building systems in real-time, optimizing energy usage for efficiency and comfort. Use digital twins to improve operational efficiency by optimizing building systems and reducing energy use.
- **Green building certification** - Pursuing certifications like LEED or ENERGY STAR provides a data-driven framework for optimizing energy performance and can unlock financial incentives.[2.6.3, 2.6.4]
- **Financing Options** - Partner with Energy Service Companies (ESCOs) on **energy-performance** contracts and look for technical assistance and rebates from **utility companies.**

Case Studies

After triumphant pilot, GSK eyes 'digital twins' to fine-tune vaccine production, development

Case Study Details - Digital Transformation - Accenture's Global Multi-Tenant Projects (weforum.org)

On the Horizon (Trends)

- **Facility Maintenance 4.0** includes the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML) and big data analytics.

Energy & Infrastructure

Sourcing Renewable Electricity

Addressable emissions category: **Scope 2**
Addressability: **High** | Emissions reduction potential: **High** | Timeline: **Low** | Upfront cost: **Low***

What is it?

Companies can transition from electricity that has fossil-fuels in the mix to 100% renewable electricity (RE) in manufacturing and administrative facilities through their energy sourcing decisions. Options include on-site generation, offsite Power Purchase Agreements (PPAs), Green Tariff and Energy Attribute Certificates (EACs).

Value Potential

Energy-intensive manufacturing and production processes are a major source of emissions for pharmaceutical companies, particularly those reliant on grid electricity. Sourcing renewable electricity through utilities or project developers allows companies to meet their energy needs while progressing towards net-zero goals. There's a strong business case for this shift: renewable energy offers price stability in onsite/ physical PPAs over conventional, volatile electricity, leading to fixed operational costs. Additionally, government subsidies and credits can further incentivize the switch. This approach not only reduces a company's Scope 2 emissions but also aligns them with initiatives like RE100, enhancing their reputation among customers, investors, and contributing to the development of new renewable energy sources (additionality) in some cases.

Key Challenges

The mechanisms for sourcing renewable electricity vary across regulated and deregulated markets. Small-mid sized facilities can coordinate with other companies to scale renewable sourcing. However, challenges remain, including price uncertainty and volatility in virtual PPAs and minimum volume requirements for long-term PPAs. Additionally, space limitations can hinder the feasibility of on-site renewable generation for some facilities.

What do you need to get started?

- Conduct assessment of current and future electricity requirements & RE procurement.
- Evaluate RE sourcing options (such as onsite PPA, onsite captive, REC, offsite physical PPAs, virtual PPAs, utility renewable energy, etc.).
- Partner with RE advisors to develop a RE strategy.
- Engage utilities and supplier partners, engage in discussions with RE transaction advisors to navigate the complex procurement landscape.
- Define region-specific energy procurement strategies.
- Identify other companies to collaborate with to achieve strategic objectives and minimize the barriers to entry for procurement.
- Renegotiate utility energy contracts to include renewable energy sourcing at an optimized price.
- Engage with vendors to assess, evaluate and source PPAs from RE developers.

Enablers:

- **Cross functional deal team**- Internal alignment across operations, sustainability, procurement, finance and legal for successful procurement.
- **RE Transaction Partner**- Partner with RE Transaction partner to ensure a wider access to market.[2.6.5]
- **Aggregate Purchasing**- Group purchasing enables collective RE investment, benefiting from economies of scale and reducing individual financial burden.

Case Studies

GSK invests £50 million in renewable energy

Joint PPA deal with cohort of nine pharma firms

Setting sights on suppliers: How biopharma is tackling the environment in its ESG commitments

Sources: 2.6.5. LevelTen Energy

Energy & Infrastructure

Decarbonizing On-site Heat Use

Addressable emissions category: **Scope 1, 2**
Addressability: **Low** | Emissions reduction potential: **Medium**| Timeline: **High** | Upfront cost: **High**

What is it?

Pharmaceutical manufacturing uses heat for steam, producing water for injection (WFI), and sterilization. Decarbonizing heating entails initiatives such as reducing heating needs, switching from fossil-fuel heat sources to renewables such as biomass, enhancing heat recovery, and use of heat pumps.

Value Potential

Decarbonizing on-site heat use offers significant financial and environmental benefits. Modern technologies like heat pumps can significantly improve efficiency compared to traditional natural gas heating. Coefficient of Performance (COP) is a ratio to measure the efficiency of heating or cooling systems. Heat pumps can achieve a COP of 3-8, compared to a typical gas furnace's COP of 0.9.[2.6.6] As the electricity grid transitions to cleaner sources, switching from gas to electric heating further reduces emissions. Biofuels like renewable natural gas (RNG) can be used as a low-carbon alternative to fossil fuels, significantly reducing Scope 1 greenhouse gas emissions. Implementing heat recovery systems can capture waste heat from equipment like dryers and chillers, potentially leading to a 40% reduction in natural gas consumption.

Key Challenges

Although cost-effective in the long-term, renewable thermal energy technologies can require high upfront investment and modification of existing infrastructure. In addition, facility design changes might be required to enhance heating efficiency, which may impact operations, or which may only be cost effective for greenfield projects.

What do you need to get started?

- Carry out audits to understand heating needs and current hotspots.
- Identify opportunities for heat use reduction, substitution of renewable fuels, transition to electrification, and heat recovery.
- Identify opportunities for maximum heating efficiency in new facility designs and constructions.
- Carry out techno-commercial evaluations of opportunities.
- Engage with vendors on procurement, installation, and potential design changes to greenfield projects.
- Build awareness and carry out training programs among on-site personnel.

Enablers:

- Financial incentives- Availability of government grants, tax breaks, rebates, or low-interest loans specifically for deploying on-site heat decarbonization technologies.
- Advanced building automation systems- Monitor and adjust heating levels based on factors like occupancy, weather conditions, and energy demand.
- Smart controls- Leverages sensors, data analytics, and automation to adjust heating settings based on real-time conditions and user preferences.

Case Studies

Switching to clean heat to decarbonize medicines manufacturing in China

Pharmaceutical Manufacturer to Cut Emissions by Using High-Temperature Heat Pump with Butane and Water

Sources: 2.6.6. Sustainable heating strategy for pharma manufacturing (2021); 1.8. smi-hstf-supply-chains-whitepaper (2022)

Energy & Infrastructure

Refrigerant Gas Substitution

Addressable emissions category: **Scope 1, Scope 3 Cat 4**
Addressability: **Low** | Emissions reduction potential: **High** | Timeline: **High** | Upfront cost: **Medium**

What is it?

This initiative pertains to transitioning to refrigerants with lower Global Warming Potential (GWP) to reduce the fugitive emissions associated with cooling and cold storage. It entails evaluating existing chillers and refrigeration systems to determine the types of refrigerants currently being used and replacing them with lower GWP refrigerants such as hydrofluoroolefins, propane, ammonia, or others.

Value Potential

Some substitutes to higher GWP refrigerants can also offer better thermodynamic properties, which can lead to improved energy efficiency and lower operating costs for chillers. Switching can also future-proof cooling systems against emerging regulations banning certain high-GWP refrigerants and improve brand reputation. General studies on this topic show that by shifting from baseline refrigerants to the low GWP refrigerants in commercial refrigeration and residential HVAC systems, a combined drop of 30.43% in the total emissions (i.e. total emissions in kgCO2eq) can be obtained.[2.6.7]

Key Challenges

Substitution to lower GWP refrigerants is dependent on compatibility, performance, and safety considerations. Additionally, refrigerant availability and supply chain security of nascent refrigerants could be a concern, stressing the need to manage risk accordingly.

What do you need to get started?

- Current state assessment and requirements diagnosis, establishing an emissions baseline.
- Determine system compatibility needs to inform refrigerant candidate identification.
- Shortlist lower GWP refrigerant options and design pilots.
- Develop a detailed plan for transition from high GWP refrigerants.
- Design a refrigerant storage and handling process.

Enablers:

- Chiller Retrofit Design Software: Streamlines conversion of existing chillers to use lower-emission refrigerants.
- Refrigerant Inventory Management: Ensures efficient use and avoids stockpiling of harmful refrigerants.
- Industry and academic research collaborations: Accelerates development and adoption of new, climate-friendly refrigerants.

Case Studies

Transition of cooling systems in China towards low-GWP refrigerants

Sources: 2.6.7. Low GWP MAC India.pdf (indiaenvironmentportal.org.in) (2022)

Energy & Infrastructure

Sustainable Construction

Addressable emissions category: **Scope 2 Scope 3 Cat 1, 2, 5**
Addressability: **High** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **High**

What is it?

Sustainable construction for decarbonization refers to the use of eco-friendly building materials, energy-efficient designs, and renewable energy sources in the construction, and operation of new facilities or remodels / additions to existing facilities. It aims to minimize the carbon footprint of these facilities throughout their lifecycle, from construction to demolition. This approach involves strategies such as using recycled or low-carbon materials, implementing energy-efficient systems for heating, cooling, and lighting, and use of low-carbon steel and low-carbon cement during construction.

Value Potential

Sustainable construction can lead to cost savings through reduced energy consumption and lower operational expenses. It also enhances the company's environmental credentials and social responsibility, appealing to stakeholders and consumers who prioritize sustainability. Building using sustainable materials can also future-proof the company's operations by reducing reliance on fossil fuels and mitigating risks associated with climate change regulations and carbon pricing. A comparison between Green Buildings and non-Green Buildings revealed that Green Buildings would save 15.1% and up to 21.9% of site energy under present and future climate conditions, respectively.[2.6.8]

Key Challenges

Initial capital investment required for sustainable construction may be higher than using traditional materials and methods. Integrating sustainable practices into existing facilities or retrofitting can be complex and disruptive. Availability and cost of sustainable materials and technologies can vary by region. Regulatory compliance and obtaining necessary certifications can add complexity.

What do you need to get started?

- Current state assessment and requirements diagnosis, establishing an emissions baseline.
- Determine system compatibility needs to inform refrigerant candidate identification.
- Shortlist lower GWP refrigerant options and design pilots.
- Develop a detailed plan for transition from high GWP refrigerants.
- Design a refrigerant storage and handling process.

Enablers:

- **Generative Design practices**- offers a path towards sustainable facilities by optimizing for lightweighting and other factors that reduce embodied carbon.
- **Life cycle assessment**- Evaluate the environmental impact of construction materials and processes throughout their life cycle, guiding decision-making towards sustainable choices.
- **Sustainable site selection tool**- helps businesses choose development locations that minimize environmental impact and promote responsible resource management.[2.6.9]

Case Studies

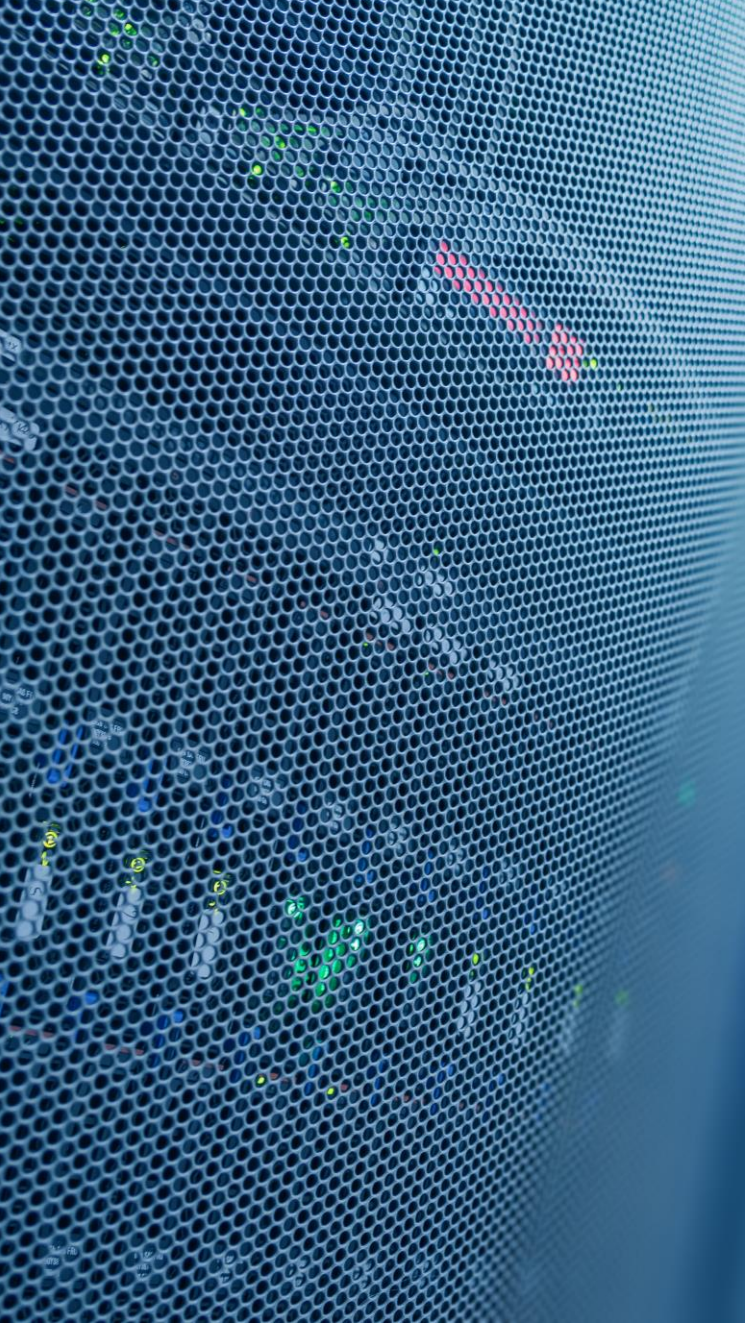
Sustainable facility design and green labs - Bristol Myers Squibb (bms.com)

Net Zero by 2040: How Pfizer is Fighting Climate Change with Ambitious Science Based Goals | Pfizer

On the Horizon (Trends)

- Adopting battery **energy storage systems (ESSs)** tailored for construction sites.
- Lookout for cutting edge energy **efficient building materials** such as plant based polyurethane rigid foam, structural insulated panels, low-E windows.

Sources: 2.6.8. Green Buildings | (mdpi.com) (2023); 2.6.9. Sustainable Sites - GSA Sustainable Facilities Tool (sftool.gov)



Section 02

Taking Action

Green IT

- Low-carbon Migration and Operations
- Efficient Servers and Low Carbon Devices

Green IT

Low-carbon Cloud Migration and Operations

Addressable emissions category: **Scope 2, Scope 3 Cat 1**
Addressability: **Low** | Emissions reduction potential: **High** | Timeline: **Medium** | Upfront cost: **Medium**

What is it?

Cloud migration involves the transfer of data, resources, and applications from on-site facilities and servers to a managed Cloud service provider. Power Usage Effectiveness (PUE) is a metric indicating how efficiently a data center utilizes power; a lower PUE signifies greater efficiency. Traditional on-premise data centers often have high PUE ratios, exceeding 1.5. [2.7.1] Leading Cloud providers like Google Cloud Platform (GCP), Amazon Web Services (AWS), and Microsoft Azure boast impressive PUE figures, typically below 1.2.[, 2.7.2, 2.7.3, 2.7.4] There are several approaches to Cloud migration, including lift-and-shift and re-platforming, where re-platforming offers the greatest potential for emission reduction.[2.7.4] By integrating sustainability metrics into procurement processes for outsourced services such as data centers and cloud computing, organizations can strategically select low-emission service providers to minimize their carbon footprint.

Value Potential

On-premise data centers and applications often use legacy, inefficient technologies and infrastructure. By dynamically provisioning capacity across users, Cloud providers minimize the need for data centers and consequential energy usage. Moving systems to the Cloud can reduce Scope 2 carbon emissions as well as reduce cost, improve data security, and support process modernization. Cloud migrations can reduce emissions by 80% while also achieving a 30-40% savings on total cost of ownership.[2.7.5]

Key Challenges

Without a clear strategy, Cloud migration can run the risk of data loss, incompatible systems, and unprepared IT teams. Additionally, it can be easy to fall into the trap of using on-demand instances (keep buffers) or under-utilized spot instances, leading to higher Cloud bills. To avoid this, robust change management teams are crucial to steward the transformation from beginning to end, ensuring efficient resource allocation in the Cloud. An additional layer of complexity specific to the pharmaceutical industry is the potential for intellectual property (IP) security concerns when considering Cloud-based solutions.

What do you need to get started?

- Analyze on-premise systems for consolidation and decommissioning opportunities to reduce energy consumption.
- Integrate sustainability goals into migration with a cross-functional team.
- Include energy reduction and resource efficiency metrics in Cloud objectives.
- Use a scorecard that includes sustainability metrics when evaluating Cloud providers (e.g. Cloud providers with strong renewable energy commitments).
- Migrate data suitable for Cloud processing to minimize local resource demands.
- Partner with providers to optimize workloads and choose a migration approach with energy efficiency in mind.

Enablers:

- **Containerization and orchestration**- Package applications into containers for portability and scalability, facilitating the migration of on-premises applications to the Cloud with efficient orchestration of containerized workloads.

Case Studies

Accenture unlocks the promise of advanced analytics with Google Cloud

The Green Behind the Cloud | Accenture

Takeda Accelerates Digital Transformation with Accenture and AWS

Life Sciences Digital Transformation | Novartis Case Study | Accenture

Sources: 2.7.1. Cloud provider annual PUE worldwide 2022 | Statista; 2.7.2. Azure Sustainability | Microsoft; 2.7.3. Sustainable Cloud Computing - AWS; 2.7.4. Sustainability | Google Cloud; 2.7.5. Accenture research (2020);

Green IT

Efficient Servers And Low Carbon Devices

Addressable emissions category: **Scope 2, Scope 3 Cat 1, 5**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **Medium** | Upfront cost: **Medium**

What is it?

This initiative focuses on extending the lifespan and improving the operational efficiency of servers and IT devices to promote an energy-efficient IT infrastructure. Implementing practices like server virtualization, Cloud computing, and energy-efficient hardware selection, reduces overall energy consumption and minimizes carbon emissions. Low-carbon policies ensure new equipment meets high energy-efficiency standards, and power management settings can optimize device usage. This holistic approach extends the usable life of devices, maximizes their efficiency, and promotes green IT practices without sacrificing performance or functionality.

Value Potential

Consuming less power results in reduced energy bills and operational costs over time. Optimizing IT infrastructure and use also reduces resource consumption such as electricity and cooling, leading to efficient resource management. Investments in energy-efficient tech also leads to more predictable long-term energy costs and reduced exposure to energy price volatility. Elongating the life of IT assets, optimizing power management setting on end-user devices, and implementing and enforcing waste segregation and recycling reduces the overall IT footprint.

Key Challenges

Upgrading servers and devices to meet sustainability targets can involve upfront costs as well as time to assess and transform legacy infrastructure, often requiring organizations to navigate complex IT infrastructures. Organizations must take a life-cycle approach to the management of end-user devices, which requires the adoption and enforcement of sustainable technology policies and employee education.

What do you need to get started?

- Prioritize energy-efficient servers and devices with certifications like Energy Star.
- Analyze server utilization, consolidate workloads with virtualization, and encourage employee power-saving practices..
- Establish metrics to track IT energy use and carbon footprint.
- Partner with certified e-waste recyclers for proper disposal and explore device refurbishment.
- Train employees on "green" IT practices to promote sustainability awareness.
- Regularly track progress towards sustainable IT goals and report results to raise awareness.

Enablers:

- **Data center infrastructure management systems**- Management of data center resources, enabling optimization of server and device usage to improve efficiency and reduce carbon emissions.
- **Procure electronics based on EPEAT registry**- Using products that meet EPEAT criteria will reduce the environmental and social impacts of IT devices.[2.7.6]

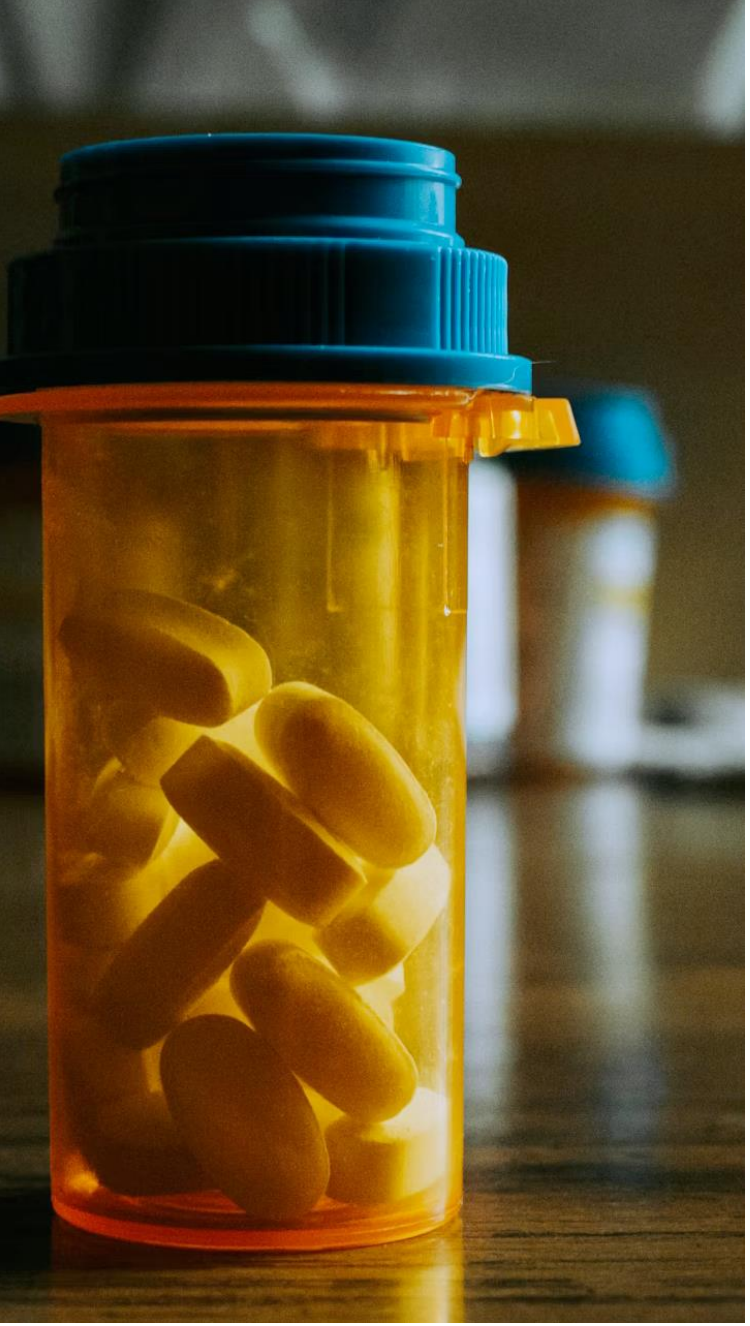
Case Studies

SITA reducing electricity consumption with more energy-efficient devices

Cisco enabling Net-Zero in transportation through greener hardware

Microsoft's leading environmental methodology to device design

Sources: 2.7.6. EPEAT Registry



Section 02

Taking Action

Marketing & Outreach

- Emissions-conscious Marketing and Advertising
- Business Travel, Sales and Employee Commute

Marketing & Outreach

Emissions-conscious Marketing and Advertising

Addressable emissions category: **Scope 3 Cat 1**
Addressability: **Medium** | Emissions reduction potential: **Medium** | Timeline: **High** | Upfront cost: **Medium**

What is it?

Emissions-conscious marketing and advertising entails reducing emissions associated with both marketing and advertising processes. This involves shifting away from physical marketing materials and towards digital content, reducing the storage and data consumption of advertisements, optimizing bidding strategies for energy efficiency, and reusing digital assets like videos and images.

Value Potential

By transitioning to digital content and optimizing its use, companies can reduce their carbon footprint by 17% for associated with marketing activities. 2.2.5 This shift can lead to cost savings in production and distribution of marketing materials. Additionally, adopting environmentally-conscious practices can enhance brand reputation and appeal to environmentally-aware consumers and stakeholders. Engaging with marketing partners on reducing emissions and developing guidelines around the same can also lead to reputational benefits among sales and medical representatives.

Key Challenges

Implementing this approach may require initial investments in digital infrastructure and training for marketing teams. There might be resistance from traditional marketing professionals accustomed to physical materials. Ensuring the effectiveness of digital campaigns compared to traditional methods could be challenging. Additionally, managing data storage and energy consumption of digital ads requires ongoing attention and potentially new expertise.

What do you need to get started?

Advertising

- Conduct a marketing mix analysis to understand sources of GHG emissions.
- Develop guidelines on emissions-conscious marketing practices to share with internal marketing teams, agencies and channel partners.
- Engage advertising vendors to measure their baseline, set science-based carbon reduction targets and use renewable energy.
- Prioritize domestic or remote production shoots over international shoots.
- Serve digital media advertisements using methodologies that minimize energy usage (e.g., adaptive streaming).

Enablers:

- **Emissions conscious marketing guidelines-** Provide frameworks and best practices for creating environmentally sustainable marketing campaigns and advertising operations, ensuring messaging aligns with eco-friendly principles.

Case Studies

McCann leveraged remote shooting for digital and broadcast content creation throughout the COVID-19 pandemic

Adaptive streaming technology from SeenThis avoids unnecessary data transfer from display advertisements

Sources: 2.8.1. McCann (2020); 2.8.2. SeenThis (2021)

Marketing & Outreach

Business Travel, Sales and Employee Commute

Addressable emissions category: **Scope 3- Cat 6, 7**
Addressability: **Medium** | Emissions reduction potential: **Low** | Timeline: **High** | Upfront cost: **Medium**

What is it?

This initiative focuses on optimizing three key areas of mobility: 1) sales fleet operations, 2) business travel for meetings and conferences, and 3) daily employee commutes. Sales teams can transition to low-carbon fleet, optimize routes, and change strategies for clinician and patient engagement. Companies can hold virtual and regional events to reduce travel emissions, produce more sustainable promotional materials, and promote responsible distribution of medication samples. Business travel sustainability is achieved by encouraging lower-emission flights, sustainable accommodations, and increasing teleconferencing use. Employee commutes are addressed by promoting public transport, carpooling, cycling, and electric vehicles for daily trips to offices and facilities.

Value Potential

Business travel and employee commute accounts for about 3-5% of a company's Scope 3 emissions, with sales fleets often representing a significant portion.[2.2.5] Implementing sustainable policies can reduce emissions by up to 30%, while offering cost savings and reputational benefits.[2.2.5] In marketing operations, business travel accounts for around 58% of emissions for a typical ad agency.[2.8.1] Transitioning to EVs, optimizing routes, and increasing virtual engagements can significantly reduce the carbon footprint of sales operations. Employee engagement is crucial for maximizing adoption of sustainable travel.

Key Challenges

Resistance from sales teams to new vehicle policies and concerns about EV range in remote areas are significant operational challenges. The high upfront costs for fleet electrification and charging infrastructure may strain budgets. Balancing reduced travel with the need for face-to-face healthcare provider interactions poses a unique industry challenge. Limited public transport options and changing long-standing employee travel habits require careful management. The shift to virtual engagements demands new skills and consideration of digital infrastructure emissions. Coordinating these changes across diverse locations, including remote areas served by sales teams, requires a holistic, industry-specific approach.

Sources: 2.2.5. Accenture Scope 3 Analysis (2023)

What do you need to get started?

- Assess the current state by conducting surveys/data collection to understand commute patterns and marketing/sales rep travel to identify key emission sources.
- Establish a sustainable transportation policy outlining the company's commitment, define reduction goals, targets and timelines.
- Transition sales/marketing fleet to low-carbon vehicles and /or incentivize for transition of personal vehicles for business travel.
- Promote employee engagement by launching awareness campaigns and incentivizing sustainable commute practices.
- Monitor and evaluate the impact of sustainable transportation initiatives.

Clinician and Patient Marketing

- Assess opportunities for holding virtual and regional events.
- Consider changes in sales/marketing territory assignments to reduce travel miles.
- Drive more sustainable promotional materials and reduce sample waste.

Enablers:

- **Sustainable travel policies**- Set guidelines for responsible travel, encouraging employees to choose lower-impact transportation methods.
- **Transport provider partnerships:** Collaborate with local businesses for carpooling initiatives, negotiate discounted public transport passes, or partner with EV manufacturers to offer employee purchase programs.
- **Travel booking platform with emissions transparency**- Integrate a platform displaying carbon footprint for each trip (flights, trains, cars) and incentivize lower-emission choices.

Case Studies

SAP to PwC: Sustainable Strategies to Cut Corporate Travel Emissions | Sustainability Magazine

NHS England » Net Zero travel and transport strategy

On the Horizon (Trends)

- **Using virtual reality and augmented reality (VR/AR)** for virtual site visits and training.

Section 03

Activating Organization Potential

Organizations on their journey to net zero face various pain points across the entire lifecycle of drug development and manufacturing

While the evaluation criteria outlined previously in Chapter 2 provide a framework for selecting effective decarbonization interventions, sustainability in the pharmaceutical sector remains inherently complex. The challenges can impede progress and hinder the successful activation of even the most well-chosen initiatives.

- Long, inflexible product development cycles that make it hard to implement rapid changes or re-design processes.
- Difficult balance between maximizing for sustainability while ensuring a high level of patient safety and product efficacy.
- Energy-intensive equipment and procedures in pharmaceutical manufacturing and biotech research.
- High R&D costs to develop and implement sustainable tech and practices.
- Cultural and organizational inertia to change required to build net-zero mindset.
- Intricate, far-reaching, and opaque supply chains that require robust coordination.
- Uncertain and rigorous regulatory environment across borders.
- Lack of reliable, accurate, and specific emissions data across Scope 1, 2, and 3.
- High implementation costs of capable technology to track and manage emissions data.
- Ensuring patient and healthcare provider buy-in for sustainable solutions.

To counter these challenges, we identified six critical capabilities to bolster decarbonization initiatives, ensuring decarbonization is embedded in the business

01

Sustainability Value Case

Establishing and proving the business value case for sustainability interventions to secure investment and confidence of internal and external stakeholders.

02

Sustainable Operating Model

Ensuring the organization has the right governance, capabilities, KPIs, and monitoring and measurement to effectively mobilize decarbonization initiatives.

03

Supply Chain Collaboration

Cultivating close supply chain relationships and bespoke processes to facilitate E2E supply chain decarbonization initiatives.

04

Net-Zero Technology Adoption

Embracing and deploying a wide array of net-zero relevant technology platforms to adequately manage decarbonization initiatives.

05

Ecosystem Development

Collaborating with industry peers, policymakers, healthcare providers, and technology partners to share net-zero best practices and learnings, enabling faster initiative innovation and execution.

06

Public Policy Engagement

Engaging with key regulatory stakeholders to create effective and workable climate/net-zero regulatory policies that enable accelerated pharmaceutical industry decarbonization.

01 Sustainability Value Case

What is it?

Attracting internal financial support along with lenders and investors for sustainability value cases by demonstrating the financial benefits of sustainability, quantifying the impact, and aligning with investor priorities.

Why is it important?

Sustainability initiatives may require upfront investment in new tech or infrastructure upgrades. Securing financing helps cover the necessary initial costs, bridging the gap between limited internal resources and allows for wider roll out.

Cost of Inaction: With the increasingly stringent and widespread regulations, companies delaying investment in decarbonization might ultimately be faced with rising costs, with the price of carbon currently forecast to reach global average of $76.4/tCO2 by 2030.[3.1] Limited implementation may restrict potential cost savings and market benefits leading to missed opportunity to gain competitive edge and proactive investments to stay compliant with the regulations, investor scrutiny.

How to get started?

- Quantify sustainable practices' cost savings and efficiency gains across operations.
- Evaluate sustainable product portfolio and R&D pipeline for revenue generation potential.
- Develop a comprehensive sustainability strategy with measurable targets and KPIs aligned to business objectives.
- Implement an Internal Carbon Pricing tool to assign a cost to carbon emissions and channel investments towards decarbonization. Leverage sources such as Pharma Net-Zero Delivery Playbook to identify potential interventions that can be taken up and resulting emissions benefits and financial considerations.
- Align with Internal stakeholders on business value of selected interventions.
- Integrate sustainability value proposition into investor materials through transparent sustainability reporting and aligning with ESG criteria of potential investors/lenders.

Leading examples from Pharmaceutical Industry

- Example tools for establishing the sustainability value case for pharmaceutical industry players:
- Internal Carbon Pricing: Amgen has implemented an internal price on carbon to incentivize emissions reduction and fund decarbonization initiatives that offer the most significant financial and environmental benefits.[3.2]
- Greenhouse Gas Equivalencies Calculator: converts emissions or energy data into concrete terms useful in communicating reduction opportunities, such as the annual emissions from cars, households, or power plants. [3.3]

Sources: 3.1. World Energy Outlook 2024 (iea.blob.core.windows.net) smi-hstf-supply-chains-whitepaper.pdf (storyblok.com); 3.2. ESG Dive: Companies setting their own carbon prices without global standard: Reuters.; 3.3 US EPA GHG Equivalencies Calculator

02 Sustainable Operating Model

What is it?

A way of working with sustainability embedded, where each part of the organization includes sustainability in its KPIs, organizational structure, decision-making processes, culture, and employee incentives.

An operating model with a long-term commitment to step-by-step change across all levels of the enterprise architecture.

Why is it important?

Improved operating model addresses challenges in organization wide adoption of interventions; challenges in adoption stem from siloed groups, unclear accountabilities, and standalone sustainability teams pushing decarbonization as a 'nice-to-have'.

There is often a need to reinvent traditional ways of working to tackle the cross-functional challenge of decarbonization, as interventions can span across R&D, manufacturing, logistics, and procurement among other functions.

How to get started?

- Mobilize key executives to align on the decarbonization ambition and roadmap.
- Determine the organizational structure and roles and responsibilities needed to execute on the decarbonization strategy.
- Capabilities, processes, and policies across various levers of the roadmap such as strategy, implementation, data management, reporting, and project budgeting.
- Develop measures to incentivize and support decarbonization efforts.

Leading examples from Pharmaceutical Industry

- AstraZeneca's governance of climate-related issues across the Board, the Executive, franchises, and sites.[3.4]
- Novartis' Environmental Sustainability Strategy is designed across 4 pillars - planet, patients, people, and policy – and underpinned by five design principles embedded across the organization.[3.5]

Sources: 3.4. AstraZeneca TCFD Report (2023); 3.5. Novartis Environmental Sustainability Strategy (2022)

03 Supply Chain Collaboration

What is it?

A structured approach to engage with suppliers across raw materials, packaging, capital equipment, 3PL and others to collectively reduce emissions across the product lifecycle.

Collaboration programs can include trainings, sharing resources, communicating sustainability requirements, and aligning on common commitments to ensure suppliers have their own roadmaps to reach Net-Zero.

Why is it important?

Given the scale of the "scope 3 challenge," there is industry-wide recognition that companies cannot reach Net-Zero alone. Major share of value chain emissions arise from the supply chain, making working with suppliers imperative to coordinate action.

Risk of inaction: Reduced insulation against carbon taxes, missed value creation opportunities from circular business models, reputational and reporting risks from lack of visibility into supplier data.

How to get started?

- Explore embedding decarbonization responsibilities in existing procurement roles (e.g., CPO, Category Manager).
- Evaluate creating new decarbonization expert roles within category management process.
- Conduct hotspot analysis for suppliers to identify areas with the highest emissions reduction potential and addressability. The addressability of different initiatives in this playbook will change based on the profile of each supplier and the hotspot analysis aids in prioritization.
- Develop training programs to upskill procurement roles and suppliers on key decarbonization topics (such as LCA and PCF), in collaboration with industry peers and platforms.
- Develop a supplier engagement approaches by tailored to supplier groups based on criteria such as supplier size, decarbonization hotspots, reduction potential, shared commitments, etc.
- Systematically integrate decarbonization criteria into procurement processes across all stages of the procurement lifecycle and help shape incentives (e.g. RFPs, award analysis, contracts, payment terms, etc).
- Work with suppliers to assess climate maturity and support in developing science-based targets.

Leading examples from Pharmaceutical Industry

- GSK's sustainable sourcing program – that includes environmental targets and supplier education.[3.6]
- Novo Nordisk is committed to working with suppliers to reach a 100% renewable power target for all direct suppliers.[3.7]
- Roche's sustainability supplier engagement program has supplier targets for 2025 on RE, green heat, and transportation.[3.8]

Sources: 3.6. GSK (2022); 3.7. Novo Nordisk (2020); 3.8. Roche (2024)

04 Technology Adoption

What is it?

Adopting comprehensive technology strategies and platforms that allow end-to-end management of GHG emissions.

It involves taking a holistic approach to weaving GHG intelligence into the core business and value chain to enable reporting, compliance, analytics, and monitoring that integrates with the existing technology systems in an organization.

Why is it important?

There is often a fragmented technology landscape across ERP platforms, functional platforms, and Analytics platforms with multiple KPIs across stakeholder groups. Tracking and managing decarbonization KPIs across systems can streamline data and enable analytics driven decisions.

Risk of inaction: Limited visibility over operational and value chain emissions, missed emission reduction opportunities due to lack of granularity, cumbersome reporting processes.

How to get started?

- Assess current and future emission management and reporting needs with respect to current maturity of data management systems.
- Identify technology platform providers that can design and implement modular or bespoke solutions.
- Develop the necessary digital architecture to capture emissions data across Scope 1, 2, and 3.
- Implement/upgrade emissions management platforms across facilities and functions.
- Carry out necessary change management and capability building activities.

05 Ecosystem Development

What is it?

Establishing or participating in focused groups with peers to advance industry-wide progress in net-zero efforts.

Participation in these groups can include common commitments, data and knowledge sharing, and collaboration among stakeholders such as other health and LS companies, NGOs, governments, and academia to enable a coordinated, scaled response.

Why is it important?

No single organization has sufficient influence to transform the value chain. Pre-competitive and collaborative frameworks facilitate lesson-sharing and exchange of data that catalyzes breakthroughs, accelerating the industry's pace towards Net-Zero.

Risk of inaction: Loss of access to innovative potential for net-zero operational and product-based breakthroughs, patchwork of 'sustainability reporting languages' misaligned with industry needs.

How to get started?

- Identify initiatives across the pharmaceutical ecosystem that are in alignment with organizational decarbonization goals.
- Share leading practices and experiences, and influence stakeholders across the platform on common frameworks and commitments to amplify decarbonization activities.
- Engage with participants to agree upon a standardized, accurate, and compatible data sharing protocol.
- Leverage networks established for research or commercial partnerships with suppliers, customers, startups, or academia.

Leading examples from Pharmaceutical Industry

- Selected active industry collaborations for sustainability in the pharmaceutical industry:
- Activate (Part of Manufacture 2030) [3.9]
- National Academy of Medicine Action Collaborative on Decarbonizing the US Health Sector [3.10]
- Biopharma Sustainability Roundtable [3.11]
- Pharmaceutical Environmental Group (PEG) [3.12]
- Pharmaceuticals Supply Chain Initiative (PSCI) [3.13]
- Scope 3 Peer Group [3.14]
- SMI Health Systems Task Force [3.15]
- Sustainable Procurement Pledge (SPP) [3.16]

Sources: 3.9. Activate (Part of Manufacture 2030); 3.10. National Academy of Medicine; 3.11. Biopharma Sustainability Roundtable; 3.12. PEG Hub; 3.13. PSCI ; 3.14. Scope 3 Peer Group; 3.15. Sustainable Markets Initiative ; 3.16. The Sustainable Procurement Pledge

06 Public Policy Engagement

What is it?

Providing education and input to regulatory stakeholders to share industry perspectives and shape public policies for decarbonization.

Engaging with third-party industry bodies that are aligned with the organization's values and position on decarbonization and advocating for policies through these bodies.

Why is it important?

Early engagement with regulators and policymakers, particularly on sustainable products and processes can streamline regulatory approvals and can build relationships with key stakeholders in the government.

Risk of inaction: Missed opportunities to impact policy and regulatory actions and cede policy space on sustainable drug products to competitors.

How to get started?

- Internally align on common public policy objectives between government relations and sustainability functions.
- Identify and engage with third parties that influence policy on decarbonization.
- Identify task-forces/working groups and other platforms within global multilateral organizations and industry trade groups.
- Ensure internal controls and protocols are in place for ethical and responsible engagement – with policymakers, as well as third-party groups.
- Share best practices, position papers, case studies, and industry perspectives to advance the organization's decarbonization strategy.

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Acronyms

1	NPV	Net present value
2	SMA	Subject Matter Advisors
3	GHG	Greenhouse Gas
4	IPCC	Intergovernmental Panel on Climate Change
5	MMTCO2e	Million Metric Tonnes of CO2 equivalent
6	LS	Life Sciences
7	MDIs	Metered Dose Inhalers
8	DPI	Dry Powder Inhaler
9	COPD	Chronic Obstructive Pulmonary Disease
10	MRs	Medical Representatives
11	GWP	Global Warming Potential
12	pMDIs	Pressurized Metered-dose Inhalers
13	BA-pMDIs	Breath-actuated pMDIs
14	DTDL	Digital Twins Definition Language
15	IoT	Internet of Things
16	AI	Artificial Intelligence
17	AR/VR	Augmented Reality/ Virtual Reality
18	FDA	The Food and Drug Administration
19	OEMs	Original Equipment Manufacturers
20	ISO	International Organization for Standardization
21	PAT	Process Analytical Technology
22	API	Active Pharmaceutical Ingredient
23	PROs	Producer Responsibility Organizations
24	FAME	Fatty Acid Methyl Ester
25	FaaS	Fleet as a Service model
26	EV	Electric Vehicle
27	IT	Information Technology
28	DFIs	Development finance institutions
29	AS/RS	Automated Storage and Retrieval System
30	HVAC	Heating, Ventilation, and Air Conditioning
31	ESCOs	Energy Service Companies
32	EPCs	Energy Performance Contracts
33	RE	Renewable Electricity
34	PPAs	Power Purchase Agreements
35	EACs	Energy Attribute Certificates
36	REC	Renewable Energy Certificates
37	WFI	Water for Injection
38	COP	Coefficient of Performance
39	RNG	Renewable Natural Gas
40	LEED	Leadership in Energy and Environmental Design
41	ESPCs	Energy Savings Performance Contracts
42	ML	Machine Learning
43	ESSs	Energy Storage Systems
44	low-E	low-Emissivity
45	PUE	Power Usage Effectiveness
46	GCP	Google Cloud Platform
47	AWS	Amazon Web Services
48	KPIs	Key Performance Indicator
49	E2E	End to End
50	ICP	Internal Carbon Pricing
51	ESG	Environmental, Social, and Governance
52	PL	Party Logistics
53	CPO	Chief Procurement Officer
54	LCA	Life Cycle Assessment
55	PCF	Product Carbon Footprint
56	GSK	GlaxoSmithKline
57	SMI	Sustainable Markets Initiative
58	PSCI	Pharmaceuticals Supply Chain Initiative
59	PEG	Pharmaceutical Environment Group
60	SPP	Sustainable Procurement Pledge
61	IFPMA	International Federation of Pharmaceutical Manufacturers and Associations
62	PhRMA	The Pharmaceutical Research and Manufacturers of America
63	SBTi	Science-based Targets Initiative
64	ERP	Enterprise resource planning
65	SAP	System Applications and Products in Data Processing

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