

Meeting the Sustainability & Green Energy Transition Objective

CIMdata PLM Educational Webinar—27 April 2023



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Meeting Sustainability and Green Energy Objectives: An Industrial Perspective

27 April 2023

Mark Reisig, Sustainability & Green Energy Practice Director
m.reisig@CIMdata.com
+1.734.668.9922

#plm4um

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The slide features a dark teal background with a faint world map and binary code. On the right side, there is a grid of hexagonal icons representing various industries: a factory, a car, an airplane, a storefront, a gear, a mobile phone, a medical symbol, a laptop, and a truck.



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Strategic management consulting for competitive advantage in global markets

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This slide uses the same background and icon grid as the first slide. The text is centered and uses a mix of bold and italicized fonts to emphasize key messages.

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Sustainability & Green Energy

Practice Overview



Director: Mark Reisig

Mission

- Provide leadership to companies transitioning to sustainable carbon-free products and plants

Areas of Focus

- Provide management consulting services to enable clients to reduce their product carbon footprint
- Assist clients to design more sustainable products
- Enable clients to embed sustainability in PLM business strategies and enabling technologies through end of life, eliminating waste, increasing recyclability, reuse, and repurposing of materials and assets
- Evaluate new technologies and provide strategic management consulting services to help companies transform to meet the demands of a “net-zero” future

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Mark Reisig



Professional background



- Over 40 years of experience in digital transformation, information technology, and engineering
- Led digital initiatives in PLM, plant design, CAD, ERP, SCM, and MDM for global businesses
- Prior to CIMdata, held executive and senior management positions at Aras, General Electric, Federation, Oracle, Auto-trol Technology, and Kraft Heinz
- Has worked with all the major PLM solution providers from both an industrial perspective responsible for large global deployments, as well as deploying those technologies from a solution provider and consulting perspective
- Industry experience includes energy, aerospace, defense, automotive, industrial, high-tech electronics, medical devices, and food & beverage


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Key Takeaways

 *Sustainability & the Green Energy Transition is the defining issue of our time*

- We are on pace to reach 2.8°C warmer than the pre-industrial period
- Corporate net-zero emission pledges are gaining momentum, but few companies understand how to reduce their carbon footprint
- Greater visibility into the supply chain is required to reduce a companies product carbon footprint (PCF)
- Embedding sustainability in PLM is fundamental to reducing a PCF
- Climate change is an existential threat and offers significant business opportunities

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Agenda

- Earth Systems
- Global Warming & Climate Change
- Sustainability
- Green Energy Transition
- The Green Energy Transition & Sustainability 2023 Survey Results
- Concluding Remarks


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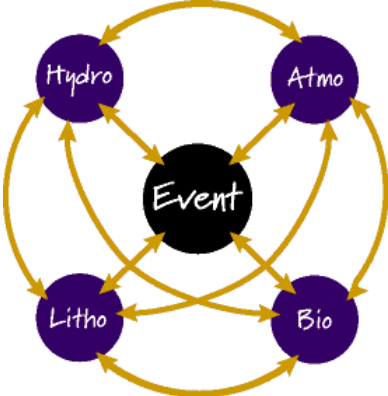
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Earth – A System of Systems

 "I realized up there our planet is not infinite. It's fragile..." – Alan Shepard



https://en.wikipedia.org/wiki/The_Blue_Marble



<http://www.csun.edu/science/books/sourcebook/chapters/8-organizing/files/earth-systems-interactions.html>

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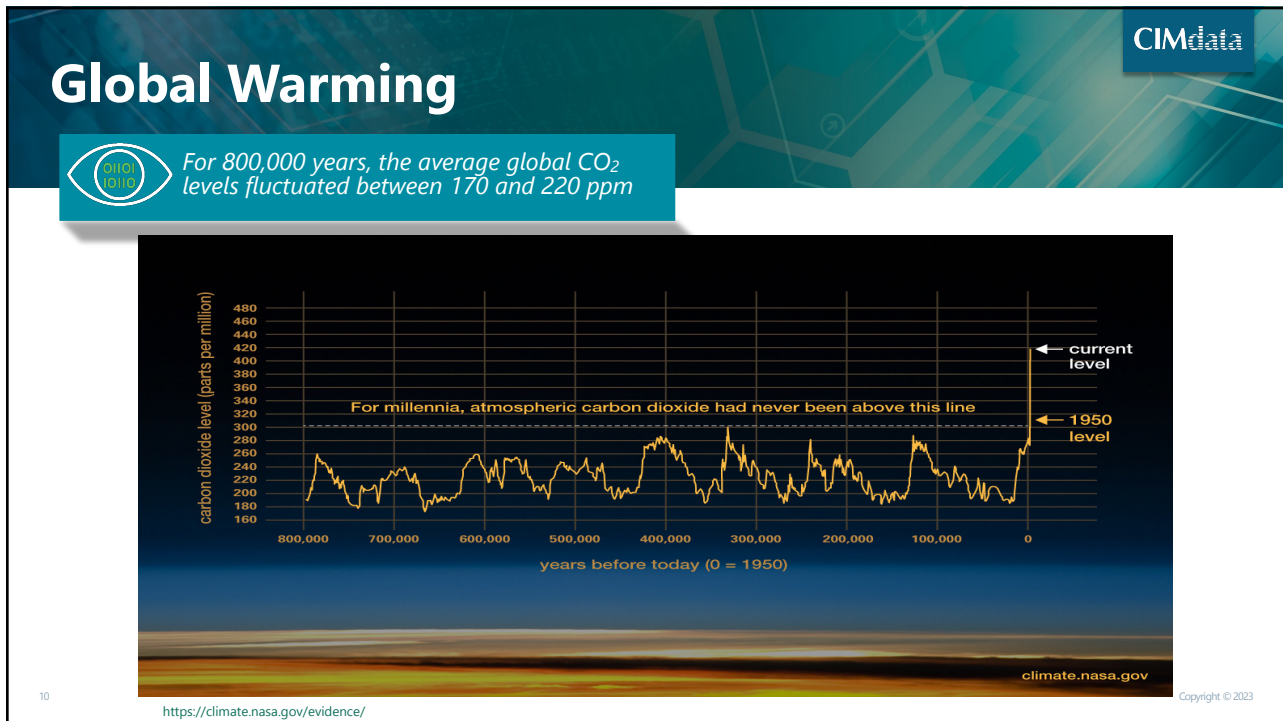
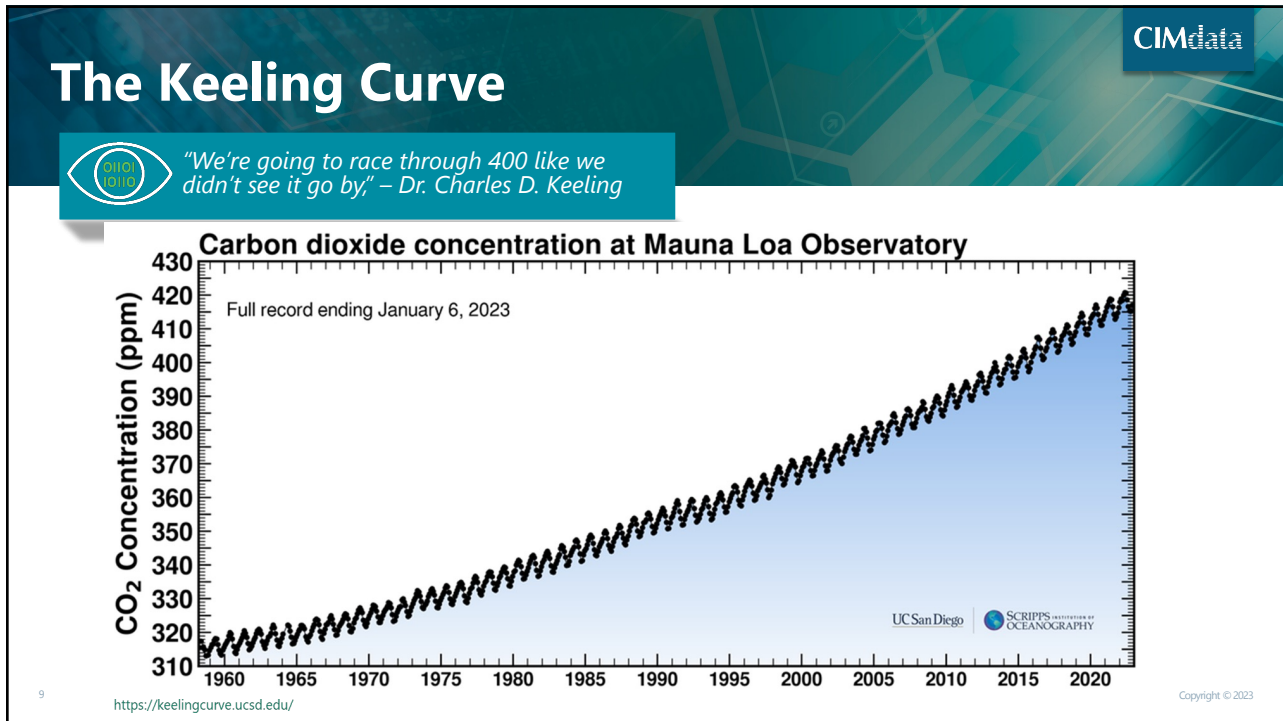
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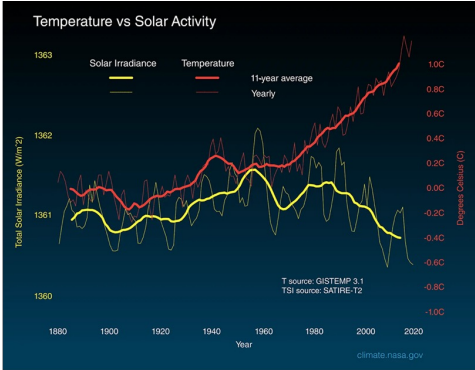
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Climate Change



humans are changing Earth's climate, primarily through GHG emissions." - NASA




<https://climate.nasa.gov/faq/14/is-the-sun-causing-global-warming/>

- There is unequivocal evidence that Earth is warming at an unprecedented rate.
- The earth is receiving the same amount of the sun's energy
- GHGs are trapping energy in the troposphere.
- This is the warmest it's been in 800,000 years.

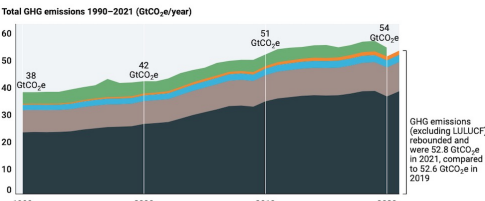
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Greenhouse Gasses Continue to Rise


Greenhouse Gasses continue to rise

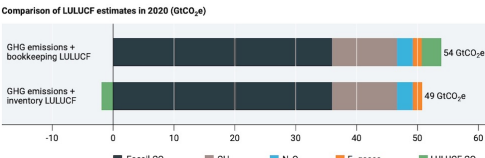
- GHG 2019 – 54.4 GtCO₂e
- GHG 2020 – 54.0 GtCO₂e
- GHG 2021 – 52.8 GtCO₂e
 - Excludes Land Use Change
- GHG 2030 – Est. 58 GtCO₂e



Total GHG emissions 1990–2021 (GtCO₂e/year)

38 GtCO₂e (1990), 42 GtCO₂e (2000), 51 GtCO₂e (2010), 54 GtCO₂e (2020)

GHG emissions (excluding LULUCF) rebounded and were 52.8 GtCO₂e in 2021, compared to 52.6 GtCO₂e in 2019



Comparison of LULUCF estimates in 2020 (GtCO₂e)

GHG emissions + bookkeeping LULUCF: 54 GtCO₂e

GHG emissions + inventory LULUCF: 49 GtCO₂e

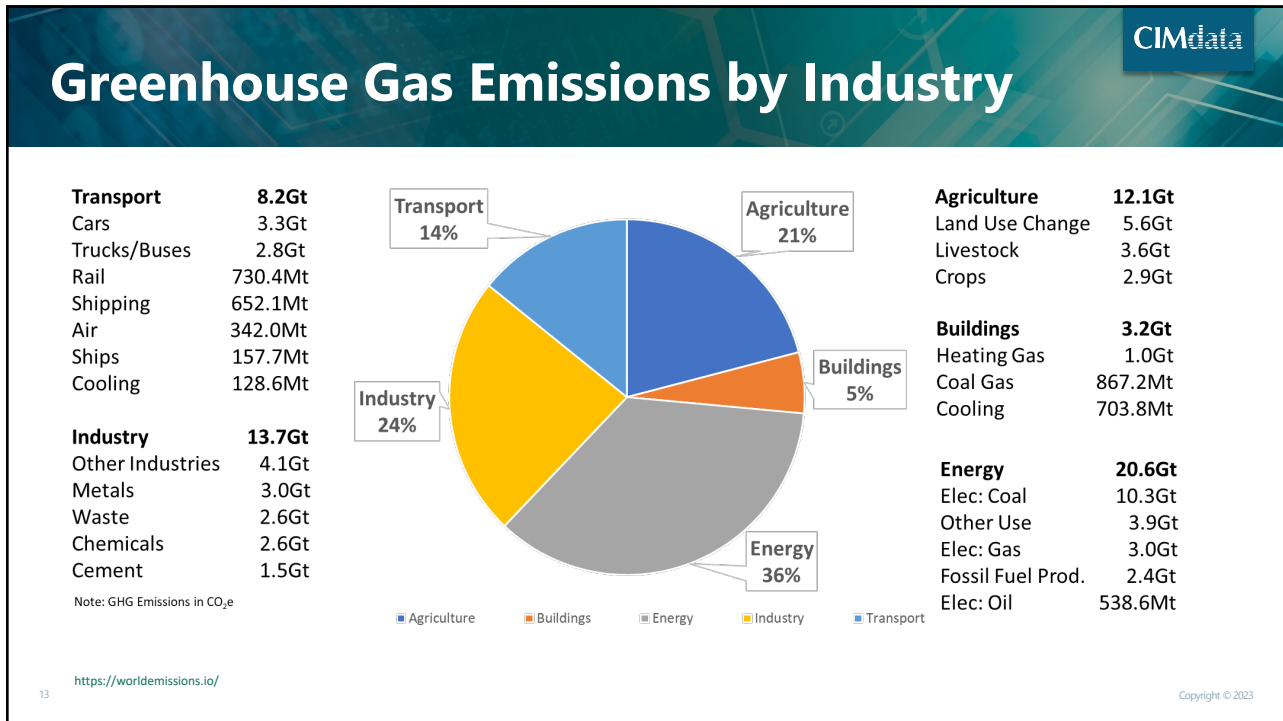
Legend: Fossil CO₂, CH₄, N₂O, F-gases, LULUCF CO₂

<https://www.unep.org/resources/emissions-gap-report-2022>
<https://www.unep.org/resources/emissions-gap-report-2022>

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UN Sustainability Goals




"The blueprint to achieve a better and more sustainable future for all"

- The 17 Goals were adopted in 2015 as part of the 2030 Agenda for Sustainable Development
- Sustainability - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs
- Paris Agreement - Strengthen the global response to the threat of climate change by limiting global warming to well below 2°C, preferable to 1.5°C, compared to pre-industrialized levels




<https://www.un.org/sustainabledevelopment/blog/2015/12/sustainable-development-goals-kick-off-with-start-of-new-year/>


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Not on Track for 2030




"We are in the fight of our lives, and we are losing" – Antonio Guterres



Increase in global greenhouse gas emissions **projected** by 2030, compared to 2010, based on available national action plans

Source: UNFCCC NDC synthesis report (Oct 2022)




Reduction in global greenhouse gas emissions **needed** by 2030, from 2010 levels, to keep warming to no more than 1.5 degrees Celsius


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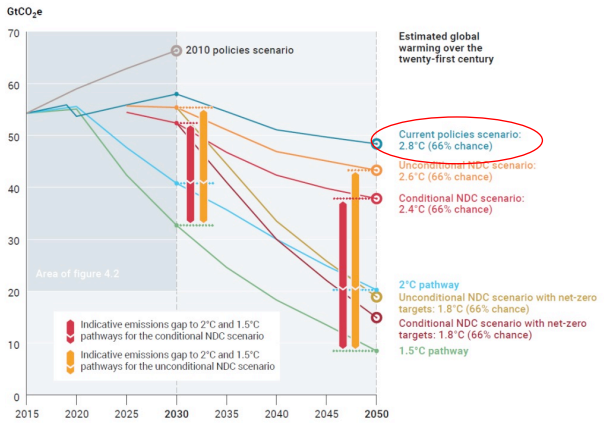
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Sustainability Facts



"There's no credible pathway to 1.5°C in place" – UNEP Emissions Gap Report



Estimated global warming over the twenty-first century

- Current policies scenario: 2.8°C (66% chance)
- Unconditional NDC scenario: 2.6°C (66% chance)
- Conditional NDC scenario: 2.4°C (66% chance)
- 2°C pathway: Unconditional NDC scenario with net-zero targets: 1.8°C (66% chance)
- Conditional NDC scenario with net-zero targets: 1.8°C (66% chance)
- 1.5°C pathway


Indicative emissions gap to 2°C and 1.5°C pathways for the conditional NDC scenario (red bars)
Indicative emissions gap to 2°C and 1.5°C pathways for the unconditional NDC scenario (orange bars)

Area of figure 4.2

<https://www.unep.org/resources/emissions-gap-report-2022>

- Global Warming 2022: 1.11°C
- Projection by 2100: 2.8°C
- CO₂ Concentration: 420.99 ppm
- Ocean Acidification: .01 pH (30%)
- Remaining Wilderness: 23%
- Biodiversity Loss: .01/yr. (200/yr.)
- Population: 8 billion people

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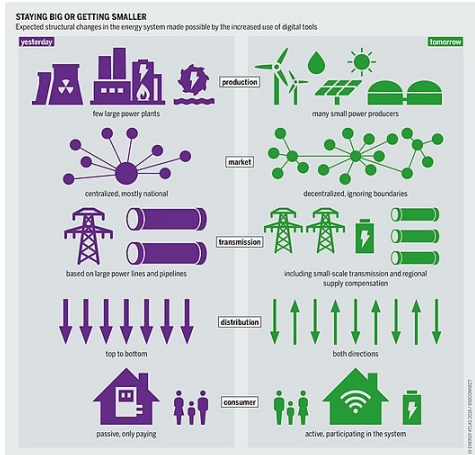


Keys to the Green Energy Transition

There is no green transition without transmission


- Smart distributed grid and energy storage
- Circular economy and design for sustainability
- Incentives to reduce emissions and invest in cleaner technologies
- Innovation and Technology
- Reducing Product Carbon Footprint
- Race to Net-zero
- EV and sustainable modes of transportation

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https://en.wikipedia.org/wiki/Smart_grid

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Survey Demographics

The Green Energy Transition Survey Demographics

- Respondents were historically comparable to previous CIMdata surveys in terms of geography, revenue size, industry, role, and work function
- Poll took place between January 5 – February 20, 2023
- Number of Respondents were 101

Geographic Region

Geographic Region	Percentage
The Americas	45%
EMEA	42%
Asia-Pacific	13%

n = 101
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Sustainability Industry Rating

Where does your industry rate, compared to other industries in terms of sustainability?

- Those rating their industry as a leader doubled since 2021, which we believe reflects a growing awareness of the Green Energy Transition

Industry Leadership in Sustainability

Industry Rating	Percentage
My industry is a leader in sustainability	55%
My industry is average in sustainability	38%
My industry lags in sustainability	7%

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Sustainability Comparison Rating

Where does your company rate in comparison with others in your industry?

- Significantly less, think their own company is a leader
- 68% think they're companies are average or lag
- CIMdata believes reality is setting in and most companies realize they need help

My Company's Sustainability

Rating	Percentage
My company is a leader in our industry	30%
My company is average in our industry	50%
My company lags in our industry	20%

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Publish an ESG Report

Does your company publish an ESG Report?

- This reflects a growing awareness of the importance of sustainability, the value of transparent reporting to stakeholders, and that climate related disclosures will become mandatory
- ESG reporting will continue to grow in coming years


ESG Report

Response	Percentage
Yes	50%
No	20%
Not Sure	25%
Other (Please Specify)	5%


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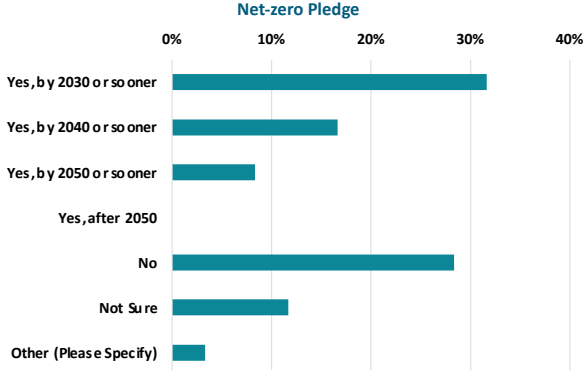
Net-zero Pledge



Does your company have a net-zero pledge that includes scope 1,2 and 3 emissions?

- 57% have a net zero target by 2050
- 32% have a net zero target by 2030
- The trend is clear with more companies making zero pledges

Net-zero Pledge



Response	Percentage
Yes, by 2030 or sooner	32%
Yes, by 2040 or sooner	15%
Yes, by 2050 or sooner	57%
No	29%
Not Sure	10%
Other (Please Specify)	3%

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Company Organization for Sustainability



How is your company organized to achieve your sustainability objectives?

- 33% rely on a lean central team.
- This indicates that sustainability hasn't risen to a strategic transformation level yet, which will result in weak adoption.

Organization for Sustainability




Organization Type	Percentage
Small and lean central team within a central support function	33%
Fully distributed resources in the business units, with cross-BU networks	28%
Lean central team with decision rights and many BU resources	12%
Don't know	10%
Sustainability is not that important at my company	8%
Central team that deploys agile/SWAT teams to BUs	5%
Large central team with a few distributed BU resources	3%
Other (Please Specify)	3%


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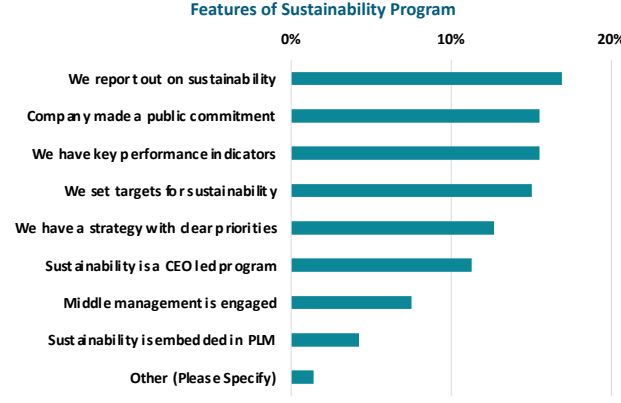


Features of Sustainability Program


What are some of the features of your company's sustainability program?

- The small percentages point to very little action being taken on sustainability.

Features of Sustainability Program



Feature	Percentage
We report out on sustainability	~18%
Company made a public commitment	~17%
We have key performance indicators	~16%
We set targets for sustainability	~15%
We have a strategy with clear priorities	~13%
Sustainability is a CEO led program	~11%
Middle management is engaged	~8%
Sustainability is embedded in PLM	~5%
Other (Please Specify)	~2%

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Corporate Sustainability Culture


What are the workforce aspects of your corporate sustainability culture?

- All responses rose since the last survey in 2021
- Only 22% consider sustainability to be part of their corporate culture
- Corporate culture lags far behind their net-zero ambitions

Sustainability Culture



Aspect	Percentage
Sustainability is part of corporate culture	~22%
Reducing costs	~18%
Employees understand how sustainability aligns with strategy	~13%
Decarbonizing products, production, and logistics	~12%
Building sustainable brands	~11%
Enabling Products as a Service	~10%
Employee training on how to integrate sustainability	~8%
Other (Please Specify)	~2%

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Motivation to Address Sustainability



Choose all the reasons that reflect why your company is addressing sustainability.


- Diversity of responses indicates a consistent lack of strategy

Motivation for Sustainability




Motivation	Percentage
Align with our goals, mission, and values	~18%
Meet consumers' expectations	~17%
Improve operational efficiency	~15%
Develop new growth opportunities	~14%
Attract, motivate, and retain employees	~13%
Make a tangible, positive impact	~12%
Build, maintain, or improve corporate...	~11%
Meet industry norms or standards on...	~10%
Meet investors' expectations	~9%
Conform with regulatory requirements	~8%
Respond to competitive pressure	~7%
Promote our ability to grow	~6%
Meet nongovernmental organizations'...	~5%
Meet expectations of supply chain ...	~4%
Other (Please Specify)	~1%

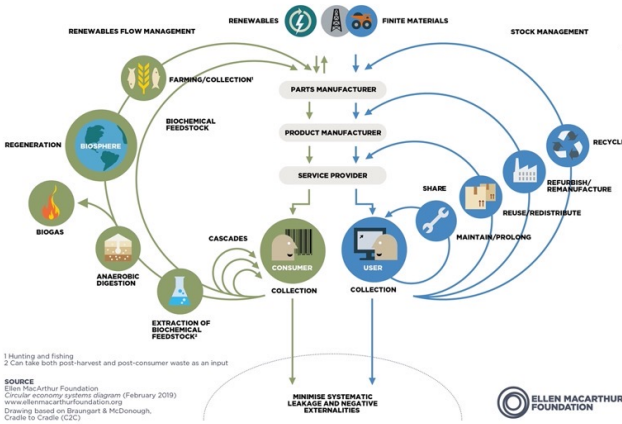
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Circular Economy



"We must transform every element of our make-take-waste system" – Ellen MacArthur



The diagram illustrates a circular economy model. It starts with 'RENEWABLES FLOW MANAGEMENT' and 'FINITE MATERIALS' leading to 'PARTS MANUFACTURER' and 'PRODUCT MANUFACTURER'. These lead to 'SERVICE PROVIDER' and 'USER'. From the user, the flow goes to 'COLLECTION', then 'REUSE/REDISTRIBUTE', 'REPAIR/REMANUFACTURE', and 'RECYCLE'. The 'RECYCLE' stage feeds back into 'RENEWABLES' and 'FINITE MATERIALS'. There is also a 'BIOCHEMICAL FEEDSTOCK' loop involving 'FARMING/COLLECTION', 'ANEROBIC DIGESTION', 'EXTRACTION OF BIOCHEMICAL FEEDSTOCK', and 'BIOCHEMICAL FEEDSTOCK' which feeds back into 'FARMING/COLLECTION'. Other stages include 'REGENERATION', 'BIOSPHERE', 'BIOGAS', 'CASCADERS', 'CONSUMERS', 'COLLECTION', 'SHADE', 'MAINTAIN/PROLONG', and 'MINIMISE SYSTEMATIC LEAKAGE AND NEGATIVE EXTERNALITIES'.

SOURCE: Ellen MacArthur Foundation, Circular economy systems diagram (February 2019), www.ellenmacarthurfoundation.org. Drawing based on Brunner & McDonough, Cradle to Cradle (C2C).

1 Hunting and fishing
2 Can take both pre-harvest and post-consumer waste as an input

ELLEN MACARTHUR FOUNDATION

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Circular Concepts in Company's Strategy

How important are circular economy concepts to your company's strategy?

- The circular economy being central to a company's product development strategy moved from 25% to 32% since the last survey in 2021

Concept	Percentage
Circular economy is central to our strategy	32%
Circular concepts are used in some functions	45%
Circular concepts are not important	23%

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Life Cycle Assessments

Does your company perform LCAs?


- 57% of companies are performing some form of LCAs
- There is a need to merge the best of PLM with LCAs to accurately report out your environmental impact

Response	Percentage
Yes	31%
Partially	26%
No	20%
Not Sure	17%
Other	6%


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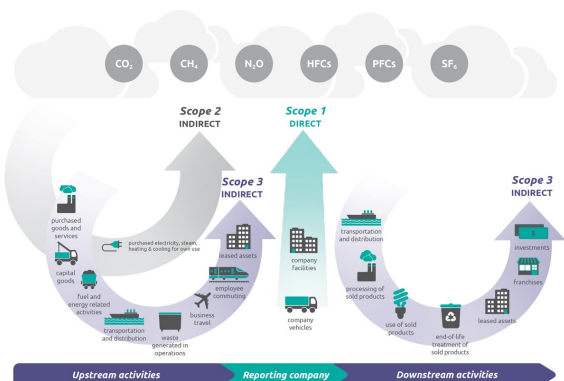
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Product Carbon Footprint



Companies are accounting for the carbon dioxide equivalents in their products




<https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>

- Approximately 80% of the environmental impact of a product is locked in during the design phase
- Connecting product design with the supply chain (~65-90% of PCF) improves decision-making, costs, CO2e, compliance, risk, and sustainability

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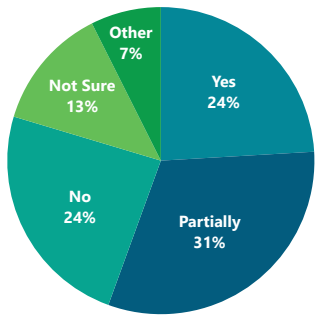


Product Carbon Footprint in Design


Does your company capture the PCF of your products during the design phase?

- Most companies do not have visibility into their supply chain during design where most of the carbon is embodied in parts and materials
- This a major problem for most companies as most of the carbon is locked-in during the design phase

Product Carbon Footprint in Design




Response	Percentage
Yes	24%
Partially	31%
No	24%
Not Sure	13%
Other	7%


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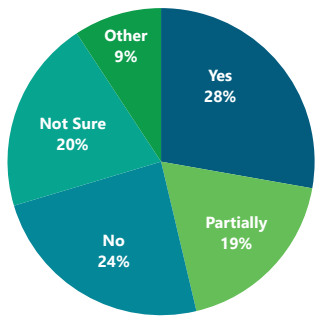


Design Engineers Access to Suppliers PCF


Do your design engineers have access to their supply chain partner's PCF?


- Only 28% have access to their supply chain partner's PCF
- As most of the environmental impact is locked-in during the design phase and most of the carbon is in the supply chain, this is a serious problem for most companies

Access to Supply Chain PCF




Response	Percentage
Yes	28%
Partially	19%
No	24%
Not Sure	20%
Other	9%

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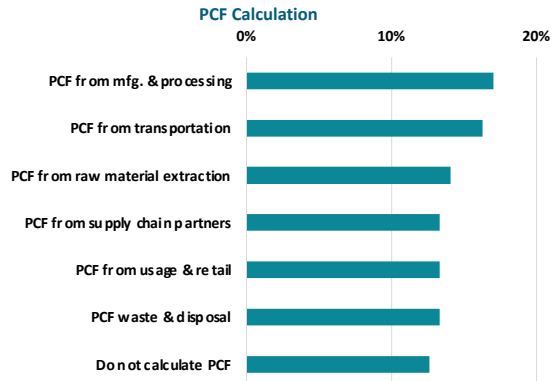


Elements Included in Calculating PCF


Which elements are included in calculating your product's carbon footprint?

- Most are not calculating the CO₂e contribution
- This is a clear opportunity to improve reducing your PCF

PCF Calculation




Element	Percentage
PCF from mfg. & processing	18%
PCF from transportation	15%
PCF from raw material extraction	12%
PCF from supply chain partners	10%
PCF from usage & retail	10%
PCF waste & disposal	10%
Do not calculate PCF	10%


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Design for Sustainability



Designing for sustainability is designing with the end-of-life in mind

Reusability **Lifecycle Thinking**

End-of-life

Refurbishment


Waste Reduction

Materials

Green Chemistry

Disassembly

Durability



Supply Chain Risk


Collaborative **Cost**

Modularity


Systems Thinking

Renewable Energy

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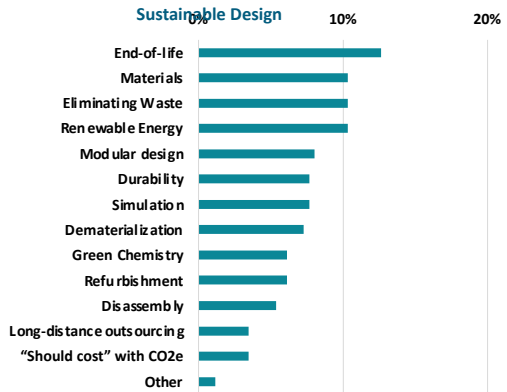


Sustainable Design



Does your company consider any of the following when designing their products?

- It's clear from the answers, that the vast majority do not practice sustainable design
- If you're not designing with the EoL in mind, you can't design a sustainable product
- CIMdata believes this is an area where much improvement is needed




Practice	Percentage
End-of-life	10%
Materials	10%
Eliminating Waste	10%
Renewable Energy	10%
Modular design	10%
Durability	10%
Simulation	10%
Dematerialization	10%
Green Chemistry	10%
Refurbishment	10%
Disassembly	10%
Long-distance outsourcing	10%
"Should cost" with CO2e	10%
Other	10%


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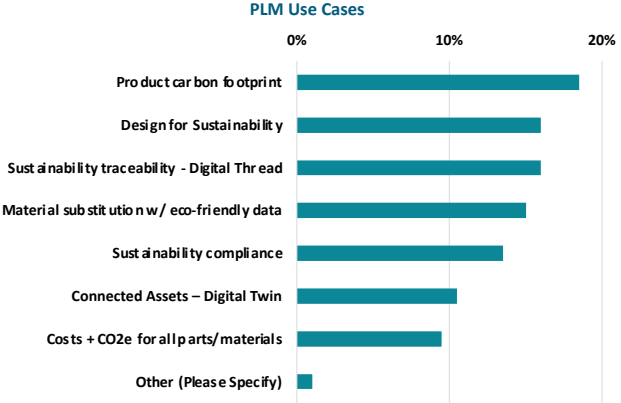


Where PLM Can Help Sustainability Goals


Select use cases where PLM could help in attaining your company's sustainability goals.


- Reducing PCF is leading, but Design for Sustainability is second and we know that's not happening
- CIMdata believes this is an area where most companies need to improve

PLM Use Cases




Use Case	Percentage
Product carbon footprint	18%
Design for Sustainability	15%
Sustainability traceability - Digital Thread	14%
Material substitution w/ eco-friendly data	13%
Sustainability compliance	11%
Connected Assets - Digital Twin	10%
Costs + CO2e for all parts/materials	9%
Other (Please Specify)	1%

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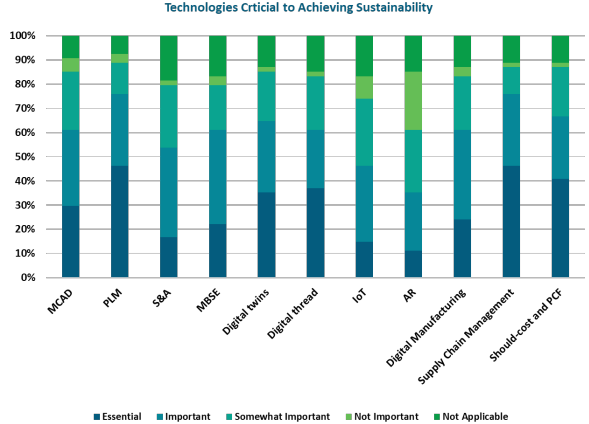


Technologies Critical to Sustainability


Please select the technologies critical to achieving your sustainability objectives

- The three most essential are PLM and Supply Chain, both at 46% and Should cost and Carbon Footprint Assessment at 41%
- If you combine Essential and Important, PLM and S/C are at 76% followed by PCF 67% and Digital Twin at 65%

Technologies Critical to Achieving Sustainability



Technology	Essential	Important	Somewhat important	Not Important	Not Applicable
MCAD	30%	55%	15%	0%	0%
PLM	46%	30%	24%	0%	0%
S&A	15%	65%	20%	0%	0%
MBSE	20%	60%	20%	0%	0%
Digital twins	35%	30%	35%	0%	0%
Digital thread	35%	50%	15%	0%	0%
IoT	15%	60%	25%	0%	0%
AR	10%	70%	20%	0%	0%
Digital Manufacturing	25%	60%	15%	0%	0%
Supply Chain Management	46%	30%	24%	0%	0%
Should-cost and PCF	41%	26%	33%	0%	0%

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Bottlenecks to Achieve Sustainability

What are the bottlenecks to your company achieving its sustainability objectives?

- There were a wide range of barriers
- PLM can overcome most, presenting companies with a significant opportunity

Bottleneck	Percentage
Resource constraints (time and people)	18%
Crossfunctional coordination	15%
Budget constraints	12%
Lack of user involvement and training	12%
Conflicting product reqts & sustainability metrics	12%
Culture/practice differences across BUs	12%
Lack of support for sustainability in tools	12%
Limited enterprise systems integration	12%
Sustainability payback is not understood	12%
Lack of management commitment and incentives	10%
Lack of strategic direction	10%
Lack of accountability meeting sustainability objectives	8%
Culture fears failure and/or the repercussions	8%
Executive sponsorship is missing or slipping	5%
Other (Please Specify)	2%

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Agenda

- Earth Systems
- Global Warming & Climate Change
- Sustainability
- Green Energy Transition
- The Green Energy Transition & Sustainability 2023 Survey Results
- Concluding Remarks

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The Business Opportunity

 *How can PLM providers best support sustainability requirements*

- Organizations need sustainability embedded in PLM to reduce their PCF, engage in sustainable design and the circular economy
- Just like PLM, this is a people, process, and technology issue
- ISVs and SIs et al. can help with all three, depending on their expertise and offerings
- Demands a systemic approach and needs to be supported by a business platform with supply chain visibility, a robust digital thread, and in many cases, digital twins
- PLM and SCM must be more symbiotic

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Concluding Remarks

 *Climate change is an existential threat that offers significant business challenges*

- All life on earth is vulnerable to global warming and climate change
- Sustainability requirements are being driven top-down in companies, but not yet ingrained in the corporate culture
- Industrial organizations have a gap between their ambition and actions required to meet their goals
- Advanced capabilities in PLM, supply chain, reducing PCF, and digital twin are seen as essential
- PLM is central to sustainability; industrials, ISVs, and SI/Reseller/VARs need to succeed together

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To Learn More...

CIMdata

- Mark Reisig, Sustainability & Green Energy Practice Director
- m.reisig@CIMdata.com
- Mobile: +1.864.320.7987
- CIMdata has several useful resources on this topic:
 - [Sustainability and Green Energy Consulting Practice](#) on this topic
 - Webinar: [The Green Energy Transition and Sustainability](#) January 23, 2023
 - Webinar: [Webinar: Meeting Sustainability and the Green Energy Transition Objectives: The industrial Perspective](#), April 27, 2023
 - Article: [Accelerating the Transition to Green Energy with Product Lifecycle Management](#) (www.powermag.com)
 - Article: [Climate Change is Transforming PLM Strategies](#) March 10, 2023, (<https://industrytoday.com/>)

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Questions & Answers

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What's on your mind?



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Serving clients from offices in North America, Europe, and Asia-Pacific

World Headquarters

Ann Arbor, Michigan USA
Tel: +1.734.668.9922

EMEA Headquarters

Weert, NL
Tel: +31 (0) 495.533.666

Asia-Pacific Headquarters

Tokyo, Japan
Tel: +81.47.361.5850

www.CIMdata.com

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