CHEMICAL PRODUCT SUSTAINABILITY

REDUCING THE ENVIRONMENTAL IMPACT OF CHEMICAL PRODUCTS

FOREWORD

There are many steps on the journey to net zero, and whilst Life Cycle Assessment (LCA) can support by benchmarking current emissions performance and identifying hotspots, organisations need to be seen to be acting and delivering reduction results.

Understanding where emissions reductions can be made requires a large-scale investment of time and resources to gather data and complete assessments – however this is also only the first step in the journey.

Taking measured, strategic, and effective actions to reduce carbon emissions requires careful consideration of the options available; interrogation of alternative solutions; and innovative and collaborative suppliers who are open to developing new solutions.

Any changes made will impact supply chains, distribution networks and manufacturing processes, therefore the implications need to be considered in terms of carbon emissions, unintended consequences, and commercial viability prior to adaptation.

Applying the principles of a circular economy can support organisations in making strategic decisions that deliver effective and efficient reductions in carbon emissions. This approach also increases the competitivity and resilience of the organisation and its products. This guide can help companies understand how to achieve this by providing insight on data collation, modelling and scenario planning. Organisations can gain confidence in their decision-making processes whilst obtaining robust, substantiated data to demonstrate the reductions achieved.

By shifting from the traditional linear economy ("take, make, dispose") to a circular economy, organisations can reduce their overall environmental impact and carbon emissions, creating economic opportunities. This transition also increases business resilience through sustainable development, contributing to a safe and sustainable future.

Steve Elliott
Chief Executive of the Chemical Industries Association

GREEN CLAIMS

Environmental credentials are a strong selling point for many products and services. However, these claims must be transparent and accurate, able to withstand the scrutiny of the media, regulators, consumers and investors. Failing to comply, even unintentionally, may expose organisations to reputational harm, fines or potential legal consequences for senior executives.

The key to a robust green claim is transparency. LCA uses standardised methodologies to calculate the environmental and social impacts of products and services. This data can be used as evidence to substantiate your green claims. As well as giving you a deep understanding of how your products or services perform, an LCA can also highlight areas for improvement.

Ricardo and the CIA have produced sector specific gudiance to LCAs, available to download for free, here.

PERFORMANCE FACTORS REQUIRED

The growing list of regulations and frameworks requiring environmental impact data to be submitted, monitored and reduced adds to the complexities facing organisations as they work to decarbonise their operations. This list is not exhaustive and more details on each of these standards, regulations and frameworks can be found in Appendix 1.

- Science Based Targets initiative (SBTi)
- Net Zero Targets
- Product Carbon Footprint (PCF)
- Product Environmental Footprint (PEF)
- Circular Footprint Formula (CFF)
- Environmental Product Declaration (EPD)
- Extended Producer Responsibility (EPR)
- Ecodesign for Sustainable Products Regulation (ESPR)
- EU Omnibus
- Digital Product Passport (DPP)
- Safe & Sustainable by Design (SSbD)
- Corporate Sustainability Reporting Directive (CSRD)
- Social Value

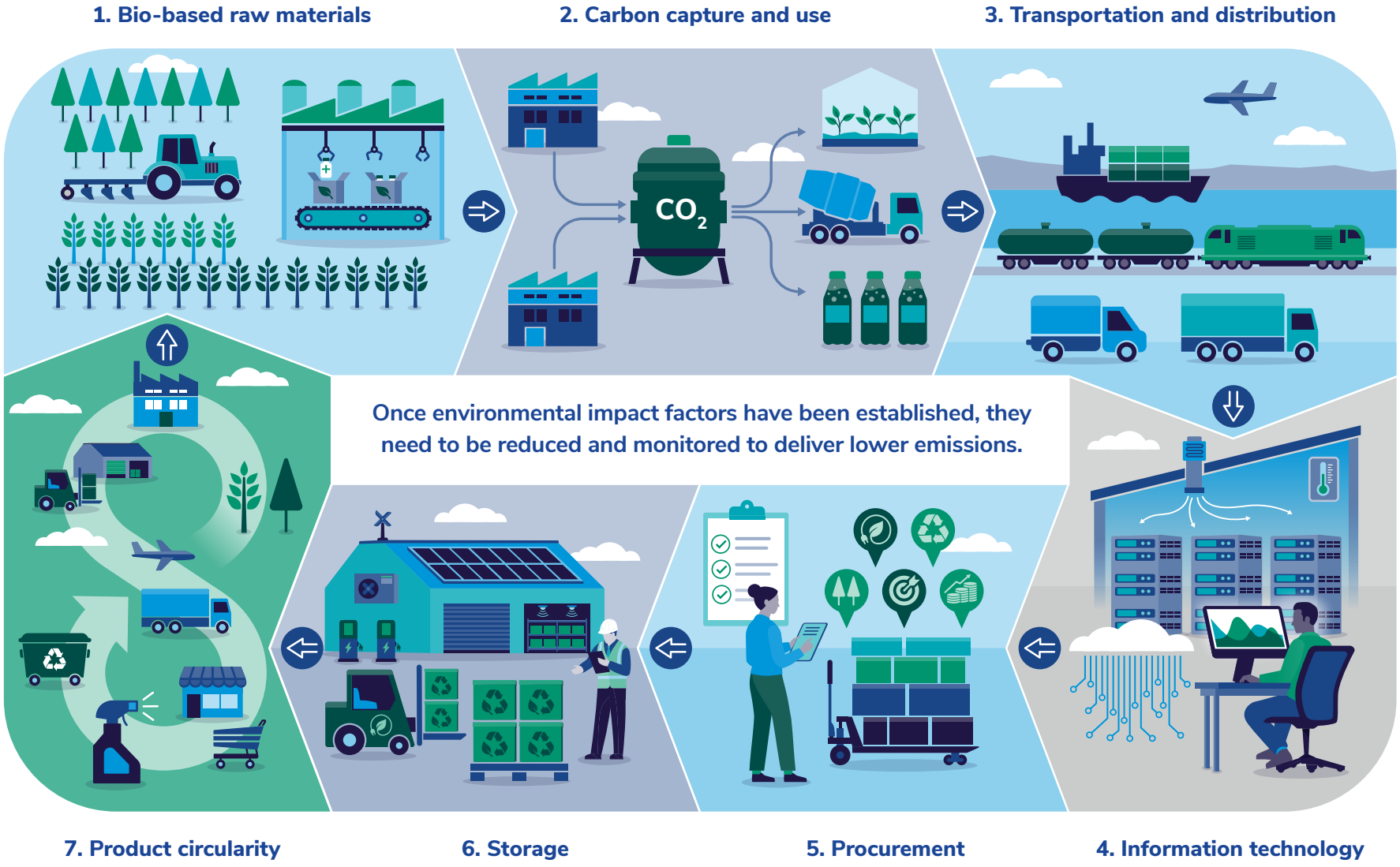
Meeting reporting requirements

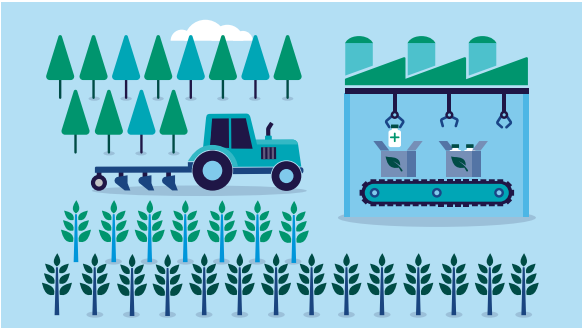
This list of regulations and frameworks is not exhaustive, and prioritisation should be given to regulatory requirements to minimise the risk of any penalties and maintain access to markets, before any consideration is given to voluntary frameworks.

Once completed, an LCA will identify greenhouse gas (GHG) or carbon dioxide emission 'hot spots', where factors have a relatively high impact on environments. Organisations can then focus their energies on finding ways to reduce the impacts caused. Depending on the factor, this may require finding an alternative ingredient source or supplier, revising logistics networks or investing in sustainable energy sources. Stakeholders throughout value chains will also have data requirements of your organisation to support the frameworks and regulations impacting their roles - whether in supply chains, the chemicals industry, or their investment portfolios.

The LCA process can enable data to be provided in terms of GHG emissions or carbon dioxide emissions. Working collaboratively with supply chains and stakeholders allows this data to be shared for up- and down-stream reporting and other sustainability assessments. Building relationships on transparency and collaboration foster trust, which can also improve organisational resilience longer-term.

ROUTES TO REDUCTION





1. Bio-based raw materials

Bio-based chemicals derived from renewable feedstocks, such as agricultural residues or algae, can reduce reliance on fossil resources. These alternative materials can be converted into biomass-derived plastics and bio-based chemicals can be co-produced alongside biofuels in biorefineries which maximise resource utilisation.

Compared with fossil-based materials, bio-based materials may have lower environmental impacts. Switching to or developing products using bio-derived feedstocks and away from fossil-derived feedstocks may result in a lower environmental impact in categories such as climate change or Global Warming Potential (GWP). Nevertheless, changes at any stage of the product life cycle will have wider implications for up- and down-stream processes.

By applying green chemistry principles and using scenario planning with LCA insights, organisations can better understand the impact of changes in raw material sourcing, manufacturing, and distribution. This holistic approach helps identify and evaluate alternative raw materials, supporting more informed decision-making.

Any changes in product formulations will be impacted by the chemical sector regulations which, as we know, are reducing the permissible toxicity of chemicals and substances available in a move towards a non-toxic environment driven by the EU's Chemicals Strategy for Sustainability.

While maintaining regulatory compliance is essential, proactively continuing to reduce the toxicity profile of any chemicals or substances used is advisable given the sustained direction of regulatory change. Add to this the requirement of evidence to assess levels of persistence/biodegradability; bioaccumulation; endocrine disruption; and environmental chemistry and toxicology (ECT), evaluation becomes increasingly important to protect environmental and human health.

By working with ECT experts to consider factors relating to the selection of environmentally sustainable chemicals throughout existing product portfolios as well as during the formulation process, products can be future-proofed, minimising the frequency of change and maximising the return from the work completed.

SWITCHING TO OR DEVELOPING PRODUCTS USING BIO-DERIVED FEEDSTOCKS AND AWAY FROM FOSSIL-DERIVED FEEDSTOCKS MAY RESULT IN A LOWER ENVIRONMENTAL IMPACT.

ECT can provide support through the robust evaluation of existing and alternative substances and formulations to assess their potential environmental impact and identify opportunities for its reduction.

This, along with conducting detailed impact assessments that consider product functionality, GHG emissions, GWP and the economic feasibility can provide vital holistic insights into the environmental impact of products throughout their life cycle.

The inclusion of ECT considerations is an essential aspect of product evaluation and can be applied to existing products, or as a key aspect of reformulation and new product development processes to minimise environmental impact.

THE EU'S CHEMICAL STRATEGY FOR SUSTAINABILITY (CSS)

The EU's Chemical Strategy for Sustainability (CSS) is a key part of the European Green Deal, aiming to reduce chemical pollution and promote safer, more sustainable chemicals.

The strategy seeks to phase out the most harmful substances, including endocrine disruptors, persistent chemicals, and those affecting vulnerable groups (e.g., children and pregnant women). It introduces the "Essential Use" concept, meaning that harmful chemicals should only be used when absolutely necessary for health, safety, or critical societal functions. The Strategy also introduces stricter hazard classifications under the Classification, Labelling, and Packaging (CLP) Regulation.

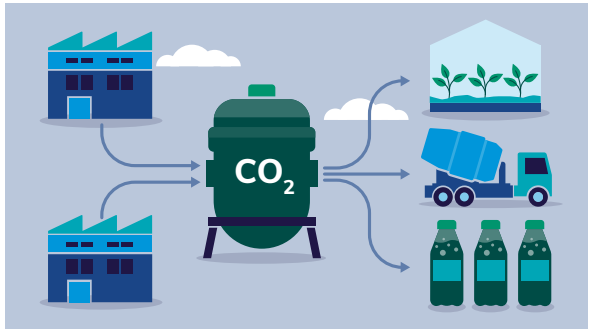
The Safe and Sustainable by Design framework

The CSS proposes stronger restrictions on chemicals that accumulate in nature, disrupt ecosystems, or persist in water, soil, and air, aligning with the zero pollution ambition. This ensures that industrial emissions and product design follow sustainability principles. The Safe and Sustainable by Design (SSbD) framework sits under the EU's Chemical Strategy for Sustainability (CSS) as a key initiative to drive the development of safer and more sustainable chemicals, materials, and products, and encourages the development of chemicals with minimal ecological footprint.

Supporting innovation and green alternatives

The strategy also calls for better assessment of chemical mixtures to prevent cumulative toxicity, and requires comprehensive LCA to evaluate the full environmental impact of chemicals. The strategy also supports innovation and green alternatives through the development of non-toxic and biodegradable chemicals, and strengthens research and funding for sustainable chemistry, including alternatives to fossil-based raw materials.

THE STRATEGY SUPPORTS INNOVATION AND GREEN ALTERNATIVES THROUGH THE DEVELOPMENT OF NON-TOXIC AND BIODEGRADABLE CHEMICALS, AND STRENGTHENS RESEARCH AND FUNDING FOR SUSTAINABLE CHEMISTRY.



2. Carbon capture and use (CCU)

Capturing CO_2 at source is another potential route for organisations to reduce their carbon emissions and overall impact of their products. Carbon capture and storage (CCS) processes intervene before carbon dioxide is released, enabling it to be captured, transported, and stored securely.

CCU is an emerging field for emissions mitigation and seeks to find alternative uses for stored carbon – and the range of products that could be produced is vast. The challenges here are the ability to source cheap, renewable energy to power the chemical process, the geographic location, and market demand for the resulting products.

There are many ways captured CO_2 can be utilised, such as in the production of building materials like concrete; reducing emissions and strengthening the product; or as a raw material in the production of some chemicals, like methanol and urea. Alternatively, CO_2 is used in the food and beverage industry for carbonation of drinks and in refrigeration systems, or in agriculture where CO_2 can be used in greenhouses.

THERE ARE MANY WAYS CAPTURED CO_2 CAN BE UTILISED, SUCH AS IN THE PRODUCTION OF BUILDING MATERIALS LIKE CONCRETE.

Captured CO_2 can also be converted into synthetic fuels which can then be used to power machinery. It may require changes to manufacturing processes to incorporate captured carbon or working collaboratively with local businesses to find opportunities for its use, and considering the wider supply chain and environmental implications of any changes made would need to be offset following implementation.

CCU is complex due to the double role of CO_2 as both feedstock and emission, and the potential benefits need to be assessed over the entire product life cycle. Focusing on decarbonising other aspects of the product value chain can also deliver emissions reductions.

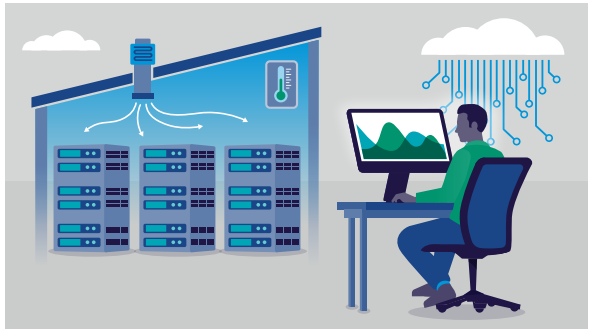
3. Transportation and distribution

The global nature of chemical supply chains can impose restrictions, as certain minerals, metals and other substances can only be mined from certain parts, but through establishing the impact of transportation emissions, decisions can be made on the best location for manufacturing plants or production lines.

Understanding the fuel types available on distribution routes can also present opportunities to reduce emissions. For example, the electrification of road vehicles has provided sustainably powered distribution solutions for low volumes over shorter distances.

There may be further opportunities to reduce emissions by working with supply chains or other parties to establish back haul logistical practices, ensuring no vehicle ever travels without cargo to maximise the value derived from the emissions created.

Equally, there may be strategic decisions around packaging formats, with larger scale parcels typically generating less packaging waste than a greater number of smaller counterparts, or optimal distribution quantities to manage the energy to weight ratio of transport. All of which should be considered with regard to the frequency of distribution and number of vehicles making equivalent journeys.



4. Information technology (IT)

The processing power required by IT solutions drives a vast amount of energy usage and finding sustainable energy sources helps organisations to reduce the associated emissions. For example, finding offsite data server storage solutions with adiabatic cooling in place of energy-hungry air conditioning provides the same solution with lower associated emissions.

Reviewing data and email retention policies to reduce the volume of data stored is another route to reducing the associated emissions.

CARBON EMISSIONS OF A SINGLE EMAIL COULD BE AS MUCH AS 26g CO_2.

Extending the useful life of assets such as laptops, tablets or mobile phones through upgrade and repair can deliver emissions benefits, and reformatting or refurbishing items for resale, or returning through take-back schemes can reduce the associated waste emissions.

5. Procurement

With 75% of a company's emissions generated by their supply chain, enforcing standards on suppliers and measuring and monitoring this through procurement processes can actively lower an organisation's carbon emissions.

Since 2021, bidders for public goods contracts in the UK have been required to confirm their commitment to reduce GHG emissions, publicly commit to being net zero by 2050 and have a comprehensive carbon reduction plan in place.

With requirements of lower carbon emissions helping organisations to successfully secure new contracts, up- and down-stream organisations will also take steps and make changes to improve or maintain their competitive edge. The purchasing power of the chemicals industry can drive production and carbon efficiencies, and support innovative new products and substances derived from low-carbon means.

THE PURCHASING POWER OF THE CHEMICALS INDUSTRY CAN DRIVE PRODUCTION AND CARBON EFFICIENCIES, AND SUPPORT INNOVATIVE NEW PRODUCTS AND SUBSTANCES DERIVED FROM LOW-CARBON MEANS.

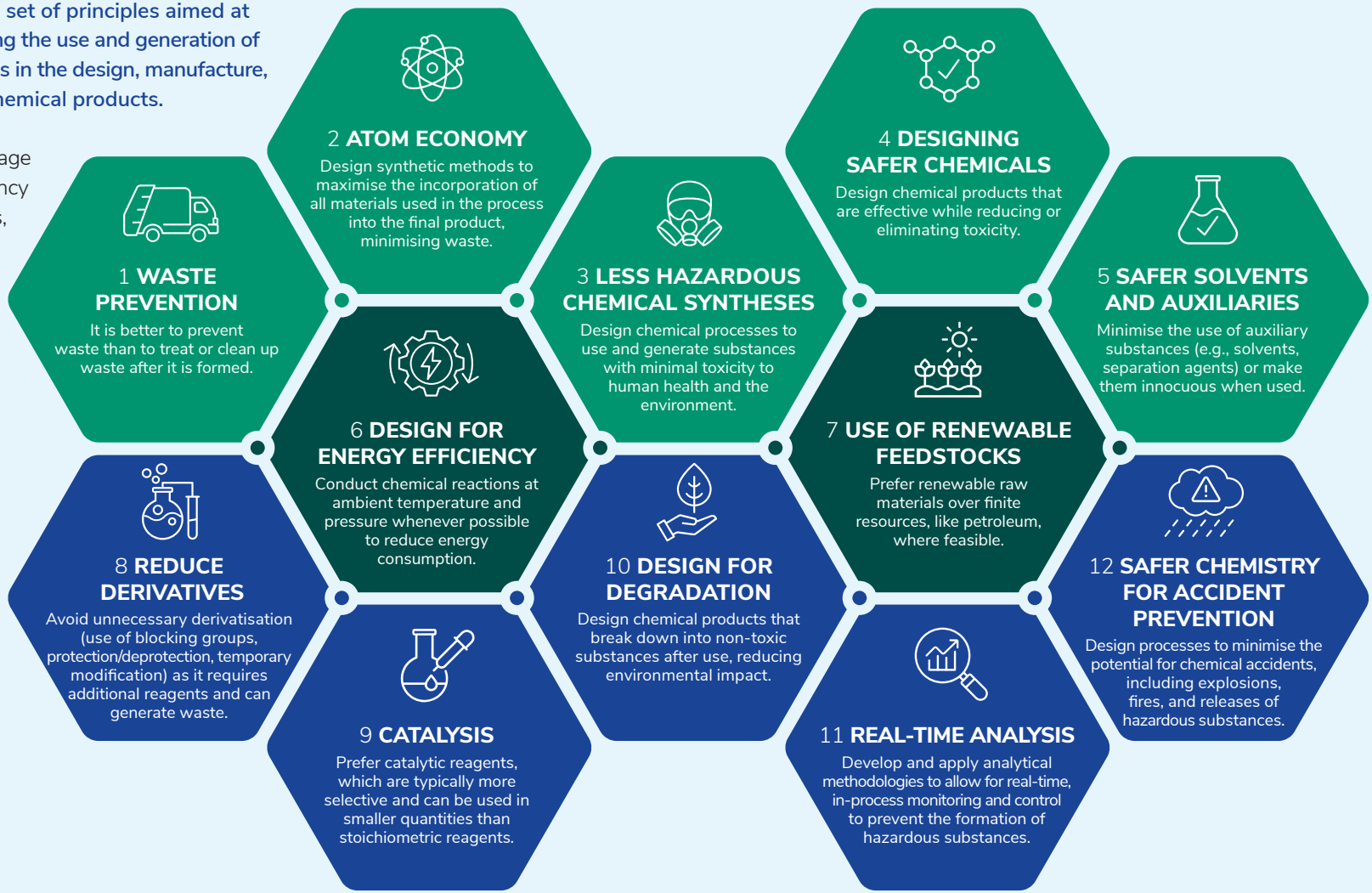
It can be challenging to engage with all supply chain parties, requiring innovative, transparent and collaborative relationships to develop new solutions – all of which takes time and investment of resource.

Procurement processes can assist with scoring or suitability testing against specific criteria. It is important that organisations consider the future requirements of their organisation, its strategic objectives, and the regulatory direction of travel to ensure its suppliers are meeting requirements today, and open to the changing requirements of tomorrow.

THE 12 PRINCIPLES OF GREEN CHEMISTRY

Green chemistry is a set of principles aimed at reducing or eliminating the use and generation of hazardous substances in the design, manufacture, and application of chemical products.

The principles encourage innovation and efficiency of chemical processes, and ultimately contribute to sustainability and environmental protection.



INSTEAD OF RELEASING CARBON INTO THE AIR, PLANT-BASED CONSUMABLES CAN REMOVE CARBON FROM THE ENVIRONMENT, REPRESENTING A CARBON-NEUTRAL ALTERNATIVE.

6. Storage

From building warehouses to individual product packaging, carbon emissions can be lowered in many ways.

Switching plastic, oil-based packaging for non-fossil fuel options, such as those made from plant-based materials, can reduce emissions as they are often designed to be biodegradable and fully recyclable. Instead of releasing carbon into the air, plant-based consumables can remove carbon from the environment, representing a carbon-neutral alternative.

Equally, moving away from traditional wooden pallets to sustainable options made from reclaimed and reformed wood with equivalent load capabilities, or finding protective packaging produced from starch or recycled paper, are other opportunities to reduce carbon emissions.

Building or investing in storage premises with sustainable design elements such as improved insulation, solar and wind power sources, heat pumps or combined heat and power solutions can reduce emissions and are often more cost-effective in the long term. Retrofitting existing facilities can also reduce emissions through improved heating, cooling, and lighting systems linked to motion sensors, further reducing energy consumption.

Changing to low-carbon energy suppliers or investing in on-site energy generation such as solar panels on warehouse roofs can also reduce emissions, and powering on-site vehicles with sustainable or low-carbon energy sources can take this further. Capturing rainwater from guttering systems for use in grey-water systems (toilet flushing) can also reduce the carbon emissions related to water use.

7. Product circularity

Product circularity aims to stop waste from being produced by recovering materials for reuse and remanufacturing these into new products. Products are designed with end of life in mind and kept in use for as long as possible through practices like repair, recycling, and redesign.

Circularity, through the use of renewable energy and re-use of materials, can help minimise the impact an organisation's activities have on the depletion of finite resources. This makes organisations more resilient and provides wider benefits to businesses, people, and the environment through resource efficiency and responsible design.

Identifying opportunities to apply the principles of a circular economy can be complex, requiring detailed analysis and investigation of the possible options available, the implications for the wider supply chain and the associated emissions.

While the options available to any individual organisation and its products will vary considerably, we explore a few options for how organisations may look to reduce emissions through the following circular solutions:

- **Reconsidering the design of products** to reduce the volume of raw materials used, improving the sustainability of those materials, and considering the end-of-life processing required to maximise recycling can reduce the associated emissions from the outset. Replacing 'high-emission materials' with more sustainable alternatives, for example, can contribute to emission reduction, such as bio-based solvents used in place of traditional industrial cleaning chemicals.

- **Creating products that can be easily recycled or disassembled** also reduces the demand for virgin materials as high quality recycled materials are available with lower associated carbon emissions due to avoided extraction and reduced processing.

- **Incorporating reuse and remanufacturing** could involve repurposing products in their current form or using their components to create new products. Examples include replacing worn parts of industrial machinery, reupholstering furniture, and used motor oil being re-refined to create lubricating oil (which also takes less energy than taking new oil from crude).

- **Extending product life cycles** for as long possible through repairing, refurbishing, and reusing items reduces demand, and therefore production of completely new products, in turn lowering emissions associated with manufacturing and transportation.

- **Finding other routes to delivery** can also reduce associated carbon emissions. For example, instead of selling products outright businesses might offer a leasing or rental service, which includes maintenance and repair over the life of the product, as keeping the asset well maintained and repaired with approved, high-quality parts maximises the life of the product.

- **Product take back options** are likely to be important for the chemicals industry. Manufacturers would 'take back' used or excess product at the end of its life and reintroduce it to the manufacturing process. By recycling or re-manufacturing products in this way, organisations can reduce waste and raw material use as well as avoid disposal or end of life management issues and the associated emissions.

SWITCHING TO A CIRCULAR ECONOMY COULD POTENTIALLY REDUCE GHG EMISSIONS BY UP TO 39% AND EASE PRESSURE ON VIRGIN MATERIALS BY 28%.[1]

1 https://www.circle-economy.com/news/circular-economy-strategies-can-cut-global-emissions-by-39

EU RIGHT TO REPAIR

The EU Right to Repair Act primarily targets consumer goods, ensuring products are easier to repair, last longer, and contribute to a circular economy.[2] While its direct impact on the chemical manufacturing sector is limited, there are important indirect effects that chemical companies need to consider, particularly in relation to sustainability, materials, and product design.

Demand for durable and sustainable materials

The Right to Repair Act promotes the longevity of products, meaning manufacturers will seek more durable and sustainable chemical formulations for coatings, adhesives, lubricants, and composites.

While there will be greater scrutiny on chemical degradation in plastics, paints, and adhesives to ensure products remain functional over time, chemical companies that innovate repair-friendly materials (e.g., self-healing coatings, easily separable adhesives, biodegradable lubricants) will likely gain a competitive edge. Collaboration with industries like electronics, automotive, and packaging will be crucial for developing repair-friendly solutions.

Chemical manufacturers may also be required to align with circular economy initiatives, ensuring their products contribute to recyclability and remanufacturing.

Non-toxic and recyclable formulations

The Right to Repair Act encourages the use of recyclable materials and modular product designs, requiring chemicals that facilitate easier disassembly and reuse, and hazardous substances (e.g., certain flame retardants, plasticisers, or adhesives) may be restricted if they hinder repair or material recovery.

It is likely that the demand for bio-based, biodegradable, and non-toxic alternatives will increase, as these materials make repairs and end-of-life management easier.

Compliance with Digital Product Passports (DPPs)

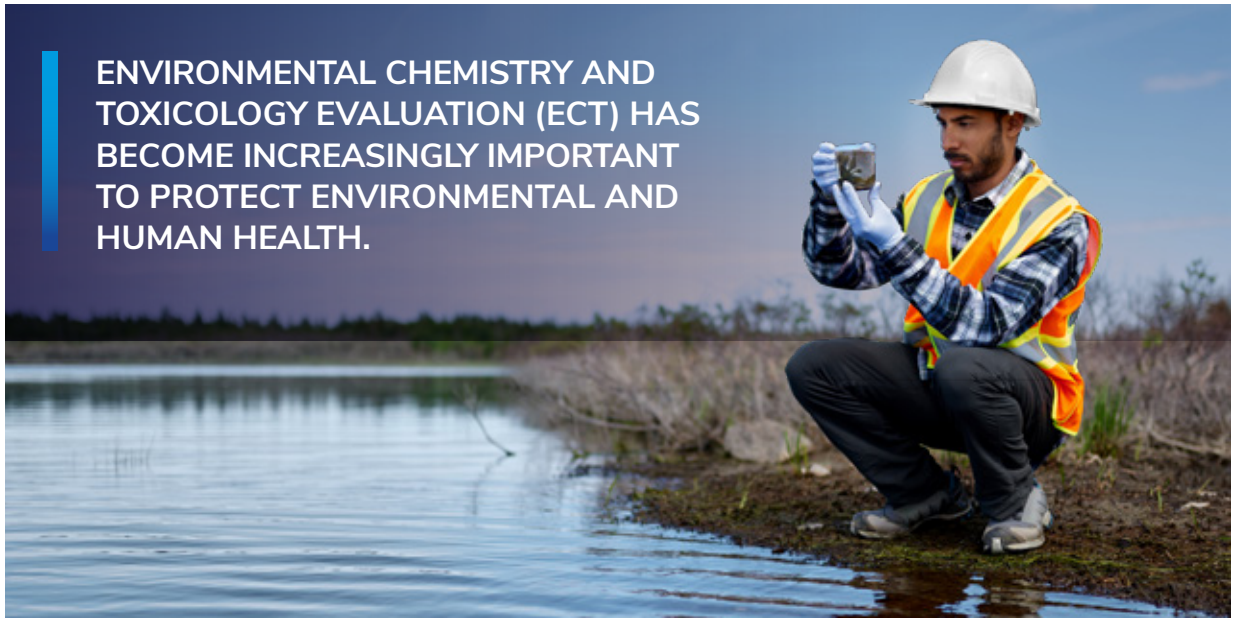
The Right to Repair Act connects with DPPs under the Ecodesign for Sustainable Products Regulation (ESPR).

Chemical composition data may need to be disclosed, impacting product labelling, traceability, and supply chain transparency.

By assessing product formulations using LCA, organisations can ensure they align with repairability and recyclability goals by developing non-toxic, repair-friendly chemicals that enhance material lifespan and recyclability. Collaboration with downstream industries (electronics, automotive, textiles) will enable companies to create repair-compatible materials.

2 https://www.europarl.europa.eu/news/en/press-room/20240419IPR20590/right-to-repair-making-repair-easier-and-more-appealing-to-consumers

TOXICOLOGY EXPERTISE



Chemical sector regulations are reducing the permissible (eco) toxicity of chemicals and substances available, in a move towards a non-toxic environment driven by the EU's Chemicals Strategy for Sustainability.

While maintaining regulatory compliance is essential, proactively continuing to reduce the toxicity profile of any chemicals or substances used is advisable given the sustained direction of regulatory change.

Add to this the requirement of evidence to assess levels of persistence/biodegradability; bioaccumulation; endocrine disruption; and environmental mobility; and environmental chemistry and toxicology evaluation becomes increasingly important to protect environmental and human health.

By working with ECT experts to consider factors relating to the selection of environmentally sustainable chemicals throughout existing product portfolios as well as during the formulation process, product portfolios can be future-proofed, minimising the frequency of change and maximising the return from the work completed. ECT can provide support through the robust evaluation of existing and alternative substances and formulations to assess their potential environmental impact and identify opportunities for its reduction.

This, along with conducting detailed impact assessments that consider product functionality, GHG emissions, GWP, and the economic feasibility, can provide vital holistic insights into the environmental impact of products throughout their life cycle. The inclusion of ECT considerations is an essential aspect of product evaluation and can be applied to existing products or as a key aspect of reformulation and new product development processes to minimise environmental impact.

BENEFITS

Reducing the environmental impact of products offers numerous benefits for companies, including regulatory compliance, cost savings, competitive advantage, and long-term business resilience.

REMAIN ATTRACTIVE

Customers and investors will be seeking organisations that align with their personal and commercial values, that can also be relied upon to deliver returns.

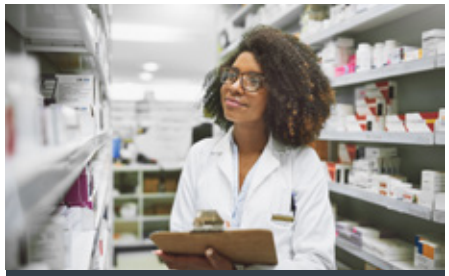
REMAIN RELEVANT

Given the widely accepted deadlines of reaching net zero by 2050, the stakeholder and regulatory pressures, and the time it will take to innovate, reformulate and redesign the vast array of chemical substances and products on today's markets, it is time to take action.

REMAIN COMPETITIVE

With stakeholders and supply chains also seeking lower carbon solutions, and with the advent of DPP meaning sustainability information is more widely accessible across the board, transparency will become a new standard. Therefore comparing products on emissions factors may implicate purchasing decisions.

REMAIN COMPLIANT



Maintaining regulatory compliance is essential to ensure access to markets, and regulatory environments are rapidly evolving to include emissions reporting. The European Union now requires companies, including chemical businesses, to report on their climate impacts, including scope 3 emissions. Global chemicals regulations are constantly evolving, but remaining proactive enhances business resilience by reducing risk.

CONCLUSION

Through LCA, chemical organisations can establish which aspects of their production process have the highest impact and look to make changes.

By modelling the known variables such as product, substance and energy sources, manufacturing locations, and global distribution and transport options, organisations can manipulate scenarios to optimise production and manufacture processes.

Working to make improvements to the known factors can drive down product associated emissions quickly, where product redevelopment, research and testing will require the investment of time and resources.

Solutions for your business

BASE

It is essential to establish a baseline for your emissions performance. Our introductory guide, Life Cycle Assessments: Establishing the Environmental Impact of Chemical Products, provides valuable insights into how LCAs can help you achieve this.

- **Life Cycle Assessment:** Enables you to develop a deeper knowledge of your products and services in comparison to others on the market and show you where the most effective changes can be made to improve sustainability.

IDENTIFY

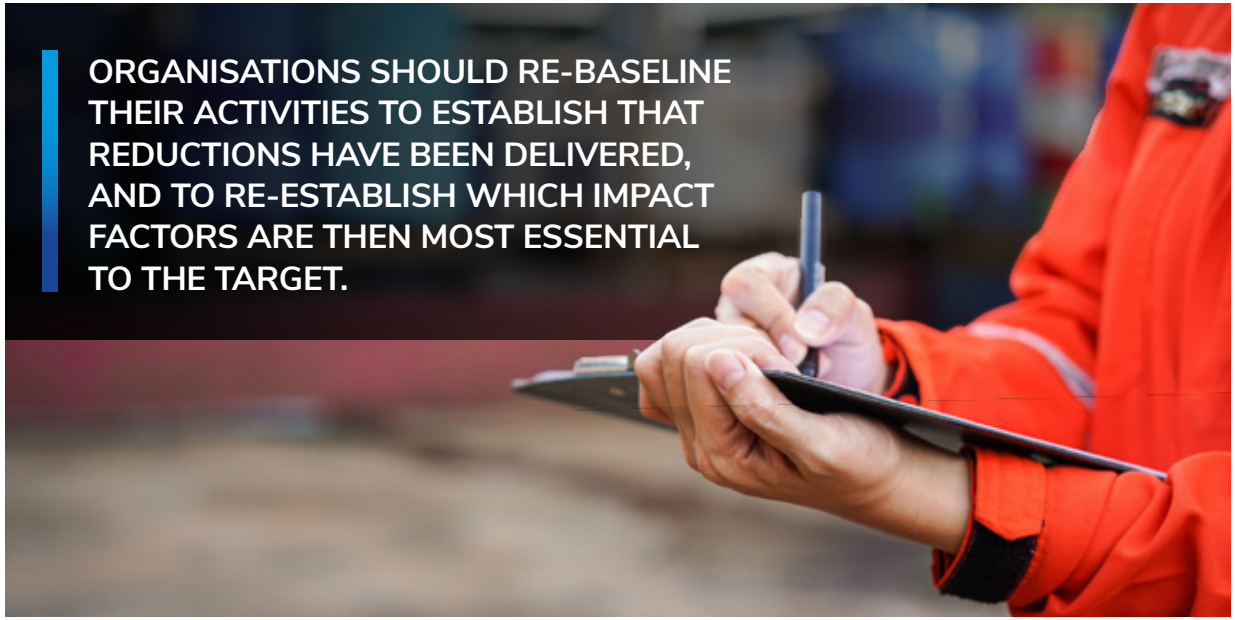
Once the baseline has been established, the impact hotspots can be identified and prioritised, as can other regulatory risks.

- **Impact hotspots:** Ricardo's dedicated and experienced team of LCA practitioners have expertise in the process, limitations and analysis of collated data, and can provide validation on any work already completed, or support with completing the initial assessments.
- **Prioritisation:** Consideration of the order to which impacts should be addressed, aiming to deliver significant reductions in emissions for least effort first.
- **Regulatory risk:** Our chemical regulatory experts can also assess the potential risks facing your organisation from the chemicals used in your products.
- **Maintaining regulatory compliance:** Capable of performing registrations, plan and managing testing strategies, and assisting with ongoing regulatory responsibilities.
- **Regulatory risk management:** Ricardo's regulatory experts are able to provide a clear view of which chemicals, compounds or products may be impacted by regulatory change in the short- and long-term future.

TARGET

Once identified, organisations will need to define a strategy outlining how the desired changes will be delivered – either through adopting circular economy solutions or carbon reduction.

The strategy will need to ensure that objectives are set against the LCA baseline information, targets are defined, and internal and external stakeholders are engaged.



Key to delivering the results, the strategy will need to identify the initiatives and actions required to deliver the objectives set, with an associated implementation plan and metrics to monitor and report on progress.

Ricardo's experienced team of circular economy experts can support organisations with identifying the required points of change, strategy development, and target setting – from researching alternative solutions to identifying the potential reductions and setting deliverable targets – our team works closely with the organisation and its stakeholders.

Working to understand the full life cycle of each single element of the greater process and its impact on the product and organisation enables our experienced team to present all opportunities, providing transparency and enabling strategic decision making.

REDUCE

Ensuring that organisations are fully supported throughout the process by providing guidance for implementing reduction strategies and tactical changes, including project management and stakeholder engagement.

Following the initial reductions activities, organisations should re-baseline their activities to establish that reductions have been delivered, and to re-establish which impact factors are then most essential to achieve the target.

For support at every stage of your journey contact our team of experts today:

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PERFORMANCE FACTORS AND DATA REQUIREMENTS

Science Based Targets initiative (SBTi)

Science-based targets are globally aligned goals, rooted in climate science, designed to reduce carbon emissions and limit global warming in line with theUnited Nations Paris Agreement of 2015[1]. These targets provide a clearly defined pathway for companies and financial institutions to reduce GHG emissions in a way that aligns with the latest climate science and the goals of the Paris Agreement[1]. By setting science-based targets for scope 1, 2 and 3 emissions, organisations are committing to taking ambitious climate action.

Net Zero Targets

The concept of net zero has gained prominence in recent years as a critical goal for addressing climate change. Originating from research in the late 2000s which revealed global warming could only be halted if carbon dioxide (CO_2) emissions are reduced to net zero: where balance is achieved between the total emissions produced and the amount removed or offset. This idea became fundamental to the goals of the Paris Agreement, where world leaders committed countries to implement plans that would support the global movement towards reaching net zero CO_2 emissions by 2050.

Product Carbon Footprints (PCF)

Designed by the Together for Sustainability initiative which is driven by chemical procurement specialists, the focus of PCF is product-centric and life cycle-specific, whereas reporting frameworks such as scope 3 are organisation-centric and focus on value chain emissions. PCFs measure the GHG emissions associated with a product throughout its entire life cycle, typically including stages from raw material extraction, manufacturing, transportation, use, and disposal (or cradle-to-grave). PCFs quantify the total emissions (often in CO_2e) for a single unit of a product, which can help companies understand and reduce the environmental impact of specific products. This also aids in communicating emissions to customers, often through labels or certifications.

Product Environmental Footprint (PEF)

An LCA-based method recommended by the European Commission and applicable to many sectors. A PEF has 16 defined points of impact categories including climate change, land and water use, and ozone depletion. PEF assessments also mandate which life cycle stages should be assessed and the use of an end-of-life methodology, the Circular Footprint Formula (CFF).

Circular Footprint Formula (CFF)

The CFF, developed by the European Commission, provides insight to the materials, energy, and disposal considerations for product circularity by allocating environmental burdens or benefits of recycling, reusing, or recovering energy between suppliers and users of recycled materials.

Environmental Product Declaration (EPD)

EPDs provide a robust, standardised view of a product's environmental footprint, measuring GHG emissions, carbon footprint, and other environmental impacts. This data enables stakeholders to make environmentally responsible decisions and valuable sustainable procurement practices.

Extended Producer Responsibility (EPR)

EPR is transforming packaging compliance, requiring manufacturers to take full accountability for packaging waste from production to disposal. Coming into effect in 2023, full financial responsibility shifts to manufacturers aligning with the 'polluter pays' principle.

Businesses may seek expert support to navigate the complex regulatory landscape, ensuring compliance, mitigating reputational risk, and leveraging sustainability as a competitive advantage. Accurate reporting is essential to ensure cost-efficient compliance.

3 https://unfccc.int/process-and-meetings/the-paris-agreement

Ecodesign for Sustainable Products Regulation (ESPR)

Implemented by the European Commission in July 2024, compliance with ESPR encourages organisations to become more environmentally conscious and embrace product circularity. Carbon emissions reporting is required.

EU Omnibus

The Omnibus simplification package is part of the broader EU Competitiveness Compass, published in January 2025, aiming to boost EU innovation, decarbonisation, and economic security. The Omnibus has the goal of streamlining and simplifying the reporting requirements of the three key sustainability directives: the Corporate Sustainability Reporting Directive (CSRD), the Corporate Sustainability Due Diligence Directive (CSDDD), and the EU Taxonomy. However, it is important to note that the exact scope of the Omnibus is also being evaluated so it could include other Green Deal related regulations and directives.

Corporate Sustainability Reporting Directive (CSRD): Requires companies to report on their sustainability impacts, risks, and opportunities against the European Sustainability Reporting Standards (ESRS). Aims to provide comprehensive and transparent information to stakeholders.

Corporate Sustainability Due Diligence Directive (CSDDD): Mandates companies to identify and address adverse human rights and environmental impacts in their operations and value chains.

EU Taxonomy Regulation: Establishes common definitions for environmentally sustainable economic activities to direct investments towards these activities.

The first Omnibus package of potential legislative changes was published in February 2025.

Digital Product Passport (DPP)

Introduced as part of the ESPR, DPPs will not only enhance the traceability of products and their components but encourage sustainability due to public access to product and environmental impact credentials such as carbon emissions – organisations will want their products to remain competitive to customers and consumers.

Safe & Sustainable by Design (SSbD)

Part of the EU Chemicals Strategy for Sustainability policy, SSbD encourages organisations to deliver environmental, social and/or economic value through their applications. Climate change factors and circularity are key to meet the requirements of this framework.

Corporate Sustainability Reporting Directive (CSRD)

Under the CSRD, businesses are required to disclose a comprehensive range of information related to their sustainability practices, aiming to enhance transparency and accountability while helping stakeholders understand the sustainability performance and impact of businesses.

Companies must report on:

1. Environmental policies, practices, and performance, including data on energy use, GHG emissions, water consumption, and waste management.
2. Social policies and practices, such as labour conditions, human rights, diversity and inclusion, and community engagement.
3. Governance practices, including board diversity, executive remuneration, and anti-corruption measures, must be provided.
4. How sustainability is integrated into their business model and strategy, including the impact of sustainability risks and opportunities on their operations.
5. Double materiality, an assessment which considers both the impact of sustainability issues on the company and the company's impact on society and the environment[4].
6. How the company identifies, assesses, and manages sustainability risks, including climate-related risks[5].
7. Key Performance Indicators (KPIs) by providing measurable and verifiable data on key sustainability indicators.

4 https://kpmg.com/uk/en/home/insights/2024/06/the-eu-csrd-and-csddd-regulations.html

5 https://www.pwc.co.uk/issues/esg/sustainability-reporting/corporate-sustainability-reporting-directive.html

Social Value

Companies are increasingly expected to report on various aspects of social value, which generally refers to the positive impact they create through their operations, products, services, and initiatives. These reports help companies demonstrate their commitment to social responsibility and build trust with stakeholders, including consumers, investors, and employees.

They often need to cover:

1. Community engagement such as supporting local community groups, charities, and establishing community amenities like libraries and playgrounds.
2. Economic contributions, including job creation, local supply chain engagement, and opportunities for skill development.
3. Environmental impact is often included, requiring reporting on efforts to lower carbon emissions, restore natural habitats, and safeguard biodiversity.
4. Initiatives that promote physical and mental health in workforces and communities, and demonstrate fair compensation and meaningful employment.
5. Transparency and accountability by using measurable metrics to provide a factual foundation for open communication about progress, successes, and challenges.
6. Compliance with established reporting standards and frameworks, such as the Global Reporting Initiative (GRI) or B Corp Certification, to ensure consistency and comparability with industry benchmarks.