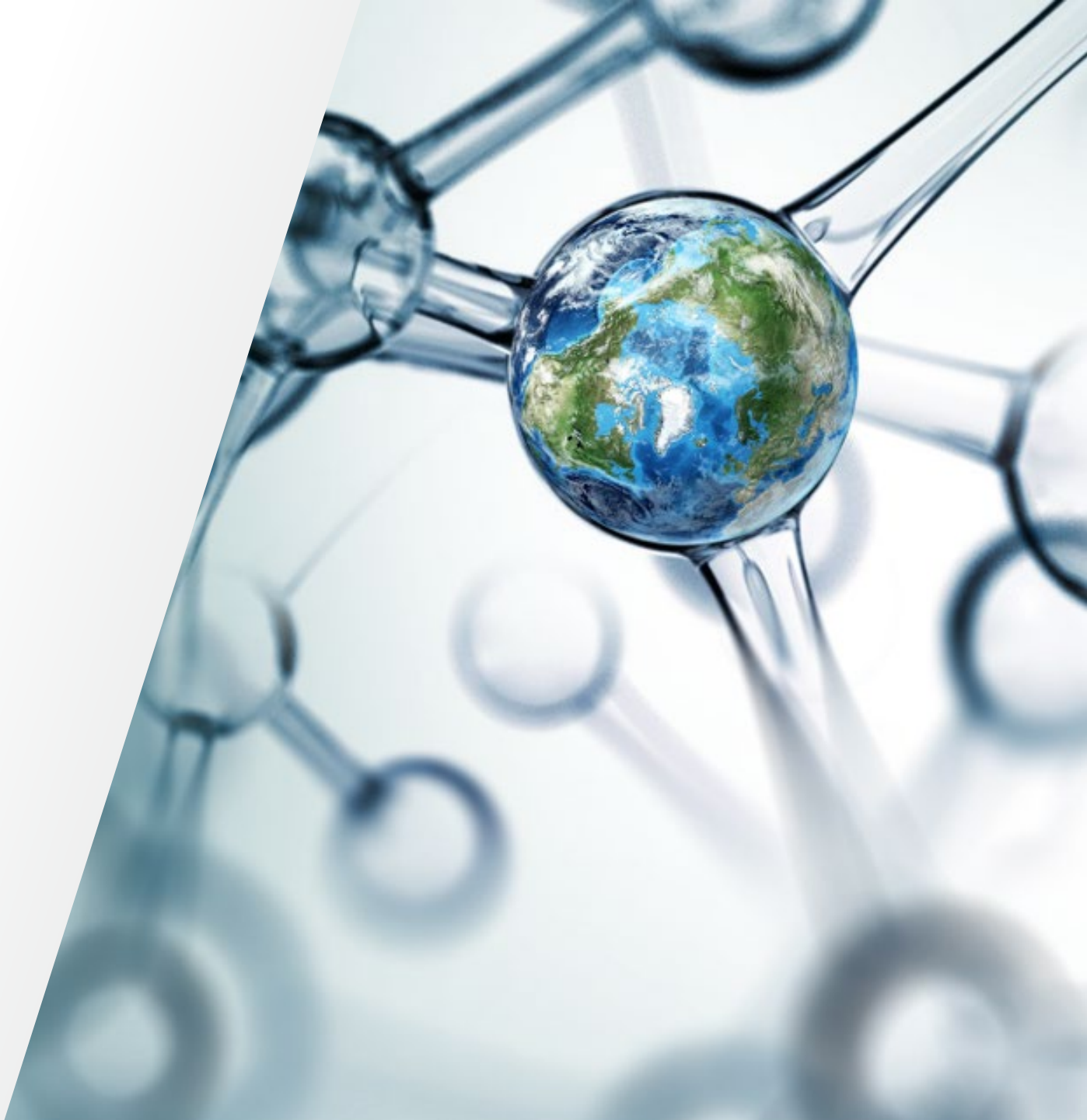
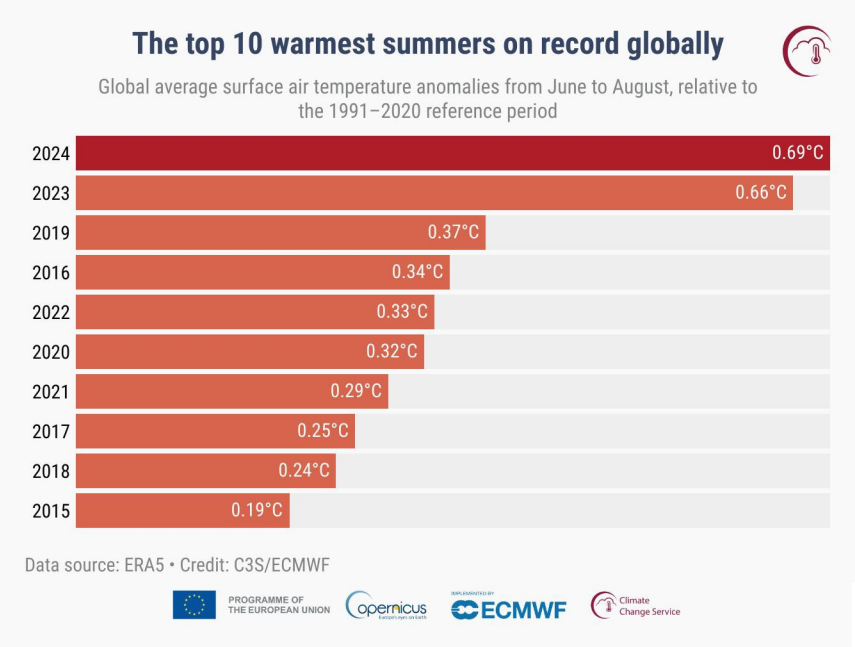
Meeting the Sustainability Challenge

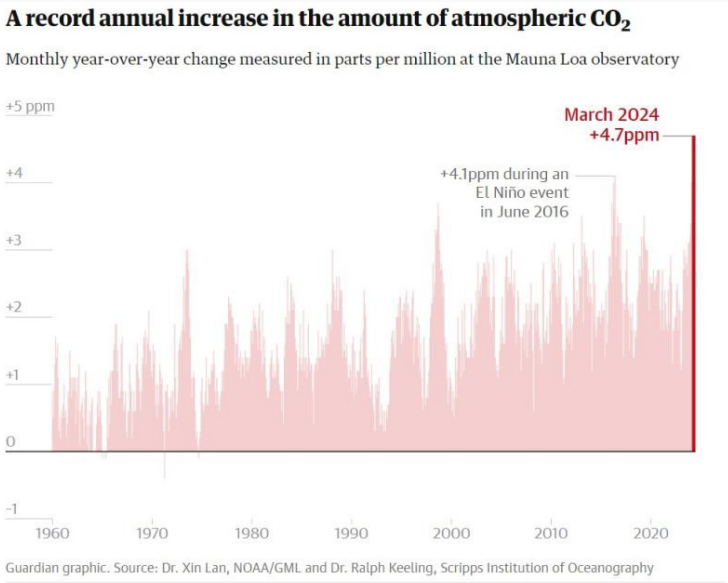
Samuel Aleman
Sr. Director Commercial Strategy, EMEA
Clean Energy & Sustainability

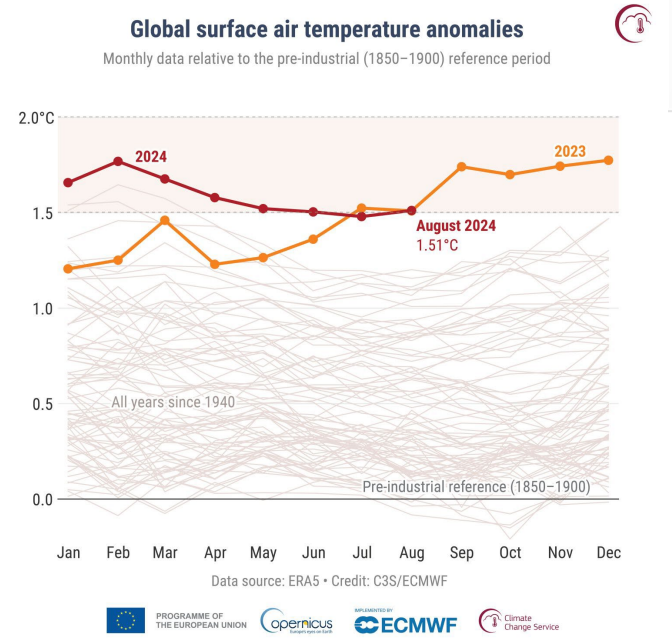


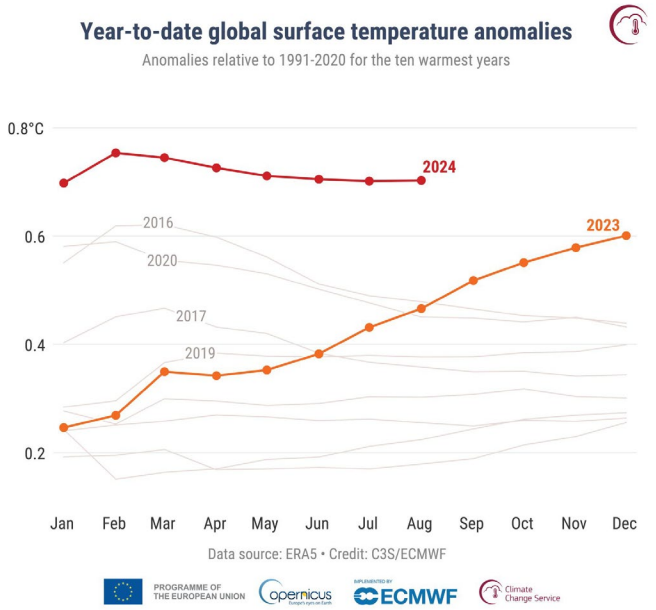
The world leader in serving science

Why this matters







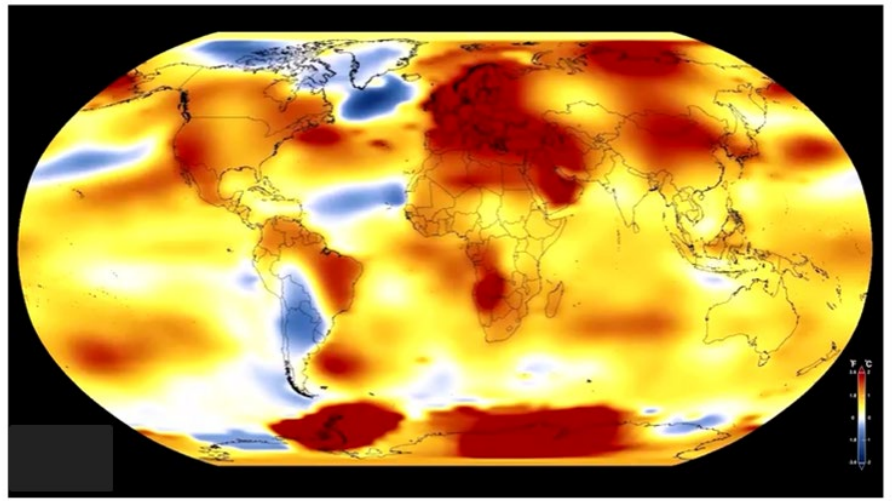


COP29

2024 will be world's hottest year on record, EU scientists say

By **Kate Abnett** and **Alison Withers**

November 7, 2024 9:52 AM GMT+1 · Updated a month ago



Summary

- 2024 will be first year over 1.5C hotter than pre-industrial period
- COP29 summit aims to increase climate change funding
- Climate change is fuelling extreme weather

Reuters

The scientists said 2024 will also be the first year in which the planet is more than 1.5C hotter than in the 1850-1900 pre-industrial period, when humans began burning fossil fuels on an industrial scale.

Why this matters – in industry look

The Carbon Impact of Biotech and Pharma: Crossing the Tipping Point of Industry Transformation

11/13/2024

My Green Lab's 2024 report reveals growing climate commitments from the biotech and pharma sectors while underscoring the urgency of accelerating Scope 3 emissions reductions.

Key Findings and Industry Progress

Emissions Challenges and Commitments

The 2024 report highlights both significant progress and challenges in emissions reduction across the biotech and pharma sectors. Among the 149 biotech and pharma companies with high-quality emissions data, 31% have set medium-term Scope 1 and 2 targets (2026–2035) that are aligned with a 1.5°C pathway. However, to fully meet climate goals, it is critical for companies to expand these targets to include Scope 3 emissions, which cover indirect emissions throughout the value chain.

The report also reveals a concerning emissions footprint across the industry. Total emissions from public companies amounted to 259 million tCO_2e, while private companies accounted for 138 million tCO_2e, bringing the total to 397 million tCO_2e in 2023. Scope 3 emissions, which encompass indirect emissions from purchased goods and services, are a major challenge. These emissions are significantly higher than Scope 1 and 2, being 5.4 times greater for public companies and 6.5 times greater for private companies.

NIH National Library of Medicine
National Center for Biotechnology Information

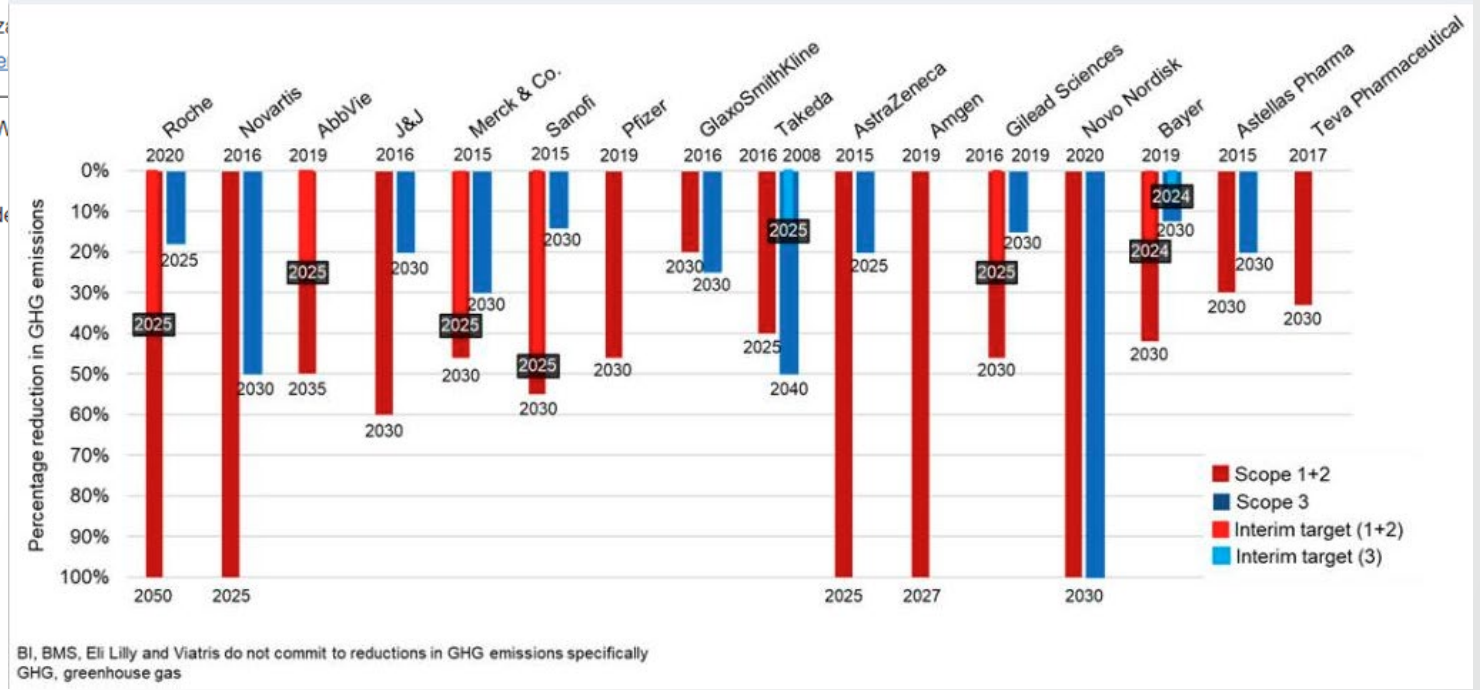
Int J Environ Res Public Health. 2023 Feb; 20(4): 3206. PMCID: PMC9967855
Published online 2023 Feb 11. doi: 10.3390/ijerph20043206 PMID: 36833902

Journal Article

Pharmaceutical Company Targets and Strategies to Address Climate Change: Content Analysis of Public Reports from 20 Pharmaceutical Companies

Amy Booth, Conceptualiz
editing,[1,*] Alexandra Jage
Formal analysis, Writing –
analysis, Data curation, W
editing, Supervision[1]

Antonio G. Oliveira, Acade



BI, BMS, Eli Lilly and Viatris do not commit to reductions in GHG emissions specifically
GHG, greenhouse gas

Why this matters – working together

Pharmaceutical Technology

Pharma's path to Net Zero: Targeting Scope 3 emissions

With a target of net zero for 2050, pharmaceutical companies need to tackle scope 3 emissions, that make up the majority of their carbon footprint.

Jenna Philpott | November 30, 2023

Reducing Scope 3 emissions is a shared responsibility

While Scope 1 emissions originate from sources directly controlled by the company, Scope 2 are indirect emissions resulting from the generation of purchased or acquired electricity, heat, or steam. Scope 3 emissions encompass the raw material production, distribution, product use, and end-of-life disposal, making them a complex part of the industry's carbon footprint.

The future of Scope 3 emissions

In order to achieve the net zero goals, pharmaceutical companies are going to need to overcome the challenge of reducing their complex Scope 3 emissions.

Climate & Energy | Industry Insight | Climate Change | Social Impact | Clean Energy

Big pharma pulls together to shrink healthcare's outsized carbon footprint

By **Angeli Mehta**

February 14, 2024 12:35 PM GMT+1 · Updated 2 months ago

The NHS told its 80,000 suppliers that by 2030, it would no longer purchase from any of them if they were not also travelling towards net zero by 2045 or sooner. A powerful incentive then. But for those suppliers that means getting the data to make the decisions that will drive progress in their own supply chains.

WORLD ECONOMIC FORUM

FORUM INSTITUTIONAL

This is why 'product carbon footprint' exchange is key to Scope 3 decarbonization

- **Decarbonizing scope 3 emissions, those from upstream and downstream partners in a company's supply chain, is a big challenge for reducing the carbon footprint of a business.**
- **Product-level information based on suppliers' primary data can help identify hotspots where materials, processes and products can be addressed regarding their emissions impact.**
- **There is a critical need for consistently calculating product carbon footprint at the most granular level and to exchange data in a verifiable, secure and interoperable manner.**

Pharma's path to Net Zero: Targeting Scope 3 emissions - Pharmaceutical Technology (pharmaceutical-technology.com)

How a product carbon footprint can help decarbonization | World Economic Forum (weforum.org)

Big pharma pulls together to shrink healthcare's outsized carbon footprint | Reuters

ThermoFisher SCIENTIFIC

Mission:

To enable our customers to make the world healthier, cleaner and safer

Together, we are building a brighter future

>125,000	7,000	$1.5B	>$40B
colleagues	R&D scientists/engineers	invested in R&D	in revenue

The world leader in serving science

Advancing our targets: Net-zero emissions and nature

Our commitment to environmental sustainability supports our Mission and helps our customers achieve their sustainability goals.

SCOPE 1&2

50%

reduction in emissions by 2030 from 2018 base year[1]

SCOPE 2

80%

renewable electricity globally by 2030

SCOPE 3

90%

of suppliers (by spend) to set science-based targets by 2027

NET ZERO

SCOPE 1, 2 and 3 EMISSIONS BY 2050[2]

Our emissions targets are **validated** by the Science Based Targets initiative

We recognize our goal in protecting the world's natural resources. That's why we are committed to preserving freshwater resources and managing waste.

Water

by **2024**

assess water usage for water intensive manufacturing facilities in water scarce areas[3]

Waste

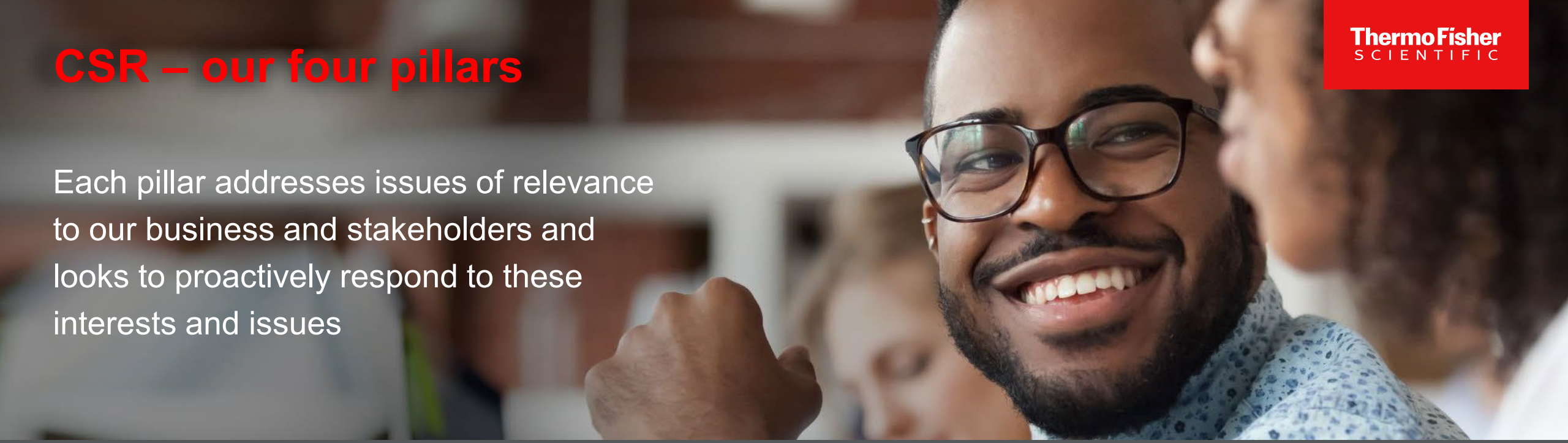
30

manufacturing and warehouse sites zero waste certified by 2025[4]

[1]Exact target is 50.4%
[2]Requires at least 90% reduction against the base year (2018 for Scope 1 and 2, 2021 for Scope 3) with long-term removal of any residual emissions generated after the target date

[3]Water intensity means a facility using over 25,000 cubic meters of fresh water per year
[4]Zero waste means less than 10% of non-hazardous waste is sent to landfill, incineration or waste-to-energy

CSR – our four pillars



Each pillar addresses issues of relevance to our business and stakeholders and looks to proactively respond to these interests and issues

Operations

Governance & Ethics

- Governance, ethics and compliance

Management Systems

- Quality management, environmental health & safety

Supply Chain Transparency

- Supplier diversity, responsible sourcing

Colleagues

Diversity & Inclusion

- Differences are truly valued; authenticity is a state-of-being

Culture & Belonging

- Respect, dignity and belonging
- Wellbeing

Talent Management

Communities

Foundation for Science

- Investing in STEM Education
- Advancing global health equity
- Driving localized impact through our Community Action Councils

Environment

Climate

- By 2030, reduce our emissions by 30%
- By 2050, achieve net-zero emissions

Product design

- Incorporating sustainability principles into the design process

Water and Waste

Our approach to environmental sustainability

Science-based and customer-centric to deliver innovative solutions

Climate

As the world leader in serving science, we support the urgent calls for action from scientists around the world to address climate change.

Nature

We recognize our role in protecting nature. That's why we are committed to preserving freshwater resources and managing waste.

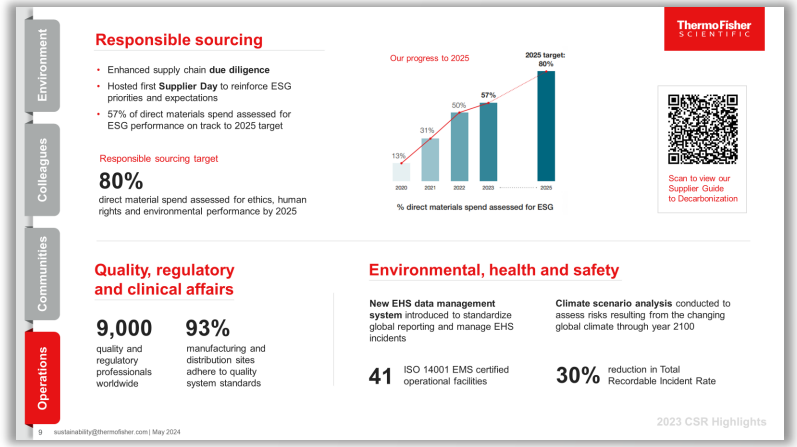
Greener by design™

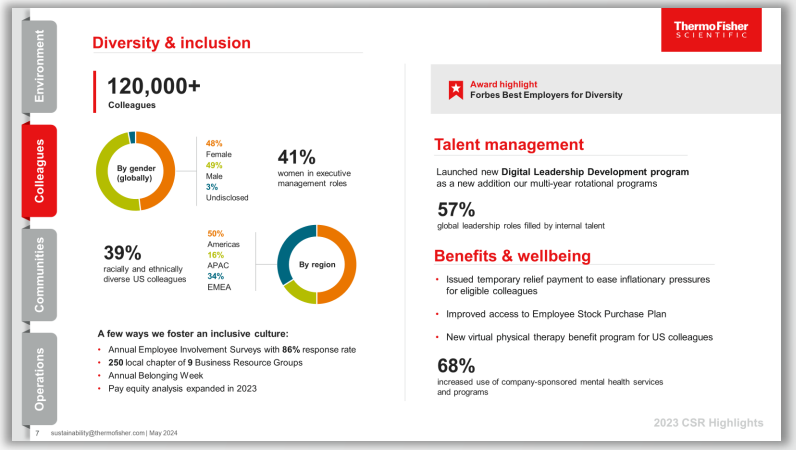
We seek to understand and minimize the environmental impact of our products and packaging — from design to end of life.

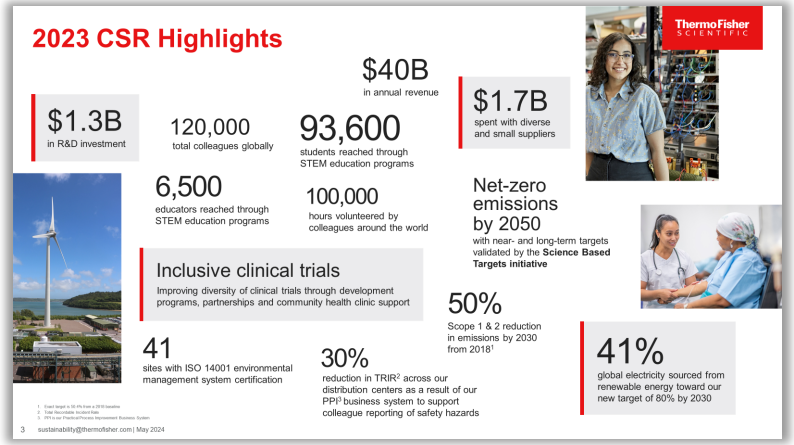
Working in partnership with our stakeholders is the foundation of our approach

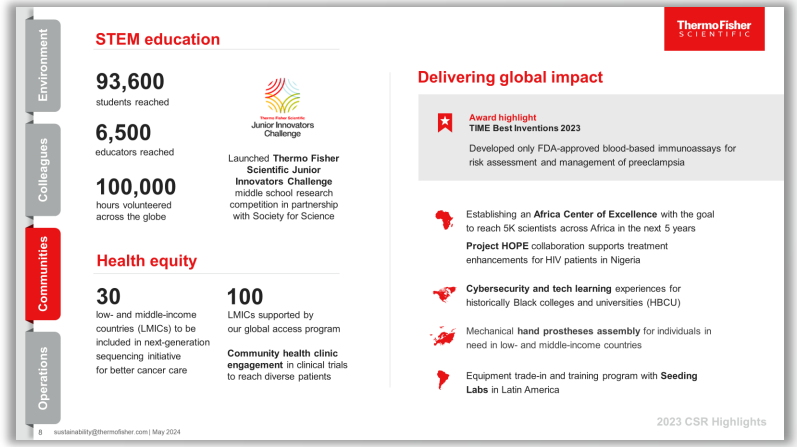
2023 CSR Report

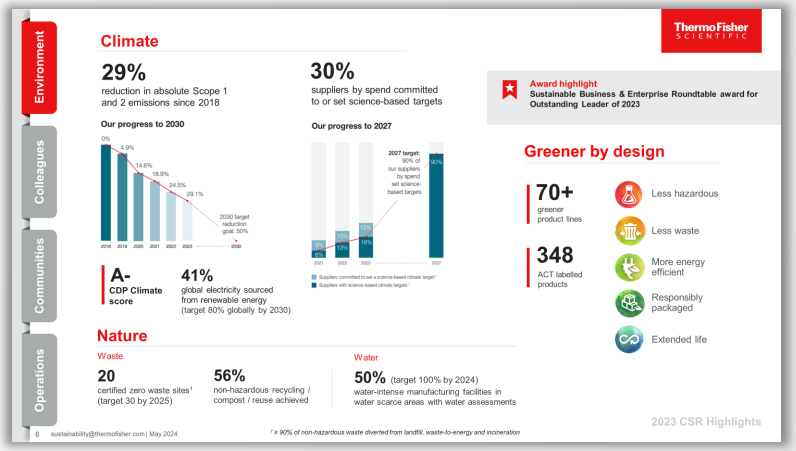
Executive summary slides











Greener by design™ program

Discover how we are innovating with the planet in mind

- We're on a journey to think differently about how we design, make and package our products.
- Moving from linear processes to a more circular economy, where we eliminate waste and keep materials in use, either as a product, components or raw materials.
- We call it **Greener by design™** program.

Learn more at thermofisher.com/greenerbydesign

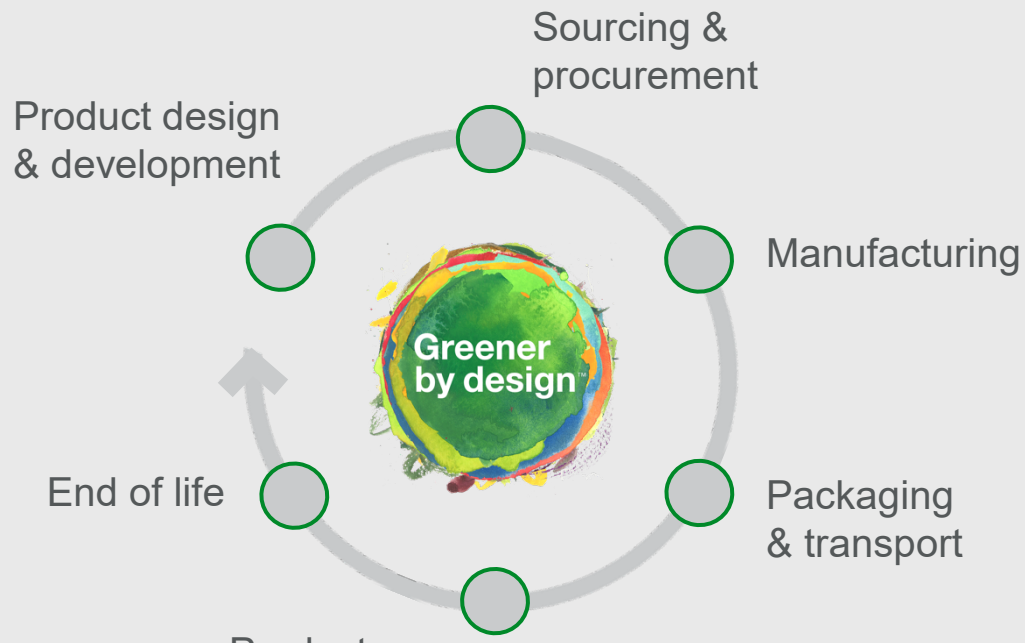
Our Greener by design™ approach

Incorporate life cycle thinking into product design early in product development

IMPACT AREAS

- Less hazardous
- Less waste
- More energy efficient
- Responsibly packaged
- Extended life

PRODUCT LIFE CYCLE



Designing more sustainable products

Innovating greener products across five important areas for environmental impact

LESS HAZARDOUS	LESS WASTE	MORE ENERGY EFFICIENT	RESPONSIBLY PACKAGED	EXTENDED LIFE
				
Platinum Direct PCR Universal Master Mix	**DynaSpin™ Single-Use Centrifuge**	**TSX Series ultra-low temperature freezers**	**Gibco™ BenchStable ™ Cell Culture Media**	**iBlot™ 2 Dry Blotting System**
No need for ethanol, mercaptoethanol or guanidine salts	Substantially reduces filter, liquid, and chemical waste	ENERGY STAR™ certified	Readily recyclable packaging and ambient storage	Mail-back program to recycle transfer stack copper

> 150 ENERGY STAR-certified products | 70+ greener product lines

For more information on our greener product criteria and claims, visit thermofisher.com/greenerbydesign

Using the Environmental Impact Factor Label: ACT

The ACT "eco-nutrition" label for laboratory products brings **A**ccountability, **C**onsistency and **T**ransparency

>350 Thermo Fisher laboratory products are using the ACT label

Learn more at act.mygreenlab.org

Thermo Fisher also participates in Green Lab Certification program

1-10 scale indicates environmental impact captures manufacturing and supply chain impacts

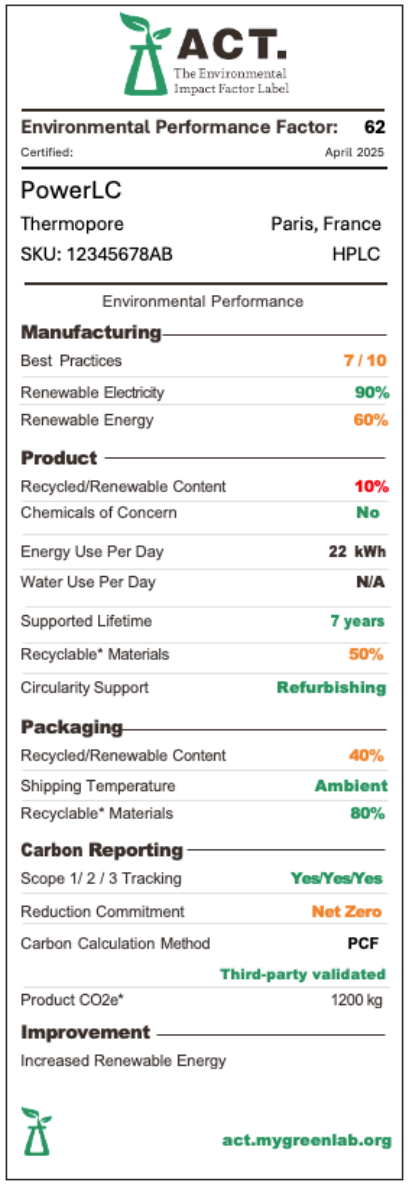
Additional information about categories available online

Energy and water consumption data help drive sustainable lab practices

Total Impact factor enables quick comparisons

Expiration date keeps data current and drives continuous improvement

Using the Environmental Impact Factor Label: ACT 2.0



- ✓ Report on products, facilities, and companies
- ✓ Provide independent third-party verification of data and claims
- ✓ Enhance circularity
- ✓ Be a guide for better manufacturing
- ✓ Incentivize continuous improvement
- ✓ Support product carbon reporting
- ✓ Include contributions from diverse stakeholders to produce an impactful, useful, functional, actionable result

Supporting more sustainable lab practices

My Green Lab Certification is recognized by **United Nations Race to Zero campaign** as a key measure of progress toward a zero-carbon future and considered the **gold standard** for lab sustainability best practices around the world.

Thermo Fisher has certified **26** labs globally, involving more than 500 lab colleagues

Bronze	Silver	Gold	Platinum	Green
40% or more of Green Lab assessment action implemented	50% or more of Green Lab assessment action implemented	60% or more of Green Lab assessment action implemented	70% or more of Green Lab assessment action implemented	80% or more of Green Lab assessment action implemented
Bremen, DE Cork, IE	Carlsbad, CA, USA Oslo, NO	Grand Island, NY, USA Oslo, NO Rochester, NY, USA x2 Rockford, IL, USA West Hills, CA, USA	Basingstoke, UK Carlsbad, CA, USA x2 Cork, IE Lillestrøm, NO Oslo, NO Regensburg, DE S. San Francisco, CA West Hills, CA, USA	Cork, IE Darmstadt, DE Dreieich, DE Hunt Valley, MD Sao Paulo, BR Vienna, AT Carlsbad, CA

my green lab certification.

Thermo Fisher supports Converge, the supply chain initiative driving sustainability in labs

Changing shipping from cold to ambient

Benefits

- Reduced cooler and refrigerant use
- Reduced packaging waste at end of life
- Reduced energy use for manufacturing of packaging
- Reduced fuel use and GHG emissions for transport and packaging

- TaqMan™ Genomic Assays
- E-Gel™ and DNA Ladders
- Capillary Electrophoresis Running Buffers
- ProLong™ Gold and SlowFade™ Gold Antifade Reagents
- AmpliTaq Gold™ 360 and AmpliTaq™ 360 DNA Polymerases
- Lipofectamine™ 2000, 3000 and RNAiMAX
- GlutaMAX™-I Media Supplement
- Custom primers and TaqMan™ probes
- TrypLE™ enzyme

No coolers and refrigerants

Reducing our packaging

TaqMan Assays and TaqMan Primers and Probes

- Re-designed packaging to reduce materials while maintaining product safety
- 57% less packaging
  - Eliminated plastic bag
  - Reduced size of product box and shipment packaging
  - 100% recycled content PET tube rack
- Requires fewer resources, emits less greenhouse gases (GHG) during transit, and generates less waste

Eliminates 17 metric tons of CO_2 emissions each year, equivalent to not driving 42,000 miles in an average passenger car

Readily recyclable 100% paper cooler

100% paper, recyclable cooler

Protects temperature sensitive products and meets the thermal requirements necessary to uphold our stringent product quality standards

2020 AWARDS CiteAb The Life Science Data Provider WINNER

BIG INNOVATION 2020 *

Gartner Power of the Profession Awards

2021 Social Impact of the Year

Visit thermofisher.com/papercooler

It’s paper. It’s cool.

* Business Intelligence Group, 2020 BIG Innovation Awards

More sustainable delivery options | EcoSafPak

Durable packaging solution that protects your product and the environment

Styrofoam®-free packaging that is fully recyclable

Packaging is sustainably sourced and certified by Sustainable Forestry Initiative®

Available for all Fisher Chemical cases in the following formats:

2 × 4L	4 × 4L
2 × 1L	1 × 4L
2 × 500mL	1 × 2.5L
6 × 1L	1 × 1L
6 × 500mL	1 × 500mL

SM SFI CERTIFIED SOURCING

FIBER USED IN THIS PRODUCT LINE MEETS THE SOURCING REQUIREMENTS OF THE SFI PROGRAM

WWW.SFIPROGRAM.ORG

fishersci.com/ecosafpak

Reusable/returnable delivery options

Packaging that is returned to the supplier for cleaning and reuse

Simple, no waste delivery and storage systems for bioproduction

Eliminates up to 600 lbs of plastic waste per shipment

FisherPak Returnable Solvent Containers: No more packaging, no more hassle

Almost 200 lbs of glass, cardboard and foam inserts are eliminated by each 200L FisherPak

Plastic recycling | reducing laboratory waste

Pipette tip box recycling

- All box manufacturers accepted
- Pre-paid shipping label included with collection box

Glove and garment recycling

- Kimberly Clark gloves and lab apparel
- Waste is recycled into benches, chairs, collection bins and more

www.fishersci.com/thinkgreen

Note: Product and service offerings vary by region

Transforming with transparency

We foster public understanding of our environmental impact and progress toward our goals.

These disclosures and insights are important to all our stakeholders, including our customers, colleagues and the local communities where we operate.

Our commitments & networks

BUSINESS AMBITION FOR 1.5°C

United Eco-Skies Alliance

BioPhorum

ecovadis

HPRC HEALTHCARE PLASTICS RECYCLING COUNCIL

EPA GREEN POWER PARTNER

WE MEAN BUSINESS COALITION

Pistoia Alliance

RENEWABLE THERMAL COLLABORATIVE

SCIENCE BASED TARGETS DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

my green lab.

Our reporting

GRI

ecovadis

SASB STANDARDS

CDP DISCLOSURE INSIGHT ACTION

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

To learn more, visit thermofisher.com/csr

In the news…

News Details

View all news →

Thermo Fisher Scientific Introduces Biobased Solutions to Help Reduce Climate Impact in Manufacturing of Therapies

06/28/2024

Media Contact Information:
Kathy Bricaud
Phone: 442-359-6848
Email: kathy.bricaud@thermofisher.com

Thermo Fisher Scientific Introduces Biobased Solutions to Help Reduce Climate Impact in Manufacturing of Therapies

New solutions include a first-of-its-kind film that can eliminate carbon emissions from plastic resin

WALTHAM, Mass., June 28, 2024 – Thermo Fisher Scientific Inc., the world leader in serving science, is contributing to the sustainability of biologics therapy manufacturing by leveraging plant-based materials, rather than fossil fuel materials, to deliver lower-carbon, biobased films for its single-use technology bioprocessing containers (BPCs). The biobased films build on Thermo Fisher's existing Aegis™ and CX film offerings that are widely used and validated by customers. As a result, customers can maintain consistency in their BPCs while also realizing a reduction in greenhouse gas (GHG) emissions. By adopting biobased, sustainable films in their BPCs, Thermo Fisher customers can eliminate carbon emissions related to the plastic resin.

The biobased films have earned an International Sustainability and Carbon Certification (ISCC) PLUS certification, a globally recognized certification for circular and biobased products. Biopharma manufacturers can pre-purchase the biobased films now to incorporate into their upstream or downstream system in early 2025. In addition, Thermo Fisher will support customers as they track their carbon reduction quantities and advance towards their sustainability objectives.

"Biopharma manufacturers are focused on maximizing productivity, accelerating time-to-market and generating efficiencies all while improving the overall sustainability of their operations," said Ray Mercier, president of Thermo Fisher's single-use technologies business. "Our biobased films allow customers to reduce their environmental impact without having to validate new BPCs, helping them bring treatments to patients faster while also helping to protect the planet."

In addition to offering BPCs with biobased film, Thermo Fisher connects customers with recyclers to enable recycling of BPCs after use. This program helps biopharma manufacturers divert waste from landfill or carbon-intensive incineration, advancing their sustainability goals through a convenient recycling service that turns BPCs into high-quality plastic lumber. Approximately 400,000 pounds of plastic waste has been diverted from landfills or incineration since initiation of the program.

October 3rd, 2024

Thermo Fisher Scientific and DHL Express collaborate to reduce greenhouse gas emissions from global shipping for clinical research, advancing more sustainable solutions for life-changing medicines

The PPD clinical research business will use DHL Express' GoGreen Plus service and invest in sustainable aviation fuel (SAF), a drop-in fuel that can be used in most conventional aircraft, to reduce emissions from air transportation.

Bonn, October 1, 2024 – DHL Express, the world's leading international express delivery provider, and the PPD™ clinical research business of Thermo Fisher Scientific, the world leader in serving science, have joined forces to drive more sustainable clinical research services for the pharmaceutical and biotech industries. The PPD clinical research business will use DHL Express' GoGreen Plus service and invest in sustainable aviation fuel (SAF), a drop-in fuel that can be used in most conventional aircraft, to reduce emissions from air transportation. The collaboration enables the PPD clinical research business, and by extension, its customers, to reduce greenhouse gas emissions associated with global clinical research air shipping logistics by up to 80% while maintaining rapid shipping timelines, sample chain of custody and quality. It reflects Thermo Fisher's commitment to sustainability and enhances the PPD clinical research business' leadership in environmental innovation, which also includes a variety of initiatives such as renewable energy for powering clinical trial sites and labs.

In the news…

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Thermo Fisher Scientific Introduces Ambient Shipping Solution for its Invitrogen™ Antibodies to Help Customers Reduce Packaging Waste and Carbon Emissions

New ambient temperature packaging represents a 90% reduction in shipment packaging mass

October 08, 2024 08:15 AM Eastern Daylight Time

WALTHAM, Mass.--(BUSINESS WIRE)--Thermo Fisher Scientific Inc., the world leader in serving science, today introduced more sustainable packaging for 125,000 of its Invitrogen™ antibodies. Transitioning from cold-chain packaging to ambient temperature shipping from distribution center to customer reduces package material mass, improves the customer experience and supports the company's global sustainability efforts.

"This more sustainable shipping solution helps simplify our laboratory's operations by reducing packaging waste and minimizing our environmental impact without compromising on our research goals."

Post this

Through functional and stability testing, Thermo Fisher has demonstrated that a significant portion of its Invitrogen antibody portfolio can be maintained at ambient temperature conditions during transport. By eliminating the use of cold gel packs and introducing a new 100% curbside recyclable paper packaging for customers, Thermo Fisher expects to eliminate more than 216,000 pounds of paper and 440,000 pounds of gel ice packs per year. This new packaging represents a 90% reduction in shipment mass, improves freight density and reduces carbon emissions.

"Our ambient shipping initiative is a response to our customers' expectations and demonstrates our commitment to sustainability and innovation," said Ellie Mahjubi, vice president, protein cell analysis, Thermo Fisher Scientific. "We are proud to launch this critical change, delivering on Thermo Fisher's Mission to enable our customers to make the world healthier, cleaner and safer. We believe this transition will have a considerable impact on the global research community by reducing packaging waste and transport emissions without compromising the quality of our antibodies."

"Antibodies are important to our work in genetics and genomics," said Graham Erwin, assistant professor, molecular and human genetics, Baylor College of Medicine. "This more sustainable shipping solution helps simplify our laboratory's operations by reducing packaging waste and minimizing our environmental impact without compromising on our research goals."

Solar Industry

HOME SOLAR NEWS

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Projects & Contracts

Thermo Fisher Signs PPA for Serbal Solar Project

By **Kimberly Warner-Cohen** - December 6, 2023

0

Marc N. Casper

Thermo Fisher has entered into a 15-year virtual PPA with ib vogt for a 91 MW portion of the Serbal solar project, located in Spain.

Eurofins Scientific collaborated in the aggregated deal for a 36 MW portion of the project, expected to be operational in January 2025. Thermo Fisher's share will match over half of its addressable European sites by delivering approximately 192,000 MWh of 100% renewable electricity annually, says the company.

To further accelerate its climate progress, Thermo Fisher has established a commitment to achieve 80% renewable electricity globally by 2030, in alignment with the Sustainable Markets Initiative Health Systems Task Force joint supplier standards. The aggregated shares will simultaneously reduce both Thermo Fisher's and Eurofins' respective Scope 2 and Scope 3 emissions.

"This new global climate goal not only strengthens our record of accelerated progress toward net-zero emissions, but it also underscores our collaborative approach on this journey," says Marc N. Casper, chairman, president and CEO of Thermo Fisher Scientific.

Sustainability

Paradigm shift

From

Compliance-only,
Box-ticking exercise

Voice of Customer

To

Powerful,
Value-delivering tool

Sustainability as value creating model

Common themes across the industries, conclusions from the F&S study

- **Across sectors:** efforts to **reduce waste generation**, a focus on **reduction water and energy consumption as well as carbon emissions**, and **adherence to environmental regulations** which drive internal sustainability initiatives and influence procurement decisions
- **Supplier codes of conduct** outlining expectations for suppliers regarding sustainability practices and adherence to laws and standards. Prioritization of suppliers with environmentally friendly and ethical labor practices, fair wages, and safe working conditions.

Biopharma

- Sustainable lab products – glass over plastics
- Sustainable packaging solutions
- Sustainable sourcing of raw materials
- Achieving net-zero emissions by 2030 and offsetting remaining emissions by 2045
- Reducing carbon emissions by 40% by 2050

Biotech

- Biodegradable materials for R&D and innovation to reduce waste and energy consumption
- Sustainable sourcing of raw materials
- Generating energy from renewable energy sources
- Supporting energy goals for 2050 and achieving sustainability targets by 2030

Battery Manufacturing & Ops

- Reduction of supply chain carbon footprint
- Sustainable sourcing of raw materials
- Partnerships for waste management
- Renewable energy sources or energy conservation in manufacturing
- Reducing waste production and greenhouse gas emissions by 15% by 2025 and 30% by 2030
- Obtaining certifications like ISO 14001

Research Labs/Academia

- High quality sustainable equipment
- Recyclable/biodegradable plastics
- Energy conservation measures
- Waste management programs
- Monitoring greenhouse gas emissions
- Enhancing animal handling practices to minimize experiments and improve animal welfare

Need scientific methods and data to drive demand for sustainable products/services

Sustainability as value creating model

John Elkington

1. Competitive Advantage
- ✓ Brand Differentiation
- ✓ Customer Loyalty
- ✓ Market Leadership

2. Cost Savings and Operational Efficiency
- ✓ Resource Efficiency
- ✓ Circular Economy Benefits
- ✓ Risk Mitigation

3. Access to Capital
- ✓ Investor Appeal
- ✓ Lower Cost of Capital

4. Regulatory and Compliance Benefits
- ✓ Proactive Adaptation
- ✓ Market Access

5. Talent Attraction and Retention
- ✓ Employee Engagement
- ✓ Workplace Satisfaction

6. Resilience and Long-Term Viability
- ✓ Futureproofing
- ✓ Stakeholder Trust

7. Innovation and Growth Opportunities
- ✓ Product Development
- ✓ New Markets

8. Enhanced Reputation and Risk Management
- ✓ Positive Public Perception
- ✓ Crisis Avoidance

Case study: follow the [science-backed] data

Sustainability in the biopharmaceutical industry

Intentions

Decarbonization:
- Disclose emissions (1-2-3)
- Renewable energy transition
- Carbon neutral / net zero (SBTi)

Other:
- Improve circularity
- Water reduction targets
- Transparency: LCA, PCF, labels & ratings

Challenges

- Complex supply chains, limited data availability
- Accuracy and standardization for Scope 3 emissions
- Incomplete Net Zero strategies
- Resource intensive processes
- Recycling of SUT plastics – contaminated waste
- …

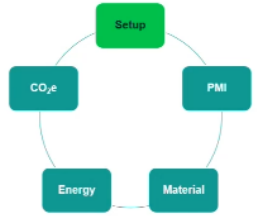
Associations

Industry:
- Pharmaceutical Supply Chain Initiative
- Sustainable Markets Initiative
- BioPhorum
- Bio-Process Systems Alliance

Frameworks, ratings:
- SBTi, CDP, PACT, EcoVadis, ACT, …

Review of 'typical' process model: SS vs SU

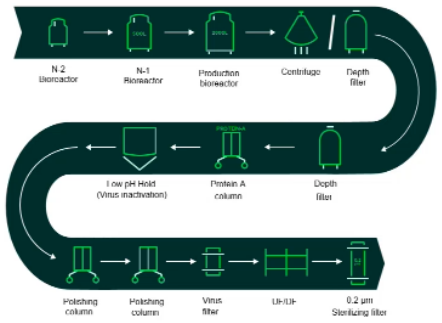
Parameter	6x 2000 SU (100 batches)	6x 2000 SS (100 batches)
COGs ($/g)	67.85	124.21
PMI	3190	17 647
Capital (M $)	64	273
Area total (m²)	6170	7602
Process intensity (g/m³/yr)	180	159
Operating CO_2e (kg/kg)	2268	3253



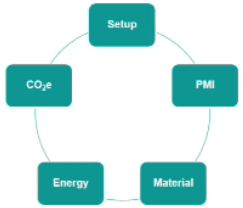
Notes:
- Same process recovery (70%)
- Same output (~700 kg/yr)
- CO_2e facility only (scope 1+2)

Observations: for 6x 2000 L facility
- Cost: SU has lower COGS (- 45 %), lower capital investment (~ 4x)
- Environmental: SU has lower PMI (~ 5x), lower operating CO_2e (- 28 %)
- In this setup, SU appears to have clear advantages

Biopharmaceutical process



Investigate:
- Process footprint
- UnitOp hotspots



Model:
- Biosolve™ Process software v9.0
- Template mAb models (BioPhorum)
- Stainless steel (SS) vs. single use (SU)
- 6 x 2000 L bioreactors
- 100 batches / year
- Titer 5 g/L

Review of 'typical' process model: SS vs SU

Parameter	6x 2000 SU (100 batches)	6x 2000 SS (100 batches)	2x 10.000 SS (20 batches)	2x 10.000 SS (33 batches)
COGs ($/g)	67.85	124.21	83.84	57.20
Output (kg/yr)	703	703	703	1160
Capacity utilization (%)	82 %	84 %	51%	84 %
PMI	3190	17 647	7962	7962
Process intensity (g/m³/yr)	180	159	99	164
Operating CO_2e (kg/kg)	2268	3253	3232	2391

Observations:
- SS facility more effective at 10 000 L scale than at 2000 L scale
- SU facility still shows lower values for COGs (- 19 %), PMI (2.5x), CO_2e (- 26 %)
- Further production increase (+ 65 %) possible in SS: lower COGS (- 16 %), PMI still higher

Case study: follow the [science-backed] data

Process Mass Intensity (PMI) is a key metric used in green chemistry and sustainable manufacturing to assess the efficiency of a chemical process. It measures the total mass of all materials (inputs) used in a process relative to the mass of the final desired product.

PMI Formula

$$\text{PMI} = \frac{\text{Total mass of all input materials}}{\text{Mass of the final product}}$$

Where:

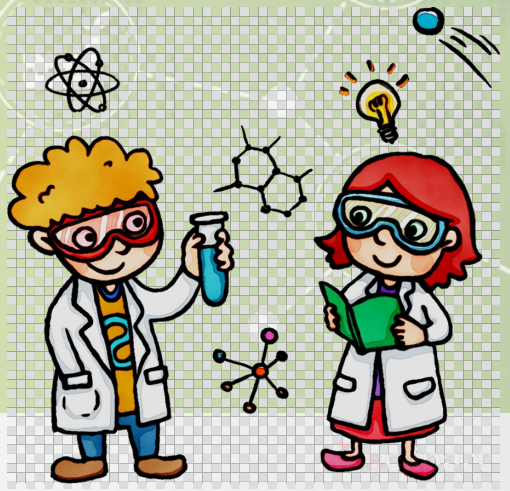
- **Total mass of input materials** includes all reactants, solvents, catalysts, reagents, and any other materials used in the process.
- **Mass of the final product** refers to the desired product, excluding any byproducts or waste.

What PMI Indicates

- A **lower PMI** is desirable, as it means the process is more efficient and generates less waste per unit of product.
- A **higher PMI** indicates less efficiency, often resulting from excess use of solvents, reagents, or inefficient reaction steps.

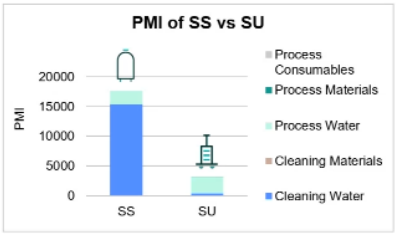
Why PMI Matters

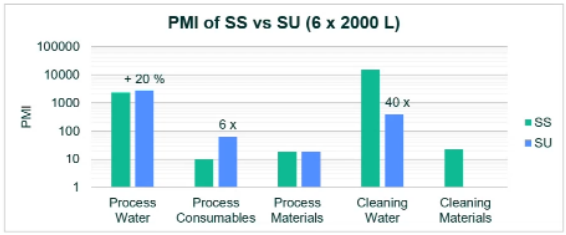
1. **Environmental Impact:** Lower PMI processes produce less waste and reduce resource consumption, making them more sustainable.
2. **Cost Efficiency:** Reducing material usage directly lowers costs in production and waste management.
3. **Regulatory Compliance:** Processes with lower PMI are often better aligned with environmental regulations.
4. **Benchmarking and Optimization:** PMI helps companies benchmark their processes and identify areas for improvement.



Case study: follow the [science-backed] data

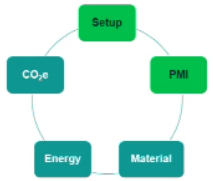
Process Mass Intensity (PMI)



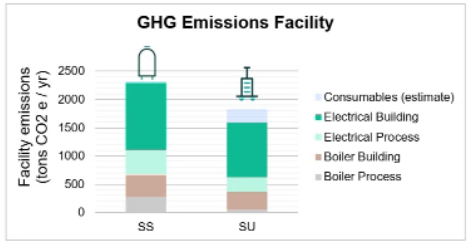


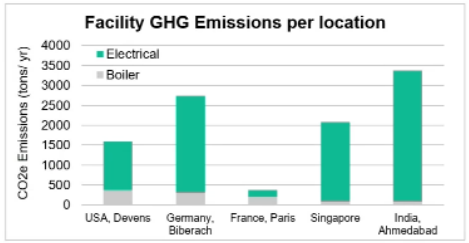
Observations:

- SU process uses ~ 40 x less cleaning water
- Similar process water
- SU process uses less water overall (22 m³ vs 124 m³ per batch)
- SU process uses ~ 6 x more consumables

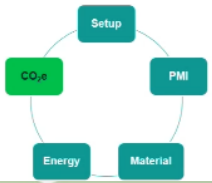


Facility GHG emissions

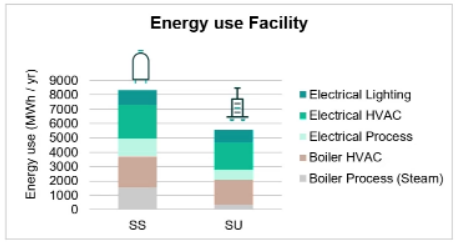


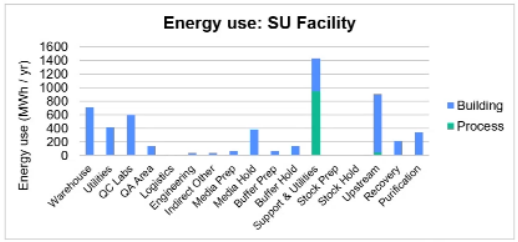


- SU facility shows lower CO_2e, result of energy use (Scope 1 + 2)
- SU uses more consumables, GHG difficult to calculate (part of Scope 3)
- Other parameters of influence:
  - Location: heating / cooling need, fuel mix factor
  - Other (not included) : transportation, end-of-life, water scarcity, …

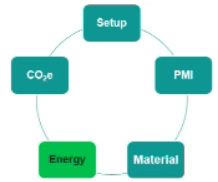


Energy use





- Buildings use more energy than process: heating, cooling, ventilation
- SS facility shows higher % of process energy (SS: 34% vs SU: 19%)
- Single use facility has lower energy use overall
- Process energy dominated by support & utilities (WFI/PW generation)



Conclusions

- Consider SU vs. SS depending on product demand, flexibility requirements, location
- Building has largest energy usage, focus on total floor space, facility volume
- Facility type, convert to SU where it has positive impacts (emissions, water, waste)
- Improve technologies, higher throughput – combine steps to reduce consumable usage
- Reduce water / buffer usage, strong impact on PMI and process energy usage
- Process intensification cost benefits, reduced number of steps increases recovery, more product produced results in lower cost per gram (reduced manufacturing cost)
- Facility CO_2 e footprint driven by support, utilities, upstream, and recovery

Sustainability value: one size doesn’t fit all

How to know which sustainability topic is relevant to each industry / segment to deliver value?

Ask!

Voice of Customer is the tool.

Focus area: Customer Sustainability Assessment (CSA)

Executive Summary

- Sustainability is no longer a ‘nice-to-have’ but a ‘must-have’ for organizations to comply with existing legislation (CSRD), remain relevant and competitive;

- It is incredibly diverse with countless options, biased message dependent on messenger, potentially confusing, risk to lose focus [can’t be all things to everyone] or paralysis by analysis [where to start?]

A CSA will enable us to deliver value by understanding our customers’ sustainability strategies and priorities.

- Phase I, pre-CSA will allow us to collect selected customers’ specific sustainability contacts for direct expert-to-expert engagement
- Phase II, CSA will allow us to gain customer-specific sustainability material information
- Phase III, post-CSA will allow us to develop a customer-specific sustainability strategy & action plan and track performance

Phase II, CSA – Assessment deep-dive

The aim of the Customer Sustainability Assessment (CSA) will be to establish a conversation with selected customers (by division colleagues already identified) around their sustainability strategies and priorities.

A key aspect of the CSA will be to identify customers' sustainability lead and engage in an open conversation (phase I). This approach is not viable for a large customer sample, which is why we're limiting the CSA to around 50 accounts (phase II).

A deliverable of the CSA would be an internal alignment score to assess alignment of our own sustainability actions with our customers' priorities (phase III).

By gaining insight into customers' sustainability priorities and strategies, we can position our own sustainability strategy into a value delivering model.

This voice of customer exercise would advance our trusted partner status strategy with customers and should be part of a broader journey aimed at expanding our Sustainability strategy to [also] become a value delivering model. Gaining insight into customers' sustainability priorities and strategies is a key milestone to achieve this expansion.

INSIGHT INTO CSA FACT-FINDING CONVERSATION

Objectives:

1. understand and identify customers' sustainability strategies, priorities, and where they are in their journey
2. provide concise overview of our own sustainability strategies and priorities sensitive to their journey stage
3. set the stage for further conversations and follow-up

Thank you!