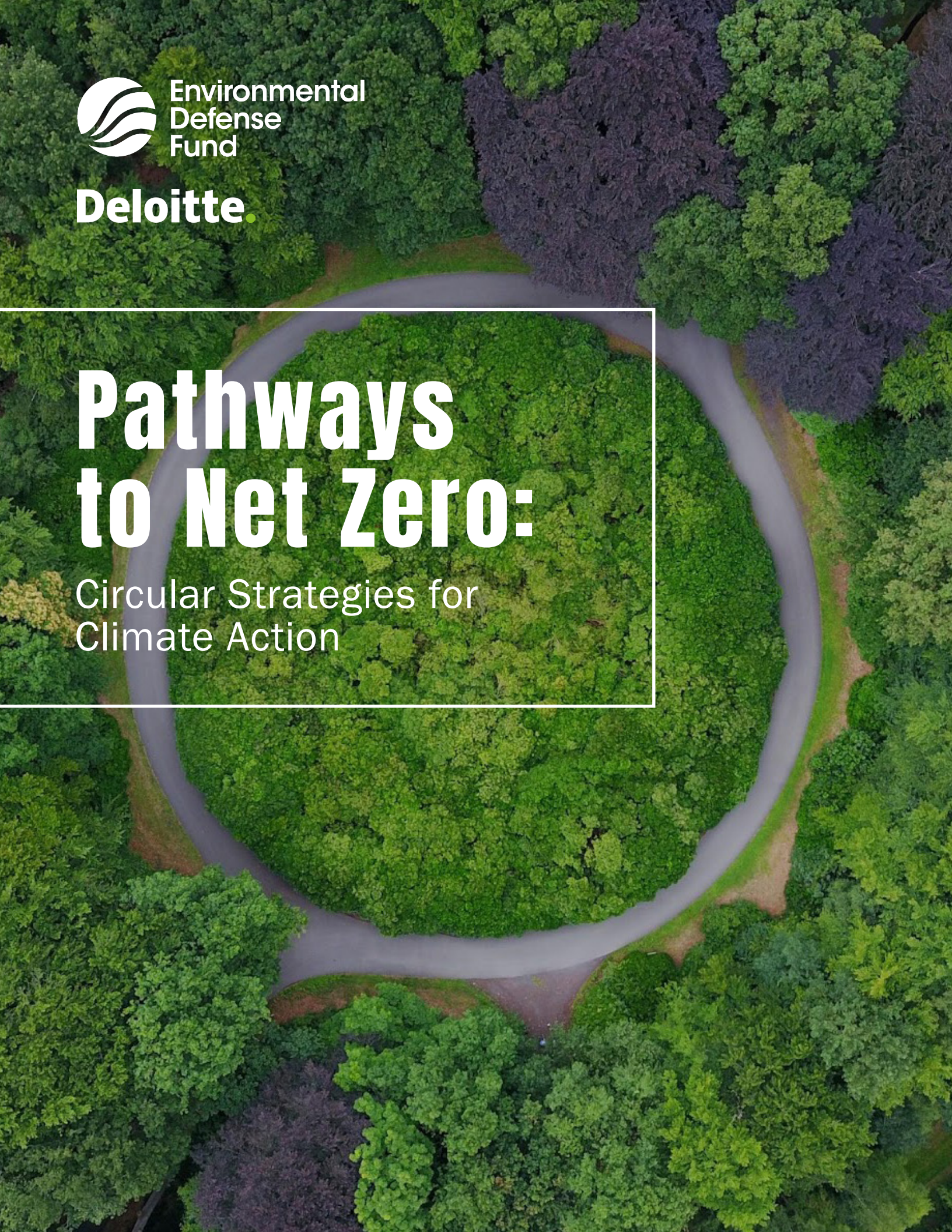
Environmental
Defense
Fund
Deloitte.
Pathways
to Net Zero:
Circular Strategies for
Climate Action

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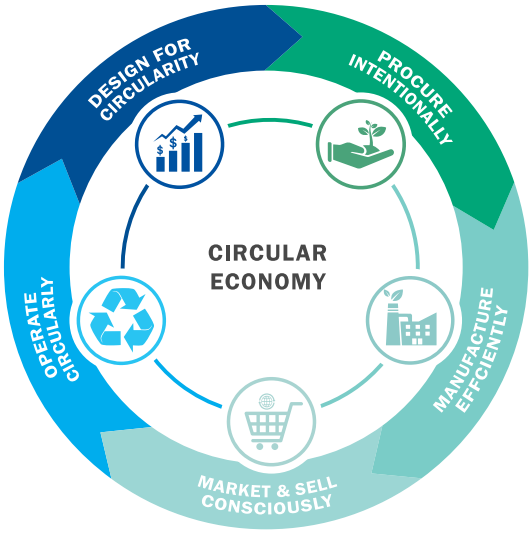
This report was produced by Environmental Defense Fund in collaboration with Deloitte Consulting, LLP,. The views within the report are that of Environmental Defense Fund, and do not necessarily reflect the views of report partners or collaborators.

Executive Summary

Today's global economy consumes 100 billion tons of materials, of which only 7.2 billion tons come from secondary materials. According to some scientists, the use of physical materials is creating harmful health outcomes, economic losses, and untenable levels of greenhouse gas emissions.

Fortunately, 'circularity' — the concept of using and wasting less — can solve several of these problems simultaneously. When done well, this category of opportunities can help businesses benefit financially from reduced resource consumption, reduced waste disposal costs, new revenue streams and more, all while reducing emissions, using less, and improving the livelihoods of impacted communities.

To incorporate circular solutions within your company, use the circular economy framework and associated value lever map to identify, prioritize, and implement specific concepts that meet your business, environmental, and social goals.



DESIGN FOR CIRCULARITY
Products are designed to use and waste less (e.g., durable, modular, lighter-weight, products as a service).

PROCURE INTENTIONALLY
Input materials maximize bio-based, sustainably-sourced, reusable, and low waste principles.

MANUFACTURE EFFICIENTLY
Manufacturing processes are optimized to reduce waste and environmental impact and optimize resource use / value.

MARKET & SELL CONSCIOUSLY
Business models, user experience, and marketing/sales channels are designed to nudge consumers toward lower consumption, lower waste behavior.

OPERATE CIRCULARLY
Business models and operations 'close the loop' to keep materials in use and at their highest value for as long as possible.

Figure 1: A Circular Economy Model

Executive Summary: Circular Strategies

Design for Circularity	Procure Intentionally	Manufacture Efficiently	Market & Sell Consciously	Operate Circularly
Collaborate with product development and design to create circular products and processes.	*Collaborate with suppliers and vendors to procure sustainably-sourced materials.*	*Optimize manufacturing processes to reduce waste and environmental impact and optimize resource use*	*Utilize circular business models and encourage customers to make sustainable choices*	*Integrate circular practices into business operations post-use including closing the loop and optimization*
Reduce **material use** (material efficiency)	Utilize **bio-based** materials or other material substitutions that **divert waste** from other waste streams	Reduce **energy use** and consumption during product manufacturing	Provide **products as a service** and allow producers to retain ownship of the product	Implement product **take-back programs and supporting management systems** (e.g., reverse logistics)
Use **safer chemicals** or **safer alternative chemicals and materials**	**Upcycle waste** into new products or materials of higher value or quality	Optimize materials flows during production **(lean production)**	Utilize a **sharing economy model** (e.g., peer-to-peer rental) to enable more efficient use	Develop a **network** of waste collection/ repair partners
Use **recycled materials**		Improve **forecasting** to limit waste	Pursue **circularity product / service certification**	**Remanufacture**, refurbish, and resale
Use **sustainably sourced materials**		Utilize a customization or **make-to-order model**	**Educate** consumers on circular solutions and practices (e.g., reuse)	**Recycle** products at the end of use
Design **energy efficient** products			Change **customer expectations** to counter need for speed	**Optimize transportation**
Increase **durability and longevity** of products			**Incentivize customers**/ consumers to return products at end of use	
Create **modular and easy to disassemble** products				
Create products that are **easy to repair/ maintain**				
Design more easily **recycled and refurbished** products, including sharing relevant product composition data				

To chart this path toward a more circular economy, companies can take a three-fold approach. While acting directly within your own value chain to reduce the consumption of your products and services is the most obvious opportunity, advocating for circular policies and advancing the ecosystem of circular infrastructure through technology, funding, and partnerships are also critical components of a holistic circular strategy. These strategies underscore that every company has a role to play in the transition to a more circular economy.

Table 1: Circular Solutions by Strategy

Companies can use a three-step process to act, advocate, and advance circularity solutions within their business, supply chain, and the economy at large.

Act

Within your organization and your broader value chain, **embed circularity within your business model and strategy; identify, prioritize, and implement circular solutions, and scale** them across the business.

Advocate

Within the markets, industries, and sectors, where you play, **champion policies, investment, and incentives** that would accelerate and fuel the adoption of circular solutions

Advance

Lay the groundwork for **broader systems change** and **acceleration of the shift to a more circular economy** by **partnering** with others and developing or investing in **technologies** and **financial solutions** that drive business value for circular strategies.

Figure 2: Act, Advocate, & Advance Framework

This report further details how businesses within the textiles, packaging, and automotive sectors can act, advocate, and advance in those specific areas. Specific solutions, policies, and strategies vary by sector, so this report highlights the nuances of three high-impact opportunities for circularity: textiles, packaging, and automotive.

Texiles

400% more clothes are produced now than 20 years ago, yet clothing **utilization has declined by almost 40%** during the same period.[1]

Circular solutions such as resale / recommerce and textile-to-textile recycling help to address this imbalance between clothing production and utilization by keeping products in use longer and cycling existing raw materials into new products.

Packaging

Only 14% of current plastic packaging is recycled, despite 70% of plastic packaging being reusable or recyclable, equating to **a loss of $80-120B per year.**[2]

Leading circular strategies within the plastic packaging industry include redesigning, reusing, recycling packaging.

Automotive

Based on current technology, the World Economic Forum estimates the opportunity for circularity could **reduce automotive carbon emissions by up to 75% and resource consumption by up to 80% per passenger kilometer** by 2030.[3]

As the automotive sector continues to evolve through electrification and further development of micromobility and multimodal transport, two key circular solutions to watch are recycling for electric vehicle batteries and mobility-as-a-service (MaaS).

Introduction

Now, more than ever, businesses must accelerate their action on climate within the rapidly closing window of opportunity to secure a livable and sustainable future for all.[4] Using and wasting fewer resources — the essence of 'circularity' — is a critical part of climate solutions that can simultaneously improve human well-being and planetary health.

Despite significant progress and investments, the Earth's atmospheric greenhouse gases continue to rise and have caused widespread adverse impacts on nature and people.

Inaction on climate could cost $178 trillion in economic value globally by 2070, while immediate action could bolster the global economy by $43 trillion over that time.[7]

Levels of atmospheric carbon dioxide, a potent greenhouse gas, increased to a high of 424 ppm, the highest in millions of years.[5] Human-caused climate change is already having adverse effects globally, including more severe storms, drought, heat waves, flooding, warming oceans, food scarcity, species loss, and an increasing number of climate refugees.[6]

Human activities have raised the concentration of greenhouse gases in the atmosphere. Greenhouse gas emissions continue to rise, and the average annual greenhouse gas emissions between 2010-2019 were higher than any previous decade on record. The impacts of climate change are vast, and some are considered likely to be irreversible (e.g., the loss of summer polar sea-ice). The **cost of inaction on climate change is estimated to be $178 trillion globally** over the next 50 years and includes food insecurity, global migration, increases in infectious diseases, increased frequency of natural disasters, and worse health outcomes.[8,9]"

Many products and processes used in modern life introduce chemical and physical pollutants into the environment.

This includes toxic and long-lived substances such as synthetic organic pollutants, heavy metal compounds, plastics, and radioactive materials, which have a diverse range of risk potentials. Chemical and plastic pollution — two areas of high concern — are closely linked to human activity and production.[10] These compounds have potentially irreversible effects on living organisms and the physical environment, including reduced fertility, genetic damage, fatality, and ecosystem collapse.

Around 45% of global emissions will still need to be addressed beyond the introduction of zero carbon energy, including through circular economy interventions across production and supply chains.

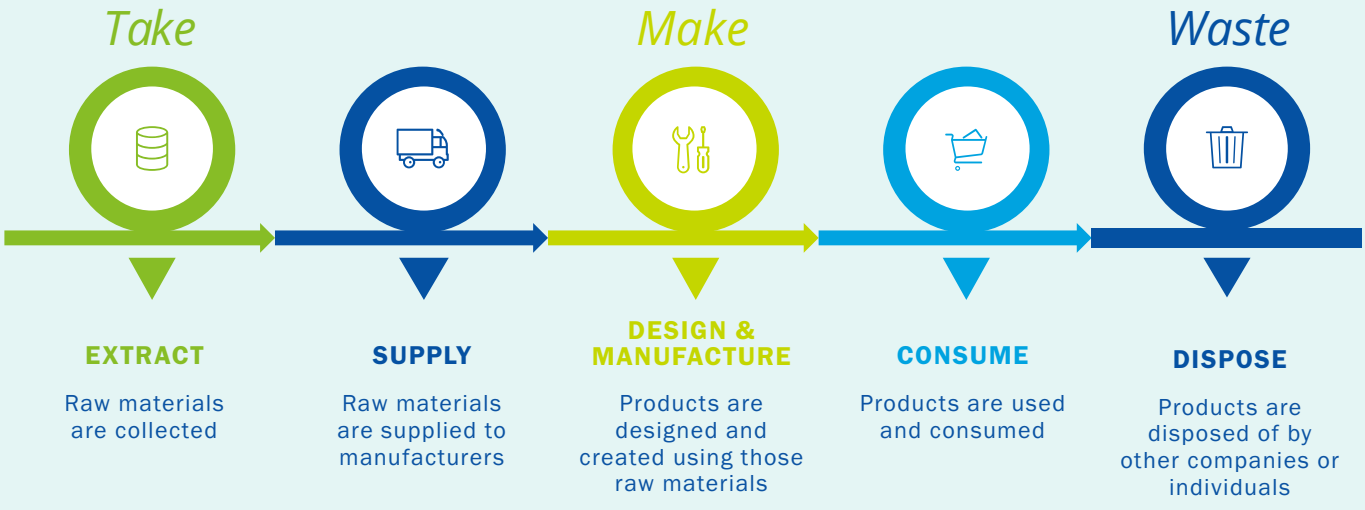


Figure 3: The 'Take-Make-Waste' Linear Model; visual adapted from Closed Loop Partners

Today's **linear economy** contributes to green house gas emissions and our overuse of novel entities through a sequential 'take-make-waste' model of extraction, operations, and value chain activities.[11] Fortunately, there's a category of solutions that can reduce both GHG emissions and novel entity generation and waste: circular solutions.

In contrast to a linear economy, a **circular economy** is "restorative or regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times."[12] This can be achieved, for example, through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling. The transition to a more circular economy needs to go **well beyond simple material efficiency and traditional recycling** – it requires rethinking traditional linear models of production and consumption and adopting a more sustainable, closed-loop system to affect all aspects of resource use and economic activities, from resource extraction to product design, manufacturing, distribution, use, and disposal.

Circular economy interventions should focus on all aspects of the product lifecycle, including the design and use of the product, not just a product's end-of-life.

Shifting from a linear economy to a more circular economy can generate both environmental and social benefits, alongside business value. Environmental benefits include reduced GHG emissions, increased biodiversity through reduced site disturbance, reduced material extraction needs, and increased climate resilience. Social benefits include less reliance on exploitative labor practices, which is a necessary first step to support a just transition; and mitigation of health inequalities from extraction, use, and disposal of resources that disproportionately impact vulnerable populations.

Despite the circular economy's potential for significant economic, environmental, and social benefits, today's economy is still overwhelmingly linear.

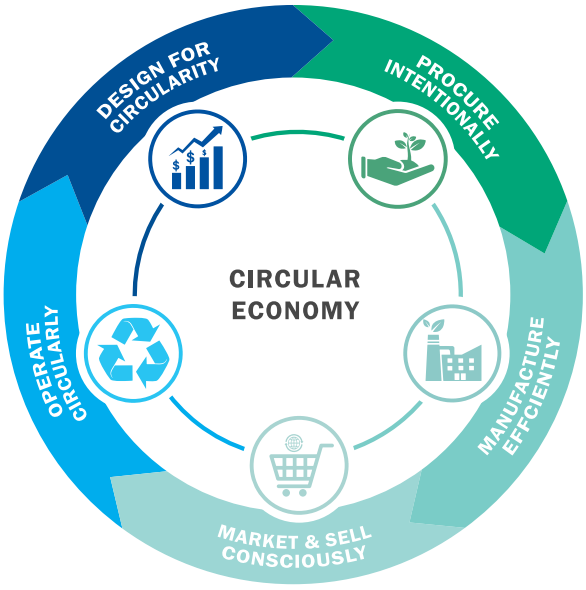


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Figure 4: A Circular Economy Model. The transition to a more circular economy affects all aspects of resource use and economic activities. Circular economy interventions should focus on all aspects of the product lifecycle, including the design and use of the product, not just a product's end-of-first use.

The Circularity Metric, introduced by Circle Economy in 2018, measures circularity by looking at what is flowing into the economy. The 2023 Circularity Gap Report cites that today's global economy consumes **100 billion tons** of materials and only a fraction of that consumption comes from secondary materials (7.2 billion tons, the 7.2% reflected above). Although the percentage of secondary materials flowing back into the economy is not a perfect measure for circularity, it serves as a useful indicator and signal to mark how circularity is trending. Since the 'Circularity Metric' was introduced in 2018, global circularity (as measured by this figure) has **shrunk from 9.1% in 2018 to 7.2% in 2023.**[14]

To transition towards a more circular economy, we must overcome a series of interconnected barriers, encompassing market, technical, regulatory, and cultural challenges.

Only 7.2% of today's global economy is circular.[13]

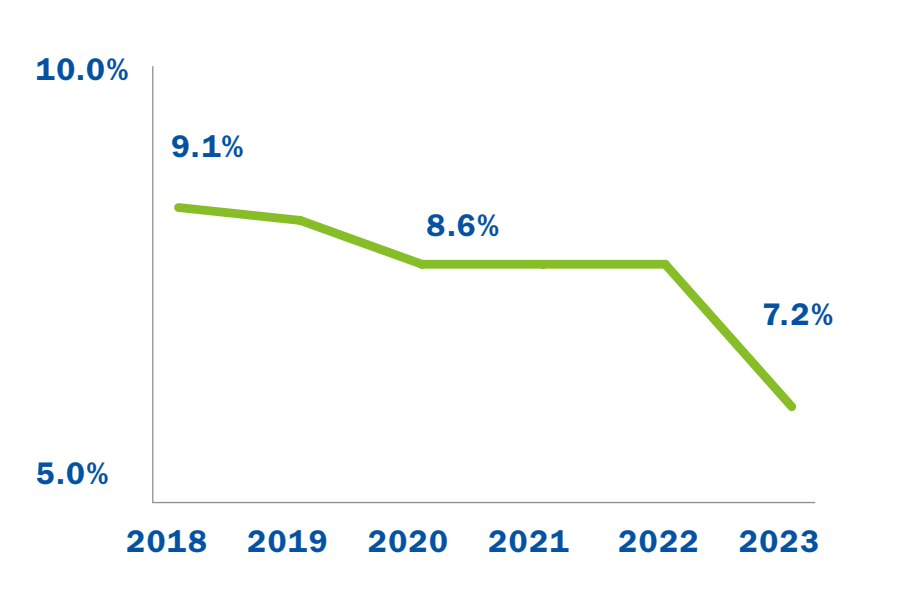
Market barriers refer to challenges that hinder the development and adoption of circular economy practices within the market and include the lack of proven economic viability of many circular business models.

Technical barriers refer to the limitations associated with integration and compatibility of circular technologies at scope and scale. Regulatory barriers include frameworks and policies that hinder the adoption of circular practices and can, in some cases, favor linear production and consumption models.

Lastly, **cultural barriers** include the societal attitudes, values, and behaviors that stem from deep-rooted cultural norms that impede the adoption of circular economy practices.

In addition, there are several systemic barriers that create an undercurrent of resistance that needs to be addressed in order to see widespread circularity adoption. Achieving circularity at scale will require a shift in mindset around the globe, as well as collaboration to coordinate supply chains and develop infrastructure.

Circularity Metric Over Time



"In just the past five years, the world's circularity has shrunk from 9.1% to 7.2% of total material inputs. This isn't simply because we're failing to cycle more. It's also due to increasing virgin extraction and the fact that we are putting more and more materials into stocks like roads, homes, and durable goods."

-Circularity Gap Report, 2023

Figure 5: A Measure of Circularity Over Time. In 2023, only 7.2% of today's global economy is circular

Market Barriers	Technical Barriers	Regulatory Barriers	Cultural Barriers
✓ Lack of proven economic viability of circular business models give current market incentives	✓ Lack of available technologies, including material chemistry processes, and low maturity of technologies to implement circular economy	✓ Existing regulations that discourage circular practices	✓ Lack of awareness and / or prioritization of circular economy principles
✓ Limited access to recycled materials in quantity and quality needed	✓ Presence of toxic chemicals in the materials can prevent them from being reused or recycled	✓ Lack of polices that support the transition to a more circular economy	✓ Lack of awareness of benefits of circular economy practices and minimal understanding of how linear practices impact the enviroment
✓ Significant investment in new technologies, processes, and infrastructure required to implement circular practices	✓ Lack of investment in circular innovation and technologies	✓ Lack of standardization and clarity in policy on how to handle and dispose of waste streams	✓ Unwillingness to pay a premium for circular products
	✓ Limited and inconsistent data hinders impact measurement of circular solutions, which inhibits investment and innovation		✓ Difficulty shifting cultural norms, habits, and behaviors given current emphasis on materialism and consumption

System Barriers
✓ Circularity at scale requires 1) shift in mindset and behavior across multiple stakeholders, 2) collaboration and coordination across the supply chain, and 3) development of industry-wide infrastructure
✓ Limited supply chain integration and collaboration among different stakeholders
✓ Friction during the transition toward a circular economy between linear systems and circular solutions, such as resistance from customers, vendor, other supply chain partners; technical challenges of building / maintaining new and existing infrastructure; etc.

Figure 6: Barriers in the Transition to a More CIrcular Economy [15,16]

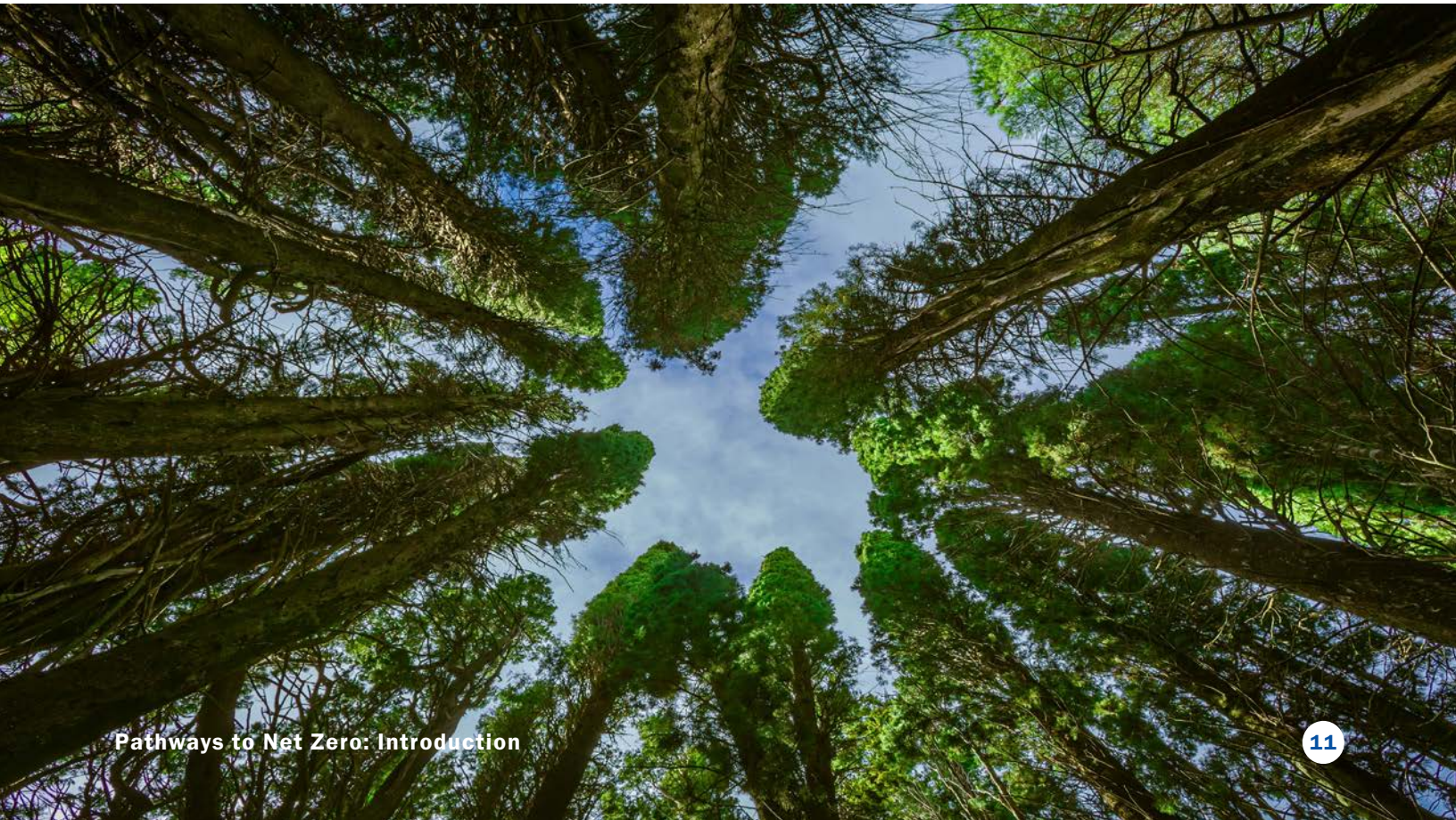
Overcoming these challenges and adopting circular solutions can drive significant business value for companies while supporting their path to net zero.

Nearly 40% of Fortune Global 500 companies have set net zero targets, but considerable action is still required to reach them.[17] The latest Intergovernmental Panel on Climate Change (IPCC) report on the climate crisis asserts that we are not doing nearly enough to cut emissions and limit temperature rise, and we are off course to meet the targets set out in the Paris Agreement.[18]

Much of the net zero focus is on clean energy, energy efficiency, and other energy issues, but this can only take you so far. Around 45% of global emissions will still need to be addressed beyond the introduction of zero carbon energy, including through circular economy interventions across production and supply chains. A circular economy plan is thus indispensable to achieving net zero targets.

Energy efficiency, renewable energy sources, and other climate measures without circular economy considerations present serious risks of rebound effects which may cancel out some of the climate benefits of those policies.

In order for a company to achieve any net zero target, the circular economy needs to be a part of its plan.



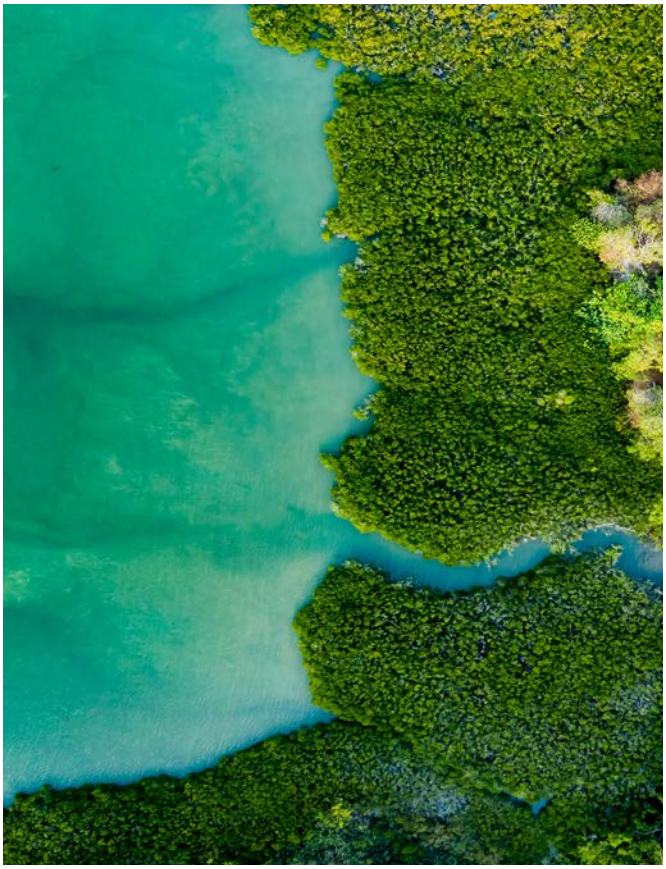
The circular economy is not just an added benefit to businesses; it is crucial to achieve their net zero targets and it makes good business sense. Core circularity value drivers for businesses include:

A circular economy could reduce global emissions by an estimated 39%.[19]

- **Reducing input costs** due to using less and using more efficiently
- Generating **additional revenue** via new business and profit models (e.g.; resale)
- Reducing GHG emissions and reporting progress against climate targets
- **Strengthening brand and reputation** via a commitment to sustainability and responsible business
- **Managing regulatory risks** through early adoption of strategies in line with anticipated requirements
- **Managing risk of resource scarcity or price volatility** through resource efficiency and diversification of supply chains
- Building **more resilient and flexible business** and supply chains to better navigate the impacts of climate change (growing seasons, natural disasters disrupting supply chain, etc.) and business environment fluctuations

This report builds on the first three 'Pathways to Net Zero' reports by helping companies adopt circular solutions to address their environmental impacts, drive value through sustainable solutions, and achieve net zero goals. It's important to acknowledge that not all circular solutions are climate solutions. This report focuses on the intersection of the two areas (circular solutions that do reduce GHG emissions) in order to demonstrate how circularity can serve as another pathway to net zero.

This report can serve as a guide to drive business value through circularity and help businesses meet critical climate goals by applying circular principles. To do this, we designed a framework for thinking about circularity and a roadmap to help guide businesses on how to act on, advocate for, and advance circular solutions. Throughout this report, we include numerous case studies to share examples of businesses leading the way on circularity and what they have learned in the process.



Lay the Foundation

Pathways to Net Zero: A Guide for Business

This report sets **the imperative for net zero** and empowers business leaders with **sector-specific pathways to reach 2050 targets,** including action items for companies, industries, and sub-sectors to take today to drive leadership, advocacy, and investment.

Chart the Path Foward

Pathways to Net Zero: The Decisive Decade

As many companies struggle to prioritize near-term actions, this report provides a two-part **playbook to help companies accelerate their climate action:** 1) how to develop a robust emissions profile, 2) prioritize abatement solutions. Together, these phases provide company leaders with a straightforward approach to accelerate their climate progress.

Develop and Deploy

Pathways to Net Zero: The Innovation Imperative

New abatement technologies and solutions are needed to reach net zero. This report demystifies the **landscape of climate technology** and provides a clear set of recommendations for how business leaders and investors can lead in a low carbon future through **strategic action and advocacy** that accelerate the development and deployment of the most promising climate technologies.

Close the Loop

Pathways to Net Zero: Circularity & Climate

An important lens for businesses to consider on their pathways to net zero journey is circularity. This report provides an **overview of the circular economy** and levers for businesses at large and by sector.

The report will include:

- Overview of general circularity levers
- Action-oriented steps for businesses to act on, advocate for, and advance circularity with case studies
- Sector-specific deep dives and strategies to accelerate circularity within textiles, packaging, and automotives

Figure 7: Building off the 'Pathways to Net Zero" Report Series [20,21,22]

The ‘What’ of Circularity: Practical Principles and Solutions for Businesses

Every company and individual has a role to play in advancing the circular economy. With levers at each step in the value chain, companies must readily and effectively take steps to incorporate circularity into their business, enabling significant progress towards a circular economy.

Business has a critical role to play in a circular economy, given that the extraction and processing of materials, fuels, and food contribute half of total greenhouse gas emissions and over 90% of biodiversity loss and water stress.[23]

Companies play an important role in bringing this circular economy to life, and circular solutions can help companies use less and waste less. This can be achieved by:

1. **Designing for circularity:** Develop products that are more durable, modular, lighter-weight or products as a service
2. **Procuring intentionally:** Minimize waste and maximize the use of bio-based, sustainably sourced or reusable materials
3. **Manufacturing efficiently:** Optimize processes to reduce waste and environmental impact and optimize resource use / value
4. **Marketing and selling consciously:** Enable and encourage customers / consumters to propel the circular economy
5. **Operating circularly:** Close the loop and keep materials in use and at their highest value for as long as possible

Within each of these stages of the circular economy, there are specific tactics/actions that you can take, depending on the nature of your business and your objectives:

Design for Circularity	Procure Intentionally	Manufacture Efficiently	Market & Sell Consciously	Operate Circularly
Collaborate with product development and design to create circular products and processes.	*Collaborate with suppliers and vendors to procure sustainably-sourced materials.*	*Optimize manufacturing processes to reduce waste and environmental impact and optimize resource use*	*Utilize circular business models and encourage customers to make sustainable choices*	*Integrate circular practices into business operations post-use including closing the loop and optimization*
Reduce **material use** (material efficiency)	Utilize **bio-based** materials or other material substitutions that **divert waste** from other waste streams[1]	Reduce **energy use** and consumption during product manufacturing	Provide **products as a service** and allow producers to retain ownship of the product	Implement product **take-back programs and supporting management systems** (e.g., reverse logistics)
Use **safer chemicals** or **safer alternative chemicals and materials**	**Upcycle waste** into new products or materials of higher value or quality	Optimize materials flows during production **(lean production)**	Utilize a **sharing economy model** (e.g., peer-to-peer rental) to enable more efficient use	Develop a **network** of waste collection/ repair partners
Use **recycled materials**		Improve **forecasting** to limit waste	Pursue **circularity product / service certification**	**Remanufacture**, refurbish, and resale
Use **sustainably sourced materials**		Utilize a customization or **make-to-order model**	**Educate** consumers on circular solutions and practices (e.g., reuse)	**Recycle** products at the end of use
Design **energy efficient** products			Change **customer expectations** to counter need for speed	**Optimize transportation**
Increase **durability and longevity** of products			**Incentivize customers**/ consumers to return products at end of use	
Create **modular and easy to disassemble** products				
Create products that are **easy to repair/ maintain**				
Design more easily **recycled and refurbished** products, including sharing relevant product composition data				

Table 2: Circular Solutions by Strategy[24]

Design for Circularity

Businesses can leverage solutions at the design stage that focus on influencing material selection to reduce input costs and improve product quality. Circularity solutions at the design stage can be broken into two categories: material selection and circular design.

Material selection levers focus on choosing materials with sustainable and circular properties to maximize resource efficiency and minimize environmental impact, including the following:

Reduce material use (material efficiency or dematerialization)
Use the minimum amount of material possible and maximize yield while still delivering the required utility which includes minimizing transportation of raw materials. Doing so can drive value by reducing raw material needs and input costs.

Use safer chemicals or safer alternative chemicals and materials
Stop the use of materials that contain hazardous elements or chemicals that harm humans or the environment and replace with known and vetted safer alternatives, formulations, and materials (sustainable chemistry). This can drive value by improving product safety and mitigating risks associated with hazardous materials at all stages of the life cycle, including possible litigation. It can also help improve brand reputation.

Use recycled materials
Develop products that incorporate materials that have been reclaimed or repurposed from waste streams or end-of-use materials. This can drive value by reducing input costs and differentiating the brand and improving its reputation.

Use sustainably sourced materials
Develop products using sustainably or responsibly sourced materials. This can be confirmed via third-party product certifications that verify sustainable sourcing practices. Third-party certifications affirm that the product or company certified meets the standards of the certifying authority. This can drive reputational value by improving the perceived quality of the product. Fibershed is an example of a non-profit organization working to strengthen textile communities through sustainably-sourced materials.

Design energy efficient products
Design and develop products to use the minimum amount of energy throughout their operational use. This can drive value for the business by reducing operating costs, creating product differentiation, and creating a premium through third-party certifications.

Fibershed: Environmental Health

Use sustainably-sourced materials

- Develops regional fiber systems focused on community and environmental health
- Over 200,000 lbs. of Climate Beneficial Wool produced
- 45 communities around the world and over 75,000 people engaged through education and community events

Circular design levers focus on designing solutions with the product's end-of-life in mind to facilitate full recovery and recycling. Consider designing for longer use to maximize a product's utility, while balancing efforts to minimize the use of materials. These strategies enable businesses to maximize returns by prolonging use and recycling.

Increase durability and longevity of products
Increase longevity and use of products by increasing physical and emotional durability. One example of an apparel company taking action to increase durability of products is Lacoste.

Physical durability: Create durable products that resist wear- and- tear over time through material choices and construction, including component reinforcement.

Emotional durability: Increase and maintain a product's relevance and desirability to users over time.

This drives value through improved reputation and by unlocking additional business opportunities that take advantage of durability, such as rental models.

Create modular and easy to disassemble products
Design modular products that are easier to disassemble and repair. This can create business value by allowing customers to customize products and helping products to retain their value because of the lower cost of repair.

Create products that are easy to repair/maintain:
Develop products that can be easily repaired and/or upgraded as needed to extend their lifespan. Consumers can perform repairs, or products can be returned to the manufacturer for maintenance. This can drive value by creating consumer loyalty and differentiating the product and brand in the market.

Design more easily recycled and refurbished products, including sharing relevant product composition data
Design products so that their components and materials can be remade or recycled into new products at end-of-life. Share product composition data with downstream users so that products can more easily be recycled at end-of-life. This can drive value by increasing the value of components and lowering the cost and effort to repair or recycle products.

Lacoste: Durability Standards

Increase durability & longevity of products

- Lacoste is applying durability standards to apparel as outlined in its product durability protocol, including work to reduce pilling and improve color retention
- The protocol has been assessed by a third party (Quantis France)

Procure Intentionally

Businesses can source sustainably and intentionally to improve resource security while also strengthening relationships with suppliers. To effectively implement procurement strategies, businesses need to work with suppliers to ensure availability of sustainably sourced products. Doing so can strengthen relationships across and beyond the value chain and minimize waste.

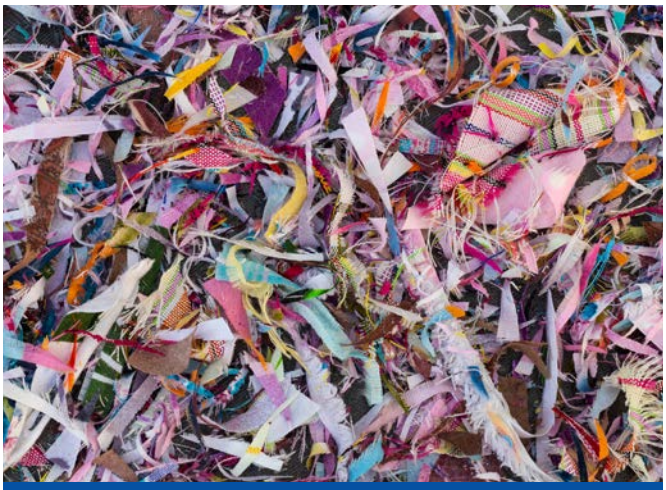
Upcycle waste into new products or materials of higher value or quality

Recover and divert materials from waste streams into new, higher quality products that can be sold back to consumers. This drives value by reducing waste management costs, unlocking additional revenue streams, and improving resource security. Note, it's important to ensure upcycled ingredients are of consistent enough quality to be used in manufacturing and to ensure product safety at scale. Looptworks is transforming excess textiles through partnerships and limited-edition upcycled products.

Utilize bio-based materials or other material substitutions that divert waste from other waste streams

Source regenerative materials and resources from waste streams from the production of food and/or forestry products to limit adverse impacts such as land use change, biodiversity loss, or deforestation.[25] This drives business value by increasing supply chain resiliency, reducing exposure to regulatory uncertainty and price volatility, and reducing GHG emissions within the value chain.

This can also create co-benefits, such as higher revenues for farmers and foresters and preservation of biodiversity. Further investment in the development and end-of-life collection of bio-based materials will be needed to make this solution viable because its small scale and sophistication of materials and applications makes bio-based packaging three to five times more expensive than fossil-based packaging materials currently.[26] Additionally, it's also critical to ensure that production of bio-based materials does not spur land conversion, deforestation, or competition with land use for food production.



Looptworks: Textile Waste Transformation

Upcycle waste into new products

- Partners with clothing companies to transform textile waste into new products
- Partners with brands including Walmart, Google, Delta, and Columbia
- Has conserved over 77m gallons of water

Manufacture Efficiently

Streamlining manufacturing processes allows businesses to minimize waste, environmental impact, and resource consumption and to reduce operational and manufacturing costs.

Manufacturing levers optimize production processes through targeted strategies such as energy reduction, lean production, and adoption of new business models like the make-to-order model. These levers help reduce costs and generate additional revenue while minimizing resource consumption.

Reduce energy use during product manufacturing Use energy efficient processes and/or renewable energy in product manufacturing can reduce operating costs.

Optimize materials flows during production (lean production/lean manufacturing): Eliminate waste (e.g., overproduction, inventory, transportation, defects, over-processing, waiting) from the manufacturing process that does not add additional value to the customer. This focuses on balancing lean supply chains with supply chain stability in the face of possible global shocks. Doing this well can reduce manufacturing costs, improve quality, and decrease time to customer.

Improve forecasting to limit waste: Utilize and strengthen forecasting and ordering tools to improve flow of inventory, which requires investment in improved forecasting technologies at various stages of the value chain. This can reduce ongoing operating costs and wastage.

Utilize a customization or make-to-order model: Use a make-to-order business strategy in which the manufacturing process starts only after a customer has placed an order for a product. This may require investment in technologies to deliver customized products (e.g., 3D printers), but offers several benefits including product customization options, reduced inventory and wastage, and the possibility to command a price premium.[27] Prose utilizes a make-to-order model to provide customized hair and beauty products.

Prose: Custom Beauty Brand

Utilize a customization or make-to-order models

- Utilizes a hyper-custom, made-to-order business model, offering products for consumers who have historically been excluded from traditional beauty offerings and often disproportionately impacted by climate change
- Creates significantly less waste than a typical mass production model by eliminating much of the surplus

Market & Sell Consciously

Companies can utilize circular business models to generate new revenue streams, encourage consumers to make sustainable choices, and drive brand loyalty. Adopting circular business models may help businesses monetize sustainability opportunities and reduce supply chain risks, but transitioning away from linear processes requires establishing new collaborations and developing new systems, which can carry risks of their own.

Provide products as a service and retain business ownership of the product: Provide services instead of products by renting or leasing the product to customers instead of selling. Producers are responsible for products at end-of-use. This typically requires heavy investment in after-sales and maintenance capabilities. This can drive new and more consistent revenue streams compared to traditional sales models, increase the opportunity for meaningful customer interactions, and help build customer loyalty.

Utilize a sharing economy model (e.g., peer-to-peer rental) to enable more efficient use: Maximize the use of goods and resources and increase the number of users per product by using digital platforms for renting, selling, sharing, and reusing. This can lead to additional revenue generation and value derived from products.

Incentivize customers and consumers to return products at end-of-use: Intentionally reward customers who opt to engage in circular business models and elevate the experience to make it more desirable in comparison to buying new (e.g., personalized services), incentivizing the return of products at end-of-use. This can build brand loyalty by increasing the number of customer touchpoints and improve access to consumer data and preferences. For example, Madewell incentivizes customers to return jeans by providing a $20 credit.

Pursue circularity product / service certification (e.g., function guarantee): Provide a certification or lifetime warranty for a product. In the latter case, the producer takes responsibility for the product's maintenance and longevity. Third-party certifications, like Cradle to Cradle (C2C),

Madewell: Denim for Insulation

Incentivize customers to return products at end-of-use

- **Recycles any denim in partnership with Cotton's Blue Jeans Go Green™ program; provides $20 credit**
- **Uses as housing insulation for communities in need; 80% of insulation made comes from post-consumer recycled denim**
- **1,096,265 jeans recycled since the start of partnership and 548 tons of waste saved from landfill**

demonstrate to consumers that your product sustainability or circularity claims have been evaluated. This can help drive price premiums and differentiate your products while building consumer trust and brand loyalty. Patagonia achieved a Fair Trade Certified™ certification for their Tee-Cycle shirts.

Educate consumers on circular solutions and practices (e.g., reuse): Inform and educate users on the benefits of circular solutions to shift consumer behaviors and consumption patterns. Empower customers to build emotional durability with products, increasing and maintaining the product's relevance and desirability over time for them. This can drive website traffic and demand and help build brand loyalty and reputation.

Change customer expectations to counter the need for speed: Influence and reward customers for prioritizing sustainability and circular economy principles when making purchase decisions (e.g., resisting the need for 1- or 2-day shipping). This can reduce costs and, if successful, improve customer satisfaction.

Patagonia: Circular T-Shirts

Pursue circularity product certification

- Tee-Cycle shirts are made from discarded T-shirts and can be recycled into a new T-shirt at the end of its useful life
- Shirts contain 70% pre-consumer recycled cotton and 30% post-consumer recycled cotton
- Already marked as Fair Trade Certified™ sewn T-shirts, Patagonia could also pursue a circularity certification once the certification space matures to lend credibility and further differentiate its product

Operate Circularly

Integrating circular practices into business operations post-use can reduce environmental impact and generate business value by adding customer touchpoints, and creating resale opportunities.

Businesses can further maximize operational effectiveness by optimizing transportation and waste-to-energy conversion. Though challenging in terms of technical limitations and infrastructure requirements, these actions can also drive business value by reducing costs and adding revenue streams.

Implement product take-back programs and supporting management systems (e.g., reverse logistics)
Implement an initiative or program to collect used products or materials from consumers. Partner with end-of-life logistics firms and material processing firms to set up necessary systems. This can drive business value by strengthening customer relationships, lowering the cost of goods sold, creating an alternate supply of input materials, and mitigating risks associated with hazardous material handling. For example, Apple stood up a take-back program for customers to bring in their used Apple products.

Develop a network of waste collection and repair partners
Build relationships with organizations that collect waste materials and repair products and partner with them to create a closed-loop system. While this can add complexity, it can help provide additional insights into the value chain and reduce raw material needs and costs.

Remanufacture, refurbish, and resale
Remanufacturing is recovering, disassembling, and repairing components for resale at "new product" performance and quality. Refurbishing is collecting discarded products and refinishing them to serve their original functions. Refurbishing is not comparable with new or remanufactured products. Implementing these solutions can create new revenue streams and increase the total utilization of the product and its materials.

Apple Trade-In Devices

Implement take-back programs

- **Program allows customers to return their used Apple devices for recycling or trade-in**
- **Customers can receive credit toward the purchase of a new Apple product**
- **Returned devices are either refurbished and resold as part of Apple's certified program or recycled to recover valuable materials**

Note: This work is an independent publication and has not been authorized, sponsored, or otherwise approved by Apple Inc.

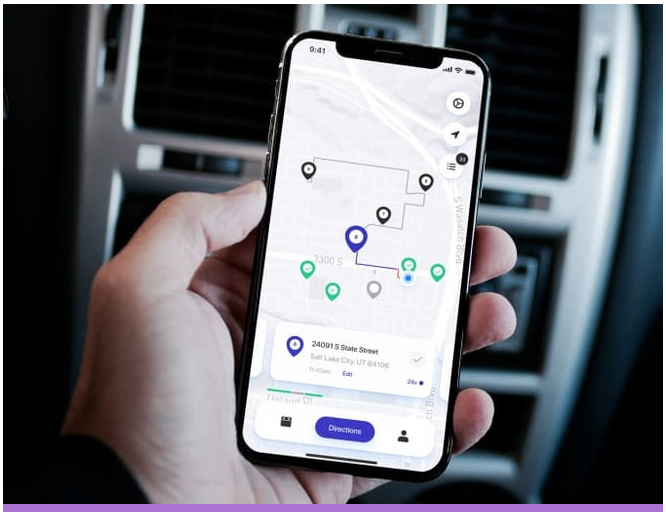
Recycle products at end-of-use

Recycle and recover waste materials to produce new products from recovered materials. This can reduce energy and raw material costs. Some challenges businesses may encounter include:

- Recycling and recovery happen at the local level where consumers live, which can be difficult for large businesses to coordinate.
- Some products are challenging to recycle (e.g., chemical additives can compromise quality or safety of recycled output) due to insufficient information for sorting, low maturity of scalable high-quality recycling technology, and a patchwork of municipal recycling systems with varied rules.

Optimize transportation

Minimize unnecessary transport by decreasing distance between processes and simplifying systems. This can reduce transportation costs and risk of product loss/damage. One instance of optimizing transportation is UPS's ORION model.



UPS: Efficient Delivery

Optimize Transportation

- Utilizes On Road Integrated Optimization and Navigation (ORION) to determine the most efficient delivery routes
- Saves over 100,000 tons of CO2 emissions annually
- Savings of $300-$400 million annually as a result of optimized routes

The ‘How’ of Circularity:
A Roadmap for Action, Advocacy, and Advancement

Companies that aim to increase their adoption and scaling of circularity can consider three main categories of action: they can Act by adopting circular solutions within their company, Advocate for policies, incentives, and investments for circular solutions, and Advance the ecosystem of partnerships, technologies, and financial solutions needed to enable other organizations’ adoption of circular solutions.

This roadmap serves as an on-ramp for businesses to achieve and scale circularity within and beyond their companies to achieve climate goals, improve their bottom lines, and reduce their environmental impacts.

Act

Within your organization and your broader value chain, **embed circularity within your business model and strategy; identify, prioritize, and implement circular solutions, and scale** them across the business.

Advocate

Within the markets, industries and sectors, where you play, **champion policies, investment, and incentives** that would accelerate and fuel the adoption of circular solutions

Advance

Lay the groundwork for **broader systems change** and **acceleration of the shift to a more circular economy** by **partnering** with others and developing or investing in **technologies** and **financial solutions** that drive business value for circular strategies.

Figure 8: Act, Advocate, & Advance Framework

Act

'Act' focuses on levers and approaches to help companies directly adopt circular solutions within the value chains of the products and services they sell. While the underlying activities vary by industry, sector, company type /size or geography, most companies can benefit from answering a set of shared strategic questions to Plan, Implement, and Scale circular solutions:

Plan 1

- What materials are we using today and how do they flow through our value chain?
- What environmental, social, and economic objectives /outcomes do we hope to achieve? What key performance indicators (KPIs) will help us measure those outcomes?
- What circularity solutions should we pilot in the near-term and long-term?

Implement 2

- What people, process, and technologies do we need in place to activate these solutions?
- How will we monitor and measure progress?
- What are the quick wins that will help us gain early momentum and buy-in with target customers and business leaders?

Scale 3

- What have been the measurable impacts of our pilots, and how can we improve upon them based on their results?
- What product lines, functions, and/or geographies can we expand our most successful pilots to?
- What financing, funding, and/or resources do we need and what metrics will help secure this?

Figure 9: Act — Plan, Implement, and Scale Circular Solutions

Plan 1

What materials are we using today and how do they flow through our value chain? To understand what circular solutions best suit your business, it's important to first establish a clear understanding of how materials flow through your value chain, what outcomes you'd like to achieve, and which levers to pull to achieve those outcomes.

Doing so can help quantify resource consumption, estimate waste generation, and measure the circularity of a system. The exact steps, diagram, etc. you use for your analysis may differ from other companies based on the nature of your business, how mature your circularity efforts are, and the type of information you have available / seek to gain. There are three primary methods to measure and monitor material flows / material efficiency.

Product Lifecycle Assessment (LCA)

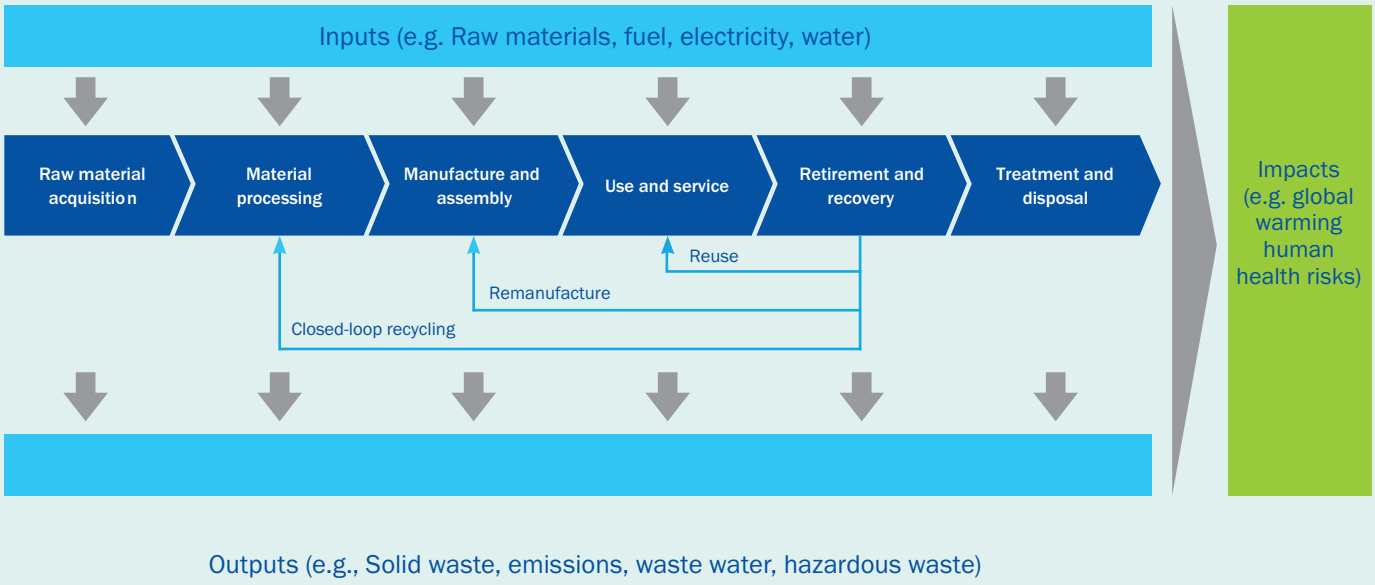
This methodology is designed to help businesses measure and quantify the end-to-end environmental and economic impacts of a product, process, or service.

By rigorously examining each step in the life cycle, a LCA considers how raw materials and chemicals were extracted and processed; the consumption of the resources involved in planning or designing the product; chemical building blocks, materials and energy used during manufacturing, packaging, and distribution; impacts from using the product; and waste and pollution created throughout the process and at end-of-life.[28]

Approach: The International Standards Organization (ISO) created ISO 14040 and 14044 standards for conducting LCA studies. Such studies involve four steps:

1. Establish the goal, scope, and boundary of the study
2. Complete a life cycle inventory analysis
3. Conduct a life cycle impact assessment
4. Interpret the results to make a business decision

To learn more about conducting an LCA and the value it can bring, check out this white paper from Deloitte.



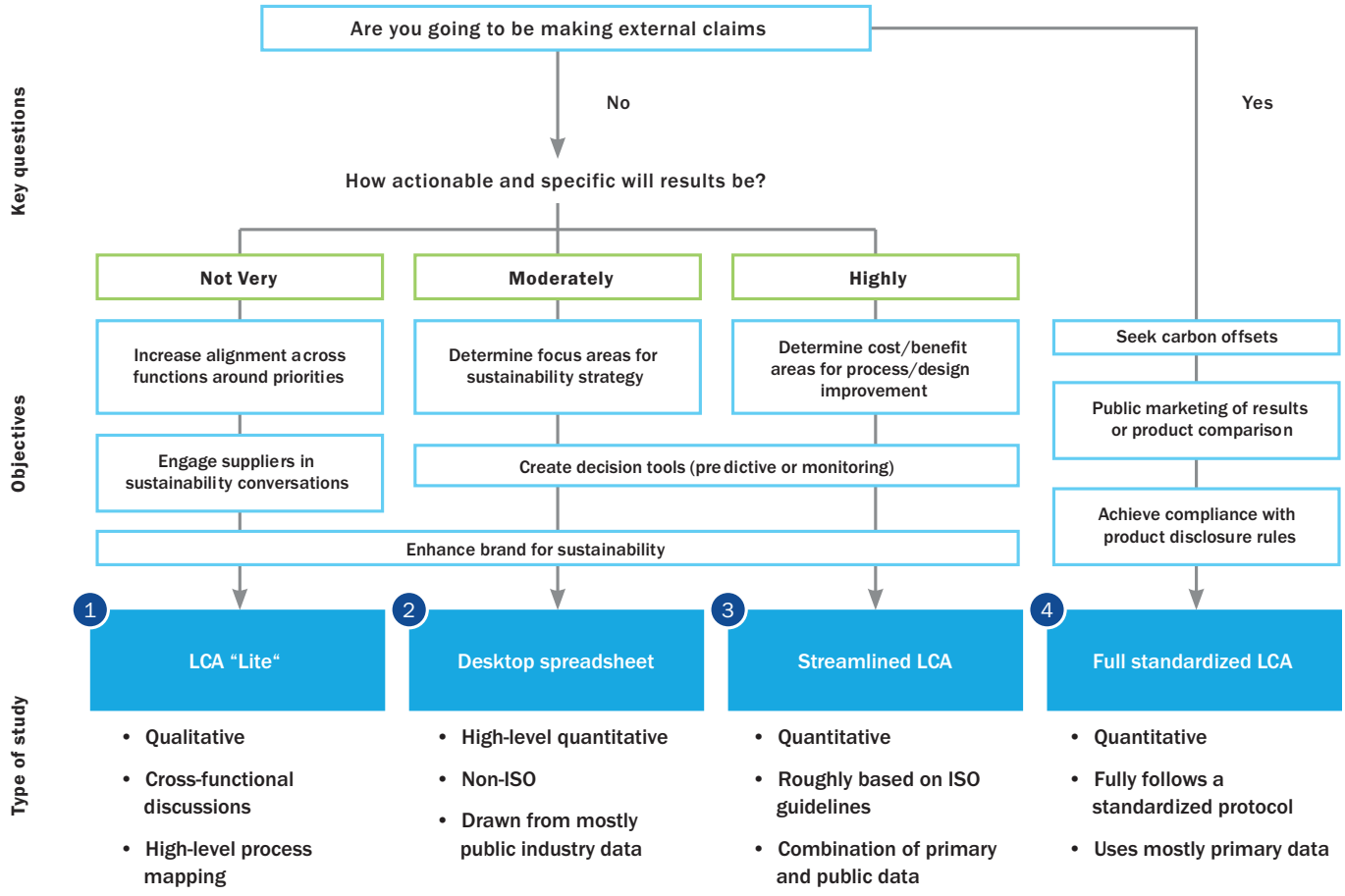


Figure 10: Product Life Cycle and Scoping Decision Tree, "Enhancing the Value of Life Cycle Assessment," Deloitte, 2012

Materials Journey / Value Chain Mapping

In this analysis, the focus is on understanding the path key raw materials currently travel through your value chain, from source to sale to post-use disposal. This mapping can help you start to think through how you might eliminate, transform, or close key material loops for products and packaging and identify opportunities to streamline materials for efficiency, safety, and sustainability; repurpose product components or wasted materials; or eliminate waste and pollution entirely.[29]

Note that this approach can also be used for forward-looking planning – exploring new paths beyond the first use of a product.

Approach: As the name implies, a value chain mapping involves laying out all the key activities along the value chain:

1. For a product / process, map out the existing steps in your value chain, including extraction, logistics and distribution, manufacturing or configuration, sales, use and end-of-life.
2. After its first use cycle, consider what happens next – biodegrading, getting reused / repurposed, getting repaired or refurbished, getting remanufactured, getting recycled, or being disposed of?
3. Document these different flows, considering different lifecycles for different components (where possible to separate).
4. Interpret results and related opportunities for circular solutions, such as focusing on the points in the value chain with the highest waste.

For more on how to conduct this mapping, you can reference high-level description here, the detailed diagram at right or the Product Journey Mapping exercise from Ellen MacArthur Foundation.

Material Flow Analysis

More technical in nature, material flow analysis (MFA) is an evaluation method which assesses the efficiency of use of materials using information from material flow accounting. Material flow analysis helps to identify waste of natural resources and other materials in the economy which would otherwise go unnoticed in conventional economic monitoring systems.[30]

Analyzing the materials and flows that go into your value chain can provide valuable insights into the overall circularity of your company's operations and areas of opportunity. Using these insights and your core business strategy can help you define the specific outcomes you'd like to achieve. This, in turn, allows you to prioritize activities and investments to support these objectives.

Approach: The high-level steps within a material flow analysis are as follows:

1. Define a question to answer and the relevant system boundaries, processes, and flows of materials / substances; while this could be done more broadly (e.g., at the economy level) you'll likely complete this at the company or product level
2. Collect data on flows and stocks needed to measure material flow
3. Use the principle of mass conservation to estimate any unknown quantities and maintain balance
4. Illustrate and interpret sources, stocks, flows, and sinks
5. Make recommendations for opportunities to optimize the system

Detail on the steps within MFA can be found above or in this OECD Guide.[31,32,33]

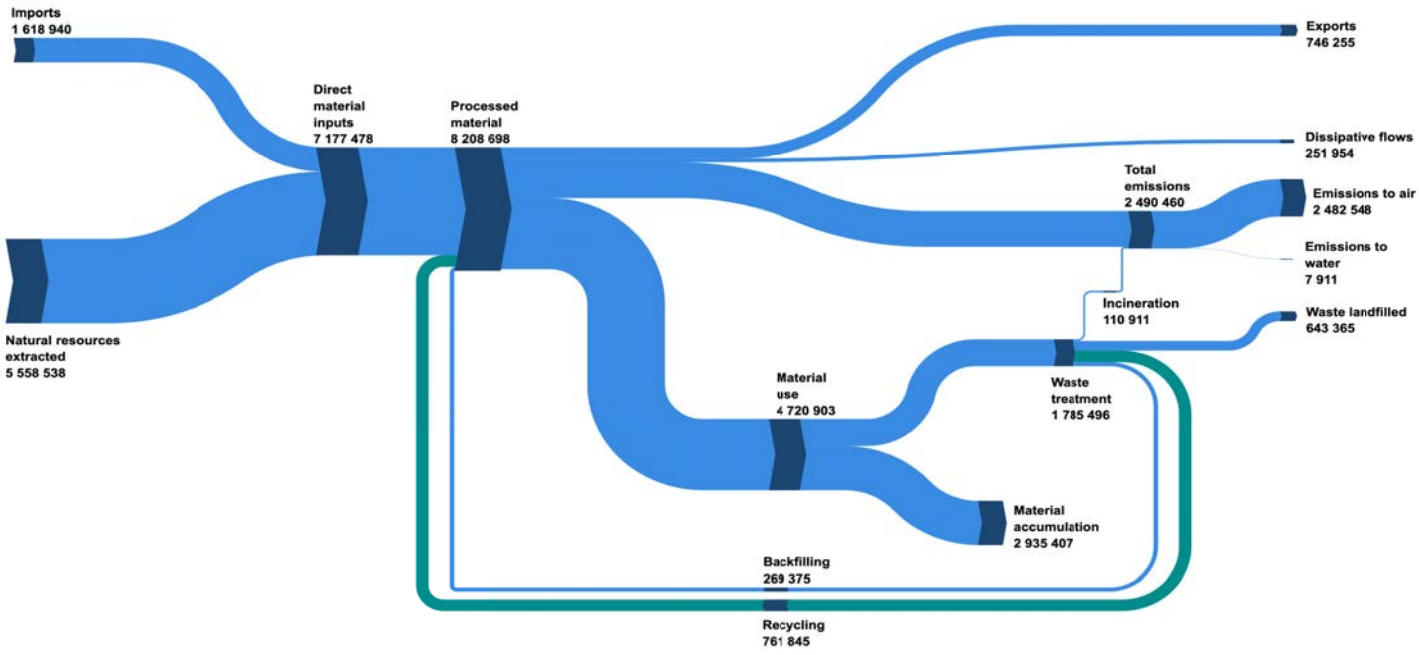


Figure 11. Illustrative Materials Flow Approach Diagram, "Material Flow Diagram," Eurostat, 2021

What environmental, social, and economic objectives / outcomes do we hope to achieve? What key performance indicators (KPIs) will help us measure those outcomes?

Just like any other area of the business, it is important to set **goals and targets** at the outset of your circularity efforts. Where possible, these goals should be **specific, measurable, achievable, relevant, and time bound.**

Questions to consider when defining the desired outcomes for your circularity and climate efforts include:

1. What environmental and social outcomes do we hope to achieve through this work?
2. What financial goals do we hope to achieve?
3. How will we define and measure success for this work 10 weeks from now? Five years from now?

Environmental Outcomes

- Reduction of waste
- Conservation of resources
- Lower carbon footprint
- Reduced pollution
- Increased resource efficiency

Social Outcomes

- Job creation
- Improved working conditions
- Improved health and safety
- Reduced inequality
- Increased community engagement

Economic Outcomes

- Cost savings
- Increased revenue
- Improved resource efficiency
- Reduced supply chain risk
- Enhanced brand value
- Job creation

Figure 12. Sample Outcomes to Consider

For each objective, there should be a corresponding metric or key performance indicator (KPI) that can be used to monitor and track results.

In its deep dive on "'Circular Metrics for Business,"' Circle Economy and Platform for Accelerating the Circular Economy (PACE) outline the landscape of circular metrics including three types of indicators:[34]

Headline indicators are focused on providing you with a verdict on how well you are performing. A limited number of indicators are used, e.g., the circularity gap metrics.

Performance indicators are focused on assessing the physical processes underlying your circular performance. Indicators should include all stages of the value chain, such as share of secondary materials used and recycling rates.

Process indicators are focused on monitoring the transition process at your organization. Many different indicators are needed to highlight different aspects of change processes.

One metric that is gaining traction as a potential standard is the **Circular Transition Indicator (CTI) framework**, developed by the World Business Council for Sustainable Development to determine and measure circularity based on the inflow and outflow of materials based on mass.

Environmental Outcomes

Headline Indicator	Sample KPIs
Reduction of Waste	Circularity %, waste levels, share of circular products
Performance Indicators	
Conservation of Resources	Share of secondary materials used, recycling rates
Lower Carbon Footprint	GHG emissions
Reduced Pollution	Pollution levels, share of renewable energy
Process Indicator	
Increased Resource Efficiency	Resource use (input, output, # of uses before EOL)

Figure 13. Potential Outcomes to Consider

Target Setting Resources

WBCSD Circular Transition Indicators

UNEP Guidance on Resource Efficiency and Circular Economy Target Setting

PACE Corporate Circular Target-Setting Guidance

Figure 14. Target Setting Resources

What circularity solutions should we pilot in the near-term and long-term?

Once a business understands its material flows and has defined its objectives/goals for circularity and target markets, it can more effectively evaluate potential circular strategies to determine which to prioritize. Though not exhaustive, the levers presented in the 'What' section of this report serve as a starting point for circular solution identification. Using the framework presented in the Pathways to *Net Zero: The Decisive Decade* report,[35] businesses can evaluate and prioritize solutions /strategies based on expected climate / waste abatement, business value, cost and feasibility, and equity and justice. Scoring and comparing these solutions based on the expected benefits (Factors 1, 2, and 4) and level of effort anticipated (Factor 3) can help you prioritize in the near and long-term. Abbreviating this evaluation process can be appropriate to improve speed to market and learning.

Climate Abatement

a. Is the magnitude of expected long-term (GWP100) emissions reduction high? medium? low?

b. If emissions include high intensity gases (e.g., methane), is the magnitude of overall expected near-term (GWP20) emissions reduction high? medium? low?

c. What is the expected timeline for realizing emissions reduction (considering technological maturity and commercial viability)?

d. What is the likelihood of it meeting its expected level of emissions reduction?

Business Value

a. Is it likely to generate new revenue for the organization through new revenue streams or new customers (e.g., appealing to younger customers)?

b. Is it likely to reduce costs for the organization?

c. Is it likely to reduce organizational risks (e.g., supply chain, shareholder, regulatory)?

d. What is the magnitude of overall expected business value?

Cost and Feasibility

a. What is the expected cost of implementation (CapEx and OpEx)?

b. What assets and what level of business transformation would it require (bolt-on vs. full reconfiguration e.g., assets)?

c. What skills and resources would it require?

d. What partnerships would it require?

Equity and Justice

a. Who is impacted by the emissions that the solution aims to reduce?

b. How would these populations be impacted by the solution?

c. What additional stakeholders would be impacted by implementing the solution, and in what way?

d. What solutions do frontline communities want to see in response to this challenge?

e. Do frontline communities support or oppose the proposed solution?

Figure 15. Pathways to Net Zero: The Decisive Decade framework for evaluating climate abatement levers

Implement

2

What people, processes and technologies do we need in place to activate these solutions?

To bring circular solutions to life, it's critical to ensure that companies have the right people, processes, and technologies in place to execute on their strategy and that these efforts are cross-functional. Pursuing quick-wins early on can help secure the momentum and buy-in needed to expand and scale efforts.

The exact people, processes, and technologies you'll need for activation will depend on which solutions you choose to activate. The following questions can help you identify what's most relevant to you and your business and where to start. Answers to these questions can be used to develop an action plan.

People	Processes	Technologies
What additional **talent and skillsets** will we need beyond current capabilities?	What **design processes** need to be established?	What **digital solution(s)** can be used to **connect consumers / users** to this effort (e.g., peer-to-peer or DTC marketplace(s), ecommerce platform(s), browser plug-ins)?
Input from internal and external teams across the value chain is needed to ensure a solution is circular. Which **function(s) or other team(s)** will be leading, supporting, and informing the effort to bring this solution to life?	What processes should be used for **approval of ideas and investments?**	What technologies can be used to **increase traceability** (if applicable, e.g., digital product passports)?
Who needs to approve **investments and related decisions?**	What internal and external **communication systems / mechanisms** should be used?	What tools or technologies can be used to **facilitate waste management** (e.g., sourcing, sorting, recycling)?
Who will be held **accountable** for the success of this effort?	What **technical processes** will be needed to implement this solution (e.g., procurement, manufacturing, operations and / or supply chain)?	Can **artificial intelligence and / or machine learning** be used to increase efficiencies and reduce waste?
What, if any, **partnerships** could help us execute?	What **commercial support** will be needed to implement this solution?	
What **additional stakeholders** would or could be impacted by implementing the circular solution, and in what way?	What processes will be used to **measure** success?	

For example, to measure and monitor progress on circularity initiatives, the right metrics and reporting tools need to be implemented. This requires working across people, processes, and technologies. More specifically, you might ask the following questions about each:

How will we monitor and measure progress?

After KPIs are set, successfully measuring them requires completing several steps, including:[36]

- Selecting the solution (data collection, storage, manipulation)
- Collecting data
- Computering and analyzing the data
- Translating into action
- Evaluating and monitoring

What are the quick wins that will help us gain early momentum and buy-in with target customers and, business leaders?

Transitioning to a more circular economy requires systems change, and therefore requires investing and acting now to influence long-term results. To garner support for such longer-term efforts, however, it is critical to show results early through quick wins.

After reviewing the circularity solutions that fit with your business, you can home in on quick win opportunities by answering a few guiding questions:

1. Which opportunities are most adjacent to our existing capabilities and technologies?
2. What subsets of our customer base (e.g., geography, product line, etc.) can we target for a pilot project? What variables are both meaningful and actionable for segmentation?
3. What hypotheses would we want to test and refine through this pilot?
4. What funding can we access and how does that align with the opportunities in consideration?

A **quick win** is a tangible, near-term opportunity to pilot a solution or intervention in a low investment, low effort manner focusing on a minimum viable product (MVP)

Scale

3

What have been the measurable impacts of our pilots, and how can we improve upon them based on their results?

Not all circularity pilots will succeed, and that's okay. Pilots should be designed with a learning mindset to test hypotheses and gather data on how solutions can be refined and scaled. In the nascent field of circularity, in which data is limited, first-hand data collection is critical.

When evaluating the success of a pilot, reflect on:

1. What were the results of our pilots (quantitative and qualitative impact)?
2. Is the sample size of data large enough to be valuable?
3. How do the results compare against our predetermined KPIs?
4. What worked well? What can be improved?
5. What alternative solutions might address the problem more effectively?
6. How could future pilots and associated evaluation methods be refined to improve the learning process and speed to market?

Direct operational and financial data from your company can serve as the foundation for pilot analysis, including key metrics such as waste, emissions, and sales. This data can be complemented by consumer / user focus groups, ethnographic research, and expert interviews. Data quality and completeness will depend on the resources of your company and the fidelity of the pilot concept; external research can help inform estimated impacts of the program to fill gaps in data and refine hypotheses as needed.

What product lines, functions, and/or geographies can we expand our most successful pilots to?

Successful pilots present an opportunity for scale, but all too often companies fail to connect successful pilot projects to successful scaled implementations. While it may sound like a perfectly logical strategy to replicate the exact elements of a pilot study to ensure its replicability, there is plenty of evidence to show that pilot results are often not replicated at scale. An analysis of these failures points to several causes. People chosen to participate in pilots may modify their behavior in response to their awareness of being monitored; the pilot participants may comprise a nonrepresentative sample of consumers and employees most interested in the concept; pilot projects are often given extra resources and support; and cultural barriers to change are often suspended due to the framing of the concept as a pilot.[37]

Overcoming these barriers requires a thoughtful balance of communicating the successes and learnings of a pilot while providing autonomy and flexibility for implementation in new products, functions, and customer segments. When scaling the solution, allow individuals and teams to adapt its elements to their unique circumstances, such as differences in customer preferences or cultural ways of working. During implementation, use the power of peer competition to spark even more innovation, and track results across teams to generate additional learnings and opportunities for solution refinement.[38]

What financing, funding, and/or resources do we need and what metrics will help secure this?

To scale efforts related to circularity, it is critical to communicate impact and opportunity size to relevant stakeholders (e.g., business leaders, budget owners) to secure the necessary funding and other resources.

To fund and bring additional pilots, expanded pilots, and / or implementation of solutions to life, it is important to:

Drive the structural changes needed at global, national, and local levels to sustain co-benefits for successful pilots (e.g., policy, government purchases, tax, corporate commitments, financial instruments, R&D funding, bank loans).

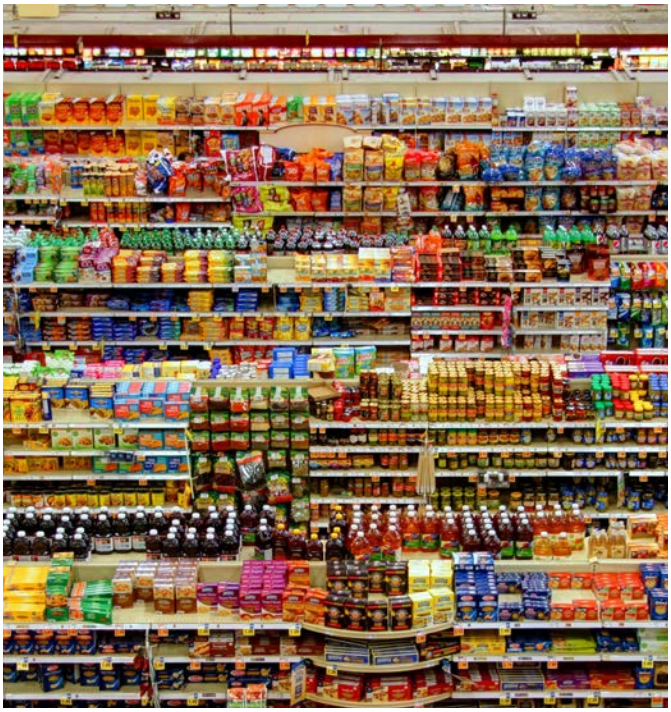
Reinforce the collective ambition across key stakeholderts (employees, investors, etc.) to build enduring trust and ownership over circular activities and outcomes.

Codify principles and an action plan for long-term circular investment and action based on flexible and agile cycles of testing, learning, and scaling to refine understanding of, and plan for, a transition to circular economy.

Communicate program successes and provide stakeholders with the data, results, tools, education, and network to lobby for change.

Research & Development Spend	To continue innovating and driving change, it's important that companies continue to fund efforts directly through R&D budgets. It's important to know budget request processes and advocate for funding.
Government Credits & Incentives	As local, state, and federal policies evolve, public funding in the form of grants, tax incentives, rebates and more may become available to support your work. These policies should be factored into strategy and applied for / applied as appropriate.
Green Bonds	Green bonds are debt securities; borrowers issue them to secure financing for projects that will have a positive environmental impact. Investors who purchase these bonds can expect to make a profit as the bond matures. Green bonds often offer tax benefits too.
Internal Sustainability Funds	Your organization may have its own sustainability fund – get to know the main objectives and targets for that fund, who makes funding decisions, and what the process is to secure funding. Tailor your application for funds to those parameters.
Partnerships / Collaborations to Co-Fund	Consider co-investing with another company or organization(s) who shares your values and / or circular ambitions. This approach provides the opportunity to combine complementary areas of expertise / operations and share benefits.

Figure 16. Circularity Funding Mechanisms



Questions to consider when evaluating sources of support include:

1. What internal / external sources of support are available for this work?
2. Who controls the funding / resources? What information do they need?
3. What is most important to us (e.g., maximizing impact, improving equity)?

Advocate

While actions taken by individual businesses are necessary, they are not sufficient to shift the global economy from a linear to circular model — this will require systems change.

To better enable circularity at the market, industry, and sector levels, it is important for organizations to promote and reinforce the policies, investments and incentives that support the transition to a more circular economy and to net zero. In this way, the regulatory environment can, in turn, make circular strategies more viable for companies.

Circularity is good for businesses, but most supply chains and infrastructure today are not built to adequately support it. Given the significant investment and effort required to shift to a more circular economy, it's important that companies not try to "go it alone" but rather think about how best to engage peers, policymakers, and lawmakers to foster a regulatory environment that can support and amplify that individual organization's aspirations more broadly. Systems change and coordination among key players (e.g., through an industry trade association) will be critical to a successful transition to a more circular economy.

Understanding the existing regulatory landscape helps **identify policies and strategies to support or oppose through advocacy efforts.** Public policy and regulation can make certain efforts more viable for businesses and drive behaviors by addressing market failures.

Much like we wouldn't expect companies to pay directly for the roads they drive on to deliver goods, we need more centrally organized, co-funded infrastructure to enable circularity. Take, for example, post-consumer plastic bottle recycling. It would be expensive and impractical (though not impossible) for most individual companies to pay for and bring to life their own collection and processing infrastructure all on their own. They can, however, advocate for policies that help bring those types of capabilities and infrastructure to life, shaping the development of laws and policies (and associated funding) — with others' support. In the U.S. context, the EPA's proposed National Recycling Strategy recognizes "the need to implement a circular economy approach for all — reducing the creation of waste with local communities in mind and implementing material management strategies that are inclusive of communities with environmental justice concerns." The EPA does not consider waste-to energy as a recycling strategy. EPA's NRS aims to create a more resilient and cost-effective national recycling system with the following objectives:[39]

1. Improve Markets for Recycling Commodities
2. Increase Collection and Improve Material Management Infrastructure
3. Reduce Contamination in the Recycled Materials Stream
4. Enhance Policies to Support Recycling
5. Standardize Measurement and Increase Data Collection

Supporting strategies and policies like this can help encourage further public policy efforts (e.g., extended producer responsibility) and drive public and private investments toward the areas where you need to see infrastructural development or innovation.

Current Regulatory Landscape

Understanding the global regulatory landscape for circularity within and beyond your geography can help identify opportunities to capitalize on circular solutions and de-risk vulnerability to regulatory changes. Many value chains are global and must comply with the regulations of the jurisdictions in which they operate, and many regulations are replicated across geographies. Understanding the landscape of circularity policies, such as single use plastic restrictions in the E.U., for example, can help inform the policies to advocate for in the U.S. and increase readiness for these potential regulatory changes. For those reasons, it's important to understand what regulations exist today, what regulations are expected to come soon, and what that means for businesses. Select policies and strategies to know include:

The E.U. is relatively advanced when it comes to circular economy, but even in the E.U., circular economy policy is still in its infancy. Actual material use in the E.U. has increased in recent years (when accounting for imported products), demonstrating a continued need for action and improvement.[40]

E.U. Green Deal *adopted by the European Commission in March 2020.*[41] The E.U.'s roadmap for a climate neutral Europe by 2050, comprised of policy on circularity, sustainable food systems, biodiversity, and financing the green transition.

- Key Circularity Component: Circular Economy Action Plan (CEAP).[42]

- Policies by product type (i.e., plastics, recycling, and waste, etc.) that targets how products are designed, promotes circularity, prevents waste, encourages sustainable consumption, and aims to ensure waste is prevented and resources used are kept in the E.U. economy as long as possible. As announced in CEAP, the E.U. has revised the circular economy monitoring framework to "ensure it responds to the latest circular economy priorities, taking better account of climate neutrality and other priorities of the European Green Deal." Published in May 2023, the revised monitoring framework introduces new indicators such as materials footprint and resource productivity to monitor the material efficiency of the E.U.'s production and consumption system as well as new indicators related to waste prevention targets.[43]

Ecodesign for Sustainable Products Regulation (ESPR) *published in March 2022.*[44,45]

A framework of ecodesign requirements to improve the circularity and energy performance of products, ESPR expands on the existing framework to include the broadest possible range of product groups (not just energy-related products) and broader requirements (e.g., durability, reliability, reusability, reparability, ease of maintenance, presence of substances that inhibit circularity, etc.).

- *Key Circularity Component:* Digital Product Passport (DPP).[46]

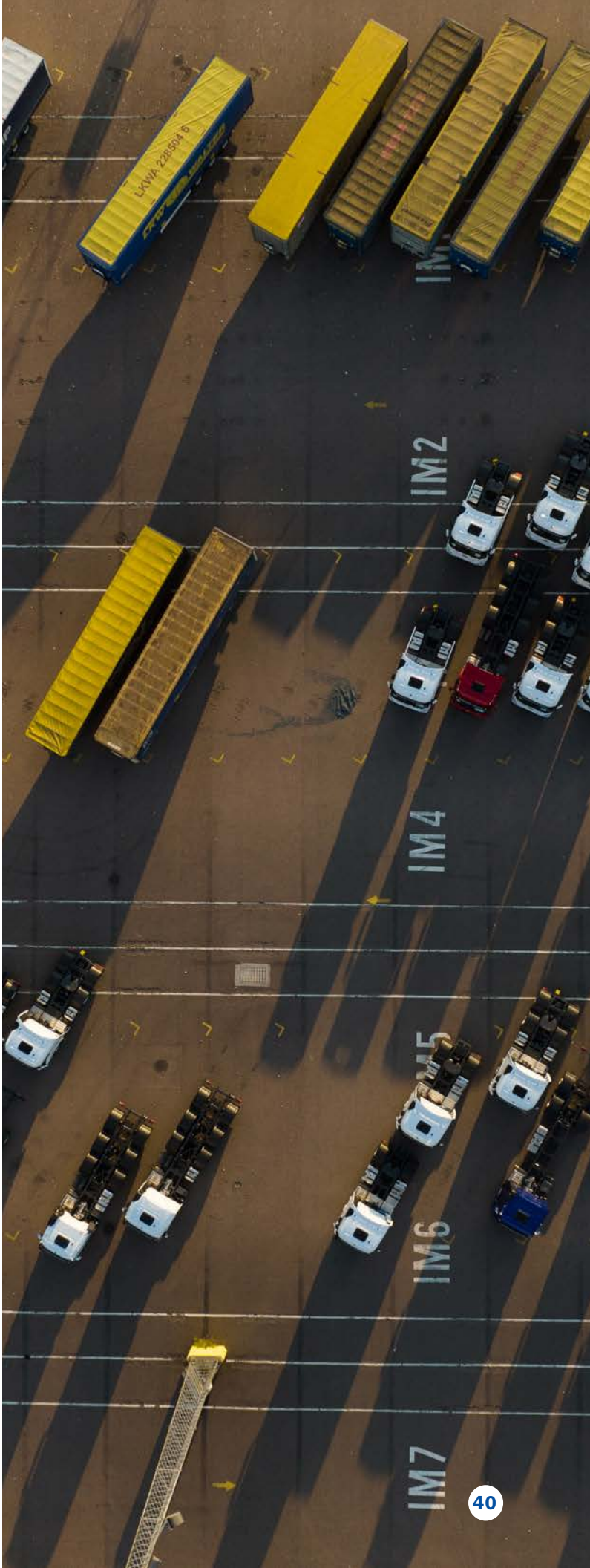
- A new requirement for regulated products, DPPs collect, store, and easily access product data across the product life cycle. They ensure consumers know the environmental impacts of their purchases and make it easier to repair / recycle products. Final approval of DPP regulation expected in 2023/2024, enforced in 2027.

Revision of the Directive on Packaging and Packaging Waste *1994 policy updated in 2018, pending change.*
The original policy outlines the E.U.'s rules on managing packaging and packaging waste. Updates include a focus on preventing the production of packaging waste and promoting the reuse, recycling, and other forms of recovery of packaging waste to contribute toward a circular economy.[47]

- *Key Circularity Component:* Extended Producer Responsibility (EPR).[48]

- This directive states that E.U. countries should have EPR schemes established for all packaging by the end of 2024.[5] Under this EPR policy, companies that produce packaging materials are required to fund local recycling programs by paying fees, shifting the financial burden away from local governments and taxpayers. EPR fees can also incentivize companies to make packaging more recyclable and use a greater percentage of recycled content. This financial support helps to ensure universal recycling access and high participation rates.[28]

Revision of directive on end-of-life vehicles published in July 2023.[49] This major revision combines Directive 2000/53/EC on end-of-life vehicles and Directive 2005/64/EC on the type approval of motor vehicles with regard to their reusability, significantly improving the reuse and recycling of raw materials in automotive value chains.[50]



Policies supporting the circular economy have taken root all around the world over the past few decades. A few examples of those policies and strategies include:

Canada

1

National Action Plan on Zero Plastic Waste two phases developed in 2019 and 2020, which presents a framework for collaborative action on plastic waste and pollution and outlines specific actions to take in Canada

United States

2

Inflation Reduction Act passed in 2022, introducing tax credits and incentives e.g., for renewable energy and domestic manufacting (encouraging recycling)

Solid Waste Infrastructure for Recycling Grant Program passed in 2022, introducing $70M in funding to improve solid waste management planning, data collection and program implementation and past-consumer materials management and infrastruture

The Recycling Education and Outreach Grant Program passed in 2022 provides $30 for projects to improve consumer education and outreach on waste prevention, reuse, recycling and composting

At the state and local level: **Plastic Bag Bans and Charges, EPR Schemes**

France

3

Tech Repairability Index introduced in 2021, combatting planned obsolescence by requiring manufacturers of certain electronic devices (e.g., smartphones, laptops) to score how repairable their products are for consumer awarenes, forcing some changes in product design

Nigeria

4

National Environmental Regulations revised in 2022, to reduce pollution from its electronics sector, strengthening the Nigerian Extended Producer Responsibilty Programme. This makes producers accountable for the end of life of their products in Nigeria, which is the leading importer of electrical and electronic equipment in Africa

South Africa

5

South African Plastics Pact led by GreenCape formed in 2022 by businesses from the plastics value chain, the government, and NGOs

China

6

Circular Economy Promotion Law of the People's Republic of China published in 2008, last updated in 2018, to promote the development of the circular economy, improving the resource utilization efficiency, protecting and improving the environment and realizing sustainable development

Japan

7

Disclosure and Engagement Guidance to Accelerate Sustainable Finance for a Circular Economy published by Japan's Ministry of Economy, Trade and Industry and Ministry of the Environment in 2021

Figure 17: Policies Supporting the Circular Economy Across the Globe

These policy trends are expected to continue, further encouraging and incentivizing a transition to the circular economy. In the E.U., for example, the European Commission, has multiple strategies and proposed legislation under review related to circularity, including the E.U.-wide end-of-waste and by-product criteria for plastics and textiles. Expected in 2024 (but subject to change based on the next election cycle), this effort seeks to identify the most suitable candidate streams for further E.U.-wide end-of-waste criteria in priority areas plastics and textiles.[51]

Promising Circularity Policies to Advocate For

Companies can advance circularity-related policies that protect human health and the environment by focusing advocacy efforts on regulation. A few to prioritize include:

Extended Producer Responsibility (EPR)
An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle, shifting responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities.

By making manufacturers responsible for the entire life cycle (design through use and disposal), EPR incentivizes manufacturers to design with environmental considerations in mind, designing products for durability, recyclability, and ease of disassembly.[52] As noted previously, many countries in Europe and other regions have passed some form of EPR legislation — often related to packaging. In the U.S., six states have passed EPR or similar laws, but all action at the federal level is voluntary. With EPR schemes in practice, manufacturers typically pay a small fee to a Producer Responsibility Organization (PRO) for every item sold, and that PRO uses that funding to build up and execute the collection and recycling processes needed.

Multiple businesses are already actively advocating for EPR schemes, recognizing the benefits such as emissions reduction (less plastic packaging per unit), less reliance on harmful polymer types like PVC, potentially lower costs of post-consumer recycled materials (PCR) and energy savings of up to 88% for using PCR rather than virgin plastics to create packaging.[53] In advocating, you should urge regulating bodies to structure these policies in a way that incentivizes and encourages innovation and addresses the core issues. For example, EPR policies could account for total absolute production levels, business-level production levels or business-level circular efforts as mechanisms to generate a relative tax or credit, rather than just applying a flat tax per item.

Case Study: Coca-Cola

Together with influential partners like the American Beverage Association and Consumer Goods Forum (CGF) Plastic Waste Coalition of Action, Coca-Cola has not only voiced its support for EPR through published perspectives and op-eds but also actively worked to develop a framework for EPR programs to support the improvement and development of waste management systems around the world, all while also leading other circular efforts through their World Without Waste initiative.

Tax Incentives, Rebates, and Subsidies

Tax incentives, rebates and other financing instruments can help offset the costs associated with transitioning to circular business models and have been very successful in increasing adoption of other climate-focused efforts such as building out EV infrastructure. One such example with implications for circularity is the Inflation Reduction Act (IRA) in the United States which includes $369B in climate and clean energy investments, making it the largest, most ambitious climate legislation ever passed by Congress. The IRA includes funding for investments in renewable energy, which will increase the need for end-of-life solutions for existing renewable energy infrastructure and assets as upgrades and advancements are made.[54,55] The IRA includes incentives that encourage recycling and reuse of materials within the U.S., such as batteries, by placing an emphasis on domestic manufacturing and defining materials sourced within the U.S. (even if recycled and originally sourced outside the U.S.) as being U.S.-based.

Standards and Targets

As previously mentioned, a key marker of circularity is the percentage of material inputs into the economy that are secondary materials vs. newly extracted. While increasing that percentage is important, it's also critical to reduce the absolute material inputs into the economy. A natural next step would be to have economy- or sector-wide targets, a policy driver that's been proven effective (like GHG or RES targets). This also signifies that circular economy is taken as seriously as climate. The European Parliament voted (non-bindingly) for the E.U. to establish such targets "based on science" and the Netherlands has such a target: by 2030 the consumption of primary raw materials should have been reduced by half. Sample targets could relate to recycling rates, resource efficiency, landfilling targets, and industry-specific targets. Two challenges to manage are that (1) **relative targets** often obscure increases in waste due to absolute increases in material use and (2) policies may lead to **rebound effects** — inducing more material use due to increased efficiency. Another step could be setting **product design standards** that promote durability, reparability, and recyclability (similar to the effect of EPR). These types of policies can be appealing to businesses because they turn the ability to design more circular products or effectively reduce waste / recycle into a necessary investment and a competitive advantage for those who succeed. They can also help monitor progress towards a more circular economy. Overall improvement in statistical capacity (a nation's ability to collect, analyze and disseminate high quality data about its population and economy) in different jurisdictions will be key to monitoring the circular economy to help understand where we are today and what progress is made. [56]

Restrictions on Hazardous Substances

Regulations that restrict or ban the use of hazardous substances in products can drive the adoption of safer and more sustainable materials as can voluntary standards like U.S. EPA's Safer Choice program. Examples of such regulations include RoHS (Restriction of Hazardous Substances) and REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) in the European Union, the Toxic Substances Control Act in the United States, and the European Chemicals Agency's proposed PFAS restriction which would extend to products imported into the E.U. These restrictions can benefit companies in the long run by shifting toward safer and more sustainable materials as they can reduce risks associated with health hazards and pollution and make recycling more feasible. They can also reduce costs if eliminating some of the infrastructure requirements, control processes and other considerations unique to transporting, handling, and manufacturing with hazardous substances. Policies like the E.U.'s Chemicals Strategy for Sustainability can complement restrictions on hazardous substances by helping to boost innovation for safe and sustainable chemicals.[57]

Recycled Content Mandates

Requirements around recycled content are considered a more advanced form of circular economy policy and, as a result, typically the last measure to be passed. These measures require that certain products contain a specified amount of recycled material; they sometimes require this to be

post-consumer recycled material or these mandates may be enforced in the form of a tax on products that do not meet the standard.[58]

While such mandates can drive up the cost of secondary materials for manufacturers by virtue of increasing demand, they can help develop the needed infrastructure (e.g., recycling) to support the supply chain if coupled with EPR schemes and / or financial penalties. They can also accelerate companies' ability to adopt circular strategies by leveling the playing field, by requiring investment in these areas e.g., a willingness to pay a higher price for secondary materials out of necessity.

Recycled content mandates around Advanced Recycling minimum content requirements should not be supported, as they can drive up demand for an unproven process that can result in greater climate and health risks than traditional recycling methods.

Models for Corporate Advocacy

Advocacy can take on many different shapes and forms. It's important that your organization focus on the topics, issues and mix of advocacy channels that align best with your circularity and climate goals and your core business strategy. Taking this approach and engaging the appropriate stakeholders could help your company promote the transition to circular economy as a climate solution, improve brand reputation, and acquire new customers. Some sample advocacy channels include the following:

DIRECT GOVERNMENT ENGAGEMENT

1. **Lobbying:** Directly lobby policymakers to promote circularity-related policies such as extended producer responsibility, waste reduction and recycling incentives, and other regulations that promote circular practices.

2. **Political contributions:** Allocate a portion of advocacy spend to political candidates who support the circularity and climate-related policies you deem necessary.

3. **Litigation:** Use legal action to advance a particular cause or issue. This could include suing companies or governments for failing to act on climate change or for other environmental harms.

4. **Community organizing:** Partner with employees, customers, local organizations, businesses, and community groups to advocate for circular climate policies at the local level; this could include working with local governments to promote circular practices and policies.

INDUSTRY ASSOCIATION LOBBYING

1. **Industry Associations:** Work with industry groups and consortia to push for concrete climate action and global standards that will incentivize and accelerate progress, which can help to build a stronger collective voice and advocate for change on a broader scale.

2. **Partnerships:** Partner with other organizations, non-profits; or advocacy groups that share the same values and goals for promoting circularity. This can help to amplify their message and build a stronger coalition to promote change.

3. **Disclosure entities:** Work with organizations that support reporting and disclosure (e.g., CDP) to set industry standards, advocate for different tools, guides and resources to enable measurement.

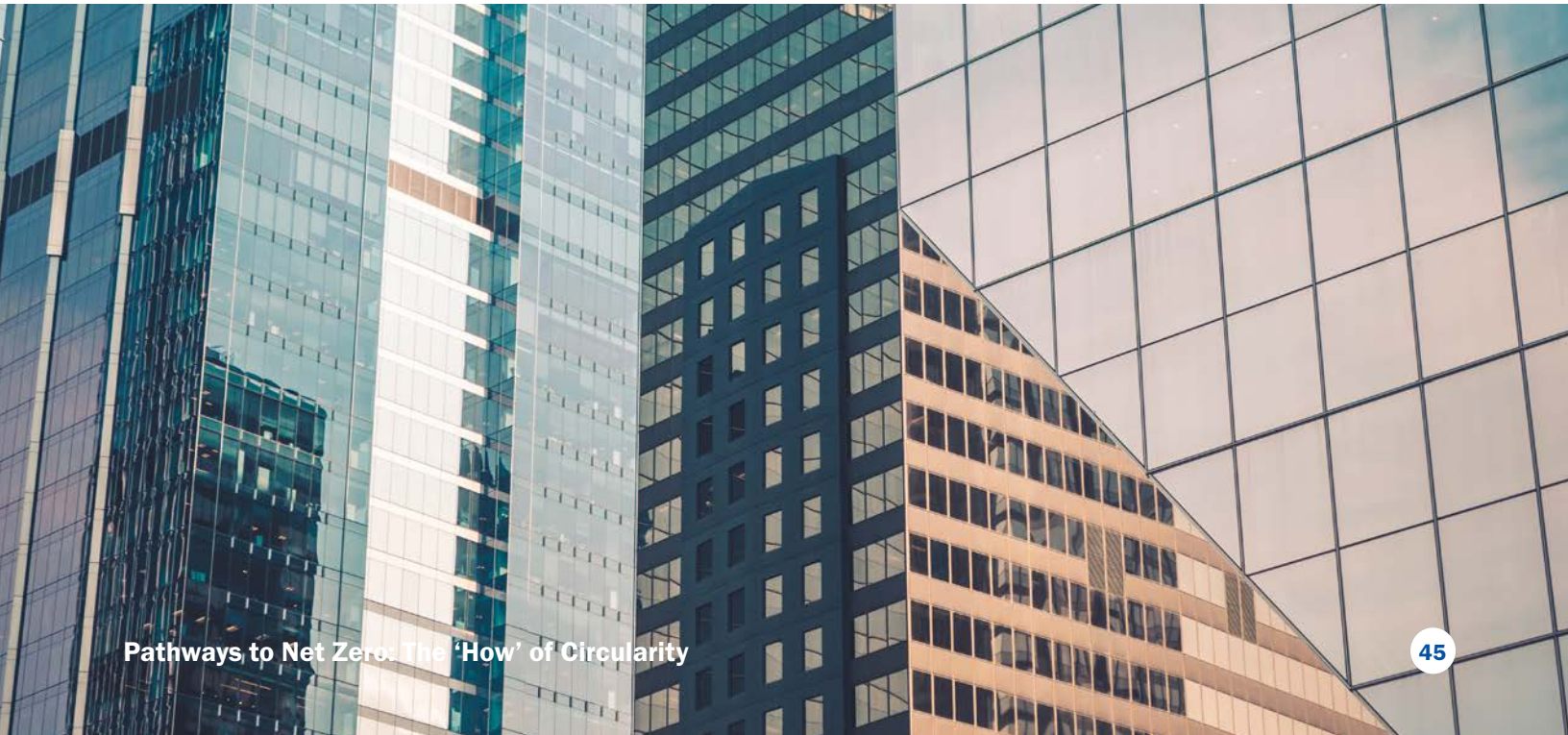
COMPANY MOBILIZATION

1. **External Affairs/PR:** Work with journalists and media outlets to share their circularity efforts and the importance of circularity-related policies (e.g., op-eds, interviews); use social media platforms to raise awareness about circularity issues;, share information about their own circular initiatives, and mobilize support for circular policies.

2. **Public Speaking:** Have representatives from your company speak at conferences, events, and other public forums to promote circularity and advocate for circular policies.

3. **Employee Engagement:** Provide opportunities for employees to get involved in circularity-related campaigns, volunteering, or advocacy initiatives, building a sense of purpose and engagement.

4. **Education and Training:** Train and educate employees, customers, and stakeholders to promote awareness and understanding of circularity-related issues, helping to build a culture of circularity and promote long-term change.



Advance

Every company has a role to play in the transition to a more circular economy, and the opportunities for action extends well beyond a company's value chain.

This can come in the form of funding, investing, and / or developing the tools, technologies, partnerships, and coalitions that can help to bring about the systemic change needed for a full transition to a more circular economy, not just a circular business models within your own company.

Changing infrastructure, culture, supply chains, and other economic structures to shift from a linear to a circular economy requires systems change through coordinated action across multiple stakeholder groups. This can be realized through building things together (e.g., forming partnerships / coalitions, building / establishing networks) while for others may be what they need to bring circularity into their businesses (e.g., the financial instruments, technologies, tools, etc.) There are four main avenues through which companies can advance the circular economy ecosystem:

Funding

Develop and / or offer financial solutions, services and instruments to help companies of all sizes and stages access the capital they need to bring circular solutions to life

Examples include:

- Grants
- Green Bonds
- Sustainability Linked Loans
- Investments
- Accelerators

Tools & Technology

Create the tools and technologies needed to enable companies to implement and scale circular solutions to achieve their net zero climate goals

Examples center around:

- Data & Measurement
- Traceability
- Operations

Partnerships

Form and / or join partnerships and coalitions with other entities in order to collectively work toward bringing about the systems change and building the infrastructure needed for circular economy

Examples include:

- Coalitions
- Co-investment (e.g., Joint Ventures)
- Supply Chain Integration and Coordination

Infrastructure

Provide the systems, processes, and physical and organizational structures and facilities needed to support the transition to a more circular economy (e.g., equipment and facilities for the collection, refurbishing, repair and recycling of physical materials)

Examples include:

- Recycling Infrastructure for proven recycling technologies
- Waste Management
- Reverse Logistics
- Materials

Figure 18: Avenues for Advancing the Circular Economy Ecosystem

Funding

Organizations like financial services and investment firms can accelerate the transition to a more circular economy by developing and / or offering the financial solutions, services and instruments needed to help companies of all sizes and stages access the capital they need to bring circular solutions to life and to achieve their net zero goals.

Grants

Grants are monies set aside for a particular purpose as a result of designated giving (restricted) or funds; grant funding does not need to be paid back.[59]

While grants are often issued by governmental bodies or non-profit organizations, many companies issue grants as well — usually as part of their Corporate Social Responsibility, Community Giving, or Philanthropy efforts. Your organization can advance other businesses', coalitions', or organizations' efforts to propel the shift to a more circular economy by allocating funding to grants to support circular initiatives.

For additional examples of how other companies structure their grant programs (not specific to circularity), see Tyson, Coco Cola Foundation, and Nike.

Green Bonds

These bonds are used to raise money for climate and environmental projects, and are typically linked to specific assets, such as stormwater infrastructure.[60]

Ex: IceBear, part of Kvitebjørn Energi A.S., is a Dutch company that "operates a combined heat and power plant that generates renewable energy from wood chips, which is in turn used to produce recycled waste wood pallet blocks. The surplus energy is harnessed to heat water, which is sold for weed control and other environmentally-friendly uses. This produces composite pallet blocks out of recycled waste wood and green energy." Together with Nordea, the largest bank in the Nordics, IceBear issued a green bond to finance this €35M project in 2020. In January 2022, they hit the milestone of producing theirits first composite pallet block.

Sustainability Linked Loans (SLL) and Bonds (SLB)

These loans and bonds have characteristics linked to environmental, social and governance (ESG) goals.[4] For example, SLLs tie interest rates to meeting sustainability targets. An SLL incentivizes companies to achieve these targets so they can secure a lower interest rate.[62]

Ex: Supported by BNP Paribas, the British supermarket Tesco established a £2.5B sustainability-linked loan (SLL) in October 2020, becoming one of the first UK retailers to do so. For this SLL, the interest rate is linked to Tesco's Little Helps Plan, which includes KPIs on food waste reduction.[63]

Investments

As the demand for "'sustainable"' investment strategies and ESG solutions continues, and pressure to reach net zero targets continues to grow, investment vehicles focused on circularity stand to gain.

Ex: BlackRock, the world's largest asset manager, launched a dedicated circular economy public equity fund in 2019, not only demonstrating their own investment in circularity but also signaling to others that the circular economy offers an opportunity for better financial and competitive returns. BlackRock recognizes the long-term value creation potential from circularity and aims to drive investment towards circular solutions with this fund. BlackRock's circular economy fund has grown from $20M seed funding in October 2019 to nearly $2B net assets of fund as of May 2023.[64]

Accelerators

These programs help startups or other organizations access mentorship, guidance, support, and other resources. Some accelerators take an equity stake in the start-up, but others do not.

For example, the first cohort of the Google for Startups Accelerator: Circular Economy kicked off in February 2023, made up of 11 Seed to Series A technology startups and NGOs focused on using technology to tackle circular economy challenges such as reuse, refill, recycling, composting, fashion, food, safe and circular materials, and the built environment.

This virtual program includes 10 weeks of equity-free support, mentorship, training, product credits and project support on technical subjects like AI and ML, geospatial, and Google Cloud. The Accelerator will focus on product design, customer acquisition, leadership development, expert-led circular economy deep dives, workshops, cutting-edge research, and leadership development.[65]

Tools and Technology

By developing the tools and technologies needed for companies to implement and scale circular solutions, organizations (like technology companies) can further accelerate the transition to circular economy and net zero — even if they themselves do not use or waste many natural resources.

Data and Measurement

Trustworthy data and consistent measurement are key to companies' ability to plan for circular solutions and track their impact. Relevant data could include details on product components for material selection, results from pilots for monitoring effectiveness, or material flows throughout the product life cycle. This is valuable not only for making individual business decisions but also for attracting additional investment in the space. Technology companies have the power and imperative to enable the circular economy and can do so by helping to overcome these measurement challenges. Such tools might support Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), or data verification.

Ex: Circulytics is a company-level tool created by the Ellen MacArthur Foundation to support businesses' transition to a more circular economy by measuring a business' entire circularity via a scorecard and highlighting strengths and blind spots. The tool has been used by a wide range of companies including Unilever, Ikea, and Volvo.[66,67]

Other examples of well-known circularity metrics and solutions include CIRCelligence, Circular Transition Indicators, and Circle Assessment Tool.

Traceability

As companies seek to better understand and account for the emissions of their value chain, traceability continues to rise in importance among those working toward a circular economy.

Many tools can help achieve this ambition — including cloud solutions for supply chain connectedness, blockchain technology and one specific application of blockchain technology, digital product passports.

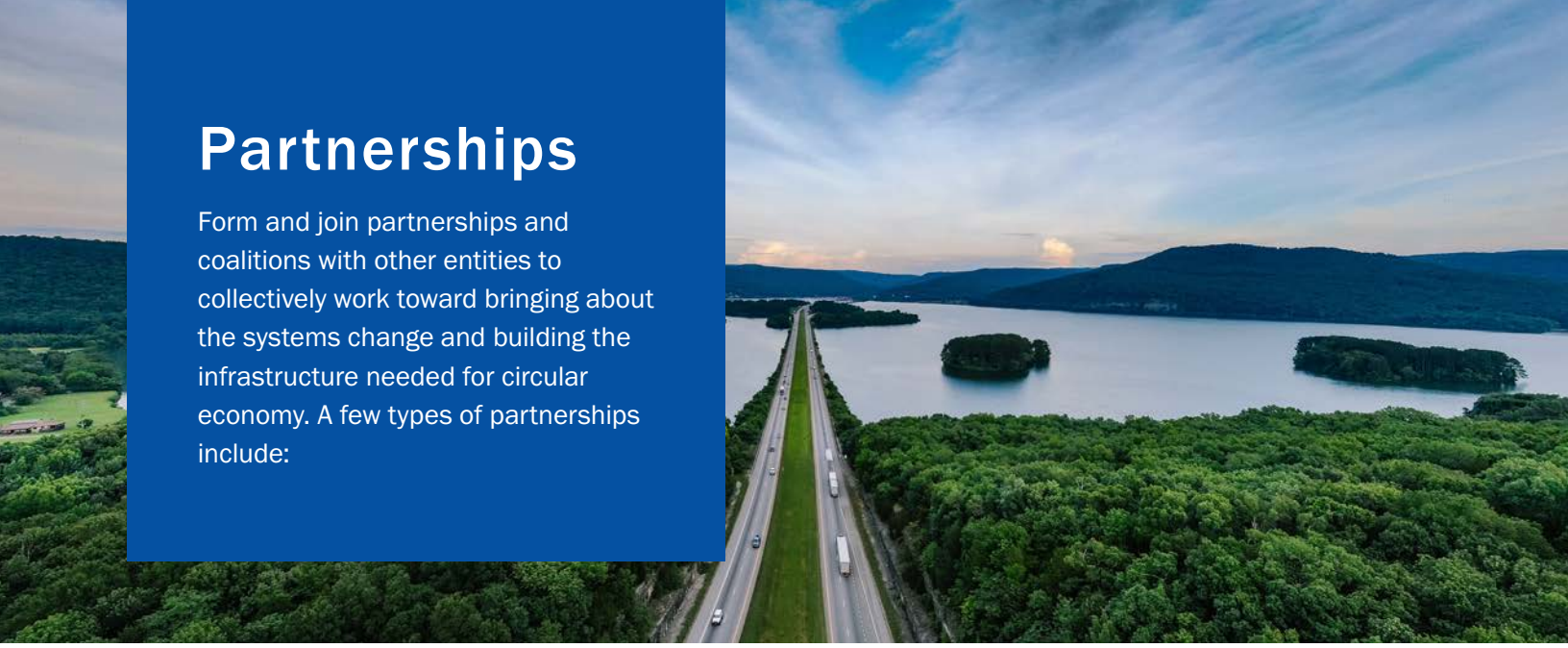
Ex: Digital Product Passports (DPPs) are a tool to collect and enable sharing of product data throughout the entire life cycle of a product, specifically to inform value chain players of a products' sustainability and recyclability attributes. DPPs bridge data gaps and create transparency, further enabling more circular supply chains.

Other examples include cloud solutions for supply chain connectedness and blockchain technology.

Operations

Another way tech firms can support those working to integrate more circular solutions into day-to-day operations is to develop tools and technologies focused on core operations. Such efforts could include programs for core functions (e.g., supply chain and procurement, waste management) and introduce or enable new approaches (e.g., AI / ML / IoT applied to these or similar areas of the business, reverse logistics solutions).

Ex: BringgGreen is a delivery Management Platform with sustainable solutions that reduce fuel consumption, offer eco-friendly fleet vehicle selection and more.[68]



Partnerships

Form and join partnerships and coalitions with other entities to collectively work toward bringing about the systems change and building the infrastructure needed for circular economy. A few types of partnerships include:

Coalitions

Defined as “an alliance for combined action,” a coalition involves coordination and collaboration between different parties who share a common interest or objective.[69] Coalitions can provide an opportunity to connect and share knowledge and resources with others and to team up for collective action. Effectively adopting circular solutions can prove to be a competitive advantage that companies would likely want to protect, but pre-competitive collaboration allows you to still exchange ideas and lessons learned to help accelerate the broader shift to a more circular economy.

Ex: The Business Coalition for a Global Plastics Treaty, convened by the Ellen MacArthur Foundation, WWF and aligned businesses and NGOs, brings together businesses and financial institutions committed to supporting the development of an ambitious, effective, and legally binding UN treaty to end plastic pollution.[70]

Other examples include the Circular Economy Indicators Coalition and the Sustainable Apparel Coalition.

Co-Investment (e.g., Joint Ventures)

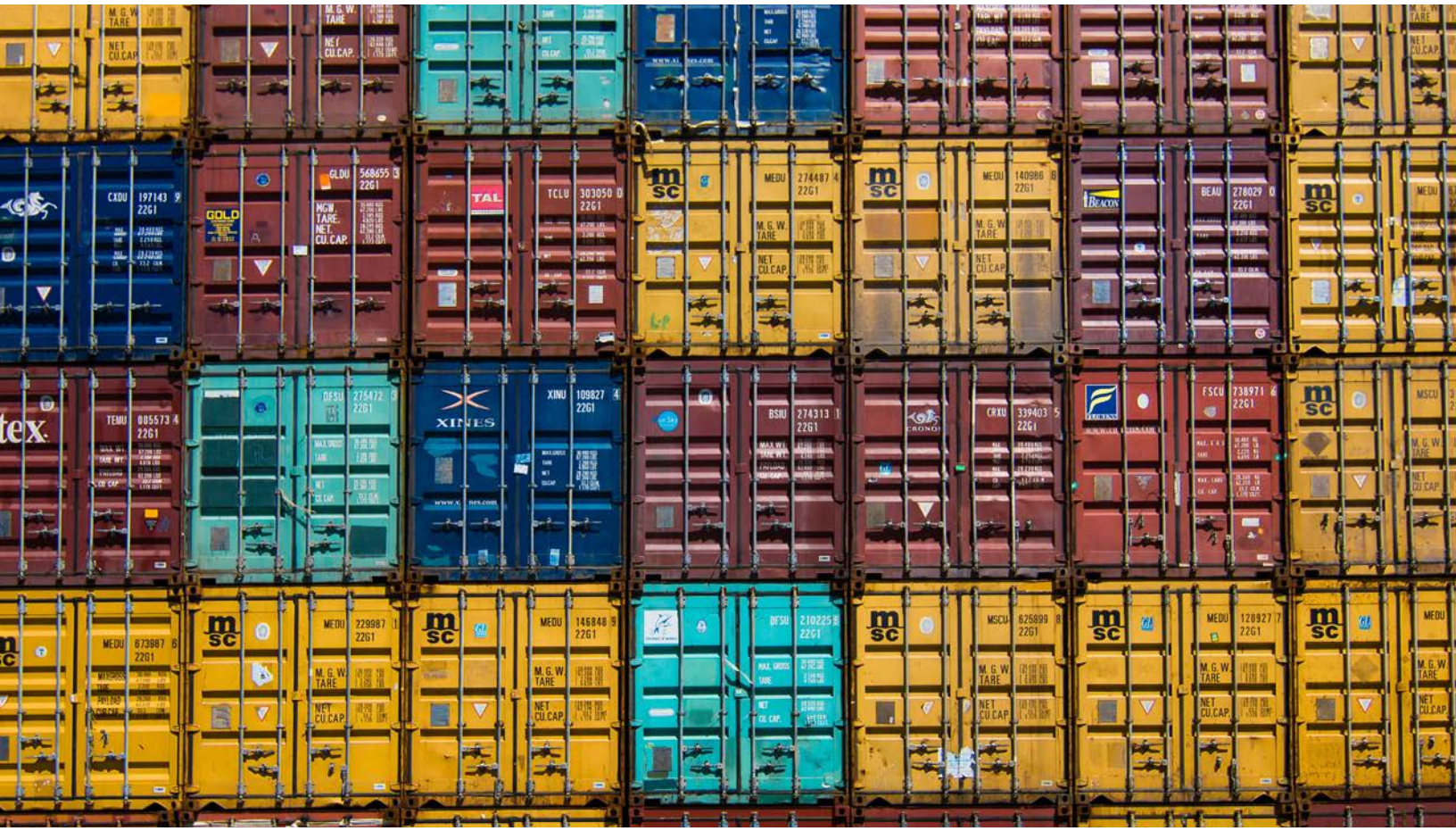
Beyond just sharing information and resources, companies and / or organizations might choose to co-invest in a particular initiative or set of initiatives related to circularity. This allows not only for collaboration on the strategy and execution behind circularity efforts but also the pooling and potential combination of capabilities, assets (e.g., supply chain infrastructure) and other resources to develop the necessary infrastructure and tools. While the structure of the deal may vary, the terms of co-investment like a joint venture will also include details of how profits will be shared between parties.

Ex: In 2021, Technip Energies, Under Armour and IBM announced a joint venture focused on building and commercializing a new recycling framework and circular economy for polyethylene terephthalate (PET). This JV combines IBM Research technologies and expertise; Technip Energies’ abilities in technology development, engineering studies and licensing proficiency; and Under Armour’s deep technical apparel, footwear, and global textile supply chain capabilities.[71] It’s too soon to assess the output and impact of this JV, but it provides a good example of bringing together complementary capabilities for a common interest.

Supply Chain Integration and Coordination

Outside of co-investing in particular strategies and initiatives, businesses might consider setting up business partnerships leveraging complementary capabilities of other players e.g., contracting for use of a certain technology or asset. This type of collaboration still allows for partnership on strategic thinking, but it tends to be more transactional in nature than a co-investment strategy. Again, the specific terms of the deal may vary but in most cases these types of partnerships would not involve the same profit-sharing that you see with co-investments.

Ex: Patagonia and Samsung teamed up back in 2021 to reduce microfiber pollution by redesigning the washing machine. For years, Patagonia had been researching microplastic pollution related to shedding of synthetic fabric in the washing process to try to reduce the impact of their product. In this partnership, Patagonia shared insight about testing for this pollution and connected Samsung with Ocean Wise, a nonprofit dedicated to protecting and restoring our oceans, which tests fiber shedding. Sharing their unique insights and capabilities, these three organizations were able to better understand how different parameters (like temperature and agitation) impact microfiber pollution and ultimately inspire Samsung's new solutions (a new filter and wash cycle) which Ocean Wise confirmed "nearly eliminated microfiber pollution."[72]



Intrastructure

Provide the systems, processes, physical and organizational structures, and facilities needed to support the transition to a more circular economy (e.g., equipment and facilities for the collection, refurbishing, repair, and recycling of physical materials).

Recycling Infrastructure

Provide the processes, equipment and / or facilities necessary to collect, sort, clean, process and / or reuse materials.

Ex: Best Buy is helping to advance the circular economy through its "Resources Reused" efforts that allow individuals to recycle electronics, appliances, and fitness equipment in their stores, which they then send to recycling partners for further processing. They also offer haul-away options for larger items and a mail-in recycling service for those who live far from a Best Buy store or can't drive to one. Additionally, Best Buy offers incentives for recycling certain product types — including discounts on select products.[73] In this way, Best Buy not only provides the infrastructure needed to collect goods but also encourages consumer participation by reducing barriers and incentivizing action — so much so that they report recycling more than 2 billion pounds of electronics and appliances since theirits recycling program was established in 2009.[74]

Waste Management

Handle the processes, actions and equipment needed to collect, sort, and dispose of solid waste, any liquids and / or chemicals used in the circular value chain.

Ex: Pacific Biochar converts retired biomass power plants into biochar production facilities where they process organic material from forests with high fire potential into biochar. By doing so, they reduce the risk of wildfire, produce biochar to distribute to agricultural suppliers and compost yards to put back into the land, and generate GHG emissions reductions that they can further monetize. Pacific Biochar is selling 1,500 metric tons of CO2 in credits to Microsoft this year, which will be third-party audited and certified by the European Biochar Certification.[75]

Reverse Logistics

Help facilitate take-back for recycling, repair, refurbishing, and / or resale either through collection sites, transportation and / or re-distribution.

Ex: Happy Returns is a software and reverse logistics company that enables shoppers to return items they bought online and/or, in person, through its network of ~9,000 "return bars," box- and label-free return locations at various merchants' storefronts.[76] By aggregating returns and transporting them in reusable totes, Happy Returns reduces GHG emissions by 120,000 lbs. for every 1 million returns while reducing costs and complexity for their retail partners. For example, Pact, the sustainable, organic cotton clothing company, was able to keep the size of its lean customer service team (and associated costs) largely unchanged as the business grew by 60% or more by partnering with Happy Returns.[77]

Materials

Support the process of sourcing, development, or re-processing (e.g., repair, refurbishment) of materials.

Ex: International Sustainability and Carbon Certification (ISCC) offers a process to assure consumers about sustainability, traceability, raw material identity and correct statements about the certified materials. Certification by the ISCC, marked by its logo, implies that "no deforestation to produce biomaterials has occurred, quantities and conversion factors throughout the value chain were closely monitored, that there has been a correct application of mass balance, attribution, and carbon footprint calculations, and much more."[78]

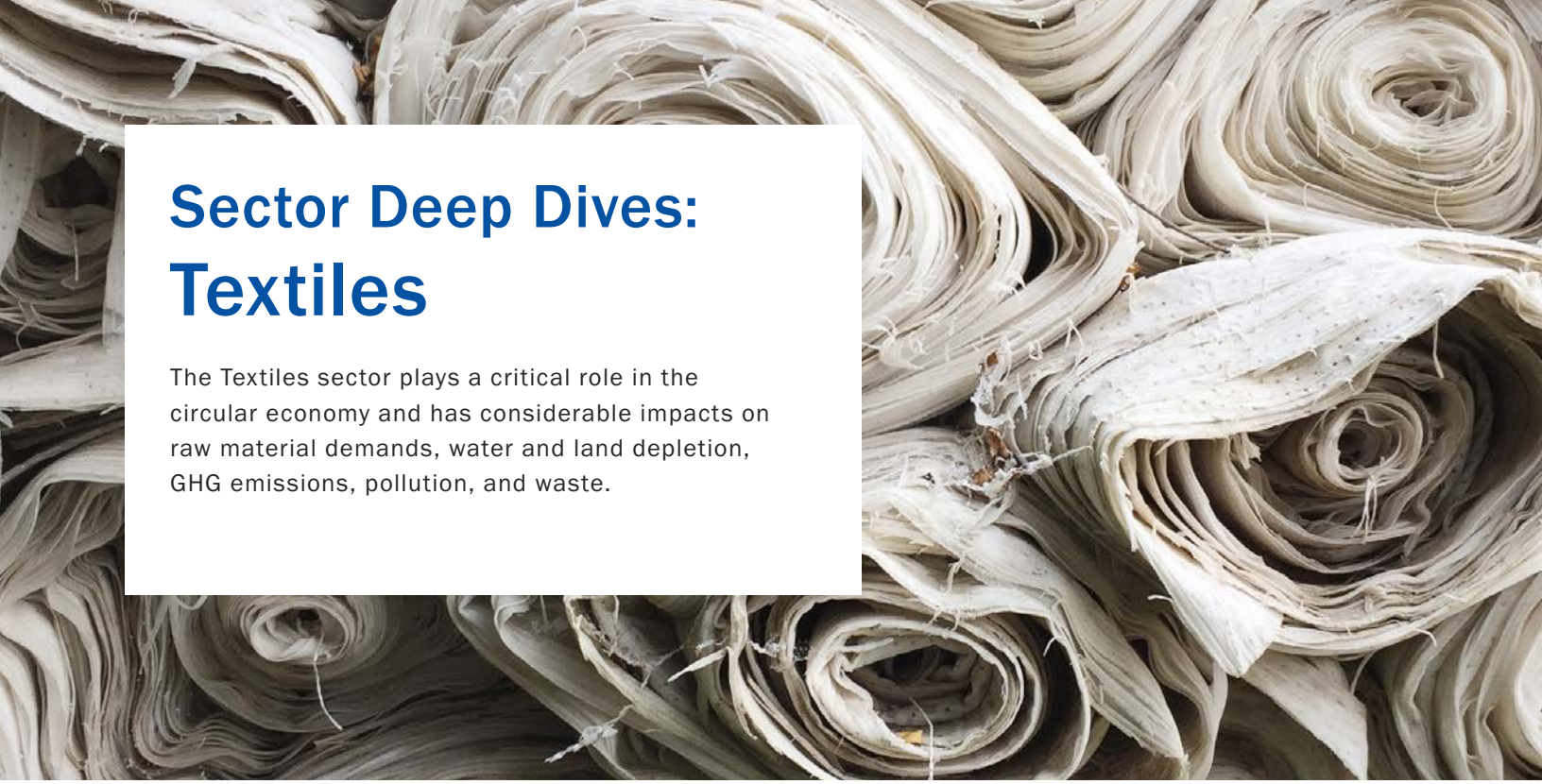
Sector Deep Dives:
Opportunities for Circularity in Textiles, Packaging, and Automotive

Value chains, materials, and market considerations vary by industry and shape the unique circularity needs and opportunities that a company faces. The **built environment**, for example, is constructed primarily from hard-to-abate materials such as cement and steel that have already been produced, which makes materials reuse and recycling critical. New construction can shift to pre-fabrication and modular construction models that promote resource efficiency and design for disassembly, in addition to decarbonizing hard-to-abate inputs. **Food systems**, by contrast, have unique circularity needs related to food waste reduction, upcycling and valorization of food waste, regenerative agriculture practices that sequester carbon and reduce the need for fertilizer inputs, and sustainable packaging, among others.

Sector	Built Environment	Mobility and Transport	Food Systems	Electronics	Textiles	Plastics & Packaging
Total Emissions (Gt Co_2e / year)	21	9.8	15	2.0	1.0–3.3	1.8
Addressable Emissions via Circularity (Gt Co_2e / year)	13.00	6.70	5.00	1.16	0.88	0.45
Time to Impact	Long	Long	Mid	Mid	Near	Mid
Level of Effort	High	High	High	Medium	Medium	Medium
Example Circularity Strategies	• Circular materials • Prefabrication and modular building	• Lightweighting • Mobility as a service	• Regenerative agriculture • Food waste prevention	• E-waste montioring • Electronic refurbishment	• Resale/ recommerce • Textile-to-texile recycling	• Packaging redesign (e.g., bio-based) • Packaging recycle

Table 3: Circularity solutions by sector, including addressable emissions via circular solutions, time to impact, and level of effort[79]

This section outlines the potential for circularity to transform three sector use cases: the **textiles and packaging sectors**, which present nearer term opportunities for circularity, and the **automotive sector**, which is gaining new traction with circularity initiatives due to the expansion of electric vehicles and the associated needs for battery recycling and other circular solutions.



Sector Deep Dives: Textiles

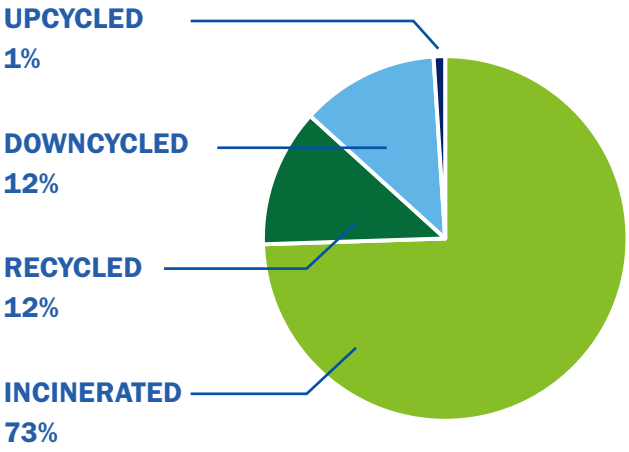
The Textiles sector plays a critical role in the circular economy and has considerable impacts on raw material demands, water and land depletion, GHG emissions, pollution, and waste.

By the Numbers:

TOTAL EMISSIONS
1.0 – 3.3 Gt CO_2e / year, including material-related emissions and operational energy use[80]

ESTIMATED ADDRESSABLE EMISSIONS
0.88 Gt CO_2e estimated to be addressable through circular solutions[82]

CIRCULARITY OPPORTUNITY
$700B in economic value could be generated by 2030 through a transformation towards circular textile business models, and each 1% increase in market share of circular business models is likely to reduce emissions by 13M tCO_2e[81]



400%

more clothes are produced now than 20 years ago, yet clothing utilization has declined by almost 40%[83]

Figure 19. End-of-life Clothing Management: What happens to clothes once they are disposed.

48 million tons of clothes are disposed of worldwide every year.

Of those, 73% are incinerated, 12% reused, 12% downcycled, and < 1% is turned into new clothes

There is a significant imbalance between the amount of clothing produced and the amount we need. Today, there is "enough clothing on the planet right now **to clothe the next six generations of the human race.**"[85] This imbalance has detrimental effects including extensive consumption of raw materials, elevated GHG emissions, and generation of unnecessary waste.

Fast fashion is a huge contributor to this problem, and typically refers to a quicker turnaround of new styles, increased number of collections offered, and often lower prices on clothing.

With increased production comes **increased GHG emissions.** Fashion contributes **8% to 10% of global carbon emissions**.[86] Textile production emits GHG emissions during production of raw materials, agriculture for natural fibers, and energy-intensive processes for synthetic fibers, manufacturing, transportation, and disposal (e.g., incineration).

Textile production also contributes to **land degradation** through use of agrochemicals and deforestation for raw material cultivation (e.g., cotton), and utilization of various chemicals (e.g., dyes, solvents, finishing agents) that can lead to **environmental contamination** and pose risks to human health with improper handling and disposal.

The waste from discarded clothing and textiles, primarily from higher income countries, pollutes waterways and often has far-reaching environmental impact that extend across borders. **20% of water pollution comes from the textile industry**, particularly from chemicals used as dyes. [87] Additionally, newer synthetic textiles can break down into microplastics, polluting waterways.

Other chemicals used as processing aids and coatings in textiles can also be toxic and energy-intensive, like per- and polyfluoroalkyl substances (PFAs) used for waterproofing.[88]

There are several obstacles that make the transition to a more circular economy challenging for textiles.

Barriers to Overcome

Market Barriers	Technical Barriers	Regulatory Barriers	Cultural Barriers
✓ **Challenges understanding ROI** including lack of clear value proposition, difficulty measuring value, and difficulty communicating value externally	✓ **Low-quality** and **low-durability garments are unsuitable** for reuse and mechanical recycling, loss of product quality	✓ **Inadequate legislation** to support system-wide infrastructure for textile mechanical recycling	✓ **Limited access to circular design know-how** to implement circular practices in textiles
✓ Inability to **source sufficient effective and economical secondary feedstocks** due to recycling inefficiencies	✓ Inability to **capture material composition information**	✓ **Lack of incentives to design for extended use and recyclability** through policy (tax incentives)	✓ Sustainability is **not consumers' primary purchasing decision driver**
✓ Externalities (e.g., GHG emissions, health hazards, water use) are not **accounted for in textile pricing**	✓ Mechanical recyclers **lack needed data** to perform textile-to-textile recycling	✓ **Regulatory differences** cause end-of-life to vary by place	✓ **Varying degrees of understanding, buy-in and commitment to sustainability and circularity across geographies.** While more developed countries tend to be concerned and prepared to act, **change is needed in developing nations** where most of the production happens
✓ **Lack of dedicated funding** for scaling of textile circularity levers such as mechanical recycling technologies	✓ Technological innovation and data collection is **expensive** and the current ecosystem lacks incentives for mechanical recyclers to improve and innovate		

System Barriers	
	✓ **Limited circularity infrastructure** for recycling and resale
	✓ Lack of standardization around data leading to **non-comparable measurements** and limited ability to benchmark

Figure 20: Barriers to a Circular Economy for Textiles [89,90]

Despite these challenges, businesses may be motivated to act due to increasing consumer awareness, new commercialization opportunities, growing regulatory pressure, and the potential to manage risks within supply chains.

Key Motivators

CONSUMER DEMAND

Consumers are increasingly conscious of a brand's purpose, and more and more consumers want to make purchasing decisions that align with their values.[91,92]

According to thredUP's 2023 Resale Report, resale is expected to grow nine times faster than the broader retail sector by 2027.[93]

There is growing scrutiny over high pollution and waste levels from clothing production and fast fashion.

Circular products and services are linked to brand lift and often rely on recurring interactions with consumers over time, which can help drive consumer retention.

Businesses can engage in new markets and unlock new revenue streams. More and more companies are exploring new business models and incorporating resale and recommerce operations into their business.

COMMERCIALIZATION OPPORTUNITIES

The ability to resell and recycle items increases a company's ability to monetize a single object or set of resources multiple times, driving revenue and reducing input costs.

Valuation and pricing capabilities improve and maximize value capture, through greater visibility into the entire life cycle of a product and changes in product quality from item data.

Partnerships and co-investments between brands, manufacturers, and suppliers create joint winning opportunities.

REGULATORY PRESSURE

Increasing policies promoting sustainability within textiles is pushing businesses to set targets, limit their environmental impact, and provide transparent reporting.

RISK MITIGATION WITHIN SUPPLY CHAINS

Businesses are faced with depleting natural resources and risk of supply chain instability.[94]

Businesses are motivated to reduce the risk of resource scarcity and reliance on depleting sources through recycling and circular design.

Data-driven decision-making drives more flexible and higher-value use of supply chain assets.

To ensure a safe and just transition to a more circular economy and create a more resilient value chain for textiles, you must ensure appropriate labor and health/safety standards and protect wages and rights across the textiles value chain.

For a safe and just transition, key considerations to keep in mind include:

Localized community health impacts of textile incineration, fiber production, and processing.[95]

Poor working conditions and worker exploitation of informal waste pickers, children, and women.[96]

- Chemical hazards to workers due to chemicals and dyes used in fabrics.
- Women make up ~80% of the garment manufacturing workforce, but also see a wide range of systemic inequality including pay inequity, discrimination, and lack of voice.[97]

Socioeconomic effects on surrounding communities along the value chain, particularly those left with discarded textiles at the end.

- In some low-income countries, production of cotton accounts for almost 7% of all employment.[98] Increasing resale and recycling will impact production jobs.[99]
- Many discarded textiles get shipped to lower-income countries, where there is a major resale market. Resale merchants purchase clothing in bales, often with loans, hoping the next bale will contain enough quality re-sellable items to make a living. Given the uncertainty of product value, this practice can pose financial risk.

Diversification and even **distribution** of industry and employment creation is necessary. The textile industry will likely see new jobs and increased automation within textile sorting, resale, and recycling, and you will need to appropriately upskill and retain workers to fulfill these new needs.[100]

Systems are needed to establish **fair labor practices** and worker protection, especially with the increase in recycled material collection.

To drive **equal access to sustainable and circular clothing**, you should consider ways to offer more affordable solutions as these clothing items tend to be more expensive.[101]

Businesses can leverage the framework introduced in this report to take action and expand upon a range of initiatives to act, advocate for, and advance circularity within textiles.

Act

Plan

- Conduct a current state assessment of your packaging to understand your value chain today
- Articulate your circular goals and aspirations and identify your target market
- Determine what packaging circular solutions to pilot in the near-term and long-term

Implement

- Collaborate and partner with suppliers to push to use and waste less packaging by pushing for more circular strategies within design, manufacturing, and recycling
- Leverage technologies to collect and track data across the supply chain, measure progress, and stand up new business models
- Hire talent and develop governance structures
- Start with quick-wins to gain early momentum

Scale

- Accelerate and drive business value
- Secure financing and funding to scale new packaging solutions and infrastructure and expand to additional markets
- Expand and embed circularity within your core business strategy

Advocate

- Understand current and upcoming policies within your geography and the impact they may have on your business
- Advocate for and scale the circular processes through policy that protects through varying channels

Advance

- Provide funding and financial solutions to companies pursuing circular solutions within textiles
- Support consumer and regulator education on topics related to different circular solutions
- Develop enabling technologies and circular textile metrics to support companies looking to implement and scale solutions
- Form and / or join partnerships and coalitions to collectivity bring about change across the textiles supply chain
- Support and develop infrastructure, processes, and systems to enable and scale circular solutions within textiles

Figure 21. Act, Advocate, and Advance Framework for Textiles.

Act

The first part of this action plan pertains to actions businesses can take within the context of their own operations to plan for, implement, and scale circular solutions.

Plan

1

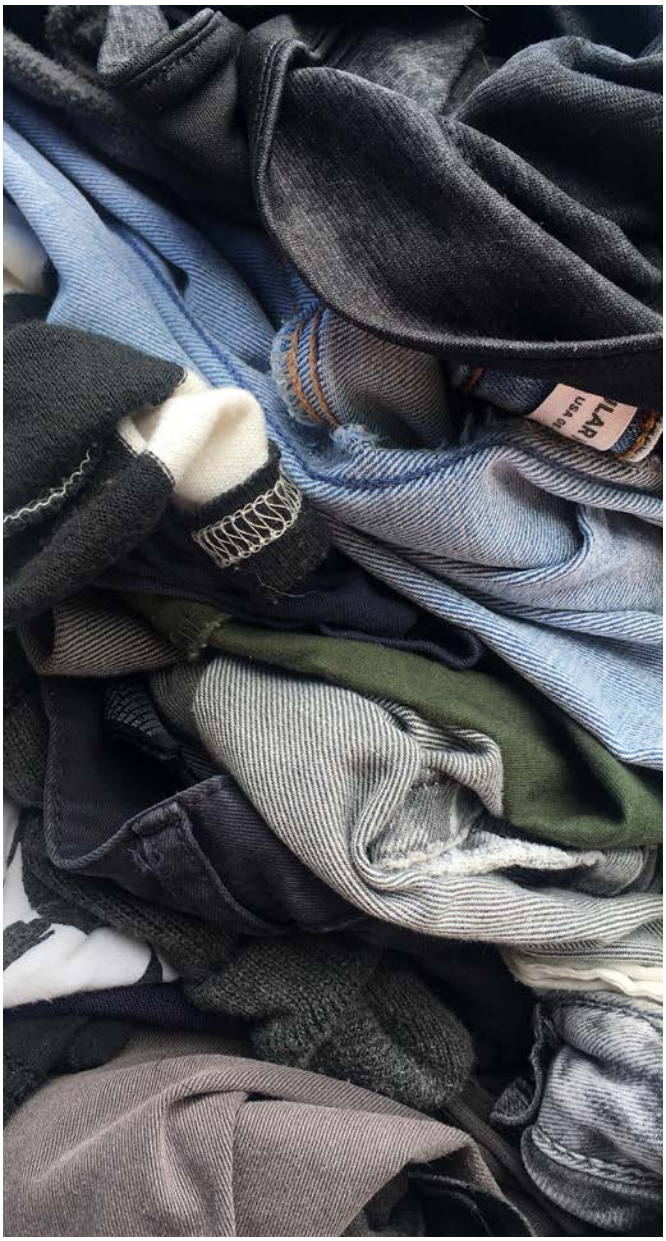
For companies within the textiles sector, a few planning actions that can be taken include:

Conduct a textile materials footprint to understand your current state value chain.

Articulate your circular goals and aspirations and identify your target marke

Determine what textile circular solutions to pilot in the near -term and long -term.

To demonstrate what solution selection could look like, the following section will elaborate on some circular solutions within textiles that businesses can pilot and present valuable market examples to illustrate their application.



Businesses can implement a wide array of solutions to embrace circularity, from material substitutions at design to rental and resale models during marketing and selling.

Some example solutions within the textile industry include:

3D printed clothes *[Manufacture efficiently]*
Garments are printed layer by layer with a flexible filament using a 3D printer, limiting excess waste as only the amount of material needed is used.

Examples: NFT Collection by Danit Peleg

Closed loop manufacturing
[Design for circularity]
Textiles designed and manufactured to be upcycled / recycled through modular design, biodegradable materials, recycling-friendly chemicals etc.

Examples: Looptworks

Make-to-order model
[Manufacture efficiently]
Garments produced only after customers have placed an order.

Examples: Hockerty

Material substitution with bio-based materials *[Design for circularity]*
Textiles made from sustainable natural materials (e.g., cotton, hemp) rather than synthetic fibers (e.g., nylon).

Examples: SPINNOVA

Rental *[Market & sell consciously]*
Subscription-based e-commerce platforms allowing users to rent and return or buy apparel.

Examples: Rent the Runway, Nuuly

Resale & recommerce *[Operate circularly]*
A business model for facilitating the exchange of secondhand items between sellers and buyers

Examples: thredUP, Goodwill, Buffalo Exchange

Textile-to-textile recycling *[Operate circularly]*
Breaking down garments into its constituent fibers and creating new textiles from those fibers

Examples: Blue Jeans Go Green, SOEX I:CO

Due to their potential for both economic and environmental impact, we will concentrate on resale and recommerce, as well as textile-to-textile mechanical recycling, providing a more comprehensive understanding of their practical implementation.

Figure 22: Circular Solutions in Textiles[102]

Resale and Recommerce

Resale and recommerce revenues could more than double from $27B in 2022 to $82B by 2026, fueled by consumer demand for sustainable products and lower-cost goods.

Resale involves the buying and selling of pre-owned products. It is a business model that focuses on facilitating the exchange of previously owned items between sellers and buyers.

Businesses **tailor resale models** based on their specific priorities (e.g., cost, brand identify, consumer demand for brand-authentication). Two common approaches are trade-in and peer-to-peer business models

	Trade-in	Peer-to-Peer
Definition	• Customers return used products directly to the retailers in return for store credit • Retailers inspect, authenticate, repair, and resell the products to other customers using their own channels	• Retailers facilitate the selling of products in a physical marketplace (e.g., Buffalo Exchange) or an online marketplace (e.g., thredUP) and take a cut of the sales • Customers selling products handle packaging, payment, and transportation of products to buyers
Advantages	• Retailers have better ownership of the value stream, thus enabling their circular initiatives • Offers a reliable supply of recycled materials and brings in new revenue streams for retailers	• Retailers do not need to invest in building and maintaining their own warehouse and logistics, or towards resources for processes such as authentication, refurbishment, and reselling
Dis-advantages	• Requires retailer to set up dedicated resources (e.g., warehouses, staff, packaging) to authenticate, refurbish, store, and resell the products	• Retailers have very little control over the quality or authenticity of the products being resold, thus posing a risk to brand identity
Examples	• Patagonia • Levi's	• Urban Outfitters • H&M

There are multiple **types of platforms and models** businesses can use to enable resale, and online resale marketplaces are currently one of the biggest enablers of circular economy.

In-house

Retailers invest in creating and designing resell platforms in-house to have greater control over quality and selling experience

B2B

Retailers work with B2B service providers to create branded re-sale platforms that preserve their unique identities with customers

Third Party

Retailers partner with established players (e.g., thredUP) who offer broad brand assortments to customers purchasing secondhand

Despite resale's longstanding existence with physical stores including Goodwill and Buffalo Exchange, recent start-ups have built entirely new businesses (and business models) around resale and recommerce, allowing existing brands to plug in to resale more easily through new tools and technology. These new technologies enable brands to work towards their climate goals while also creating new revenue streams. One of the most well-known players in this space is thredUP.

thredUP: Resale as a Service

- An online consignment and thrift store for buying and selling secondhand clothes
- Offers Resale as a Service (RaaS) including inventory sourcing, processing & quality, pricing, returns, order fulfillment) to Madewell, Gap, Vera Bradley, etc.
- 5M items listed through RaaS program, 55K+ brands listed, 1.3B lbs. of CO_2e displaced

Brands that have launched resale and collection programs for downcycling include lululemon and Levi's.

Lululemon: Resale Program

- Resale trade-in program launched called lululemon Like New.
- Consumers can trade in lululemon gear for credit, and lululemon will refresh gently used items to be sold again.
- Eligible products include bags, leggings, outerwear, and shorts.

Levi's: Designing Recycled Denim

- Developed a dedicated line of circular jeans.
- Utilizes blended certified organic cotton with Renewcell's CIRCULOSE® fiber, a sustainably produced fiber made in part from post-consumer recycled denim.
- Pocketing details, labels, and thread are made with 100% cotton for easier recycling.

Textile-to-Textile Recycling[103]

Textile-to-textile recycling can unlock **$382B worth of uncaptured remaining value from clothing waste** that could be recycled and **reduce 18M tons of CO_2e annually.**

This refers to the process of breaking down post-production or post-consumer garments into constituent fibers, and then creating new textiles from those fibers. Textile-to-textile recycling (also referred to as fiber-to-fiber recycling) enables a closed loop system through diversion of waste from landfills and helps brands deal with resource depletion, reduce waste product and environmental impact, and limit demand for raw materials.

Textiles recycling can take several forms, here is one example: →

MECHANICAL RECYCLING

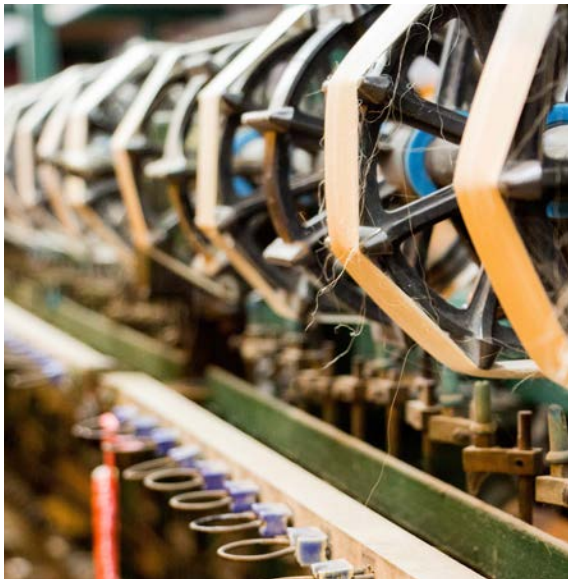
Method where garments are separated by color, shredded, pulled into fibers, combined with virgin fiber for strength, and then woven into a new garment.

Lower environmental impact (cotton recycling uses no water or chemicals)

Works best with homogenous fabric types; not viable for blended fabrics

Recycled fibers are coarser than virgin material

Manual shredding creates fibers that are shorter and have lower tensile strength, typically combined with polyester to increase the performance



Considerations: Currently, many efforts to use recycled materials in textile production rely on plastic waste, particularly recycled bottles, as their source material. Doing so, however, removes bottles from circular bottle recycling loops and hinders the transition to a more circular economy for both the textiles and packaging sectors.[104] Keep these challenges in mind as you consider upcycling materials within textiles.

Challenges

Collections and reverse logistics: Processes, incentives, and infrastructure to collect post-consumer goods are minimal and small scale, providing low recycled material yield.

Material limitations / workability: Fabric is difficult to recycle because it can only incorporate a limited number of recycled fibers to maintain the quality and performance of the fabric otherwise it hinders durability and presents risks to brand image and reputation; it can also be difficult to replicate the aesthetic look of virgin garments.

Chemical concerns: The presence of toxic chemicals in many textile inputs and materials can render them unsafe for mechanical recycling. Furthermore, toxic chemicals (i.e., solvents) are involved in the textile recycling process.

High-cost barriers: Recycling requires high initial investment cost with little immediate return; scaling technologies and reverse logistics infrastructure is expensive and requires regulatory action to drive investment; there is a lack of capabilities and digitalization.

Inaccurate and incomplete textile data: Having limited information about the textiles you use prevents proper sorting and ultimately recycling of textiles.

Case Study

Reformation: Recycling Clothes via RefRecycling

- Partnering with SuperCircle, a reverse logistics platform, Reformation is incentivizing consumers to return old garments to be recycled, making new Reformation garments out of old ones.
- SuperCircle works with waste management partners and fiber-to-fiber recyclers to make new Reformation products.
- Since its launch in March 2022, > 5,900 people have joined the RefRecycling platform, with more than 500 people actively recycling, diverting 2,000 pounds of Reformation clothing from landfill.

Implement

2

For companies within the textiles sector, a few actions to help implement circularity into their businesses include:

Collaborate and partner with suppliers to push for more circular product design and manufacturing.

Leverage technologies to collect textile data across the supply chain, measure progress, and stand up new business models.

Hire talent and develop governance structures.

Start with quick wins to gain early momentum.

Technology plays a vital role in realizing a circular economy by addressing the challenge of missing and inaccurate data throughout the supply chain.

A critical step to enable circularity is solving for missing and incorrect data. By leveraging technology, businesses can effectively solve these data-related issues and ensure the integrity and transparency of information across the entire circular value chain.

Material composition data is required for recycling processes but brands struggle to track and share this information completely and accurately for use by downstream players.

- Item data needed includes components of a garment (e.g., material composition, dyes, embellishments) and record of all additives and chemicals used; this requires visibility into life cycle and material data.
- This data is necessary because every material requires different recycling processes; technology is sensitive to impurities and unclear information can contaminate the entire batch. Without this information, clothing goes to landfill.
- Causes for this problem include fragmented supply chains; limited trust, collaboration and cooperation between brands and suppliers; lagging digitization; focus on short-term benefits and aversion toward risks of investing in sustainable ventures; unclear data needs; data privacy concerns; and clothing tag degradation.

Value Drivers for Data

SUPPLIERS

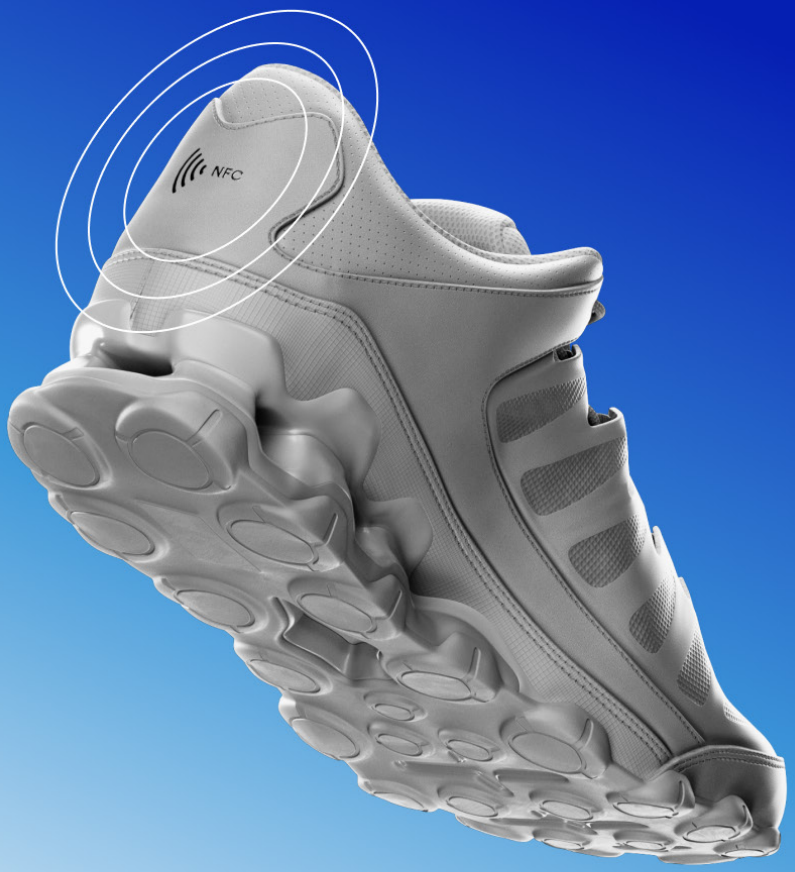
Maintain and strengthen contracts with brands and unlock access to new customers that may be actively seeking the ability to create products with valid certifications, thereby increasing the market reach of your business

BRANDS

Operational: Supply chain visibility and reduced risk; more informed sourcing decisions; improved efficiency from automation; increased effectiveness from better data; and waste reduction.

Reputational: Increased marketing opportunities; better brand image; fulfilled ESG commitments; and consumer preference and trust.

Financial: Longer-term cost savings from reduction in virgin material purchase; more value extracted out of resources already paid for; and fewer costly sourcing / supply emergencies.



Case Study

EON: Enterprise Digital ID Technology (Digital Product Passports)

If you're looking for other companies to partner with or technologies to use to help implement your circular solutions, there are several examples across the value chain. Additional companies that provide recommerce and resale technology for brands to scale resale programs include Recurate, Trove, and Beni (among others).

- Generates a unique Digital ID for every item to make it traceable, intelligent, and more valuable.
- Enables item-level traceability for the full product life cycle, helping brands unlock insights, scale new business models, and comply with policy requirements.
- Developed EON Exchange — a network of 40+ pre-integrated retail business partners including Vestiaire Collective, thredUp and Trove, enabling brands to embed new capabilities and services into their connected products.
- Serves clients such as Coach, Victoria's Secret, H&M, and Target.

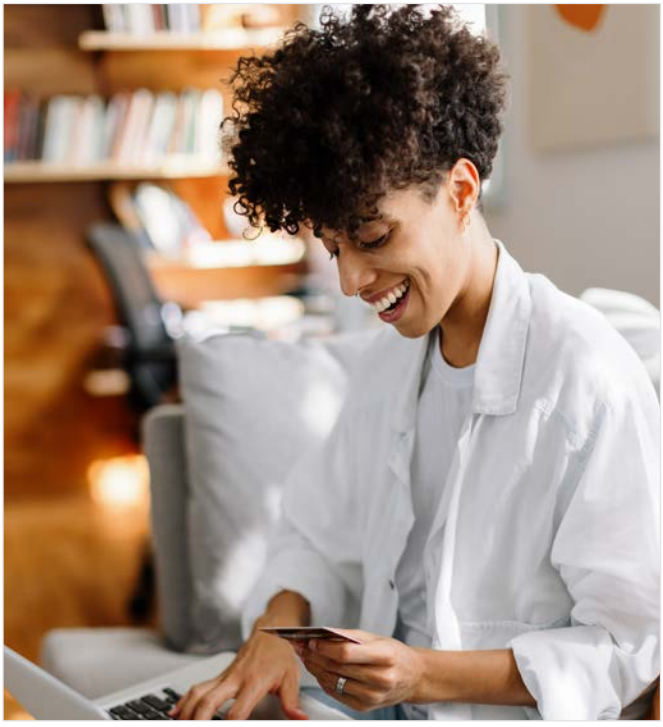
Case Study

Trove: Branded Recommerce

- Pioneered branded resale in 2016 and remains the market leader with over 65% share of branded resale site traffic globally, powering recommerce for the world's best brands.
- Processes millions of items annually allowing brands to grow revenue without growing emissions.
- Solves the reverse logistics challenges of a single SKU and enables brands to list returns with immediate ROI.
- Powers world-class brands including Patagonia, lululemon, Canada Goose, REI, and Eileen Fisher, to launch resale programs for pre-loved clothing and omni-trade-in to drive loyalty – unlocking new revenue streams, attracting new customers, increasing LTV and reducing environmental impact by increasing the number of use-cycles for garments.
- Has invested $100M+ in the world's most advanced Recommerce Operating System.

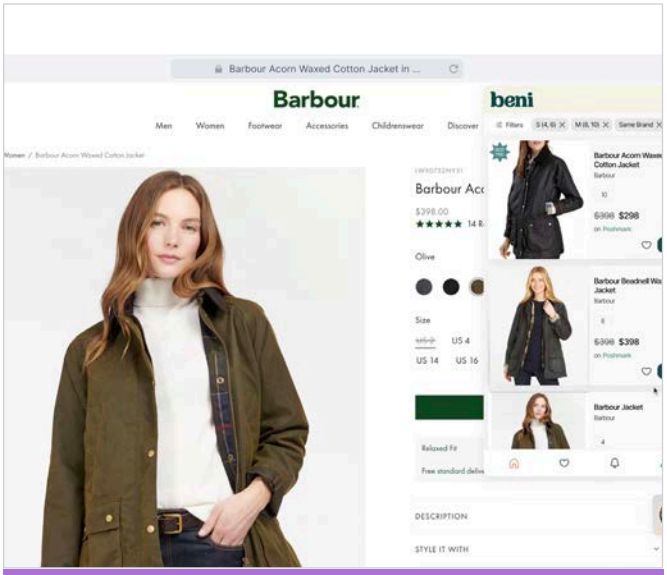
Technologies such as Recurate offer full-service platforms that brands can easily partner with to develop their own resale offerings. Technologies like Beni are designed to eliminate friction for consumers interested in resale and act as a partner for marketplaces to help drive traffic.

> "There are already so many marketplaces — they're doing the heavy-lifting operationally. Beni focuses on the shopper experience, making it more accessible and more attractive to buy secondhand which, in turn, will bring new shoppers to resale marketplaces and ultimately make online recommerce viable and normal."
>
> — Beni co-founder and CEO Sarah Pinner



Recurate: Full-service Resale Platform

- Full-service resale platform supporting peer- to- peer model, takeback model, and brand supply model (sell returns and imperfect inventory).
- Working with brands like Steve Madden, Michael Kors, Amour Vert, and more.



Beni: Browser Extension to Transform Consumption

- A browser extension that uses AI to find similar resale items that drive consumers to purchase secondhand instead of new.
- Integrated with more than 40 resale marketplaces including Poshmark and eBay.

Another start-up focusing on consumers as key drivers of change in circular fashion is start-up Circular Way. Their business, set to launch in 2023, brings circular design principles into every aspect of their operations, from the products they sell (all fully regenerative clothing), the production process to make them and cycle the materials back, and the shopping experience they use to sell them.

Scale

3

When textiles companies are ready to scale and accelerate their circularity efforts, a few actions they might take include:

Accelerate and drive business value by pursuing third party certifications.

Secure financing and funding to scale solutions and expand to additional markets.

Expand and embed circularity within their core business strategy.

One way that companies in the textile space can accelerate and scale the business value of their circular efforts is to leverage third-party certifications to increase trust with consumers.

Businesses can leverage third-party sustainability or circularity certifications (e.g., Cradle-to-Cradle) to increase trust with consumers by **demonstrating their commitment to sustainable and circular practices.**

These certifications can build trust and provide business value by:

Increasing credibility and transparency:

- Provide objective assessment of a company's environmental performance.
- Establish credibility and transparency and showcase adherence to recognized standards and best practices.
- Build trust with consumers who are increasingly concerned about the environmental impact of the products they purchase by providing transparency.

Validating businesses marketing claims:

- Validate claims made by businesses regarding their sustainability and circularity efforts because certification process involves rigorous evaluation and verification.
- Provide evidence to consumers that their claims are backed by independent verification.

Increasing consumer awareness:

- Serve as educational tools and raise awareness about circularity.
- Educate consumers about associated environmental benefits to ultimately make more informed purchasing decisions.

Providing a competitive advantage:

- Differentiate from competitors and position as a leader in the space.

By leveraging third-party circularity certifications, businesses can enhance their reputation, foster consumer trust, and align themselves with the growing demand for sustainable and circular products. These certifications serve as valuable tools in communicating a company's commitment to environmental responsibility and can contribute to long-term customer loyalty and market success.

Case Study

Ralph Lauren: Cradle to Cradle Certified™ [105]

- Cradle to Cradle Certified® is the leading multi-attribute standard that assesses the safety, circularity, and responsibility of materials and products.
- Ralph Lauren achieved Cradle to Cradle Certified™ Gold for its cashmere crewneck and turtleneck sweaters.

Advocate

Beyond acting within the scope of their own operations, companies can also advocate for policies and investments that support the transition to a more circular economy, which is the next stage of this circularity action plan.

Within the textiles sector, companies might try to:

Understand current and upcoming policies within their geographies and the impact they may have on their business.

Advocate for and scale policies that can help enable circular solutions by providing required infrastructure, reducing costs, and requiring transparency and certifications.

To successfully make the textiles value chain more circular, companies can focus their advocacy on three key areas: product standards, data and analysis tools, and incentives for sustainable production.

Extended Producer Responsibility

Following global EPR trends in packaging, you should look out for similar regulation in the textile sector if you work in textiles. As of July 2023, the Netherlands will implement an EPR scheme for textiles, making producers responsible for an appropriate collection system, recycling and reusing of clothing and household textiles and the financing of this entire system. Considered a leading effort, this will be a key policy to watch as it rolls out.

Product Standards

Product standards for textiles, like those outlined in the E.U.'s Ecodesign for Sustainable Products Regulation (ESPR) proposal, can promote considerations like durability, reliability, reusability, reparability, ease of maintenance, encouraging circular efforts.

These standards can make circular strategies a necessary investment and a competitive advantage for those who succeed.

Sustainable Production Incentives

To make the textiles value chain more circular, it's critical that the cultivation of textile raw materials be more sustainable – across water, biodiversity, hazardous chemicals and energy through certification, improved cultivation practices or alternative systems such as regenerative farming.

Additional investment, innovation and incentives are needed to scale existing efforts and make further improvements.

Figure 23: Key Advocacy Areas for Textiles[106]

Given the size and scale of its GHG emissions, the textiles sector has already been the target of multiple sustainability-focused policies and regulations, some of which are in effect today. With the network of brands, retailers and other strategic partners involved in the textiles sector, nonprofits and policy groups play a critical role in connecting the ecosystem of stakeholders to organize around circularity.

Key Policies to Know

European Union Ecodesign for Sustainable Products Regulation (ESPR)
ESPR includes a revision of the Ecodesign Directive which sets sustainability standards for ~30 product categories (expanding from energy-related products to more materials-based products) including broader considerations of durability, reliability, reusability, reparability, ease of maintenance, etc.[107,108]

Within the textile context, another key aspect of this initiative is the Digital Product Passport (DPP).[109] A new requirement for regulated products, DPPs collect, store, and easily access product data across the product life cycle.

This will help brands communicate the environmental impacts of their products to customers and make it easier to repair / recycle products. Final approval of DPP regulation is expected in 2023 or 2024, and it would be enforced in 2027. Advocating for this type of initiative could spur investment and innovation in a space that enhances traceability, data collection, measurement, and tracking.

E.U. Strategy for Sustainable Textiles

The E.U. has published its vision that:
"By 2030 textile products placed on the E.U. market are long-lived and recyclable, to a great extent made of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. Consumers benefit longer from high quality affordable textiles, fast fashion is out of fashion, and economically profitable re-use and repair services are widely available. In a competitive, resilient, and innovative textiles sector, producers take responsibility for their products along the value chain, including when they become waste. The circular textiles ecosystem is thriving, driven by sufficient capacities for innovative fiber-to-fiber recycling, while the incineration and landfilling of textiles is reduced to the minimum."[110]

[U.S.] RECOVER Act (H.R.2357)
Introduced to the U.S. House of Representatives in 2021, this bill would authorize the Environmental Protection Agency (EPA) to establish a recycling infrastructure program. It would also allocate $500M in financial assistance to eligible states, local governments, and tribal governments to support and expand their recycling infrastructure and programs, in the form of federal matching grants.[111]

[U.S.] New York Assembly Bill A8352
Still in committee, this bill requires fashion retail sellers and manufacturers to disclose environmental and social due diligence policies; and establishes a community benefit fund for the purpose of implementing one or more environmental benefit projects that directly and verifiably benefit environmental justice communities.[112]

Other Policy Considerations

Data Governance
The lack of consistent metrics, data, and information about the impact of circularity efforts to date makes it more difficult to communicate the business and environmental cases when seeking investment. Guidance around measurement and data governance can help standardize this and spur investment in the space.

Policy Players to Know

American Circular Textiles (ACT) Policy Group
Founded by Circular Services Group, Resource Recycling Systems, thredUp, Rent the Runway, Recurate, Trove, and others working across reuse and rental services, this group seeks to develop and shape policies to support textile recycling and recovery in the United States.[113]

Global Fashion Agenda
A non-profit organization that fosters industry collaboration on sustainability in fashion to drive impact. With the ultimate vision of a net positive fashion industry, Global Fashion Agenda is on a mission to accelerate impact by inspiring, educating, influencing, and mobilizing all stakeholders.[114]

Sustainable Apparel Coalition
A global multi-stakeholder nonprofit alliance for the consumer goods industry, the SAC brings together 280+ member organizations representing 36 countries to transform business for “exponential impact” through groundbreaking tools, collaborative partnerships, and trusted leadership for industry sustainability.[115]

ZDHC Foundation
ZDHC is a multi-stakeholder organization with over 320 signatories, including brands, suppliers, solutions providers, and chemical suppliers, committed to moving towards safer chemical management.[116]

Advance

All companies working in relation to textiles and fashion can seek out ways to advance the broader circular economy, regardless of whether they use and waste materials.

A few examples of ways to do so include:

Provide funding and financial solutions to companies pursuing circular solutions within textiles.

Support consumer and regulator education on topics related to different circular solutions.

Develop enabling technologies and circular textile metrics to support companies looking to implement and scale solutions.

Support and develop infrastructure, processes, and systems to enable and scale circular solutions within textile

Businesses can facilitate the adoption of circularity within textiles by providing tools, technology, and support that address barriers related to data, infrastructure, and systems change. According to EON's Head of Sustainability, Product, Julie Brown, "Interoperability is key to capturing the value of connected products. We need to work together to develop solutions that work at scale."

Within textiles, technologies and coalitions are two powerful ways companies can advance circular efforts. One example of an organization providing tools to advance circularity is the Sustainable Apparel Coalition, which developed the Higg Index to standardize measurement of value chain sustainability.

Technologies

As demonstrated earlier, technological innovation can be very powerful for the textiles sector in terms of developing ways to more effectively and / or efficiently cycle back or resell products. While many players have already entered the space, areas with continued need for innovation and development include:

- **Verifying data:** Audit data for validity, accuracy, and integrity (can also leverage blockchain here).
- **Connecting supply chain**: Increase information associated with garments through the supply chain; gather item-level data and enable data collection and attribution.
- **Embed digital trackers into physical products:** Create and utilize tracking tools (e.g., QR codes, NFC tags, RFID tags) on clothes to embed product origin and life cycle data and enable tracking and transparency across the supply chain.

Coalitions

While companies can always work to form new coalitions, there are many already in place in the textiles space. To keep advancing the broader circular economy — sharing resources and knowledge and learning from insight and resources of others — you might consider joining one of the many coalitions that already exist. One example is **CIRPASS**, a consortium of 30+ industry partners **laying the groundwork for Digital Product Passports (DPPs).**[117] Funded by the European Commission under the Digital Europe Programme, this group seeks to prepare brands for piloting and deployment of DPPs starting in 2023 (with a focus on electronics, batteries, and textiles).

Additional ecosystem coordinators that are working to ease the transition to a more circular economy include the Global Fashion Agenda, Fashion Takes Action, Textile Exchange, UN Alliance for Sustainable Fashion, Apparel Impact Institute, and Mistra Future Fashion.

Depending on the size of your company and your objectives, it may or may not make sense to formally join these coalitions. Even if you're not able to join, it's a good idea to follow them and reference the resources they put out to stay knowledgeable on driving forces and efforts underway by other players in the textiles sector.

Case Study

World HIGG Index[118]

- A suite of tools for standardized measurement of value chain sustainability at the product, brand, and facility levels, including the cradle-to-grave environmental impact and overall environmental performance. The Higg Index is now part of Worldly, which rebranded in 2023.
- Launched in 2011 and used by >21,000 organizations globally.
- Developed over the course of 10 years in partnership with Sustainable Apparel Coalition (SAC) members to enable systemic change via a common language and platform, the success of this index comes in part from its already established influence in the industry to initiate standardization and push for adoption.
- Despite some concerns from stakeholders about the use of the Higg Index in 2022, it still serves as a helpful example of collaboration across stakeholders and a helpful starting point for measuring and benchmarking efforts related to sustainability.

Sector Deep Dives: Packaging

While plastic packaging is ubiquitous in our current society, its production and disposal have significant environmental, health, and social impacts. Adopting circular solutions is crucial for the future of sustainable packaging and the broader goal of reaching net zero.

Designing for circularity with sustainable chemistry principles further helps by preventing 1) the re-circulation of toxics when they are recycled or composted and 2) impacts to climate or health during manufacturing or any point in the life cycle.[119]

By the Numbers:

TOTAL EMISSIONS
1.8 Gt CO_2e / year, including material-related emissions and operational energy use[120]

ESTIMATED ADDRESSABLE EMISSIONS
0.45 Gt CO_2e estimated to be addressable through circular solutions[122]

CIRCULARITY OPPORTUNITY
$80B–120B opportunity by recovering plastic packaging material currently lost after single-use[121]

"Following our current trends, there could be more plastic than fish in the ocean by 2050 (by weight)."
– Ellen MacArthur Foundation

20x

Global consumption of plastics has increased twentyfold in the last 50 years, and 40% of plastics are used for packaging[123]

14%

Of current plastic packaging is recycled, despite 70% of plastic packaging being able to be reused or recycled, equating to a loss of $80B-120B per year[124]

Overview

Plastic packaging is extremely versatile and cheap, making it ubiquitous in our society. However, packaging poses large environmental and health hazards, filling up landfills and waterways and requiring large amounts of energy for production. In addition to its low cost and versatility, plastic is **extremely flexible, durable, and lightweight**, which, combined with its low cost and versatility, makes it a widely-used packaging solution today. The **volume of plastic packaging will continue to grow** and is expected to **quadruple by 2050**.[125]

Related to our **current linear production system**, there are significant **health and environmental impacts resulting from plastic packaging:**

- Plastic breaks down into microplastics and are found in everyone, including newborns. Scientists are continuing to study the health effects and damage caused by microplastics.
- More than 13,000 chemicals are identified to be associated with plastic production. Over 7,000 of these chemicals have been studied for their hazardous properties, and more than 3,200 are known to be hazardous.[126]
- Chemicals in food packaging can leach into food and are linked to causing endocrine disruption which can tie to childhood obesity, cardiovascular disease, depression, cancer, infertility, etc.
- Plastic pollution in the ocean accumulates in oceans and other waterways, harming wildlife and ecosystems and damaging fisheries, shipping, and tourism.
- It is estimated that plastic pollution kills 100,000 marine mammals each year and that 56% of the planet's whale, dolphin, and porpoise species have consumed plastic.[127]
- Production of virgin plastics is energy-intensive and relies heavily on fossil fuels, contributing to GHG emissions, accounting for roughly 2% of total global emissions.
- Furthermore, on average, the production of packaging comprises 5% of energy used in the life cycle of food products.
- Pollution and toxic contamination from production and recycling of plastic and associated chemical inputs have a disproportionate impact on fenceline communities in close proximity to these facilities. These communities are known to be at a higher risk for heart disease, cancer, and respiratory problems related to poor air quality, like asthma and emphysema.[128]

These health and environmental risks alone make a compelling case for change, but achieving that change is, of course, no easy feat. Transitioning to more circular packaging requires overcoming several obstacles, including changing consumer behavior (e.g., shifting away from single-use systems) and coordinating across the value chain. The table below outlines several of the relevant barriers.

Market Barriers	Technical Barriers	Regulatory Barriers	Cultural Barriers
There is a lack of alternative materials that have comparable functionality and pricing, and that also have a lower environmental impact[1]	Post-consumer plastics are often mixed and contaminated, compromising the quality and safety of outputs[2]	There is a lack of incentives to design for extended use and recyclability through policy (tax incentives)[1]	Sustainability is not consumers' primary purchasing decision driver, although increasingly they desire to purchase sustainable products[1]
Virgin plastics are cheap and easily accessible, providing little incentive for businesses to utilize and source recycled feedstock[1]	There are poor unit economics for recycling as technology requires large quantities to be economically viable	Oil production is often subsidized, serving as a perverse incentive for a circular economy within plastics[1]	Consumer behavior change is required to adopt reuse and refill systems and decrease reliance and expectation of single-use culture. While consumer awareness is rising, convenience may compromise behavior change
The business case for reuse of plastics is challenging with high operational costs for reuse business models and low profitability as sourcing and cleaning plastics is expensive.[1]	Take caution against un-proven chemical recycling practices that can impose greater climate and health risks than traditional recycling methods.	There are a variety of reuse policies that have slowed down both implementation and scaling	There are some concerns about the hygiene and safety of reused plastics, especially coming out of COVID-19 pandemic
Externalities (e.g., GHG emissions, health hazards, water use) are not accounted for in packaging pricing[1,2]	Certain plastics have limited recyclability, and plastic quality is degraded post-recycling. PET can be recycled a maximum of 2 to 3 times	Limited financing models for recycling infrastructure make funding difficult to secure	Improper disposal of plastics at end-of-use, including types of plastics that can be collected, disrupts the recycling loop[2]
There is a lack of funding for R&D on recyclability of plastics and polymers	The use of laminates and other multi-type or multi-layer plastics can be hard to separate		
The value of different postconsumer waste types fluctuates making it difficult to predict and plan for	Companies have difficulty finding people with the technical skills needed to implement circular solutions		

System Barriers

- ✓ Insufficient recycling service or collection points, leading to improper disposal of plastic waste. Recycling services vary by geography and even by municipality
- ✓ Inconsistent labeling contributes to consumer confusion
- ✓ Infrastructure is dependent on the collection of separated plastics form consumers and requires a network of collection points, which is costly to implement
- ✓ Global waste trade landscape is everchanging and is fragmented; changing regulations increase cost and complexity that disincentivize transportation of plastics for recycling
- ✓ Fragmented and uncoordinated value chain limits impact at scale

Figure 24: Barriers to a Circular Economy for Packaging [129,130]

Despite these challenges, you and your business still have many reasons to embrace circular solutions including alignment with consumer preferences and regulatory trends.

Key Motivators

CONSUMER DEMAND

Consumers are increasingly conscious of and want to make purchasing decisions that align with their sustainability values, seeking out products with minimal or plastic-free packaging.

Social media movements are gaining traction and calling out brands for excessive plastic packaging.

Trends to become zero waste have taken hold, and the number of packaging-free stores and products to meet their needs have increased.

REGULATORY PRESSURE

Increasing policies around sustainable packaging are pushing businesses to set goals and take action to limit the environmental and health impact of their packaging (e.g., free of intentionally -added PFAS).

More than 100 countries have legislation prohibiting plastic bags, with some instituting a modest tax on single-use plastic and paper bags.

Many countries have banned specific single-use plastic items.

Globally, there has been an increase in Extended Producer Responsibility (EPR) legislation, much of which focuses on packaging (see the 'Advocate' section for more information).

With both these challenges and drivers for change in mind, it's important to **ensure the transition to a more circular economy is both safe and just.** To achieve this, circular strategies must center the needs and voices of communities that have historically borne the burden of plastic pollution.[131]

Some social and environmental justice issues present in today's linear value chain for packaging that may be reduced or alleviated through circularity:

Informal waste pickers and collectors involved in municipal waste management **experience hazardous conditions and low incomes.**

1. Waste pickers and collectors play an important role in municipal waste collection, sorting, and recycling. Many of these workers are exposed to hazardous conditions and subsist on very low incomes.[132]

2. Additionally, waste pickers and communities at the end of the plastics value chain often struggle with waste management, which is especially common in the Global South, and also suffer from air, water, and soil pollution from disposal and incineration.[133]

People may suffer both environmental and health impacts related to the packaging life cycle.[134]

1. Communities located near industrial facilities for raw material extraction and manufacturing are exposed to toxic emissions, chemicals from production as well as additional emissions from warehouses and trucks.

2. **Women are at higher risk** to plastic pollution due to higher aggregated exposure and use of plastics in household, personal care and feminine care products.[135]

For a safe and just transition, key considerations to keep in mind include:

There are toxicity concerns with some plastics recycling approaches; businesses should commit to **safe business practices** and work to limit waste and pollution of local communities and environments, and should support laws and regulations that protect human health and the environment.[136]

Businesses need to ensure **fair treatment and protection** for both existing waste pickers and new employees involved in sorting and recycling plastics.

1. Businesses and policies will need to provide targeted support to formalize informal jobs in recycling and waste management and transform them into decent employment opportunities.[137]

2. The livelihoods of waste pickers are at risk, but certain countries have taken steps to involve them in new processes. These initiatives provide services that foster collaboration among local authorities, businesses, government, and citizens, creating synergies for all stakeholders.[138]

3. By improving and enhancing recycling practices, businesses and countries can **unlock benefits such as increased revenues and improved access to critical resources**, further supporting livelihoods of local populations.[139]

Businesses can act, advocate for, and advance circularity within plastic packaging through a variety of initiatives from pilot projects to participation in packaging coalitions.

Figure 25. Act, Advocate, & Advance Framework for Packaging

Act

Plan

1

Three key strategies to transition towards a circular economy are to redesign packaging, reuse packaging, and recycle plastic packaging.

This report will deep dive into redesigning and innovating packaging and reuse packaging because of their potential for impact to reduce and manage waste. In fact, focusing on these strategies can limit the amount of packaging and the climate impact of recycling.

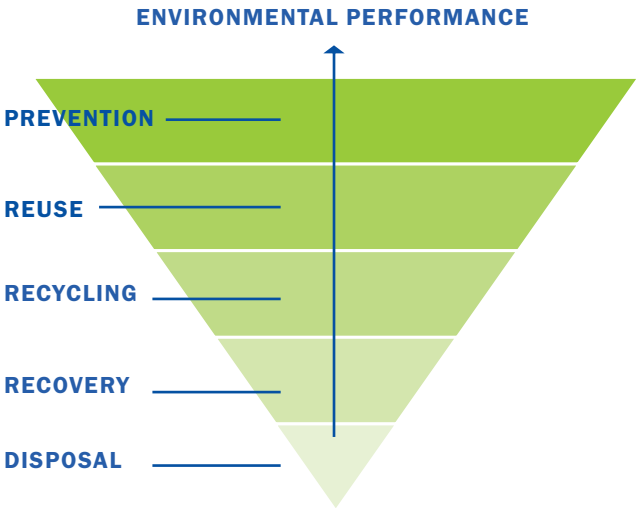


Figure 26. The Waste Management Hierarchy

The waste management hierarchy aims to guide and rank decisions and emphasizes prevention, reuse, and recycling as critical for sustainable management.[3]

Redesign & innovate packaging to prevent waste *[Design for circularity]*
Rethinking and modifying the design of product packaging to improve its sustainability and safety while maintaining its functionality.

Examples include: design for recycling; design without toxic chemical additives; delivery model design; minimalist packaging; bio-based packaging and alternative materials

Reuse packaging *[Operate circularly]*
Utilizing packaging materials multiple times before they are discarded or recycled, often by using packaging that can be easily cleaned, maintained, and use again.

Examples include: milkman model and reverse logistics; retaining packaging ownership; refillable packaging

Recycle plastic packaging *[Operate circularly]*
Converting plastic waste into new products or raw materials, rather than discarding them in landfills or incinerating them.

Figure 27. Circular Solutions in Packaging

Redesign and innovate packaging to prevent waste

Focusing on **packaging redesign and innovation** can save 30% of plastic packaging that would not otherwise be reused or recycled and that is destined by design for landfill, incineration, and / or leaking into the environment.[140] Strategies to redesign and innovate packaging includes:

Design for recycling
Designing with recyclability in mind to maximize recoverability of materials for use in new packaging. For example, new labeling practices can prevent printed labels from impairing recyclability.

Additionally, it's important to design out toxic chemical additives so that they aren't recycled into new materials or into soil if they do make it into a compost or recycling bin.

Delivery model design
Streamlining of and creativity within delivery processes can minimize the need for certain packaging.

Minimalist packaging
Reducing the amount of material used in packaging and simplifying packaging designs while maintaining its integrity and functionality. This helps to minimize resource consumption and transportation emissions while improving recyclability.

Bio-based packaging and alternative materials
Utilizing biodegradable and compostable packaging materials can help businesses reduce the environmental impact of packaging waste and avoid harmful materials, assuming other factors remain climate neutral. Note that these materials are not always better. Consider the upstream and downstream implications before implementing these solutions.

Vegware: Compostable Certification Program

- Develops products made from plants using renewable, lower carbon, recycled or reclaimed materials that are designed to be commercially compostable and break down in <12 weeks in industrial composting facilities.
- Products are certified 'compostable' by various independent bodies including BPI Certified Compostable and Compost Manufacturing Alliance.

Coca-Cola: PlantBottle™

- In 2021, developed a bottle made from 100% plant-based plastic, excluding the cap and label, using technologies that can commercially scale.
- Opened up the PlantBottle™ IP more broadly to competitors in the beverage industry and non-competitive companies to scale up demand and drive-down pricing.
- The bottle is fully recyclable within existing recycling streams.

Amazon: "Frustration-Free Packaging" Initiative

- Aims to reduce excess packaging and make it easier for customers to open and recycle their packages.
- Works with manufacturers to box products in certified Frustration-Free Packaging.
- Since 2015, Amazon has reduced per-shipment packaging weight by 38% and eliminated more than 1.5M tons of packaging material.

Reuse packaging

Focusing on **reuse** can drive $9B in additional economic value through new delivery models and shifts in consumer use, representing 20% of total plastic packaging.[141] Reusable packaging involves implementing systems, such as reverse logistics processes or package ownership initiatives, that allow businesses to reduce single-use packaging waste. Common reuse archetypes include refill at home, return from home, refill on the go, return on the go, and business-to-business refills and returns. While these reuse strategies help to reduce single-use packaging, they still need to account for and consider end-of-life and overall life cycle impacts.

REFILL AT HOME

Consumers reuse their containers by refilling at home via a bulk refill source

Ex: Cif Ecorefill, ATTITUDE

RETURN FROM HOME

Consumers arrange for containers to be collected from their home or mailed from home and refilled

Ex: Loop, Bower Collective

REFILL ON THE GO

Consumers refill their containers through dispensing systems in stores

Ex: Algramo, Rainbow Grocery

RETURN ON THE GO

Consumers return containers at a drop-off point, and it is collected and refilled by manufacturers

Ex: Koinpack, Returnr, Universal Reusable Bottle

BUSINESS-TO-BUSINESS REFILLS AND RETURNS

Circularity as a service where businesses rely on reusable container providers for container delivery, collection, and cleaning

Ex: MIWA, Dishcraft, Dispatch Goods, Microstar Logistics

Figure 28. Common Reuse Archetypes[142]

Loop: Reuse Subscription Service

Return from Home

- A global subscription-based shopping platform that partners with major brands (e.g., Walmart, Procter & Gamble, Unilever) to offer products in reusable containers.
- Customers return empty containers, which are then cleaned, refilled, and reused.
- Started in 2019, Loop has diverted 40 million pounds of waste.

Algramo: Reusable Stations

Refill on the Go

- Sells reusable product containers and enables refill stations using IoT and RFID so that consumers only pay for how much they purchase.
- Based in Chile, Algramo serves 50,000+ customers across 2,000 locations.
- Key partners include Unilever, Nestlé Purina, and Clorox.

Rainbow Grocery Cooperative:

Bulk Refill on the Go

- Offers a comprehensive selection of 800+ bulk products including herbs, teas, spices, coffees, granolas, olives, nuts, flours, olive oils, miso, etc.
- Consumers bring their own containers and fill up on desired products at desired quantities.

Implement

2

Utilizing technology to measure and track KPIs can help businesses understand how initial implementation of a given strategy meets its packaging goals.

One company leveraging technology to support tracking and measurement is BASF Canada, which leverages blockchain and the full network of plastics players to enable circularity in plastics.

Case Study

BASF Canada & the reciChain™ program: Blockchain to enable Plastics Circularity

- The reciChain™ program is a technology-enabled ecosystem that brings together all the plastic value chain players to enable circularity, tracking, and sorting of recycled plastic throughout the lifecycle.
- The concept includes a physical tracer that identifies and follows plastic features and a blockchain platform powered by Realizse, which enables the transparency and traceability of information and maintains enterprise privacy.
- Created by BASF in Sao Paolo, Brazil, the reciChain concept was tested in 2020 with an initial proof-of-concept pilot in British Columbia, Canada. With the support of Alberta Innovates, the reciChain™ program is now expanding to Alberta to conduct a subsequent project phase to scale the solution to a semi-commercial phase.

Examples of key metrics that businesses can leverage to track circularity of packaging include:

RESOURCE PRODUCTIVITY

The total sales of a business in dollars, divided by the mass of virgin material inflow.

Demonstrates how effectively companies allocate materials, with the greater the ratio meaning greater circularity and operational efficiency.

MATERIAL EFFICIENCY

Using materials and water efficiently to maximize their utility and minimize waste or resource consumption.

Typically measured via a material flow analysis and through the amount of waste generated by a business against the portion of waste diverted from landfill.

Toxic chemical audits and tracking to effectively manage and minimize the impact of toxic and harmful chemicals in packaging.

COLLECTION RATE

The amount of plastic packaging collected (excluding any contaminants) vs. the amount of plastic packaging placed on the market.

Indicates the effectiveness of collection systems and processes in place to recover plastic packaging materials and highlights how much material is not captured and lost from the system.

May track pre- and/or post-consumer recycling, depending on the business.

CLOSED LOOP RECYCLING RATE

The amount of recycled plastic material (pre-consumer, post-consumer, or both) that is used to manufacture new plastic packaging or other plastic products.

As opposed to the overall recycling rate, this indicator only considers recycled plastics being used to manufacture new plastic packaging.

Offers a more targeted assessment of the circularity of a specific material's recycling practices.

RECYCLED CONTENT RATE

The amount of recycled (pre-, post-consumer) plastic used in the manufacturing of new plastic packaging vs. the production volume of new plastic packaging.

Shows how much recycled plastic is in fact used to make new packaging.

Note: mass balance accounting is not a reliable recycled content calculation.

Scale

3

Current circular infrastructure and solutions are primarily within the pilot or start-up stage. As of 2021, 77% of plastic packaging reuse solutions fall within these categories.

With ~1,000 pilots or start-ups recorded, there is no shortage of solutions in consideration.

Of solutions included in this analysis, only 18% are at the growth stage or above.

To help protect this strong pipeline of solutions and effectively scale/grow prioritized efforts, companies need to invest in and support these ideas.

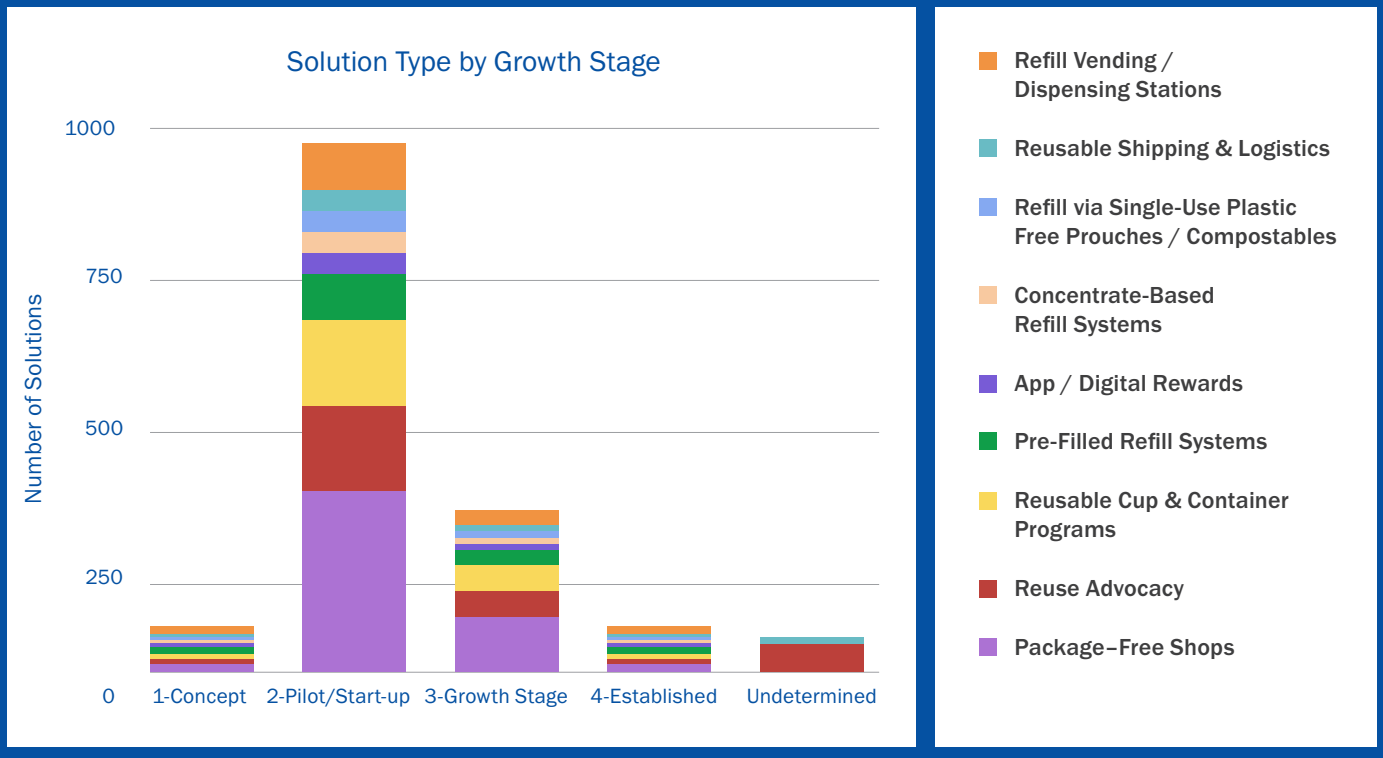


Figure 29. Funding for Reuse — Solution Type by Growth Stage[143]

Closed Loop Circular Plastics Fund *Flexible Financing*

- Provides flexible financing for circular economy infrastructure, technologies, and companies that advance the recovery and recycling of plastics
- Offers support and advice from experts with 200+ years combined industry and financial experience

Organizations and coalitions offer financial opportunities to help advance the circular economy for plastic packaging. To continue to scale efforts related to circular packaging, it is critical to communicate the impact and opportunity to relevant stakeholders and find financing and funding to scale solutions. Some relevant funding sources include:

R&D Spend
Drive change and innovation directly through R&D spend.

Partnerships / Collaborations to Co-fund:
Bring together various actors such as businesses and non-profit organizations to take initiative on plastic packaging solutions.

- Closed Loop Circular Plastics Fund
- Sustainable Packaging Coalition's Innovation Fund
- Polyethylene Terephthalate (PET) Recycling Coalition

National and Regional Government Programs
Play a critical role to support programs through funding initiatives such as grants or low-interest loans.

When determining how best to scale a successful packaging pilot program or start-up, businesses should consider key questions like:

1. How does our current infrastructure (e.g., manufacturing, distribution, take-back logistics, recycling) enable our ability to expand these efforts into new markets or product lines?

2. What are the expected or potential business benefits? Are there any specific challenges or risks (e.g., regulatory, environmental, health, social) associated with scaling our operations?

3. Are the dynamics of this market (e.g., consumer preferences/ values/behaviors, tariffs, resource availability, transportation costs) similar to other geographies that we could expand to?

4. Is the current technology or material compatible with our other product lines? Does it have a similar make-up, form, or function?

   For example, shampoo vs. bleach require different containers and soap dispensers vs. garbage bags have different forms that require different solutions.

5. What steps can be taken to ensure a smooth scaling process without compromising quality or customer satisfaction?

Advocate

With various types of regulations, bans, taxes and incentives in place and continued emphasis placed on it, packaging also has various areas of advocacy to consider — including EPR, plastics treaties and tariffs.

Extended Producer Responsibility

Extended Producer Responsibility is particularly relevant for packaging and plastics, given that many of the EPR policies and schemes in place around the world today are focused on packaging, with some movement in other categories as well. EPR schemes can help fund investment in the infrastructure and processes needed to manage end-of-life for packaging products.

Plastic Treaties

In recent years, many corporations and countries (including 175 member nations of the UN) have increased pressure on plastics through calls to action, pledges and treaties. While commitments do not equate to action, they present an opportunity to keep regulatory pressure high and push policymakers and peers alike to act.

Tariffs

For many global companies, tariffs play an important role in shaping their traditional supply chain decisions. As things like extended producer responsibility continue to take hold and shift focus to the full lifecycle of packaging, changes to countries' policies and tariffs on pre- and post-consumer materials can have significant impacts on the decisions you make.

Figure 30. Key Advocacy Areas for Packaging

Key policies to know:

United Nations Treaty on Plastic Pollution
In March 2022, 175 member nations of the UN agreed to develop a legally binding agreement on plastic pollution by 2024. This agreement is expected to include diverse alternatives to address the full life cycle of plastics, the design of reusable and recyclable products and materials, and the need for enhanced international collaboration to facilitate access to technology, capacity building and scientific and technical cooperation.[144]

This decision comes amidst rising public pressure, including pressure from more than 70 leading businesses and financial institutions who issued a joint statement and more than 2,000 people around the world who signed a WWF petition on the topic leading up to the UN Environment Assembly.[145,146]

Policy Options to Eliminate Additional Marine Plastic Litter
In this "think piece,' the United Nation Environment Program (UNEP) and its International Resource Panel (IRP) outline the different policy options that could help create the enabling conditions needed to reduce plastic leakage to the ocean to 5M tones by 2040 and closer to net zero by 2050 through systems interventions.[147]

Through the Osaka Blue Ocean Vision, G20 countries voluntarily commit to "reduce additional pollution by marine plastic litter to zero by 2050 through a comprehensive life-cycle approach." This 'think piece" was commissioned by the G20 to support that vision.[148]

Revision of the Directive on Packaging and Packaging Waste
The original policy outlines the E.U.'s rules on managing packaging and packaging waste and updates include efforts to work toward a circular economy.[149]

This directive states that E.U. countries should have EPR schemes established for all packaging by the end of 2024.[150] Under EPR policy, packaging manufacturers become responsible for the full life cycle of the packaging they produce. In practice, they are typically required to fund local recycling programs by paying fees to a Producer Responsibility Organization (PRO) who then manages the recycling and / or disposal process. EPR fees can also incentivize companies to make packaging more recyclable and use a greater percentage of recycled content. This financial support helps to ensure universal recycling access and high participation rates.[151]

Despite coalition opposition to the strict single-use plastic targets anticipated for areas like food delivery in the latest revisions proposed in 2022, many companies proactively advocate in favor of EPR schemes.

Other Considerations: Tariffs and Trade Policies
For businesses with global supply chains, the transition to a more circular economy is closely linked with international trade through cross-border supply chains, end-of-life value chains and services trade.[152]

Typically supply chains are designed with tariff avoidance in mind. When you introduce any type of recycling, repairing, refurbishing, or reselling, those-take-back, reverse logistics and end-of-life value chain add more complexity when it comes to navigating tariffs.

Advance

Businesses are making organized commitments around plastic packaging that demonstrate their commitment to driving the transition, ultimately encouraging innovation, collaboration, and development of sustainable packaging solutions. While businesses must take the first step of setting ambitious commitments on plastics and packaging, they must also back their commitments with clear, time-bound plans to achieve these goals to demonstrate their roadmap to stakeholders.

The New Plastics Economy Global Commitment 2022 Progress[153]

Key 2025 targets are expected to be missed, reinforcing the urgency for businesses to accelerate action.

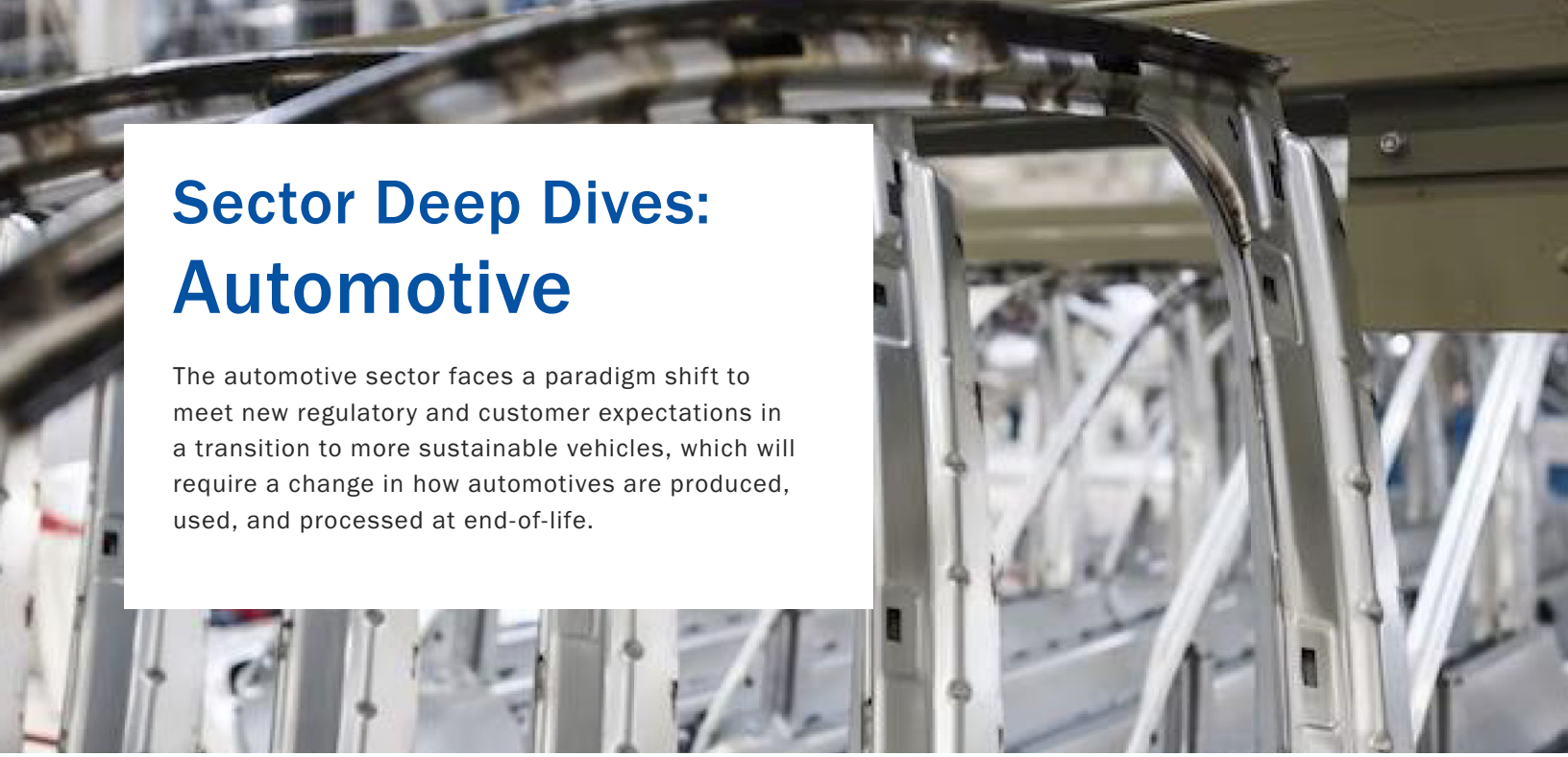
Businesses should accelerate action around reuse, flexible packaging, and decoupling business growth from packaging use.

Requires action by governments to drive and accelerate action through legislation.

ADDITIONAL COMMITMENTS INCLUDE:

Plastic Pacts Initiatives

Collaborative initiatives that bring together businesses, governments, and NGOs such as the U.S. Plastics Pact.



Sector Deep Dives: Automotive

The automotive sector faces a paradigm shift to meet new regulatory and customer expectations in a transition to more sustainable vehicles, which will require a change in how automotives are produced, used, and processed at end-of-life.

By the Numbers:

TOTAL EMISSIONS
9.8 Gt CO_2e / year, including material-related emissions and operational energy use[154]

ESTIMATED ADDRESSABLE EMISSIONS
3.92 Gt CO_2e estimated to be addressable through circular solutions[157]

CIRCULARITY OPPORTUNITY
Reduce material emissions 57–70%[155] and unlock revenues 15–20x sales price[156]

"Based on current technology, we see the opportunity [for circularity] to reduce [automotive] carbon emissions by up to 75% and resource consumption by up to 80% per passenger kilometre by 2030"
– World Economic Forum[158]

Overview

PRODUCTION

Current production processes demand extensive global supply chains, which introduce business risk and can cause environmental degradation through mining operations and historically toxic battery remanufacturing processes.

Resources to produce automotives often come from countries with weaker labor and environmental protections than the countries where vehicles are produced. This can result in exploitative practices in the traditional, linear development supply chain.

Continuing to produce and use automobiles at the current rate will result in the production of 2 billion vehicles by 2030, with increased CO_2 emissions and resource consumption, blowing past the global CO_2 budget for a net zero economy.[159]

USE

In 2020, there were 1.2 billion automotive vehicles globally that contributed 3.4 Gt of CO_2 per year and consumed 113 Mt of resources.[160]

END-OF-LIFE PROCESSING

Today, only 50-60% of automotive fleets enter recycling infrastructure.[161]

There are several obstacles that make the transition to a more circular economy challenging for the automotive industry. These include market, technical, regulatory, and cultural barriers. Underlying these are systemic barriers that need to be addressed to realize a circular economy in the automotive industry.

Market Barriers	Technical Barriers	Regulatory Barriers	Cultural Barriers
Misaligned incentives lead OEMs to focus on costs and selling vehicles to consumers rather than looking at service-focused business models that promote circularity	Plastics and metals are often **downcycled** rather than recycled	Legislation does not focus on full lifecycle emissions	Customers use autos inefficiently, with **vehicles sitting unused** much of the year and seat capacity rarely filled
Mobility-as-a-Service (MaaS) and associated **revenue streams are underdeveloped** as of now	The **scale** of recycling technologies, including battery recycling techniques such as Thermal Pretreatment and Hydrometallurgy, Hydro-to-Cathode Processing, and Direct Recycling Practice makes executing circular strategies difficult	Emissions largely remain externalities and are not priced into the cost of mobility	Consumer preferences focus on owning a vehicle as a **status symbol** and sign of independence
Returns on circularity can be difficult to capture by existing market players	For some parts like tires, the **physical chemistry doesn't exist** to break down a particular material for recycling		

System Barriers

- **Limited circularity infrastructure** for recycling and the **high cost of new infrastructure** require significant up-front investment to encourage adoption
- **Existing business models** inhibit circular value capture
- Limited spent EV batteries makes battery recycling a small market in the near term
- Not designing for recyclability makes it **difficult to break down** existing vehicles into component parts

Figure 31. Barriers to a Circular Economy in Automotives[162,163]

Despite these challenges, businesses are motivated to act due to increasing consumer awareness, new commercialization opportunities, growing regulatory pressure, and the potential to manage risks within supply chains.

Key Motivators

CONSUMER DEMAND

Consumers are increasingly conscious of a brand's purpose with more and more consumers wanting to make purchasing decisions that align with their values.

In the U.S., there are tax incentives for EVs, helping drive demand.

There is a desire to reduce operating costs through fuel and repairs, and increase the reliability and life of vehicles.

Businesses can engage in new markets and unlock new revenue streams. An increasing number of companies are exploring new business models and incorporating resale and recommerce operations into their business, realizing pent up consumer demand

RISK MITIGATION WITHIN SUPPLY CHAINS

Supply chain risk can be reduced through reduced reliance on virgin materials.

Improved visibility into supply chain planning allows for mitigation of risks and bottlenecks.

COMMERCIALIZATION OPPORTUNITIES

Lightweighting vehicles can reduce material needs and costs, as well as ongoing operating costs through greater efficiency.[164]

Circularity solutions can unlock new revenue streams such as remanufacturing and repair.[165]

Mobility-as-a-Service (MaaS) and vehicle leasing to provide transportation-on-demand introduce new forms of ownership.[166]

Businesses have increased opportunities to update marketing and brand image to increase market share.

End-of-life material value typically increases as supply chain becomes more circular.[167]

Fleet servicing for MaaS can provide additional revenue streams.[168]

Based on scale, costs of recycling and circular design processes can be lowered.[169]

REGULATORY PRESSURE

Global policies have emerged to promote automotive circularity, including the E.U.'s Batteries Regulation and End-of-Life Vehicles Directive.[170]

U.S. policy focus on sourcing EV materials from North America introduces tax credits through the Inflation Reduction Act.

California battery labelling requirements.[171]

To achieve a safe and just transition to a more circular economy for automotives and mobility, it is crucial to prioritize job creation and ensure safety and accessibility.

Environmental justice issues present in a linear economy that may be be resolved through a more circular solution could include:

People of color are disproportionately affected by fossil fuels as they are more likely to live near petrochemical plants and oil refineries. Consequently, these communities experience **elevated levels of exposure to toxic emissions** and increased rates of heart disease, cancer, and asthma.[172]

Contamination from automotive and fossil fuel operations drive down home prices, leading to reduced property values that make it difficult for families to build wealth, sell homes, and ultimately move away from toxic pollutants.[173]

An **inequitable distribution of pollution burden** exists as people of color are less likely to own cars compared to the amount of emissions they are exposed to.[174]

The extraction of critical minerals for EV batteries can contribute to the displacement of local communities, low wages, humans rights abuses, and adverse health impacts caused by exposure to dust containing cobalt and other metals.[175]

For instance, cobalt miners frequently encounter inadequate safety equipment and instances of child labor.

For a safe and just transition, key considerations to keep in mind include:

Public and accessible charging infrastructure is critical for a just transition to electric vehicles.

The high cost of electric vehicles is a deterrent.

Of drivers surveyed, 71% said they were interested in getting an electric car, but 48% said that lack of access to public charging infrastructure was holding them back, and 43% cited vehicle cost as a disincentive.[176]

Businesses should prioritize **safety of EV battery recycling** by promoting and sharing publicly accessible safety and material composition information to optimize battery reuse and recycling processes.[177] This will help not only increase battery recycling and reduce mineral extraction, but also improve the safety of workers in the recycling industry.

The creation of quality jobs in the reuse and recycling sector is necessary, as is improvement of working conditions for mine extraction workers to ensure they can sustain a decent livelihood.[178]

Act

Plan

- Conduct a materials footprint assessment to understand your current state value chain.
- Articulate your circular goals and aspirations and identify your target market.
- Develop the business case for circular solutions.
- Prioritize circular solutions to pilot in the near-term and long-term.

Implement

- Collaborate and partner with suppliers, recyclers, and dismantlers to push for more circular product design and manufacturing.
- Invest in capital, such as new factories and technologies, necessary to design and produce more circular vehicles.
- Start with quick-wins to gain early momentum.

Scale

- Work with industry groups to advance recycling and material re-use across the industry.
- Secure financing and funding to scale solutions and expand to additional markets.
- Expand and embed circularity within core business strategy.

Advocate

- Improve access to repairability through standardized design and repair processes, as well as third-party and owner access to knowledge and repair technology.
- Support greater recycling capabilities and funding to scale.
- Support government incentives through new policies like the Inflation Reduction Act.

Advance

- Fund emerging circularity technologies, such as 3D printing complex parts for repair and material chemistry for battery recycling.
- Work with suppliers and regulators to develop necessary technologies and processes to scale circularity within each relevant jurisdiction.
- Form and/or join partnerships and coalitions to collectivity bring about change across the automotive supply chain.
- Support and develop infrastructure, processes, and systems to enable and scale circular solutions within automotive.
- Support new business models and access to transportation, such as MaaS.

Figure 32. Act, Advocate, & Advance Framework for Automotives

Plan

1

Automotive companies can focus on six high-impact, well-established circularity solutions:

Lightweighting *[Design for circularity]*
Using lighter weight materials and improved designs to reduce vehicle weight and improve efficiency.

Example: nTop

3D Part Printing *[Manufacture efficiently]*
3D manufacturing of complex automotive parts for quick repair/replacement.

Examples: Porsche, Volkswagen, BMW

Mobility as a Service *[Market & sell consciously]*
Providing transportation on an as-needed basis to improve vehicle utilization and capacity rates, including mass transit.

Examples: Uber, Lyft, Whim

Circular Factories *[Manufacture efficiently]*
Building factories to focus on circular vehicle manufacturing, from design to vehicle production.

Examples: Renault

Battery Reprocessing *[Operate circularly]*
Extracting battery elements for recycling without degradation.

Examples: Ascend Elements, Redwood Materials

Materials Recycling *[Operate circularly]*
Recycling materials such as glass and steel for future vehicles.

Example: Audi MaterialLoop

Due to their potential for both economic and environmental impact, we will concentrate on **battery reprocessing,** *as well as* ***materials recycling****, providing a more comprehensive understanding of their practical implementation.*

Looking more closely at these last two solutions, **battery reprocessing and metal recovery is expected to grow to $95B by 2040**, fueled by regulatory pressure, regionalization of supply chains, and technological innovation. Lithium-ion batteries, used in electric vehicles, require several metals traditionally sourced through global supply chains. As regionalization takes hold and policies develop requiring more local sourcing and recycling of these batteries' materials, the market for battery reprocessing is expected to grow significantly. New technologies to support metal recovery will help accelerate the transition.

Additionally, **closed loop recycling can drive higher revenues and reduce material sourcing costs for new vehicles,** from an estimated €200-500 today to €8,000-13,000 in value realized per vehicle, according to a World Economic Forum analysis conducted in the E.U.[181] Materials recycling involves implementing new systems and technologies, as well as scaling existing technologies, to recycle used components into automotive-grade materials. One goal is to minimize downcycling, during which materials are recycled into lower grade products and not able to be reused in vehicles. Recycled materials include steel, plastic, aluminum, and glass.

Method	Process	Advantages & Challenges
Traditional Pyrometallurgy	1. Disassemble old battery 2. Smelt the disassembled battery contents 3. Create a slag of metals 4. Leach 5. Extract and purify metals 6. Synthesis 7. Produce new cathodes 8. Manufacture new battery	• Energy intensive • Well established • Primarily sources cobalt, which plays an integral role in traditional Li-Ion batteries
Hydro-to-Cathode Processing	1. Shred the battery contents 2. Leach 3. Create impurity extraction 4. Synthesis 5. Produce new cathodes 6. Manufacture new battery	• More efficient than pyrometallurgy and hydrometallurgy • Newer technology; needs to scale
Thermal Pretreatment and Hydrometallurgy	1. Shred the battery contents 2. Leach 3. Extract and purify metals 4. Synthesis 5. Produce new cathodes 6. Manufacture new battery	• Able to extract lithium and iron, improving recovery efficiency compared to traditional pyrometallurgy
Direct Recycling Practice	1. Discharge/dismantle 2. Treat spent cells with supercritical CO_2 3. Physical separation	• Low energy consumption • High recovery rate • Experimental; needs to scale

Table 4: Methodologies for Battery Reprocessing and Metal Recovery [179,180]

Implement

2

New capital investments play a vital role in realizing a circular automotive economy by unlocking the necessary infrastructure and technology to support circular processes.

A critical first step to enable circularity is developing the necessary infrastructure. By investing in these capital projects and technologies, businesses can realize significant value through cost savings and environmental benefits.

New infrastructure and technology investments are required to realize circularity in the automotive sector and can include the following:

BATTERY OPTIMIZATION

Invest in battery technology and design to extend the life of batteries, create second life opportunities for used batteries, and develop recycling processes to reclaim used materials from spent batteries.

3D PART PRINTING

Invest in machinery and training to produce complex parts without needing to retool. This can be particularly valuable for retrofitting older vehicles with rare parts for which retooling is not financially viable.

Renault RE:Factory

Invest in Circular Capital

- Centralizes remanufacturing efforts to support knowledge sharing and accelerate research
- Remanufacturing, or restoring old parts, reduces costs to Renault and customers
- Significant environmental savings, including 80% less energy, 88% less water, and 70% less waste compared to new part production

Nio: Smary Power Service

- Chinese EV maker with over 14,000 charging stations throughout China
- Established fast battery swapping, allowing for customers to change batteries in under 5 minutes
- Over 1,300 battery swapping stations installed to-date, with a goal of 2,300 battery swapping stations by the end of 2023

FULL-VEHICLE RECYCLING

Develop processes and knowledge for deconstructing old vehicles to reuse parts and recycle materials without quality loss.

BENEFITS

Manufacturers:

- Reduce parts costs by recycling, repairing, and reusing components when possible. Manufacture rare parts without costly retooling.
- Reduce resource needs and harden supply chains to mitigate reputational and operational risks.

Customers:

- Less expensive parts replacement, allowing customers to repair their vehicles more easily and keep their vehicles on the road longer.

Scale

3

How does our current infrastructure (e.g., manufacturing, distribution, recycling) impact our ability to expand these efforts into new markets or product lines?

1. How does our current infrastructure (e.g., manufacturing, distribution, take-back logistics, recycling) enable our ability to expand these efforts into new markets or product lines?

2. Are there any specific challenges or risks (e.g., regulatory, environmental, health, social) associated with scaling our operations?

3. Can circular design principles be applied to future vehicle designs?

4. Is the current technology compatible with our product lines? Do our vehicles allow for repair, replacement, and remanufacturing of components?

5. What steps can be taken to support smooth scaling of circular processes without compromising quality or customer satisfaction?

Skoda Octavia

Skoda applied circular design principles in designing newer models of the Octavia, a compact car from this Czech brand under the Volkswagen group and the brand's most popular vehicle. In designing this vehicle, Skoda sought to reduce environmental impacts and new resource inputs and recycle as much as possible at the vehicle's end of life.

- Using recycled materials for parts of the vehicle, including floor mats and insulation, reduces virgin material requirements
- Efficient design, including aerodynamic wheels and underbody covers, reduce drag and improve efficiency, reducing fuel consumption
- 85% of the vehicle is made with recyclable materials that can be reprocessed at end-of-life
- Over 60% decrease in CO2 emissions during vehicle production when compared to 2010

Advocate

Automakers should support tools to improve repairability and compatibility, such as standardized design for key components like batteries, and advocate for government-backed recycling programs.

Repairability

Focus on extending the life of vehicles by enhancing their repairability, both through existing channels and new ones. Improve communication and knowledge sharing with owners. Support new technologies such as 3D part printing for rare or old part replacement.

Standardized Design Principles

Key components such as batteries should be standardized as much as possible to support replacement when needed. This can also help OEMs realize efficiencies in the production process and provide better customer support after market.

Recycling Programs

Focus on large-scale recycling regulation and programs, such as battery regulations in Europe. Engage governments in supporting the creation of these recycling efforts to achieve scale.

Figure 33. Key Advocacy Areas for Automotives

Vehicle and battery recycling regulations have been in place in major markets around the world for years. New and increasing regulatory pressures to responsibly recycle vehicles and battery components, especially as EVs become more predominant, further make the case for innovation and change. Some key policies to know in major markets include:

E.U. Batteries Regulation

New comprehensive battery regulation supporting circularity, which is set to take effect in 2023. Specific measures include:

- Consumer right to repair/replace EV batteries. This includes requirements that vehicles are designed in such a way as to allow owners to replace the batteries.
- Battery labeling requirements, including a digital battery passport.
- Recycling and material recovery targets, including for Lithium. This will drive recyclers away from thermal recycling and towards new battery recycling technology.[182]
- EV battery collection, for free, regardless of vehicle ownership or use.[183]

Japan Policies

Japan has adopted ambitious targets to decarbonize transport, with 100% of new vehicles sold as "environmentally friendly" by 2035 (2030 for Tokyo).

Additionally, the 2000 Law for Promotion of Effective Utilization of Resources allows industry operators to determine the best way to collect, reuse, and recycle batteries in Japan. Japan does not have specific targets for battery recycling and is unlikely to set them.

The Japanese Automobile Recycling Law requires all end-of-life vehicles to be recycled at a rate of 95%.[184]

U.S. Inflation Reduction Act

Pricing incentives for electric vehicles are tied to specific circularity principles, including:

- A certain percentage of critical minerals in batteries must be sourced/processed in North America or countries with a free trade agreement. This includes recycling programs. The percentage of critical minerals that must be compliant starts at 40% in 2023 and rises to 80% in 2027 and beyond.[185]

Advance

Businesses can facilitate circularity within the automotive sector by supporting shared mobility and collaborating on a pre-competitive basis to advance circular technologies.

Mobility-as-a-Service Enabling Technology Platforms: Support consumers' mobility needs while reducing the total number of vehicles required and optimizing the use of existing transportation.

Shared Vehicle Programs: Allow consumers access to transportation when needed, without having to own a vehicle themselves.

Ridesharing: Provides just-in-time transportation and improves vehicle usage time compared to private vehicle ownership.

Battery Recycling: Support new technologies that continue to improve battery recycling efficiency and reclaim minerals for future battery production.

Materials Recycling: Mature the technologies and supply chains to produce recycled materials, such as steel, without degradation for reuse in automotives.

3D Parts Printing: Develop and mature technologies to print complex parts that have the endurance and strength required for high-use automotives.

Conclusion

The urgent need to transition to a circular economy is clear. Our current linear economic models are unsustainable, leading to resource depletion, environmental degradation, and climate change. The road to net zero is impossible without fundamentally rethinking how we finance, design, create, sell, and deliver products and services today. However, circularity offers a promising alternative that not only addresses these challenges but also presents significant business opportunities.

At its core, circularity centers around three key principles: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. By embracing these principles, businesses can adopt innovative business models and operating models that decouple economic growth from resource consumption. The circular solutions highlighted in this report — designing for circularity, procuring intentionally, manufacturing efficiently, marketing and selling consciously, and operating circularly — serve as a concrete starting point for companies to plan, implement, and scale solutions that can reduce emissions while using and wasting less.

Companies can approach circularity through a three-fold strategy of acting within their own operations, advocating for supportive policies, and advancing the ecosystem for circularity:

ACT

Begin by understanding your current materials flow in your value chain, and then identify the circular solutions that have the potential to reduce material consumption and waste. Prioritize those that best suit your objectives, business model, customer preferences, and core capabilities. During implementation, start small, fail quickly, and empower your people with flexibility to tailor the solutions to their unique business, operational, and cultural context.

ADVOCATE

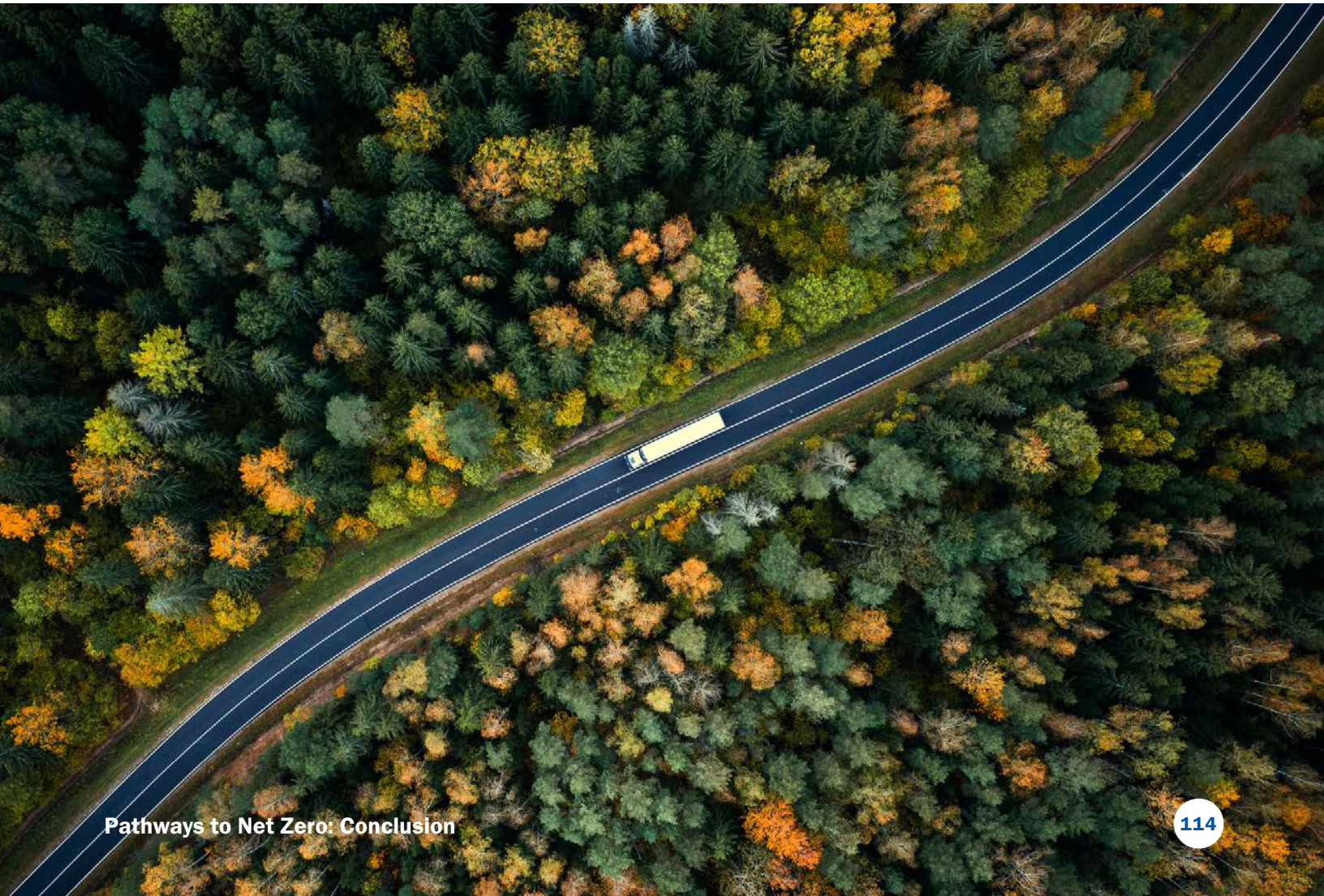
Policies such as extended producer responsibility (EPR), tax incentives, standards and targets, hazardous substance restrictions, and recycled content mandates (excluding advance recycling content mandates) can help create the economic playing field needed to use circularity as a competitive advantage. Identify the specific policies within your jurisdiction that can help activate these regulatory structures, and, perhaps more importantly, audit your company's existing lobbying efforts to withdraw support for structures that counter the transition to a circular economy.

ADVANCE

Develop enabling technologies, such as measurement tools that verify the resource consumption of a product or software platforms that enable resale models, that can help drive scale quickly across industries. Creating financing structures and cross-value chain partnerships can help provide resource-intensive companies with the resources they need to incorporate circularity into their businesses. These indirect, enabling contributions underscore that every company has a role to play in the circular economy, not just those with significant material footprints.

Circular solutions and strategies will vary by industry, geography, and company size, among other factors, but the underlying principles are consistent. The sector deep dives included in this report highlight the level of sophistication and creativity that circularity presents and can help inspire innovative analogous approaches across other sectors and contexts.

In an increasingly resource-scarce and climate-change-threatened future, embracing circularity is not just a moral imperative but a smart business decision. Companies are already capitalizing on the business value of reduced resource consumption, increased resource efficiency, and new revenue streams. Much like carbon and climate action, we expect circularity to progress slowly and then accelerate. Those that act now with an offensive approach are likely to gain first mover advantages in the transition to a circular economy while meeting their environmental and social targets.



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