

# Towards *Planet Positive Chemicals*

→ *A chemical transformation roadmap enabled  
by a circular economy*



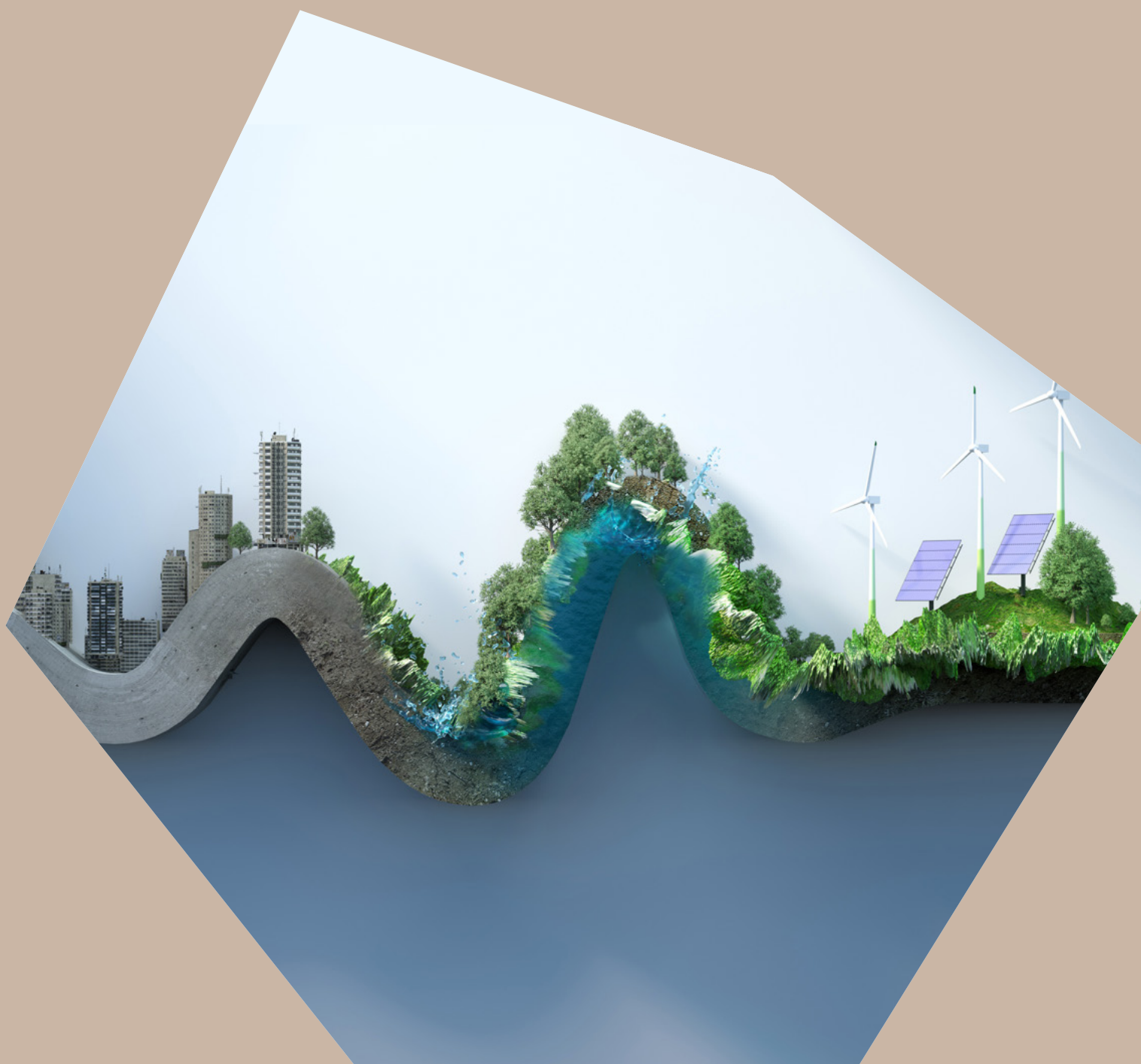
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*These companies contributed to this roadmap:*



# The case *for change*



# 01.

# 01. The case for change

The chemical industry and its value chains play a crucial role in the global economy. However, many business practices are not sustainable, raising challenges such as carbon footprint intensity, pollution or social impact. This has already led to mounting public, regulatory and legal pressure and an erosion of the industry's social license to operate. Recognizing this, nine leading chemical companies – that see a transformation toward sustainable production and use of chemicals as paramount – took the initiative to create this transformation roadmap in collaboration with WBCSD and sustainability consultancy ERM.

## What is the roadmap for?

These organizations have built the roadmap using a shared vision:

*"We use circular economy principles and the power of sustainable chemistry to transform the value systems humanity live in. Together with value chain partners, we will drive a just, people-centered transition to net-zero and nature-positive chemicals by 2050."*

It maps out how to implement this shared vision and sets near-term pathways and intermediate actions. It serves as a call to action and a blueprint for collaboration to close gaps, innovate and boost transformational change throughout chemical value chains to achieve the sustainable production, use and regeneration of chemicals.

## Why now?

For 200 years, the chemical industry and its value chains have contributed to human, social and economic development by producing innovative goods that fulfil human needs. From electronics to vehicles, from textiles to pharmaceuticals, more than 95%<sup>1</sup> of all manufactured products and materials rely on industrial chemical processes.

However, past business models and methods have come at a great cost, including impacts on:

1. **Climate** – In 2019, the chemicals sector represented 6.3% of global greenhouse gas emissions.<sup>2</sup> Without action, this emissions trajectory aligns with the Intergovernmental Panel on Climate Change (IPCC) 4°C global warming in 2050 scenario.<sup>3</sup>
2. **Nature** – Chemical production, use, and disposal have led to the release of large quantities of manufactured chemicals into the water, air, and soil, posing major risks to human health and the environment.<sup>4</sup>
3. **Equity** – The impacts of chemical pollution and climate change are not equal; almost 92% of pollution-related deaths occur in low- and middle-income countries.<sup>5</sup>

Chemicals respond to global consumption patterns still mainly driven by a linear economy.<sup>6</sup> They contribute to the related global challenges triggered by this linear economy:

- The overshooting of most planetary boundaries,<sup>7</sup> exceeding the safe operating conditions of Earth's biosphere.

- Resource extraction, responsible for 90% of global nature loss.<sup>8</sup>

In acknowledgement of the former and current adverse impacts of chemicals and the implications for the global economy, it is imperative to accept that the **transformation** is **inevitable** and **necessary** for companies producing, using and recycling chemicals.

Chemicals play a pivotal role in virtually every sector. Chemicals and chemical processes have enabled major shifts in energy production, healthcare, communication, mobility and even food production. Sustainable chemistry concepts can help solve climate, nature, pollution, safety and equity issues. However, to enable this sustainable future and make the massive scaling up of these solutions possible, transformation of the sector is necessary.

## The challenge

Despite the need for urgent action, there has been limited progress. Only a few chemical companies have set greenhouse gas emissions targets for scope 1, 2 and 3 emissions.<sup>9</sup> Beyond emissions, very few companies have created adequate plans to tackle the impacts of chemicals on people and the environment from a cradle-to-cradle perspective.

Chemical value chains are diverse and deeply intertwined. Drawing boundaries between companies and sectors can be challenging. The difficulty in quantifying greenhouse gas emissions and deploying reduction measures exacerbates this.

Furthermore, it is difficult to untangle the chemical industry's social and environmental impacts from that of other sectors. Transforming the chemical industry can only succeed if the sector's value chains and other networks the industry depends on transform simultaneously. This means the comprehensive transformation of the sector depends on mobilizing all relevant actors.

### ***The consequences of non-action***

Companies in the chemical supply chain need to realize business-as-usual actions carry increasing risks. Proactive action is critical to preventing companies throughout the chemical value chain from:

- Losing their social license to operate;
- Potential litigation;
- Failing to access and secure long-term finance;
- Increased cost due to delayed action or slow technology development,
- Creating supply chain disruptions due to a failure to secure the availability of and access to sustainable chemicals.

### ***The opportunity and the roadmap approach***

Embracing sustainable transformation and operating within planetary boundaries are crucial to the chemical industry and require deep organizational and mindset shifts. This creates the opportunity to shape a viable industry vision for chemicals, leverage strengths, foster supportive environments, accelerate earning processes, invest in new technologies, create stakeholder value and reestablish chemicals as a positive force for development.

*The Towards Planet-Positive Chemicals: A chemical transformation roadmap enabled by a circular economy* roadmap features a systems approach to achieving this vision. It looks at value chains holistically – from feedstock to business models, to product end-of-life and resource regeneration. Implementing the principles of a circular economy is a strategic lever to enable this system change.

The companies behind this roadmap are convinced that taking concerted action now will unlock a sustainable future for the chemicals industry, its supply chains and the broader chemical value chain.



# The roadmap



## 02.

## 02. The roadmap

This roadmap sets out the necessary steps to transition to planet-positive chemicals. It comprises a **shared vision**, a **call for action** and a response to unlock a **sustainable future for chemicals** and the transition of sectors relying on chemicals. Nine leading chemical companies working with the WBCSD and our professional services partner ERM developed the roadmap, which includes feedback from stakeholders in the value chain.

### A shared vision

We use circular economy principles and the power of sustainable chemistry to transform the value systems humanity lives in. Together with value chain partners, we will drive a just, people-centered transition to net-zero and nature-positive chemicals by 2050.

### A call for action

We have articulated this vision via **six pathways – 3 imperatives and 3 enablers** – and the 33 short- and near-term actions needed. We've defined, in the context of the chemicals industry and value chains, the core climate, nature and equity **imperatives** for the system's transformation according to WBCSD's Vision 2050,<sup>9</sup> as:

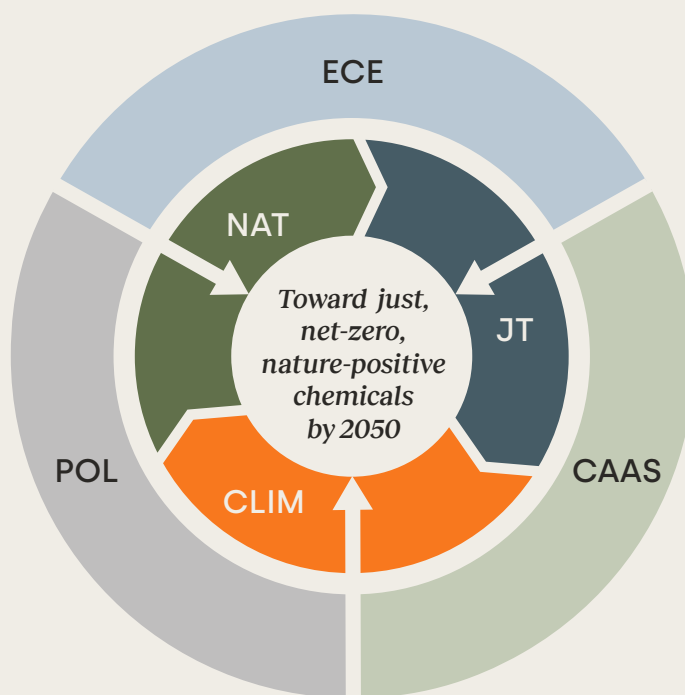
- ◆ **Net-zero chemicals** – Commit and deliver net-zero scope 1, 2 and 3 industry greenhouse gas emissions by 2050 in a way that prioritizes emissions reductions and limits the use of offsetting to unavoidable emissions. (→ [CLIM](#))
- ◆ **Nature-positive chemicals** – Commit to a trajectory that halts and reverses the impact of chemicals on nature loss by 2030 and achieves full recovery by 2050. (→ [NAT](#))
- ◆ **A just transition for chemicals** – Co-create transformative solutions with value chain partners that put people at the center in all stages of the chemical product life cycle, including preventing harm, empowering employees and fostering the adoption of fair working conditions. (→ [JT](#))

The system's transformation requires looking at value chains holistically – from feedstocks to business models, to product end of life and resource regeneration – and calls for the implementation of a circular economy. The three **transformational enablers** identified to achieve this are:

- ◆ **Empowering a circular economy** – Creating the financial, organizational, regulatory and business conditions by 2030 that enable the decoupling of value creation from resource consumption. (→ [ECE](#))
- ◆ **Activating sustainable chemistry as a solution** – Committing to leverage the power of sustainable chemistry to unlock the chemical value chain transformation by 2030. (→ [CAAS](#))
- ◆ **Combatting pollution** – Delivering an action agenda by 2030 to steer toward zero pollution throughout the chemical value chains. (→ [POL](#))

The next section introduces each of these pathways, their challenges, actions to date and what companies behind this work foresee to be done. To help the reader connect the roadmap actions to these, we have introduced a code for actions (see Figure 1). We then summarize the pathways and actions in [Table 1](#) and [Table 2](#).

**Figure 1: Imperative and enabler pathways of the chemical transformation roadmap**



#### Imperatives

- ◆ Net-zero chemicals
- ◆ Nature-positive chemicals
- ◆ A just transition for chemicals

#### Enablers

- ◆ Empowering a circular economy
- ◆ Activating sustainable chemistry as a solution
- ◆ Combatting pollution

# Chemical *transformation roadmap:* *Pathways and actions*



## 03.

## 03. Chemical transformation roadmap: *Pathways and actions*

### Imperative 1: Net-zero chemicals

#### Objective

Commit and deliver net-zero scope 1, 2 and 3 industry greenhouse gas emissions by 2050 in a way that prioritizes emissions reductions and limits the use of offsetting to unavoidable emissions

#### The challenge

The chemical industry is responsible for emitting approximately 2.7 to 4.5 Gt CO<sub>2</sub>e per year,<sup>11,12,13</sup> accounting for over 6% of global greenhouse gas emissions annually. Major efforts are needed to abate scope 3 emissions, which represent approximately two thirds of total emissions. It is a twofold endeavor to decarbonize energy and move from fossil feedstocks to more sustainable alternatives for raw materials. Lack of data availability, quality and consistency make emissions quantification and reduction a challenge.<sup>14,15</sup>

The chemical industry consists of an intersecting network of actors, ranging from primary chemicals to specialty players, with different degrees of back integration, interdependency, product complexity and proximity to downstream value chains. While emissions data for primary chemicals are reasonably quantified, this is not true for other parts of the chemical industry. Chemical value chains are complex and identifying boundaries between companies and sectors can be difficult.

#### Action to date

As of January 2024, chemical companies represented 2% of all companies with Science Based Targets initiative (SBTi) net-zero targets for scope 1,2 and 3 emissions.<sup>16</sup> SBTi is developing chemical sector guidance documents with input from an expert advisory group consisting of chemical companies, NGOs and research organizations for finalization and publishing in October 2024.<sup>17</sup>

#### What needs to be done

##### Individual company initiatives ▲

- Set ambitious evidence-based net-zero transition plans for scope 1, 2 and 3 emissions. **Reduce carbon intensity** by deploying **decarbonization technologies** (e.g., alternative feedstocks), implement all **circular economy** principles to **eliminate emissions** at the source and foster the development of climate-positive solutions → **CLIM-1, CLIM-3, CLIM-8**

- Set up **monitoring** and **reporting mechanisms** to **review progress** on net-zero transition plans, promote accountability and transparency throughout the industry and adapt to changing environments (e.g., technologies, portfolio) → **CLIM-6, CLIM-7**

##### Chemical industry initiatives ●

- Encourage **setting ambitious, evidence-based** net-zero **targets** built in collaboration with value chains and support the implementation of net-zero transition plans → **CLIM-1**
- Enable the **development** of robust **frameworks** and **methodologies** to quantify and report scope 1, 2 and 3 emissions → **CLIM-2**
- Create a greenhouse gas **emissions data sharing platform** to foster emissions transparency in the industry and support decarbonization in up- and downstream value chains → **CLIM-5**

##### Cross-sector initiatives ■

- Develop robust **frameworks** and **methodologies** to quantify and report scope 3 emissions → **CLIM-2**
- **Partner with priority value chains** and support them in reaching their net-zero targets → **CLIM-4**
- Collaborate **across sectors** to ensure **compatibility** with the industry greenhouse gas **emissions data sharing platform**, which supports decarbonization in up- and downstream value chains → **CLIM-5**



## Imperative 2: Nature-positive chemicals

### Objective

Commit to a trajectory that halts and reverses the impact of chemicals on nature loss by 2030 and achieves full recovery by 2050

### The challenge

At the heart of the “nature-positive” approach is the ambition to halt and reverse nature loss by 2030 and achieve full recovery by 2050.<sup>19</sup> This goes beyond damage limitation to encompass enhancing the resilience of ecosystems and societies.

There is no single metric to become nature positive. The term is location-specific, so the impact of chemical manufacturing, uses or disposal will vary.<sup>20,21</sup> Chemical value chains need to identify impacts on and risks for nature and adopt actions that reverse nature loss.

Significant impacts of chemicals on water and aquatic ecosystems have already been identified (e.g. water intensive production, ecosystem changes, and pollution through chemical use). The industry must however expand on this approach to **identify impacts** from chemicals on nature from extraction to disposal and regeneration, assess associated **risks**, adopt **actions** to reverse the damage, and **report** in accordance with international frameworks.

### Action to date

Leading companies in the chemical industry build on robust environment, health and safety (EH&S) policies that incorporate some environmental considerations for the scope of their operations.

In 2007, the European Chemicals Agency implemented the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation in the European Union to limit risks from chemicals to human health and the environment. It requires companies to identify and manage risks and to demonstrate safe use. Authorities have the power to restrict the use of the chemical when risks are unmanageable.<sup>22</sup> REACH has set a standard for chemical risk compliance and several countries have adopted it. However, to achieve a net-positive contribution to nature, efforts must extend beyond product safety compliance to include the reversal of nature loss and the restoration and regeneration of ecosystems.

### What needs to be done

#### Individual and chemical industry initiatives ▲ ●

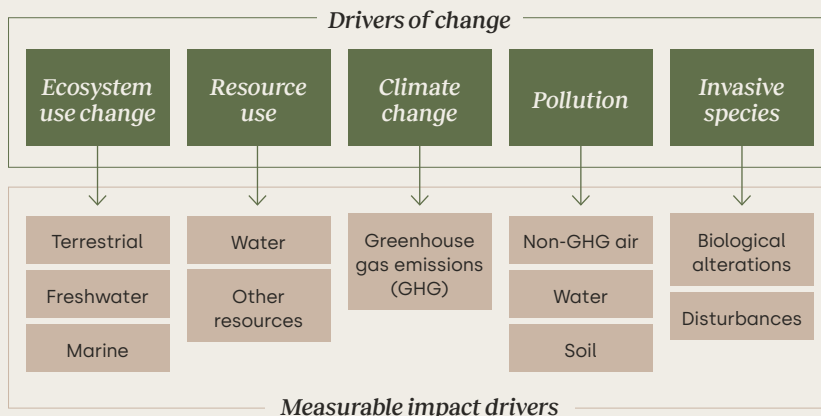
- By 2025, develop a nature-positive narrative to support industry transformation pathways → NAT-1, NAT-2

- Foster sector adoption of nature-positive strategies → NAT-2
- Promote nature-related reporting among stakeholders in the sector using internationally recognized frameworks such as the Taskforce on Nature-related Financial Disclosures (TNFD) → NAT-3
- Establish a standard mechanism aligned with international standards to measure and monitor the water footprint of the chemical industry → NAT-4

#### Cross-sector initiatives ■

- Create a comprehensive nature-positive action agenda for chemicals covering the impacts from resource extraction to product disposal and regeneration → NAT-1
- Develop an engagement plan to drive the implementation of the nature-positive action agenda for chemicals and foster its adoption throughout value chains → NAT-2
- Initiate the development of nature-positive chemical solutions → NAT-5
- Drive coordinated sector action on water by assessing the potential, relevance and feasibility of pricing water based on environmental and social impacts → NAT-4
- Explore sustainable chemistry and engineering solutions to reduce water consumption, particularly in sectors facing high water stress → NAT-4

Figure 2: Realms of nature, drivers of nature change and measurable impact drivers<sup>18</sup>



## Imperative 3: A just transition for chemicals

### Objective

Co-create transformative solutions with value chain partners that put people at the center in all stages of the chemical product life cycle, including preventing harm, empowering employees and fostering the adoption of fair working conditions

### The challenge

Historically, business decisions in the chemical industry focused more on technology and assets, with less consideration given to societal impacts beyond immediate product introductions. This had multi-faceted knock-on effects:

- **Human health** – In 2021, the World Health Organization (WHO) estimated the disease burden preventable through sound management and the reduction of chemicals in the environment at around 2 million lives or 3.6% of total deaths.<sup>23</sup>
- **Working conditions** – Although the chemical industry has implemented several health and safety programs at manufacturing facilities, accidents in other parts of the value chain (e.g., refineries and downstream manufacturing plants) reportedly kill hundreds of workers each year.<sup>24</sup>
- **Fair wages throughout supply chains** – Paying below the living wage in low-income countries to deliver lower cost goods in high-income countries is an issue in many industries with global supply chains that a lack of transparency exacerbates.

As the industry undergoes a sustainable transformation, there is an opportunity to address these issues and take a people-centered approach to enable a "just transition". The chemical industry has a duty to protect those working in the industry as well as those indirectly impacted. This means addressing risks and exposure throughout the entire chemical product life cycle by preventing harm for people and the environment, fostering the adoption of fair working conditions and prioritizing well-being over historic practices of in-mass product development.

As chemicals transition to net-zero and nature-positive, the mitigation of adverse impacts on employees in existing value chains and the industry is also essential. Defining what a "just transition" entails in this context remains a challenge and requires building a collective understanding and a relevant action agenda.

### Action to date

Leading companies have started to incorporate equity considerations in their practices. This often remains limited to the scope of direct operations. Though the concept of a just transition to net-zero and nature-positive chemicals does not yet have a definition, WBCSD members engaged in this work stress two fundamental elements:

- Developing services, chemicals and technologies supporting the transition must **prioritize a people-centered approach**.
- Empowering employees across the chemical industry and value chains to carry out the transition involves equipping them with the **necessary skills** and **support** to adapt.

### What needs to be done

#### Cross-sector initiatives ■

- Define and implement a just transition program for chemicals → **JT-1**
- Embed key elements of a just transition in companies' portfolio sustainability assessment tools to enhance equity actions and prevent harm throughout the product life cycle → **JT-2**
- Assess living wage practices and create a collective action agenda to drive equity → **JT-3**
- Co-create upskilling and reskilling programs to support all value chain actors and their employees throughout the industry and the value chain transformation, with a focus on the adoption of circular principles → **JT-4**
- Identify and disseminate best practices to lead the organizational change required to implement a transition to net-zero and nature-positive chemicals → **JT-5**

## Enabler 1: Empowering a circular economy

### Objective

**Creating the financial, organizational, regulatory and business conditions by 2030 that enable the decoupling of value creation from resource consumption**

### Role in the transformation

A circular economy optimizes resource use and eliminates waste by promoting continuous product and material reuse.<sup>25</sup> This encourages businesses and consumers to rethink and decouple value creation from resource use by moving away from the traditional production, consumption and ownership patterns optimized for volume. Implementing circular economy principles can eliminate a portion of the impacts at the source. The transition to net-zero and nature-positive chemicals will include increasing the availability and adoption of circular feedstocks, leveraging safe and sustainable-by-design chemistry and engineering innovations to reuse, refurbish and regenerate resources at a product's end-of-life.

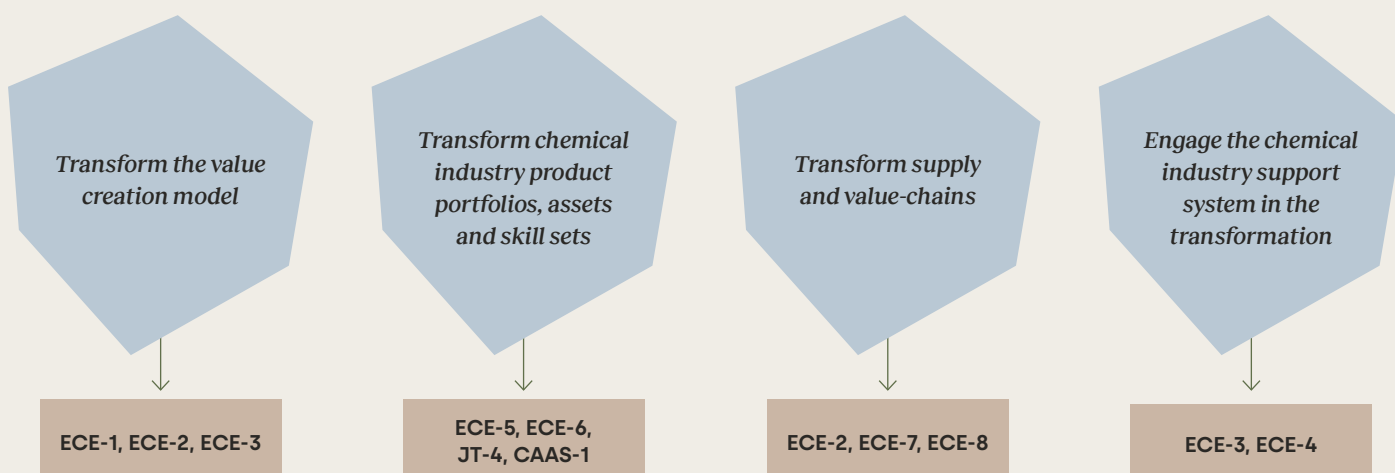
### Action to date

Leading companies have started to incorporate circularity principles in their practices, including embedding circular raw materials in their products, investing in recycling schemes and technologies, encouraging design for recycling, pursuing light-weight and long-lasting materials/product design and, to a small degree, investing in performance-based business models. However, these initiatives remain isolated practices in the larger chemical sector.

Aligned on a shared definition of a circular economy (see [Glossary](#)), WBCSD members have acknowledged that the chemical industry needs to grow the scale of its circular practices and are collaborating on paving the way to this transformation. This growth will entail creating a **value creation** model, transforming chemical industry **assets, supply and value chains** and engaging the chemical industry **support system** (i.e., **financial** institutions and **policymakers**) to finance the transformation while mitigating impacts on daily business.

Figure 3: Empowering the circular economy

### Transformation areas to empower a circular economy



## What needs to be done

*Develop, pilot and deploy a value creation model enabling the transformation with value chain partners (→ ECE-1, ECE-2, ECE-3)*

### Cross-sector initiatives ●

- Identify partners interested in shaping a coalition and develop, pilot and deploy a new value creation model supporting the transition to net-zero and nature-positive chemicals → **ECE-2**
- Assess impacts and map needs to operationalize this value creation model (e.g., asset and capacity, value chains, skills gaps) → **ECE-1**
- Develop value creation and transition metrics with thought leaders to measure progress throughout the transformation process → **ECE-1**
- Conduct pilots to identify impacts, shortcomings and best practices, refining the metrics as needed → **ECE-2**
- Select priority value chains for the transition and map challenges, opportunities, solutions and key lessons learned and optimize and improve value creation model and metrics → **ECE-3**

### Chemical industry initiatives ■

- Develop company guidelines to measure value creation performance and the contribution to the chemical value chain transformation → **ECE-3**

*Transform chemical industry product portfolios, assets and skill sets (→ ECE-5, ECE-6, JT-4, CAAS-1)*

### Individual company initiatives ▲

- Map opportunities for **sustainable chemistry** and engineering to support the transformation to circular portfolios/offerings → **CAAS-1**
- Build and implement **product portfolio** transformation plans that are safe and sustainable for a circular economy → **ECE-5**
- Build and implement **asset** transformation plans (including retrofitting and repurposing) geared toward decoupling value creation from resource consumption → **ECE-6**

### Chemical industry initiatives ■

- Create strategies to upgrade plants and products using alternative feedstocks and circular technologies → **ECE-5, ECE-6**
- Assess options and promote lessons learned from plant/equipment repurposing to accelerate transition plans → **ECE-6, JT-4**
- Promote innovation and circular business model skills in the industry → **JT-4**

*Transform supply and value chains to deliver net-zero and nature-positive chemicals (→ ECE-7, ECE-2, ECE-8)*

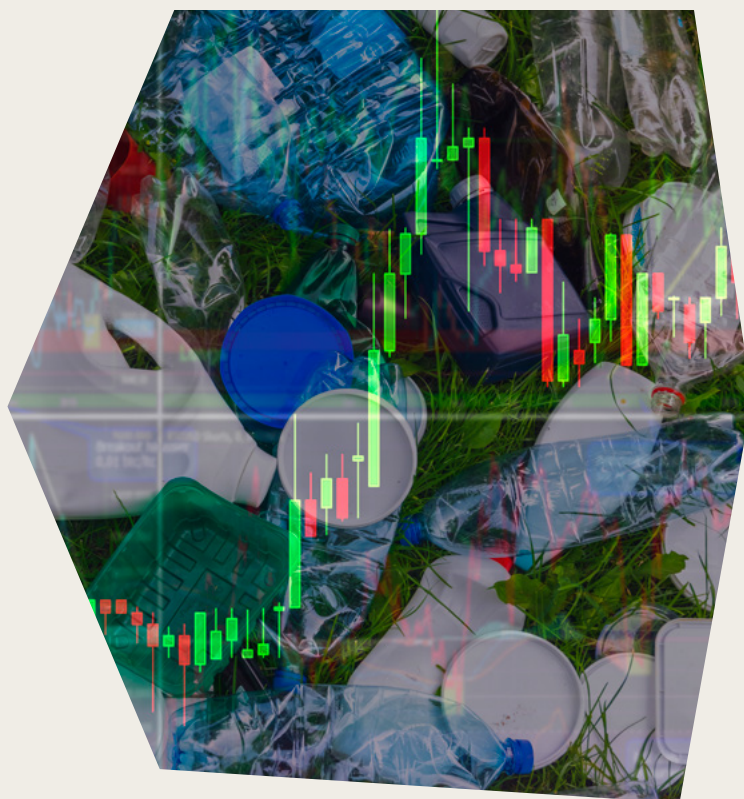
### Cross-sector initiatives ●

- Develop strategies to increase the availability, accessibility and sustainability of circular alternatives to fossil feedstocks → **ECE-7**
- Partner with up- and downstream actors and set value chain targets to foster the adoption of circular alternatives to fossil feedstocks → **ECE-7, ECE-2**
- Partner with value chain actors to co-develop and scale performance-based circular business models that decouple resource use from value creation → **ECE-8, ECE-2**

*Engage the chemicals support system (financial institutions, investors and policymakers) in the transformation (→ ECE-3, ECE-4)*

### Cross-sector initiatives ●

- Engage with early adopters of the financial community to create buy-in and secure sufficient investments to transition to the new value creation model → **ECE-3**
- Identify key policy obstacles to implementing the value creation model supporting the transition → **ECE-4**
- Develop a proposal for policy actions and advocate with policymakers for solutions to address these barriers → **ECE-4**



## Enabler 2: Activating sustainable chemistry as a solution

### Objective

**Committing to leverage the power of sustainable chemistry to unlock the chemical value chain transformation by 2030**

### Role in the transformation

The negative impacts of single-use plastics on human health and the environment (such as bisphenol A, phthalate plasticisers or so called “forever chemicals”) dominate headlines, often overshadowing the importance and benefits of chemicals to society such as ammonia for food production, hand sanitizer for improved public hygiene or polymers for wind turbines or solar cells. To change this narrative, the focus must shift to leveraging sustainable chemistry to address climate, nature, pollution, safety and equity issues. Sustainable chemistry, which encompasses chemical engineering and biotechnologies, is key in creating circular loops, identifying sustainable alternatives to products with high pollution risks and transitioning to a net-zero and nature-positive value chain for chemicals.

### Action to date

The chemical industry holds extensive knowledge in chemicals, engineering and processes. While voluntary or regulatory initiatives that aim to foster safer/more sustainable chemicals (e.g., the United Nations Environment Programme (UNEP) global chemical framework<sup>27</sup> and the developing European Union safe and sustainable by design framework<sup>28</sup>), exploring the power of “chemistry as a solution” remains a vastly untapped opportunity.

### What needs to be done

#### Chemical industry initiatives ■

- Review existing definitions of sustainable chemistry and frameworks and establish a standardized set of guidelines to implement sustainable chemistry solutions → **CAAS-1**
- Identify and foster sustainable chemistry solutions by facilitating cross-industry collaboration on innovative pilot projects → **CAAS-1, CAAS-2**

#### Cross-sector initiatives ●

- Co-develop criteria and metrics for use throughout entire value chains to monitor and measure the implementation of safe and sustainable chemistry solutions → **CAAS-3**

#### Individual company initiatives ▲

- Support the chemical industry and cross-sector initiatives by participating in collaborative pilot projects and innovation programs → **CAAS-2**



## Enabler 3: Combatting pollution

### Objective

Delivering an action agenda to steer toward zero pollution in chemical value chains

### Role in the transformation

The United Nations identifies pollution as one of the three planetary **crises**,<sup>29</sup> along with climate change and biodiversity loss. Air pollution is responsible for the premature deaths of up to 7 million people annually, while 9 out of 10 people worldwide are breathing air with a pollutant content higher than WHO guidelines.<sup>30</sup> Water and soil pollution require dedicated efforts to address challenges related to chemicals, including aerosols, persistent organic pollutants, plastics and microplastics, and waste (e.g., nitrogen and phosphorus).

Combatting pollution is imperative to achieving nature-positive chemicals. In some countries, laws mandate pollution prevention to secure the authorizations required to operate a chemical plant. Pollution prevention strategies must, however, extend beyond the scope of operations and address chemical product life cycles, including supply chain logistics, production, downstream use and disposal, while aiming to replace high-risk products with sustainable alternatives.

Developing effective strategies for zero pollution starts with establishing a standardized definition of chemical pollution and fostering collective action in addressing the adverse impacts of chemicals along the value chain.

### Action to date

UNEP engages with governments and industries to minimize the impact of chemicals on human health and the environment and develops solutions for the management of chemicals and waste. A collaborative effort to align plans for zero pollution with the European Union in 2021 resulted in the promotion of multilateral cooperation, a strengthening of political support for chemical waste management and the spearheading of circularity in impact sectors such as plastics.<sup>31</sup> In 2023, UNEP launched the Global Framework on Chemicals.<sup>32</sup>

At the regional level, the European Commission, in alignment with UNEP's principles, launched the Chemicals Strategy for Sustainability (CSS), a zero-pollution plan that aims to reach zero air, water and soil pollution by 2050. The European Chemicals Agency plays an influential role in including regulatory development and compliance, health and environmental protection, transparency, innovation and collaboration in the region.<sup>33</sup>

### What needs to be done

Scaling up the steering toward zero pollution would require the development of comprehensive strategies in collaboration with value chains and supporting the conditions to accelerate their adoption. This includes:

#### Chemical industry initiatives ■

- Leverage existing definitions and frameworks and develop a shared definition for pollution that meets international standards and stakeholder expectations → **POL-1**
- Identify chemicals that pose significant pollution risks and explore alternatives that have minimal environmental impact → **POL-3**
- Commit to product reformulation where possible to ensure biodegradability → **POL-3**

#### Cross-sector initiatives ●

- Set up programs that foster an understanding of the fate, degradation and pollution mechanisms and controls for chemicals in value chains with high pollution risks → **POL-2**
- Develop a tracking system to assess the impact of these pollution prevention strategies throughout the value chain → **POL-3**
- Develop pollution prevention actions targeted at chemicals in products and products that leverage circular economy principles and include the substitution of chemicals with high pollution risks, reformulation for biodegradability for chemicals prone to leaching in the environment and shelf-life extension for chemicals and products made from them → **POL-3, POL-4**

## Chemical transformation roadmap: Pathways and actions

Table 1 and Table 2 summarize the roadmap pathways and actions identified. We have classified them according to short- and near-term time horizons, suggesting when companies need to complete the actions. The following symbols indicate the scope of cooperation foreseen (individual company, chemical industry or cross-sector):

- ▲ **Individual company:** Action for individual chemical companies
- **Chemical industry:** Action requires cooperation between companies in the chemical industry (e.g. WBCSD Chemical Group)
- **Cross-sector:** Action requires cross-sector cooperation (e.g. value chains actors or chemicals support system actors)

**Table 1: Chemicals Transformation Roadmap: Pathways and actions – part 1: Imperatives**

	Short term (2024-2027)	Near term (2027-2030)
<b>Imperative 1: Net-zero chemicals</b> Commit and deliver net-zero scope 1, 2 and 3 industry greenhouse gas emissions by 2050 in a way that prioritizes emissions reductions and limits the use of offsetting to unavoidable emissions		
CLIM-1	Adopt a globally recognized, science-based framework to set decarbonization targets ▲ ■ ●	
CLIM-2	Develop missing emissions calculation methodology and framework ▲ ■	
CLIM-3	Develop transition plans to reach net-zero emissions targets ▲ ■ ●	Initiate implementation of net-zero transition plan, including deployment of appropriate decarbonization technologies ▲ ■ ●
CLIM-4		Partner with priority sectors to support value chains in reaching their net-zero targets ●
CLIM-5		Develop and implement an integrated and compatible greenhouse gas emissions data sharing platform ■ ●
CLIM-6		Monitor progress on net-zero emissions targets ▲ ■
CLIM-7		Report progress on net-zero emissions and disclose decarbonization performance to key industry stakeholders ▲
CLIM-8		Initiate development of climate-positive chemical solutions ▲
<b>Imperative 2: Nature-positive chemicals</b> Commit to a trajectory that halts and reverses the impact of chemicals on nature loss by 2030 and achieves full recovery by 2050		
NAT-1	Develop a roadmap to nature positive: Establish foundations for the chemicals system and identify priority actions ■ ●	
NAT-2		Engage with the broader industry to foster implementation of the roadmap through the full chemical value system ■ ●
NAT-3	Report and disclose nature-positive risks, impacts and initiatives for chemicals ▲ ■	
NAT-4		Establish a holistic approach to water-related challenges ■ ●
NAT-5		Initiate development of nature-positive chemical solutions ▲
<b>Imperative 3: A just transition for chemicals</b> Co-create transformative solutions with value chain partners that put people at the center in all stages of the chemical product life cycle, including preventing harm, empowering employees and fostering the adoption of fair working conditions		
JT-1	Define and implement a just transition program for chemicals ●	
JT-2		Embed key elements of a just transition in companies' portfolio transformation and sustainability assessment tools to enhance equity actions and prevent harm throughout the product life cycle ●
JT-3		Assess living wage practices and create a collective action agenda to drive improvement throughout the entire value chain ●
JT-4		Co-create an upskilling and reskilling program to support all value chain actors and their employees as the industry and value chains adopt circular economy principles ■ ●
JT-5		Identify and disseminate best practices in leading the organizational change required to implement a transition to net-zero and nature-positive chemicals ●

**Table 2: Chemicals Transformation Roadmap: Pathways and actions – part 2: Enablers**

	Short term (2024-2027)	Near term (2027-2030)
<b>Enabler 1: Empowering a circular economy</b> Creating the financial, organizational, regulatory and business conditions by 2030 that enable the decoupling of value creation from resource consumption		
ECE-1	Redefine "economic value creation" and "economic risk" to include principles of a just transition and circular economy and support the transition to just, net-zero, nature-positive chemicals ■ ●	
ECE-2	Create a coalition that will pledge, pilot and deploy the value creation model that supports the transition to just, net-zero, nature-positive chemicals ■ ●	
ECE-3	Engage with the C-suite of early adopters and the financial community to create buy-in and secure sufficient investment to transition to the new value creation model ■ ●	
ECE-4		Engage with policymakers to remove barriers and develop solutions to implement the value creation model supporting the transition ■ ●
ECE-5	Develop circular innovations for companies in the chemical value chain to transform their product and service offering ▲ ■ ●	
ECE-6	Develop circular innovations to transform the existing assets of the chemical industry and wider chemical value system ▲ ■ ●	
ECE-7	Transform supply chains to enable access to circular feedstocks through the chemical value system ●	
ECE-8	In targeted value chains, pilot and scale successful practices supporting the transition to just, net-zero, nature-positive chemicals ●	
<b>Enabler 2: Activating sustainable chemistry as a solution</b> Committing to leverage the power of sustainable chemistry(*) to unlock the chemical value chain transformation by 2030		
CAAS-1	Identify and map how sustainable chemistry(*) and engineering processes could support the transition to just, net-zero, nature-positive chemicals ■	
CAAS-2		Design and implement programs to pilot sustainable chemistry solutions and engineering processes ▲ ■
CAAS-3		Develop criteria and metrics for use throughout the value chain to measure the implementation of sustainable chemistry solutions ■ ●
<b>Enabler 2: Combating pollution</b> Delivering an action agenda by 2030 to steer toward zero pollution throughout value chains		
POL-1	Develop a common definition for pollution by leveraging existing frameworks and definitions ■	
POL-2		Assess product degradation and fate from a cradle-to-cradle perspective ●
POL-3	Develop mitigation strategies for products with pollution risks and address them in order of priority ■ ●	
POL-4	Implement strategies for products with identified pollution risks ●	

(\*) For the definition of sustainable chemistry, see the [Glossary](#)

## Conclusion

*This roadmap, developed through the collaboration of nine leading chemical companies, ERM and WBCSD, with input from value chain actors, sets a shared vision for planet-positive chemicals. It aims to create value for the industry, its customers, society and the environment by outlining six pathways and the key actions needed for sustainable chemical production, use and regeneration.*

Achieving these pathways requires cooperation throughout the entire value chain, as no single group can accomplish them alone. The roadmap serves as a call to action, fostering transformational change and providing a blueprint for collaboration among the nine originators and others joining this journey. It will also guide stakeholder and partner engagement to advance the roadmap's objectives.

Initial steps will focus on consolidating a shared understanding and establishing clear definitions, which will enable the implementation of longer-term actions.

The roadmap for planet-positive chemicals is a bold vision, guiding the industry toward a sustainable future and positioning it as a crucial player in building a more equitable world. The time to act is now.



# Glossary

*This glossary provides definitions for key terms and concepts used throughout this roadmap.*

## **Circular economy**

The circular economy is an economic model that is regenerative by design. The objective is to retain the value of the circulating resources, products, parts and materials by creating a system with innovative business models that allow for renewability, long life, optimal (re)use, refurbishment, remanufacturing, recycling and biodegradation. By applying these principles, organizations can collaborate to design out waste, increase resource productivity and maintain resource use within planetary boundaries.

This roadmap endorses as definitions:

- Concepts as per the global commitment<sup>34</sup> and WBCSD Circular Transition Indicators;<sup>35</sup>
- A holistic approach anchored in the implementation of the 10Rs of circular economy;<sup>36</sup>
- The value hill in circular business,<sup>37</sup> meaning the principle to maximize value retention.

## **Cradle-to-cradle**

Cradle-to-Cradle refers to taking a holistic approach that expands the life-cycle boundary of a product from its creation (cradle) to its next life stage where materials cycle back into the system until no further circularity is possible due to physical, chemical, technological and economical constraints. This is a key principle underpinning this roadmap.

- This does not exclude that for disclosure purpose, in some specific cases, a cradle to gate might be more practical.
- This does not refer explicitly to or require the C2C® certification from M. Braungart and W. McDonough.

## **Chemical Value system**

Chemical industry transformation depends on the transformation of value chains and the broader economic system in which they operate. The **chemical value system** in this roadmap encompasses all actors that have an impact on the value creation of chemicals. This includes chemical companies, actors of the chemical value chains as well as other actors with impacts on chemicals (e.g., financial community). Value creation refers to economic, environmental and social value creation.

## **Just transition**

The Business Commission to Tackle Inequality (BCTI) *Tackling inequality: An agenda for business action*<sup>38</sup> report defines a just transition as "acting in line with science to address the climate emergency and restore nature, while leveraging these transformations to advance shared prosperity."

## **Sustainable chemistry**

We use this term for simplification purposes in the report. It refers to exploring how sustainable chemistry, chemical engineering processes and technologies as well as biotechnologies can provide solutions to address some of challenges highlighted in the transformation.

# Acronyms & abbreviations

<b>Acronym</b>	<b>Meaning</b>
<b>BCTI</b>	The Business Commission to Tackle Inequality
<b>CAAS</b>	Reference code for the activating sustainable chemistry as a solution pathway
<b>CCU</b>	carbon capture and utilization
<b>CLIM</b>	Reference code for the net-zero chemicals pathway
<b>CSS</b>	Chemicals Strategy for Sustainability
<b>ECE</b>	Reference code for the empowering a circular economy pathway
<b>ESG</b>	Environmental, social and corporate governance
<b>EU</b>	European Union
<b>GHG</b>	Greenhouse gases
<b>IFRS</b>	International Financial Reporting Standards
<b>JT</b>	Reference code for a just transition for chemicals pathway
<b>LCA</b>	Life cycle assessment
<b>NAT</b>	Reference code for the Nature-positive chemicals pathway
<b>POL</b>	Reference code for the combatting pollution pathway
<b>REACH</b>	Registration, Evaluation, Authorization and Restriction of Chemicals
<b>SBTi</b>	Science Based Targets initiative
<b>UNEP</b>	United Nations Environment Programme
<b>WBCSD</b>	World Business Council for Sustainable Development
<b>WHO</b>	World Health Organization

# Endnotes

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  - Scope 2 includes indirect emissions from the generation of purchased energy, e.g., purchased electricity.
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WBCSD would like to thank the following companies for their insights and collaboration:

Chemicals Circularity project members, for their engagement and collaboration throughout the work: Sylvie Despret, Noel Zilberfarb (Arkema); Daniela Malkowsky, Talke Schaffranek (BASF); Amber Wellman (CHEMOURS); Bettina Siggelkow (Clariant); Ralf Kelle (Evonik); Leo Scheiwiller (Sika); Dominique Debecker, Adrienne Pedrosa (Syensqo), Anastasia Behr (UL Solutions).

Chemical value chain actors for their valuable insights on the work: Art Fong (Apple); Aris Vrettos (Croda International); Martijn Antonisse, (dsm-firmenich); Hallvard Bremnes (Givaudan); Uwe Bermann, Dirk Ullrich (Henkel); Roberto Barrantes Guerrero (Philips); Rupert Posner (Unilever)

Subject matter experts, for their stimulating workshops on climate, nature and equity respectively, which inspired the ambition: Sophie Hermann, Peter Goult (Systemiq); Nadine McCormick, Nazwa Khalid and Ruth Thomas (WBCSD)

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Please note that the data published in the report are as of March, 2024.

## About The Chemical circularity project

The Chemical circularity project is an ecosystem of leading companies and organizations united around a shared vision working together to develop the action agenda, tools and frameworks required to accelerate a just transition to net-zero, nature-positive chemicals empowered by a circular economy.

## About WBCSD

The World Business Council for Sustainable Development (WBCSD) is a global community of over 225 of the world's leading businesses driving systems transformation for a better world in which 9+ billion people can live well, within planetary boundaries, by mid-century. Together, we transform the systems we work in to limit the impact of the climate crisis, restore nature and tackle inequality.

We accelerate value chain transformation across key sectors and reshape the financial system to reward sustainable leadership and action through a lower cost of capital. Through the exchange of best practices, improving performance, accessing education, forming partnerships, and shaping the policy agenda, we drive progress in businesses and sharpen the accountability of their performance.

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