Appendices

1. List of selected cases with key information
2. Summaries of cases

1. List of selected cases with key information

List of selected cases with key information 1/4

Case Id	Case title	Author	Year	Reference	Circular strategy/strategies	Company name(s)	Type	Industry	Country	Size of company	Mission/Vision	Product category
1	Recycling plastic pipes for construction sector	PlasticsEurope	n/a	Link	Chemical recycling, recycled materials, take-back	Neste	Public company	Chemical manufacturing	FI	5000	Everything we do at Neste serves one purpose: to create a healthier planet for our :children	
						Borealis	Privately held	Chemical manufacturing	AT	7000	We bring together the thinkers of tomorrow.	plastics, Polyethylene, PE, Polypropylene, PP, and Base Chemicals
						Uponor	Public company	Wholesale Building Materials	FI	3,600	Our values – Connect, Build, Inspire – are the words that capture the essence of Uponor.	Indoor Climate solutions (radiant floor heating & cooling systems), Plumbing solutions (plastic and composite pipe systems), Infrastructure solutions (municipal water service and storm water/drainage systems), and Project services
						Wastewise Group	Privately held	Envrionmental services	FI	2-10	Our world is on its way from a fossil economy to a circular economy. We want to speed up this transition! Our passion is to work with challenging waste streams, to develop new technologies and solutions to be able to reuse wasted material so that exhaustible natural resources could be left for future generations.	plastic recycling, chemical recycling, circular economy, and pyrolysis plant

List of selected cases with key information 2/4

Case Id	Case title	Author	Year	Reference	Circular strategy/strategies	Company name(s)	Type	Industry	Country	Size of company	Mission/Vision	Product category
2	CIRCULAR FOAM	(Project coordinator) Dorota Pawluca, Covestro Deutschland	2024	Link	Recycled materials, take-back schemes, circular design	Covestro Deutschland (Project coordinator - there are other companies participating)	Public company	Manufacturer of polymers	DE	16500	Develop and demonstrate all technological steps required to achieve circularity of plastics in post-consumer applications, using the example of rigid PU foams used as insulation in refrigerators and construction.	Manufacturer of polymers for automotive and transportation industries, construction, furniture and wood processing, as well as electrical, electronics, and household appliances industries.
3	FAERCH Group Tray 2 Tray	Fearch	n/a	Link	Take-back schemes, recycled materials, closed loop	n/a	Privately held	Packaging and Containers Manufacturing	DK	5,400	Our purpose is to supply the global food industry with quality food packaging solutions whilst driving the circular transition as an integrated recycler.	Food packaging, Circular solutions, Recycling, PET plastics, Extrusion, Thermoforming, Injection Moulding, and PP plastics
4	Recycling PVC window frames in Germany	Rewindo	n/a	Link	Take-back schemes, recycled materials, closed loop	n/a	n/a	Partnerships	DE	n/a	We at Rewindo see ourselves as a value-added service provider for the leading German window profile manufacturers and as a driver of a functioning recycling partnership and economically ecological alliance.	Partnerships, service, information and communication.
5	Philips	PolyCE	2020	Link	Recycled WEEE plastic in new products		Public company	Consumer products	NL/EU	10,001+	As a technology company, we – and our brand licensees – innovate for people with one consistent belief: there's always a way to make life better.	Espresso machines and vacuum cleaners
6	Whirlpool	PolyCE, Roberta Bernasconi	2020	Link	Recycled WEEE plastic in new products	n/a	Public company	Manufacturing	EU/US	59,000	Be the best kitchen and laundry company, in constant pursuit of improving life at home.	Brand Leadership, Product Leadership, Operational Excellence, People Excellence, Innovation, Manufacturing, Diversity & Inclusion, Social Responsibility, Environmental Sustainability, and Marketing

List of selected cases with key information 3/4

Case Id	Case title	Author	Year	Reference	Circular strategy/strategies	Company name(s)	Type	Industry	Country	Size of company	Mission/Vision	Product category
7	Recycled ABS plastic	Bage plastics	2023	Link	Recycled materials, injection moulding,	ENGEL	Privately held	Machinery manufacturing	AT	7,000	True to our motto "be the first", we help our customers to be pioneers. With them, we set new standards in plastics processing - in injection moulding machines, technologies and digital solutions.	Injection moulding, injection moulding machine manufacturing, process technologies, automation solutions, mold project planning, plastics industry
						ROCTOOL	Public company	Plastics manufacturing	FR	51-200	Our mission is to partner with brands across the globe to reach the next gen product design ambition, genuine finish and part performance.	Advanced Heat and Cool Technologies, Induction Technologies for Molding, Composite and Plastic Expertise, Top Surface Quality for plastics and composites, Induction Powered Generators, Materials, Industrial Design, New Materials, Metal Processing, Automotive, Consumer Electronics, Consumer Products, Medical Devices, Recycled Materials, Mechanical Design, Molding, Heat and Cool, and Design
						BAGEPLASTICS	Public company	Plastics manufacturing	AT	51-200	We have made it our goal to offer our customers plastic pellets of the highest, consistent quality	Compounds, WEEE Mixed plastics, plastics, ReABS, UL-ABS, RePC-ABS, ReHIPS, ReHDPE, PP, PE, HIPS, ABS, PS, and PC-ABS
8	Partnership for production of 100% circular plastic	DOW	2021	Link		Dow	Public company	Chemical Manufacturing	NL	35,900	Our ambition is to be the most innovative, customer-centric, inclusive, and sustainable materials science company in the world.	Chemicals, Packaging, Infrastructure, Consumer Products
						Fuenix	Privately held	Waste treatment and disposal	NL	11-50	By giving plastic waste a new life, we prevent it from polluting the environment, reduce CO2 emissions, and contribute to a cleaner world for future generations.	Innovation, Chemical recycling, plastic recycling, circular economy, Technology developer, R&D, waste industry, petrochemical industry, CO2 reduction, scale-up, impact investment, green investment

List of selected cases with key information 4/4

Case Id	Case title	Author	Year	Reference	Circular strategy/strategies	Company name(s)	Type	Industry	Country	Size of company	Mission/Vision	Product category
9	Cirplus	Cirplus	n/a	Link	Innovation, Funding, marketplace	Cirplus	Public company	Information technology & services	DE	11-50	Our mission is to bridge the gap between buyers and sellers of plastic recyclates, and in doing so enhance supply stability and availability. By using technology to facilitate relationships of trust, we aim to build the digital infrastructure needed for a physical transition from new to recycled materials.	Circular economy, digitization, IoT, platform economy, sustainability, blockchain, plastic, plastic waste, waste management, disposal industry, plastics, packaging industry, and packaging.
10	Igus	Igus GmbH	n/a	Link	Innovation, recycling, marketplace	Igus	Privately held	Plastics Manufacturer	DE	1,001-5,000	Improve all types of motion with motion plastics while maintaining a carbon-neutral footprint and being the easiest company to work with.	Plastic energy chains / drag chains, maintenance-free and lubricant-free plastic plain bearings, highly flexible special cables, maintenance-free and lubricant-free linear bearings, linear technology, linear drive technology, linear axes, low-cost automation, thread technology, plain bearings.
11	Transportation packaging products	Cabka	2023	Link		Cabka	Public company	Packaging and containers manufacturing	DE	+700	Enable breakthrough all over the supply chain and beyond with smart, reusable solutions for transport packaging	product development, logistics, supply chain, large containers, Circular Economy, Reycling, EcoProducts, Plastic Pallets, and Transformation
12	Re:Mix blender	Increase, Flora Poppelaars, Jos Vlugter, Rosa Jager & Tim de Ruiter	2023	Link		OpenFunk	Privately held	Computers and electronics manufacturing	DE	2-10	We're on a mission to change the way we make and fix home electronics.	Home electronics, Consumer electronics, Sustainability, Circular economy, and Kitchen appliances
13	Gomi	Increase, Flora Poppelaars, Jos Vlugter, Rosa Jager & Tim de Ruiter	2023	Link		Gomi	Privately held	Consumer electronics	UK	2-10	Our design philosophy is that tech shouldn't become obsolete. Instead, we design for circular lifespans. Waste plastics and second-life batteries form the building blocks. Modular design allows us to fix what might otherwise have been thrown away.	Design, sustainability, waste, recycle, tech, circular economy, product design, portable charger, speaker, sustainable design, material design, sustainable tech, and brighton

2. Description of case parameters

Case assessment parameters

Key perspectives and factors applied for the qualitative evaluation

The analysis is based on a qualitative evaluation of the three perspectives and six factors based on the available information in individual cases. All cases are scored qualitatively according to the six factors on a low-to-high scale, see appendices for further details.

Perspectives

Supply chain	The supply chain perspective analyses how material flows, partnerships, and processes support or hinder circular business models. This includes evaluating the availability and quality of recycled feedstock, the role of technological solutions like sorting and traceability, and the importance of logistics and location in minimising environmental impact. By identifying key enablers and barriers, this perspective highlights where investments, collaborations, or operational improvements can drive greater circularity.
Product	The product perspective focuses on how design and production processes enable circular solutions. It examines technological feasibility for integrating recycled materials, design strategies like recyclability and modularity, and commercial viability in terms of cost, quality, and performance compared to virgin alternatives. Regulatory alignment and market dynamics are also considered to assess how circular products can meet sustainability goals while remaining competitive.
Customers	The customer perspective evaluates how end-users influence the success of circular products. It explores drivers such as sustainability benefits, transparency through LCAs, and economic incentives, while also addressing behavioural factors like participation in take-back schemes or preferences for modular solutions. Understanding this perspective is key to identifying how customer trust, awareness, and willingness to engage can accelerate adoption and support material circularity.

Factors

Technological viability
Potential to readily deploy solution based on available technology and innovations that supports circularity or recycling. High scores indicate cases enabled by viable technology matching plastic properties, homogeneity, and traceability. Low scores indicate dependence on immature or undeveloped technology.

Commercial viability
Potential to achieve economic success based on e.g. market demand, cost efficiency, and scalability. High scores indicate commercial success without public financing. Low scores represent uncertain projects in demonstration or research phases.

Regulatory viability
Potential to be aligned with existing regulations related to circularity, recycling and waste management. High scores indicate regulatory compliance and support. Low scores indicate unresolved regulatory complexity and uncertainty.

Reputational impact
Potential to impact the public perception of the company’s engagement with sustainability. High scores indicate cases with circularity impacts clearly communicated based on data. Low scores indicate cases with claims not backed by substantial evidence.

Climate change impact
Potential to reduce climate change impact. High scores indicate documented emission reductions and use of renewable energy for recycling. Low scores indicate cases that potentially lead to higher carbon emissions than with other available options for plastic management.

Other environmental impact
Potential to reduce other environmental impacts relative to traditional production methods. High scores indicate documented reductions in pollution, waste minimisation, improved waste management, or other environmental impacts. Low scores indicate cases with no documentation or potentially increased pollution levels.

3. Summaries of cases

Case 1

Recycling plastic pipes for the construction sector

DTU Circularity

Case: Recycling plastic pipes for construction sector

A four-way collaboration addresses the challenge of recycling hard-to-recycle plastic waste using innovative chemical recycling technology.

PEX | Chemical engineering | Chemical recycling and industrial symbiosis

ABOUT	In an innovative approach, Neste, Borealis, Uponor, and the Wastewise Group have successfully transformed Uponor’s post-industrial waste plastic (PEX) from the production of pipes into new high-quality plastic that Uponor can use in the production of new pipes for the construction sector.
ENABLERS	From a supply chain perspective, the collaboration between Neste, Borealis, Uponor, and Wastewise enables circularity through a seamless closed-loop system, transforming hard-to-recycle industrial plastic waste into high-quality PEX pipes using advanced chemical recycling technologies. On the product side, the chemically recycled polyethylene retains identical quality to virgin materials, meeting strict regulatory standards and ensuring full traceability through ISCC PLUS certification. From a customer perspective, the resulting PEX pipes offer high performance and sustainability, even for sensitive applications like drinking water systems.
BARRIERS	From a supply chain perspective, barriers include the high dependency on each participant in the loop, where disruptions from any partner can affect the system's functionality, and the need for advanced technologies to handle hard-to-recycle plastics under precise operating conditions. On the product side, competition with cheaper virgin materials and the energy-intensive nature of chemical recycling limit cost-effectiveness and environmental benefits, while potential waste generation from residual by-products adds complexity. From a customer perspective, skepticism about the sustainability of chemical recycling, and the association of outputs with petrochemicals, may hinder adoption.

Picture from Neste / Fanny Haga

Picture from Borealis

Case: Recycling plastic pipes for construction sector

Case: Recycling plastic pipes for construction sector
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Innovative chemical recycling technology: The Wastewise Group's pyrolysis-based chemical recycling technology is key to breaking down hard-to-recycle PEX plastic into reusable building blocks. This is a significant enabler as conventional recycling methods fail to process such plastics effectively.	**Circular value creation:** Each partner in the collaboration realises commercial value. Wastewise creates the recycled intermediate, Neste refines it into high-quality feedstock, Borealis polymerizes it, and Uponor uses it to manufacture new pipes.	**Compliance with quality standards:** The recycled polyethylene meets stringent regulatory requirements, including those for drinking water applications, avoiding barriers related to health and safety.	**Sustainability leadership:** Participation in an innovative circular solution enhances the reputation of all involved companies as sustainability leaders, particularly in an industry often criticised for its environmental footprint.	**Lower carbon footprint:** Using recycled feedstock reduces the carbon footprint of the production process compared to using virgin materials.	**Waste reduction:** The integration of post-industrial waste into new products reduces overall waste generation, minimising environmental harm.
Drop-in feedstock compatibility: The chemically recycled feedstock can seamlessly integrate into existing manufacturing processes without requiring additional testing or validation, even for high-standard applications like drinking water systems.	**Reduction in virgin material use:** By using recycled feedstock, the process reduces dependency on virgin resources, potentially lowering raw material costs and improving market appeal for sustainable products.	**ISCC certification**: The whole process is traceable via ISCC PLUS certified mass-balancing – a chain of custody certification scheme designed to track the flow of materials through a complex value chain.			**Renewable feedstock refinement:** Neste RE™, refined from the recycled intermediate, contributes to reducing fossil fuel dependency.

Case: Recycling plastic pipes for construction sector

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Temperature constraints: Pyrolysis and chemical recycling are sensitive to operating conditions, which may restrict the types of plastics that can be processed.	**High dependency on each participant in the loop:** The process relies on the advanced technologies of each participant, which makes the loop vulnerable to disruptions e.g. if one participant stop realising value from the collaboration.	**Ambiguity in policy support:** Regulations surrounding chemical recycling are not as clear or supportive as those for mechanical recycling. For example, some jurisdictions may not classify chemical recycling as a form of recycling under existing laws.	**Public perception of chemical recycling:** There may be scepticism about the environmental sustainability of chemical recycling compared to mechanical recycling, as it can be perceived as a less energy-efficient, a resource-heavy process or questioning whether it counts as recycling.	**Energy intensity of chemical recycling:** Pyrolysis and the associated refining processes are energy-intensive, which could lead to a higher carbon footprint compared to other recycling methods unless renewable energy sources are used.	**Potential waste generation:** If not optimised, the chemical recycling process could produce residual by-products or waste streams requiring further treatment, potentially limiting its environmental benefits.
	Market competition: Virgin materials are often cheaper due to subsidies or established supply chains, making it harder for recycled materials to compete.	**Strict product requirements:** the recycled content must meet strict requirements to enter new production of e.g. pipes.	**Association with fossil fuels:** As some chemical recycling outputs may be refined into petrochemicals, stakeholders might view the process as sustaining reliance on fossil fuels rather than reducing it.	**Limited emissions data:** There is no explicit mention of the overall carbon savings from this closed-loop system compared to alternative approaches, which might hinder stakeholder confidence.	

Case 2

Circular Foam

DTU Circularity

Case: Circular Foam

A cross-industry collaboration, with EU funding support, to improve the collection and recycling of polyurethane foam in three countries.

Polyurethane foam | Manufacturing and buildings | Recycling technology and industry transformation

ABOUT	The Circular Foam Project is a consortium project aiming to develop and demonstrate all the steps to create a circular loop for polyurethane rigid foam, which is used for insulation in refrigerators and in the construction industry. The project is led and coordinated by Covestro, which is a major producer of polymers for a variety of industries. Also included in the project are companies from across the value chain, including waste collection, chemical recycling, and manufacturers of refrigerators and insulation for buildings.
ENABLERS	The project is taking a full value-chain perspective, so it can take an iterative approach to constructing a functional circular value chain. Advancements in recycling technologies, such as smart chemolysis and improved material designs (e.g., monolayer facers), are making PU foam recycling more viable. Digital tools like Circularise enhance data transparency and support process efficiency. The project has EU funding and support, which enables the participation of private companies, universities and municipalities. Project deliverables can thus include technical, commercial, economic and societal knowledge.
BARRIERS	High costs of recycling processes and limited infrastructure for material recovery pose economic constraints. Complex material compositions and the nascent stage of chemical recycling technologies create challenges in potentially scaling up operations. The lack of standardization in dismantling and recycling further complicates implementation.

Picture from Covestro

Case: Circular Foam

Picture from Covestro

Case: Circular Foam
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Innovative recycling methods: Advancements such as smart chemolysis and pyrolysis show promise for efficiently recycling PU foams.	**Potential cost reductions:** Using recycled materials offers potential cost savings in production.	**EU circular economy directives:** Policies like the Ecodesign for Sustainable Products Regulation (ESPR) and waste management frameworks encourage recycling and circular design.	**Sustainability as a competitive edge:** Companies adopting circular economy practices enhance their brand image and stakeholder trust. This project thus lends reputational benefits to the participating companies.		**Pollution mitigation:** Recycling PU can prevent leaking of hazardous substances, such as flame retardants from the foam, into soil and water systems, mitigating contamination risks.
Material design improvements: Development of new insulation boards and refrigerator components optimised for recycling, such as the use of monolayer facer materials.	**Supportive partnerships:** Collaboration among stakeholders in the value chain enhances the feasibility of this solution, which includes material certification and digital tools for traceability.	**Support for Innovation:** Government funding and incentives for circular economy projects lower financial risks – in this case, the project has EU funding.	**Transparency initiatives:** Tools like Circularise allow businesses to demonstrate their commitment to sustainability.		
Digital tools for traceability: ICT platforms like Circularise, which is a partner in the project, improve transparency and efficiency across the value chain by enabling secure data sharing.			**Regulatory and public push for climate neutrality:** EU policies promoting CO2-neutral systems align with the project's objectives.		

Case: Circular Foam Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Complexity of Material Composition: Existing products include mixed materials that complicate recycling	**Economic Viability of Recycling Processes:** High costs and limited profitability of recycling polyurethane (PU) foams due to challenges in separating and processing materials. **Uncertain Market Acceptance:** Concerns about consumer willingness to purchase products made with recycled materials, impacting adoption rates. **Limited Infrastructure for Material Recovery:** Insufficient facilities and logistics for collecting and processing end-of-life PU foam. The infrastructure to collect and process, in the investigated regions, is not very well-developed.	**Compliance Complexity:** Navigating regulations across multiple jurisdictions adds complexity for multinational stakeholders. This project investigates the potential for circularity in Germany, Poland and the Netherlands, which have differing regulatory frameworks.	**Risk of Greenwashing Accusations:** The project deliverables state a concern that the companies involved may face scrutiny if the recycling practices are perceived as insufficient or insincere. **Risk of Greenwashing Accusations:** The project deliverables state a concern that the companies involved may face scrutiny if the recycling practices are perceived as insufficient or insincere.	**Carbon Intensity of Recycling Processes:** The tested chemical recycling methods may initially require significant energy inputs, posing challenges to achieving net climate benefits, especially if not using renewable energy.	**Contamination of Recycled Materials:** The presence of mixed materials or hazardous substances in PU foam, such as adhesives and flame retardants, poses a challenge for safe recycling. Contaminants can compromise the quality of recycled products and lead to environmental risks if not properly managed. **Microplastic Generation:** Some recycling processes or degradation of PU foam might contribute to microplastic pollution, which can have detrimental effects on aquatic and terrestrial ecosystems

Case 3

FAERCH Group Tray 2 Tray

DTU Circularity

Case: FAERCH Group Tray 2 Tray

Successful transition to 57% recycled content in food trays and has a take-back scheme, effectively managing a closed loop.

PET | Packaging | Take-back scheme and recycling

ABOUT	The FAERCH Group's Tray 2 Tray initiative focuses on creating a closed-loop recycling system for food trays. The company is an integrated plastics producer and recycler, meaning it designs the trays for circularity and with 57% recycled content, establishes take-back schemes with partners, and then recycles the trays into new trays.
ENABLERS	From a supply-chain perspective, the initiative is enabled by Faerch's ability to make use of household waste and manage a take-back scheme, ensuring available feedstock for recycled content. On the customer side, there is sufficient demand for this product, because customers are seeking to reduce their carbon and material footprint, mainly driven by new and upcoming regulatory requirements, such as the EU Packaging Regulation. On the product side, Faerch produces trays that are able to meet industry food safety standards, which is key.
BARRIERS	From a supply-chain perspective, a barrier in the coming years will be feedstock availability, as demand for plastic from household waste is increasing, so the supply will be limited.

Picture from FAERCH

Picture from FAERCH

Case: FAERCH Group Tray 2 Tray

Case: FAERCH Group Tray 2 Tray

Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Advanced Sorting Technology: Use of AI-based sorting systems and near-infrared (NIR) technologies for accurate material recovery.	**Integrated recycler:** The company owns the recycling plant in the Netherlands and has been able to gradually scale-up production, to now manage 60,000 tonnes of feedstock from post-consumer waste (annually).	**Extended producer responsibility:** These legislative requirements increase requirements for companies.	**Communicating benefits:** The company is concluding its LCA of the recycled material in the trays it produces and aims to focus on using this to communicate the lower environmental burden. This benefits the company reputation and reduces potential accusations of greenwashing.	**Commitment to net-zero emissions across the value-chain by 2040:** The company's recycling initiatives are also motivated by its net zero targets, which are SBTi verified.	**Reduction of plastic waste incineration:** The business takes in household waste to use as feedstock in new trays, preventing this waste from disposal.
Design for recycling: Development of mono-material trays optimised for recycling.	**Customer preferences:** Growing customer demand for packaging that contains recycled content and is driving their commercial success – allowing them to invest in increased recycling capacity.	**Packaging and packaging waste regulation:** The upcoming packaging and packaging waste regulation is expected to be a major driver of success for their trays and other packaging – as their customers will need to improve packaging circularity to be compliant.	**A large plastic packaging manufacturer:** Faerch is one of the biggest plastics producers in Europe, producing close to 30 million trays annually. The company is now able to report that 57% of the plastic content in these trays is recycled.	**Renewable energy:** The company has a target to use 100% renewable energy by 2030, which further reduces the climate burden of its products, because recycling processes still require energy.	
	Buy-back scheme and collaboration with partners: The Tray 2 Tray programme is a direct collaboration with large partners, such as Tesco, that includes a buy-back scheme to ensure the materials can stay in a closed loop.				

Case: FAERCH Group Tray 2 Tray

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Material Recovery Technology: Difficulty in efficiently separating and cleaning trays, especially multilayer or contaminated plastics. For household waste content, the quality of the bales they receive reflects how well plastic is sorted by consumers.	**Feedstock availability:** As demand for recycled content increases, Faerch is increasingly challenged to secure sufficient household waste material with the right quality. This barrier is mitigated by ensuring effective take-back schemes.	**Food safety:** A key aspect of recycled content for the food packaging sector is ensuring that the material meet food safety regulations. Faerch has achieved this – but it is always an important consideration for food packaging	No significant barriers arising from reputation.	**Securing certified renewable energy:** To lower the climate burden of the recycling initiatives, Faerch strives to sign Power Purchasing Agreements, but has been challenged to do so in some countries.	**“Waste-of-waste”:** Because the company receives household waste, some fractions will not be recyclable, due to incompatibility with production processes. This is a barrier to circularity. At the tray recycling plant, these waste streams are sent to the neighbouring waste to energy plant.

Case 4

Recycling PVC window frames in Germany

DTU Circularity

Case: Recycling PVC window frames in Germany

Rewindo operates Germany's longstanding take-back system, recycling PVC window frames into granulate for new frames and construction profiles.

PVC | Buildings & construction | Collection, recycling and production

ABOUT	Rewindo is a German company that operates a nationwide take-back system for PVC window frames. This system has been in place for decades, making it one of the most well-established examples of a plastic recycling system. The frames are then processed into PVC granulate that is used to manufacture new window frames or other construction profiles.
ENABLERS	From a supply chain perspective, collection of used PVC frames is enabled by a nationwide network of partnerships with construction companies and waste collection facilities. The initiative is decades old, so these partnerships are well-established. From a product perspective, PVC is highly recyclable and does not lose its quality when being recycled several times, so recycled PVC frames can compete directly with frames produced from virgin materials. Initial start-up costs for the initiative were high, but the initiative had funding support from the German government, allowing it to build scale and produce products. From a customer perspective, recycled PVC window frames help building and constructions companies to achieve sustainability certifications that are established by the German Sustainable Building Council.
BARRIERS	Recycling legacy materials with hazardous additives requires advanced processing, while bulky PVC frames result in high transportation costs and logistical challenges. On the product side, competition with cheaper virgin PVC and the energy-intensive recycling process limit cost-effectiveness and environmental benefits, compounded by stricter regulations and limited demand for high-value applications. From a customer perspective, scepticism about the quality and sustainability of recycled PVC highlights the need for clear communication of environmental benefits and alignment with carbon neutrality goals. Addressing these barriers requires innovation and collaboration across the value chain.

Picture from Rewindo

Case: Recycling PVC window frames in Germany

Picture from Rewindo

Case: Recycling PVC window frames in Germany

Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Advanced Recycling Technologies: Rewindo invested in technologies that improved the separation of PVC from other materials like glass and metal, ensuring high-quality recycled PVC.	**Partnership Network:** Rewindo was established as a joint initiative by leading PVC window manufacturers and recycling companies, creating a strong foundation of industry support.	**Producer Responsibility:** Rewindo leveraged Germany's extended producer responsibility framework to align manufacturers' interests with recycling efforts.	**Sustainability Messaging:** Rewindo effectively communicated the environmental benefits of PVC recycling, such as reduced landfill waste and carbon savings, to stakeholders and the public.	**Carbon Footprint Reduction:** By reusing PVC, Rewindo contributed to lowering greenhouse gas emissions associated with the production of new materials.	**Waste Management Leadership:** The initiative helped divert substantial volumes of PVC waste from landfills and incineration, reinforcing its environmental credibility.
	Cost Efficiency: By achieving economies of scale, Rewindo made recycling PVC frames more cost-effective than disposal.	**Mandatory Recycling Quotas:** Compliance with recycling quotas for construction and demolition waste further reinforced the demand for Rewindo's services.	**Certifications and Transparency:** Adhering to standards for recycled content boosted trust among consumers and industry players.		**Contaminant Handling:** The initiative addressed challenges like legacy additives (e.g., lead or cadmium) by adopting advanced methods to safely process older materials.
	Government Support: Access to subsidies and financial incentives for recycling operations helped offset initial costs.	**Green Building Standards:** The rise of sustainability certifications, like DGNB (German Sustainable Building Council), emphasized the use of recycled materials, indirectly supporting Rewindo.			

Case: Recycling PVC window frames in Germany

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Recycling Legacy Materials: Older PVC frames may contain hazardous additives like lead and cadmium, which require advanced processing to remove safely	**Competition with Virgin PVC:** When oil prices are low, virgin PVC becomes cheaper, making it harder for recycled PVC to compete in price. **High Transport Costs:** The bulky nature of PVC window frames makes transportation costly, especially over long distances. **Limited Demand in High-Value Applications:** While recycled PVC is suitable for many uses, finding enough high-value applications to absorb the supply remains a challenge.	**Increasing Standards:** Stricter regulations on recycling processes, emissions, and material quality might raise operational costs.		**Energy Use in Recycling:** The recycling process for PVC, especially for older frames with contaminants, can be energy-intensive, potentially offsetting its environmental benefits **Carbon Neutrality Pressure:** As climate targets tighten, Rewindo must ensure its operations align with Germany's and the EU's carbon neutrality goals, including switching to renewable energy for recycling facilities.	**Secondary Waste Management:** Recycling processes may generate secondary waste, such as separated glass, metal, and non-recyclable components, which must be managed responsibly.

Case 5

Philips

DTU Circularity

Case: Philips

Philips integrates recycled plastics and modular designs to lead sustainable innovation in premium consumer electronics.

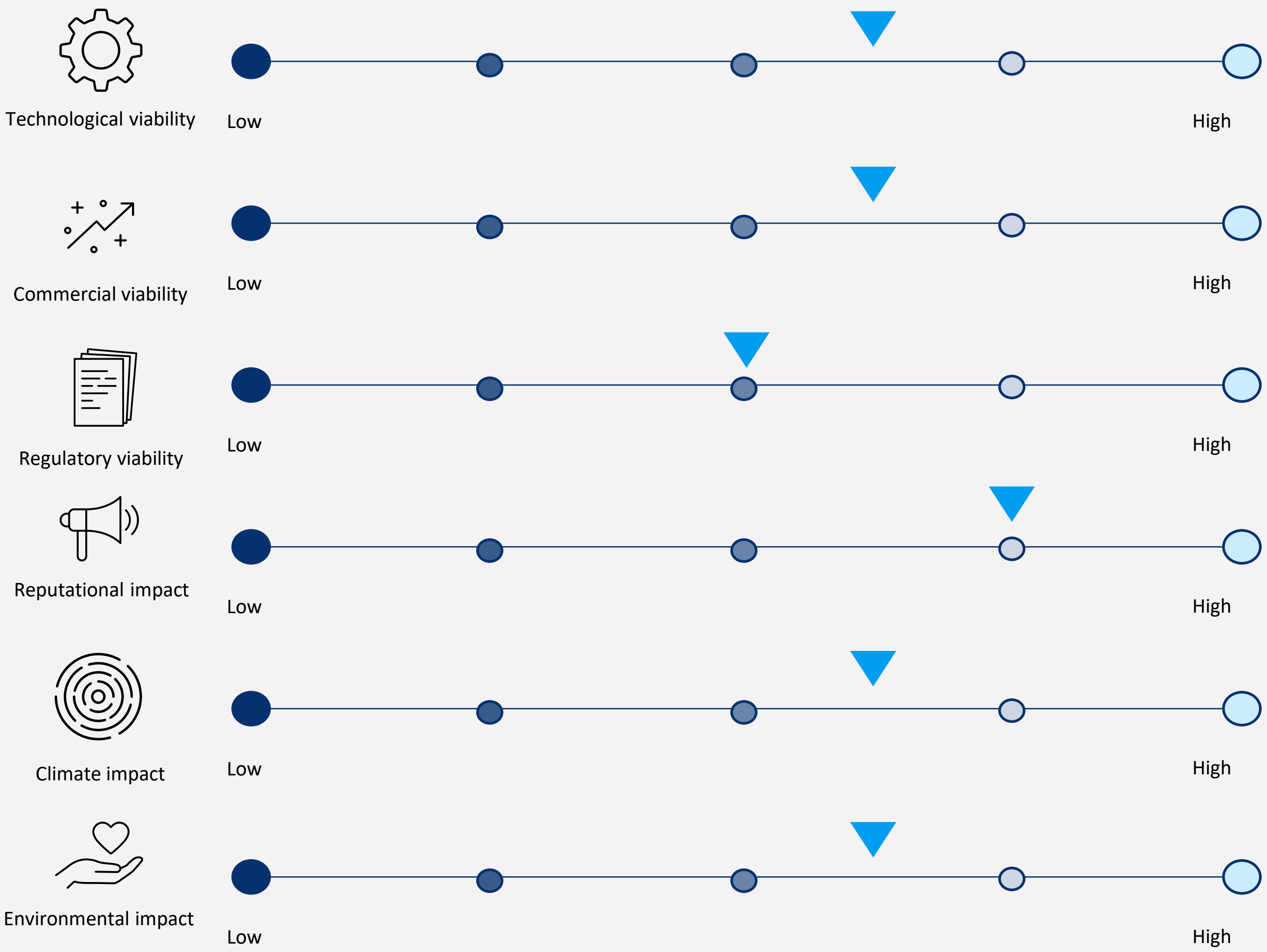
rABS, rPC | Consumer goods | Industrial symbiosis, design for recycling

ABOUT	Philips is a global leader in health technology and sustainable innovation, committed to advancing circular economy principles. Through its PolyCE project, Philips integrates high-quality post-consumer recycled plastics into products such as coffee machines, vacuum cleaners, and shavers. By leveraging modular designs, advanced recycling processes, and partnerships with material suppliers, Philips demonstrates how circular materials can be successfully incorporated into premium, durable, and high-performing consumer electronics.
ENABLERS	From a supply chain perspective, Philips' PolyCE project is enabled by collaborations with recyclers and material suppliers, ensuring a consistent supply of high-quality post-consumer recycled plastics such as rABS and rPC. On the product side, advanced manufacturing techniques and modular designs allow recycled plastics to meet stringent performance and aesthetic standards, while simplifying disassembly and recycling at the product's end of life. From a customer perspective, Philips offers durable and sustainable consumer electronics, such as the Senseo Eco coffee machine, that align with growing consumer demand for eco-friendly and high-quality products.
BARRIERS	From a supply chain perspective, barriers include the inconsistent quality and limited availability of high-grade post-consumer recycled plastics, which can complicate manufacturing and increase costs. On the product side, challenges arise in ensuring that recycled plastics meet the strict performance, durability, and aesthetic requirements for premium electronics, particularly for specialized applications like food contact or high-temperature resistance. From a customer perspective, higher production costs can result in increased retail prices, potentially deterring price-sensitive consumers, while lingering perceptions of recycled materials as lower quality may impact adoption.

Picture from Philips

Case: Philips

Picture from Philips



Case: Philips
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
High-Quality Recycled Plastics: The project demonstrates the successful integration of post-consumer recycled (PCR) plastics like rABS and rPC into products such as coffee machines, vacuum cleaners, and shavers while maintaining performance and aesthetics.	**Market Differentiation:** The use of recycled plastics aligns with increasing consumer demand for sustainable products, creating a competitive advantage.	**Alignment with EU Green Deal:** The project aligns with European Union policies, including WEEE directives and circular economy goals, encouraging greater adoption of recycled materials.	**Leadership in Sustainability:** Philips' commitment to using 7,600 tons of recycled plastics by 2025 strengthens its reputation as an environmentally responsible company.	**Reduced Carbon Footprint:** Using PCR plastics significantly lowers CO_2 emissions compared to virgin materials, contributing to climate goals.	**Waste Diversion:** Recycling plastics from WEEE (waste electrical and electronic equipment) reduces landfill and incineration, minimizing environmental impact.
Advanced Manufacturing Processes: Techniques like colour sorting, high-gloss finishing, and specialized moulding enable the use of recycled plastics in components with stringent requirements.	**Scalability and Supply Chain Optimization:** Partnerships with specialized recyclers and material suppliers, such as MGG polymers and Sitraplas, ensure consistent quality and supply of recycled materials.	**Compliance with Safety Standards:** Products meet stringent regulatory requirements, such as IEC safety tests, ensuring they are viable for mass-market use.	**Consumer Engagement:** Launching sustainable product lines like the Senseo Eco coffee machine and highlighting circularity in marketing campaigns resonate with eco-conscious consumers.		**Circular Value Chain:** The project supports reverse logistics, efficient sorting, and innovative recycling processes, enabling a closed-loop system.
Modular and Design-for-Recycling Approach: Products are designed to simplify disassembly and recycling at the end of their lifecycle, ensuring resource recovery.	**Cost Reduction Potential:** Leveraging existing moulds for "drop-in" solutions reduces initial investment costs while integrating recycled materials into production.				

Case: Philips
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Material Challenges: Issues like contamination, material shrinkage, and reduced chemical resistance of PCR plastics compared to virgin alternatives can hinder performance. **Application-Specific Limitations:** Strict requirements for chemical resistance, food contact safety, and durability limit the use of recycled plastics in certain products, such as medical devices and high-wattage hairdryers. **Complexity in Moulding Processes:** Achieving consistent high-quality finishes, such as deep black gloss, requires advanced manufacturing techniques and fine-tuning.	**Higher Costs for Recycled Plastics:** Producing high-quality PCR materials can be more expensive due to additional sorting, cleaning, and compounding processes. **Supply Chain Limitations:** Ensuring a consistent supply of high-quality recycled plastics is challenging, especially for products requiring specific grades or colours. **Market Sensitivity to Pricing:** While consumers demand sustainable products, higher costs may deter mass-market adoption.	**Lack of Incentives:** Limited financial support or tax incentives for using recycled plastics makes adoption less economically appealing.	**Perceived Quality Issues:** Consumers may associate recycled plastics with lower quality, despite Philips' efforts to match or exceed virgin material standards.	**Energy-Intensive Recycling Processes:** The recycling and processing of PCR plastics require significant energy, which could offset some climate benefits if not powered by renewable energy. **Global Logistics Impact:** Sourcing and transporting recycled plastics from various locations add emissions, complicating climate impact assessments.	**Limited Consumer Recycling Participation:** Ensuring that products are returned for recycling relies on consumer behaviour and the availability of effective collection systems.

Case 6

Whirlpool

DTU Circularity

Case: Whirlpool

Whirlpool advances sustainability by incorporating recycled plastics into durable appliances without compromising quality or design.

rPP, rHIPS

Manufacturing

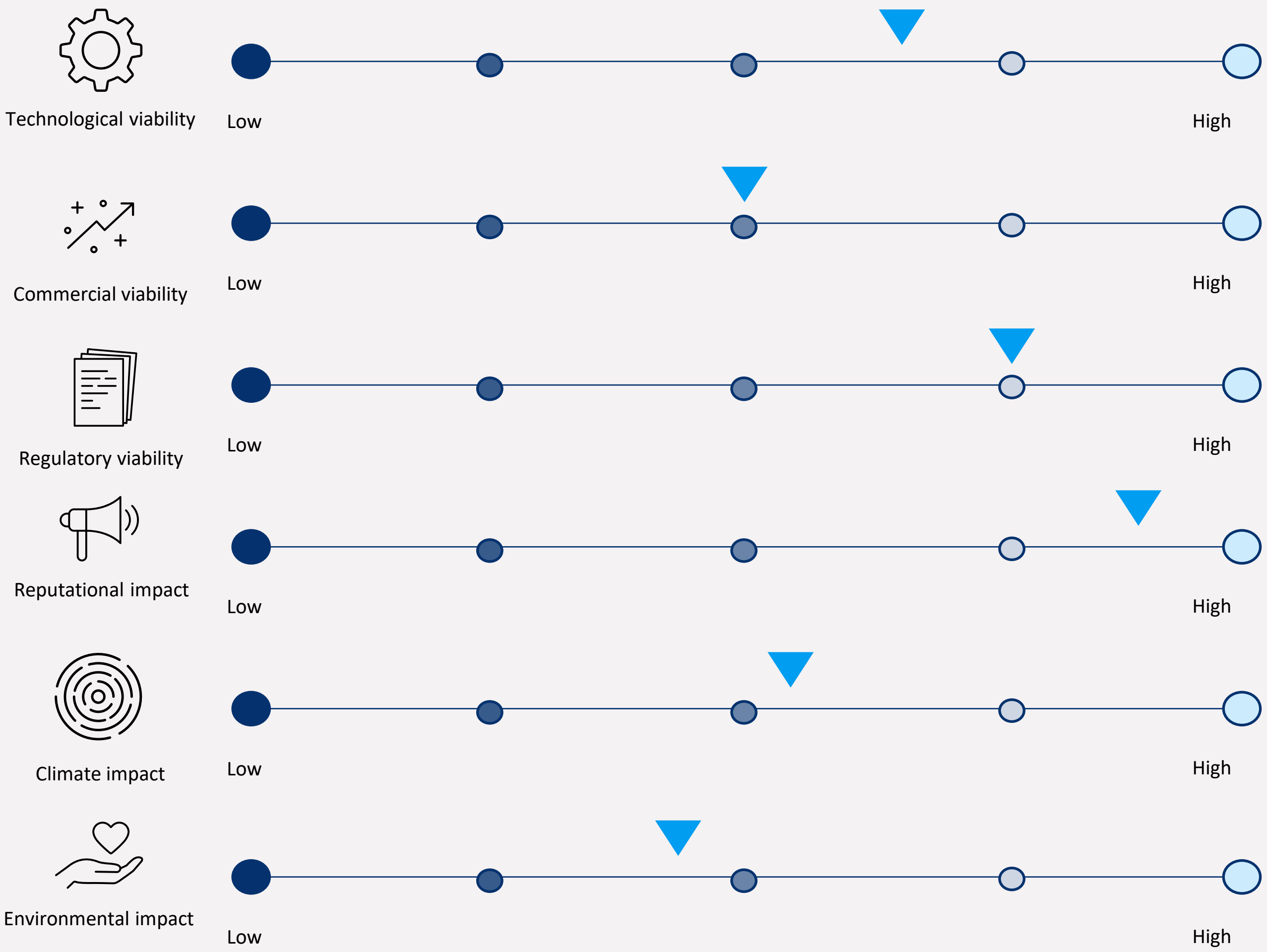
Recycled WEEE plastic in new products

ABOUT	Whirlpool is a global leader in household appliances, committed to advancing sustainability and circular economy principles. Through the PolyCE project, Whirlpool integrates high-quality post-consumer recycled (PCR) plastics into key components like washer tubs and refrigerator liners. By leveraging innovative clustering techniques, advanced material recycling, and strategic collaborations with recyclers and material suppliers, Whirlpool demonstrates how durable, high-performing appliances can incorporate recycled materials without compromising quality or aesthetics.
ENABLERS	From a supply chain perspective, Whirlpool's PolyCE project is enabled by innovative clustering and pre-treatment techniques that ensure the high purity of post-consumer recycled plastics, such as rPP and rHIPS, and strong partnerships with recyclers and material suppliers like MGG Polymers. On the product side, the use of drop-in recycled plastics allows seamless integration into existing production moulds while maintaining performance and durability standards. From a customer perspective, the project meets growing consumer demand for sustainable appliances, showcasing high-quality, durable products that incorporate recycled materials without compromising functionality or aesthetics.
BARRIERS	From a supply chain perspective, barriers include the inconsistent quality and contamination of post-consumer recycled plastics, as well as challenges in maintaining a steady supply of high-grade materials for large-scale applications. On the product side, ensuring that recycled plastics meet stringent performance, durability, and regulatory requirements—such as chemical resistance and food-contact safety—can be complex and resource-intensive. From a customer perspective, higher production costs may result in increased retail prices, potentially deterring price-sensitive consumers, while lingering perceptions of recycled materials as lower quality could impact broader market adoption despite growing interest in sustainability.

Picture from Whirlpool

Picture from Whirlpool

Case: Whirlpool



Case: Whirlpool
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Advanced Material Sorting and Recycling: The project employs clustering strategies for waste streams, such as isolating washer tubs and refrigerator components, to ensure high-purity post-consumer recycled (PCR) plastics like polypropylene (PP) and high-impact polystyrene (HIPS).	**Cost Efficiency through Recycled Materials**: By integrating PCR plastics into production, Whirlpool demonstrates the feasibility of cost-effectively replacing virgin plastics, particularly for large-scale applications like washer tubs and fridge liners.	**Compliance with EU Directives**: The project adheres to key regulations such as REACH, RoHS, and WEEE, ensuring that recycled materials meet safety and environmental standards.	**Commitment to Sustainability**: Whirlpool's involvement in the PolyCE project aligns with its longstanding focus on sustainability and circular economy principles, enhancing its reputation as a global leader in environmentally responsible practices.	**Reduction in Virgin Material Usage**: The use of PCR plastics significantly reduces the environmental footprint by decreasing reliance on virgin plastic production.	**Durability of Recycled Materials**: The PCR plastics used in washer tubs and fridge liners meet or exceed the performance of virgin materials, ensuring long product lifespans and reducing waste.
Drop-In Solutions: The recycled plastics are designed as drop-in solutions, meaning they are compatible with existing production moulds and processes, minimizing the need for additional investments in tooling or equipment.	**Scalability of Recycling**: The clustering and recycling approach shows potential for scaling across other large household appliances (LHAs), broadening its commercial viability.	**Alignment with Circular Economy Goals**: The initiative supports the EU's circular economy strategy, including achieving targets for the use of recycled materials in consumer products.		**Waste Reduction**: Recycling plastics from large household appliances reduces waste sent to landfills, contributing to lower greenhouse gas emissions.	**Resource Efficiency**: The clustering approach optimizes resource recovery, allowing for the effective use of mixed plastic waste streams.
Compliance with Stringent Standards: Materials like rPP-CaCO3 meet Whirlpool's technical specifications and demonstrate comparable performance to virgin materials in tests such as tensile strength, flexural strength, and chemical resistance.	**Partnerships with Recyclers**: Collaborations with MGG Polymers and other consortium members ensure a consistent supply of high-quality recycled materials, supporting the production of durable and compliant components.				

Case: Whirlpool
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Material Contamination: Ensuring the purity of post-consumer recycled (PCR) plastics remains a challenge, as contamination from additives, coatings, or mixed polymers can compromise the quality and usability of recycled materials.	**High Processing Costs**: Recycling and sorting processes, especially for clustered waste streams, can be costly, reducing the financial competitiveness of PCR plastics compared to virgin materials.	**Compliance Challenges:** Adhering to stringent EU directives, such as REACH, RoHS, and WEEE, for products containing PCR plastics can increase complexity and cost, particularly for components like food-contact parts.	**Consumer Perception of Recycled Plastics**: Customers may associate recycled materials with lower quality or durability, which could impact their willingness to purchase appliances made with PCR plastics.	**Energy Intensity of Recycling**: Advanced recycling and processing techniques required for PCR plastics can be energy-intensive, potentially offsetting some environmental benefits if not powered by renewable energy.	**Inefficiencies in Recycling Infrastructure**: Limited availability of specialized facilities capable of handling complex plastic waste streams, such as mixed or flame-retardant plastics, hinders effective recycling.
Performance Variability: While PCR plastics like rPP-CaCO3 are designed as drop-in solutions, maintaining consistent performance comparable to virgin materials—particularly in applications requiring high durability and chemical resistance—can be difficult.	**Demand-Supply Imbalance**: Ensuring a steady supply of high-quality recycled materials is a challenge, particularly for large-scale applications like washer tubs and fridge liners.	**Limited Standardization**: Variability in recycling regulations and standards across regions can create logistical challenges and restrict scalability	**Risk of Greenwashing Allegations**: Without clear communication about the benefits and limitations of recycled materials, Whirlpool could face scepticism about the authenticity of its sustainability claims.	**Transportation Emissions**: Sourcing, collecting, and transporting recycled materials across regions can contribute to carbon emissions, complicating the overall climate impact assessment.	**Consumer Recycling Participation**: Ensuring sufficient volume and quality of input materials relies heavily on consumer behaviour and robust collection systems, which may not always be consistent or reliable.
Limitations in Material Application: Certain product components may have technical requirements, such as food safety or thermal resistance, that recycled plastics struggle to meet without additional processing or additives.	**Price Sensitivity**: While consumers value sustainability, the potential for higher production costs to translate into increased retail prices could deter broader market adoption.				**Residual Waste Challenges**: Even with advanced sorting and clustering, some fractions of waste may remain non-recyclable, requiring disposal or incineration.

Case 7

Recycled ABS plastic

DTU Circularity

Case: Recycled ABS plastics

ENGEL, in partnership with bage plastics and ROCTOOL, is recycling end-of-life ABS plastics into high-quality feedstock for new components.

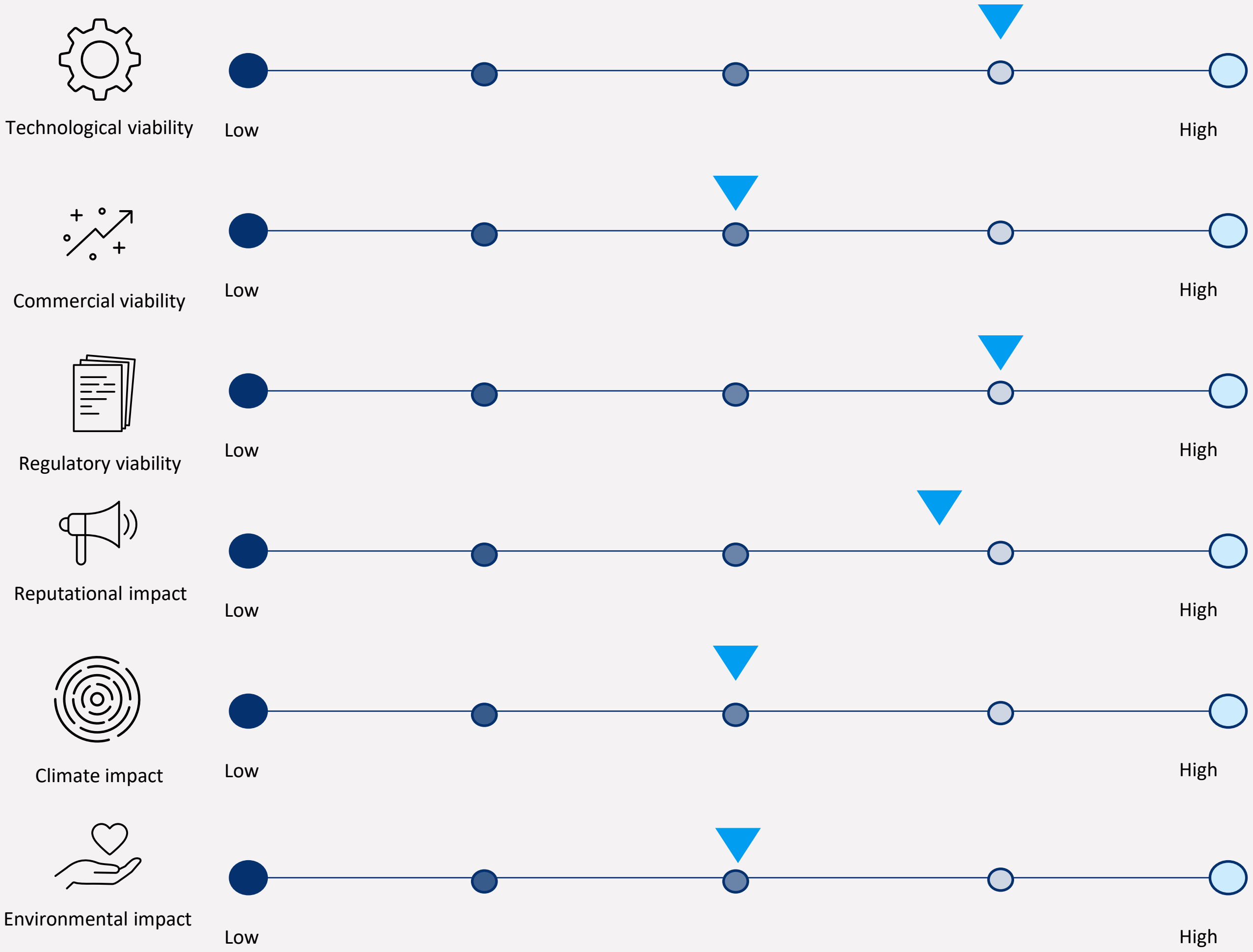
ABS | Plastics manufacturing | Recycled materials, injection moulding,

ABOUT	ENGEL, in collaboration with bage plastics and ROCTOOL, is leading an initiative to develop a closed-loop system for ABS (Acrylonitrile Butadiene Styrene) components. The project focuses on recycling end-of-life ABS plastics into high-quality feedstock to produce new components.
ENABLERS	The initiative is enabled primarily by a collaborative effort between companies operating different parts of the value chain. Combining ENGEL's manufacturing technologies, bage plastics' recycling know-how, and ROCTOOL's thermal innovation creates a holistic approach to ABS recycling and production. From a customer perspective, the project enables the production of plastic electronic box components, from recycled content.
BARRIERS	From a supply chain perspective, barriers include integrating technologies from multiple partners, ensuring consistent quality of variable ABS feedstocks, and high initial investments for scaling closed-loop systems. On the product side, risks of material degradation and complex certification processes add challenges, while compliance with regulations like REACH increases processing demands. From a customer perspective, competition with alternative materials and concerns over energy use and measurable carbon footprint reductions may hinder confidence and market adoption of recycled ABS.

Picture from bage plastics

Picture from bage plastics

Case: Recycled ABS plastics



Case: Recycled ABS plastics

Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Advanced Injection Moulding Technology: ENGEL's expertise in precision moulding enables efficient production of high-quality components from recycled ABS, maintaining material performance comparable to virgin ABS.	**Market Demand for Recycled ABS:** Industries such as automotive, electronics, and consumer goods are actively seeking sustainable alternatives to virgin plastics, providing a robust market for recycled ABS components.	**Supportive Policies:** EU policies, such as the Circular Economy Action Plan, emphasize recycling and the use of secondary raw materials, creating a favorable regulatory environment.	**Sustainability Leadership:** The initiative positions ENGEL, bage plastics, and ROCTOOL as innovators in sustainable manufacturing, enhancing brand image and stakeholder trust.	**Carbon Emission Reduction:** Using recycled ABS significantly lowers greenhouse gas emissions compared to virgin ABS production, aligning with corporate and global climate goals.	**Reduction in Plastic Waste:** Closing the loop for ABS diverts plastic waste from landfills and incineration, directly addressing plastic pollution.
Recycling Expertise from bage plastics: bage plastics' specialization in processing and preparing recycled ABS ensures a consistent, high-quality feedstock for new components.	**Cost Efficiency Potential:** Using recycled ABS can reduce raw material costs over time, especially as recycling processes become more efficient and feedstock availability improves.			**Energy-Efficient Processing:** ROCTOOL's heat control technologies and ENGEL's energy-optimized injection molding reduce the overall energy footprint of the process.	
Heat and Energy Optimization: ROCTOOL's heat control technology enhances the molding process by improving energy efficiency and ensuring the quality of the finished products.	**Collaborative Business Model:** The partnership leverages combined expertise to provide a comprehensive solution, from recycled material production to finished ABS components.				

Case: Recycling ABS Plastic
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Material Degradation: Recycled ABS can degrade in quality during repeated recycling cycles, limiting its performance for high-demand applications without proper additives or processing.	**High Initial Investment:** Implementing closed-loop systems and integrating technologies requires substantial upfront capital, which could deter adoption at scale.	**Complex Certification Processes:** Products made from recycled ABS must meet stringent safety and performance standards, which can delay market entry.	**Competition for Visibility:** With many companies adopting circular economy strategies, standing out as a leader in ABS recycling requires consistent innovation and effective communication.	**Energy Demand for Recycling:** While less than virgin ABS production, recycling processes still require substantial energy, which could undermine climate benefits if non-renewable sources are used.	**Contamination Risks:** Recycled ABS can contain additives or contaminants from previous applications, posing challenges for maintaining environmental safety during processing.
Technological Integration Challenges: Synchronizing technologies from three partners (ENGEL, bage plastics, ROCTOOL) requires seamless collaboration, which can be resource-intensive	**Variable Feedstock Quality:** Dependence on post-consumer ABS waste introduces inconsistencies in raw material quality, impacting production efficiency and cost predictability.	**Hazardous Substance Concerns:** Trace contaminants in post-consumer ABS feedstocks must comply with strict EU regulations, such as REACH, adding processing complexity.		**Carbon Accounting Complexity:** Measuring and communicating the carbon footprint reductions achieved through recycling can be challenging and subject to scrutiny.	
Process Optimization: Scaling up closed-loop systems for ABS involves optimizing feedstock quality and processing conditions to match or exceed virgin ABS standards.	**Market Competition:** Competing solutions, including bio-based plastics, could challenge market share for recycled ABS.				

Case 8

Partnership for production of 100% circular plastic

DTU Circularity

Case: partnership for production of 100% circular plastic

Dow and Fuenix Ecogy Group tackle plastic waste challenges by transforming it into 100% circular polymers through advanced feedstock recycling technology

Mixed plastics | Chemical manufacturing | Chemical recycling, plastic recycling, industrial partnership

ABOUT	Dow has partnered with Fuenix Ecogy Group to create 100% circular plastic by converting mixed plastic waste into pyrolysis oil, which is processed into new polymers at Dow's Terneuzen facility in the Netherlands. These polymers are identical to those made from traditional feedstocks and can be used in applications such as food packaging, marking a significant step toward advancing feedstock recycling and promoting circularity in plastics.
ENABLERS	From a supply chain perspective, the Dow and Fuenix partnership is enabled by Fuenix's advanced pyrolysis technology, which converts mixed plastic waste into pyrolysis oil. This oil serves as a reliable feedstock for Dow's European operations, supporting their commitment to integrating 100,000 tonnes of recycled plastics by 2025. On the product side, the resulting polymers are of virgin quality and suitable for high-demand applications such as food packaging, ensuring performance standards are maintained. From a customer perspective, this collaboration provides businesses with sustainable plastic solutions, helping them meet growing consumer and regulatory demands for environmentally responsible products.
BARRIERS	From a supply chain perspective, barriers include the variability in the quality of plastic waste feedstock, which can affect the efficiency of Fuenix's pyrolysis process, and the significant investment required to scale the technology to industrial levels. On the product side, the energy-intensive nature of the pyrolysis process poses challenges in maintaining environmental benefits, especially if powered by non-renewable energy sources. From a customer perspective, market adoption is hindered by concerns over the perceived quality of recycled plastics for sensitive applications like food packaging, as well as the complexity of navigating regulatory certifications required for such uses.

Picture from Dow website

Case: partnership for production of 100% circular plastic

Case: partnership for production of 100% circular plastic

Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Advanced Recycling Technology: Fuenix employs pyrolysis to break down mixed plastic waste into pyrolysis oil, enabling the production of Dow's virgin-quality polymers.	**Increase in recycled content of Dow's products:** The partnership ensures a steady supply of pyrolysis oil feedstock for Dow, supporting its commitment to incorporate at least 100,000 tonnes of recycled plastics into its European product offerings by 2025. **Market Development:** By creating value from Fuenix's pyrolysis oil, the collaboration supports demand for plastic-waste as a resource and it helps to grow the market. **No significant changes in production:** Neither company should change their production methods or core business model, thereby avoiding associated costs, the commercial value is connected to the price of the recycled pyrolysis oil.		**Sustainability stewardship:** This collaboration enhances Dow's reputation as a leader in sustainable practices by advancing the circular economy for plastics and reducing reliance on virgin raw materials.	**Reduction of CO_2 Emissions:** By converting plastic waste into reusable feedstock, the partnership contributes to potential reductions in CO_2 emissions compared to traditional plastic production methods.	**Waste Diversion from Landfills**: The process diverts plastic waste from landfills, promoting environmental conservation and resource efficiency.

Case: partnership for production of 100% circular plastic

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Feedstock variability: The quality and composition of plastic waste can vary significantly, potentially affecting the efficiency and consistency of the pyrolysis process.	**Economic viability:** The cost of producing polymers from recycled feedstock may be higher than using traditional fossil-based feedstocks, potentially impacting competitiveness. **Feedstock availability:** the scope of producing polymers from recycled feedstock depends on the availability of recycled feedstock in the market. If demand surpasses supply, availability can become a barrier. **Technology expansion:** Scaling up advanced recycling technologies like pyrolysis to industrial levels requires significant optimisation to ensure consistent product quality and process efficiency		**Public Perception:** Despite the environmental benefits, there may be skepticism about the safety and quality of products made from recycled plastics, particularly for sensitive applications like food packaging.	**Energy Consumption:** The pyrolysis process is energy-intensive, and if not powered by renewable energy sources, it could offset some of the climate benefits gained from recycling.	

Case 9

CirPlus

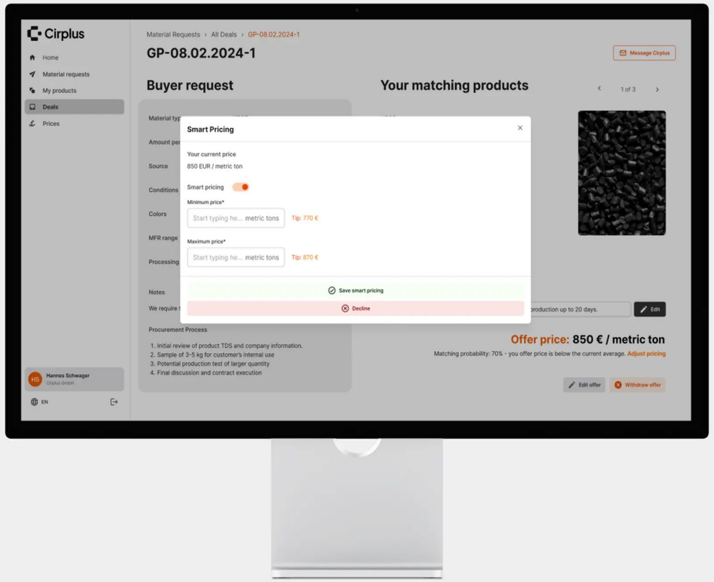
DTU Circularity

Case: Cirplus

Cirplus innovates the recycled plastics market with a digital platform that support efforts to match supply with demand.

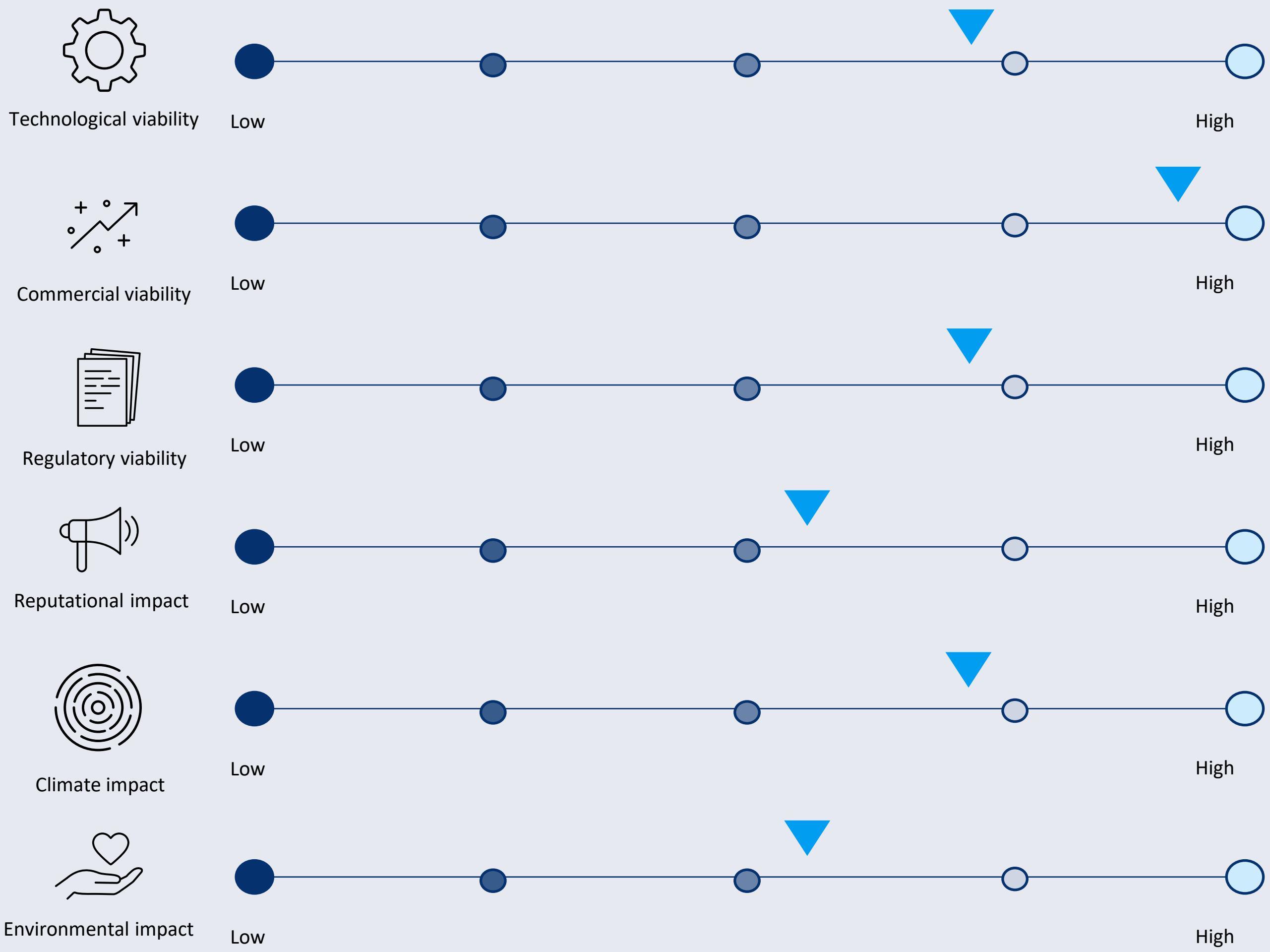
Mixed plastics | Information and technology | Innovation, Funding, marketplace

ABOUT	Cirplus is a digital marketplace dedicated to facilitating the global trade of recycled plastics, aiming to streamline the procurement and sale of recyclates and feedstock. By standardizing and digitizing the circular plastics supply chain, Cirplus addresses key challenges in the recycled plastics market.
ENABLERS	From a supply chain perspective, Cirplus is enabled by its digital platform, which connects suppliers and buyers of recycled plastics globally, and the adoption of DIN SPEC standards, ensuring standardized and reliable material data. The platform's extensive network, encompassing over 4 million tons of circular materials, facilitates efficient transactions and access to high-quality recyclates. On the product side, Cirplus supports industries across packaging, automotive, and construction by ensuring that recycled plastics meet performance and regulatory standards. From a customer perspective, Cirplus provides a cost-effective, transparent, and user-friendly solution for sourcing sustainable materials, meeting the growing demand for recycled plastics in a wide range of applications.
BARRIERS	From a supply chain perspective, barriers include the inconsistent quality of recycled plastics across suppliers, limited adoption of DIN SPEC standards, and challenges in integrating the platform into existing procurement systems. On the product side, competition with cheaper virgin plastics and the variability in recycled material quality can hinder broader market adoption. From a customer perspective, the complexity of compliance with fragmented regional regulations and the perceived complexity of the platform, particularly for smaller players, may discourage participation. Additionally, price volatility and trust issues in emerging markets add further challenges to scaling Cirplus's marketplace.



Picture from Cirplus website

Case: Cirplus



Picture from Cirplus

Case: Cirplus
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Digital Platform Integration: Cirplus utilizes a comprehensive digital platform that connects buyers and sellers of recycled plastics, enabling efficient transactions and real-time communication.	**Extensive Network:** With access to over 4 million tons of circular materials from more than 3,000 companies worldwide, Cirplus offers a vast network that enhances market liquidity and provides diverse sourcing options for buyers.	**Alignment with Circular Economy Policies:** Cirplus's operations support the European Union's circular economy initiatives by promoting the use of recycled materials and reducing plastic waste.	**Industry Recognition:** Cirplus has received accolades such as the National Standardization Awards 2022 for Climate Protection and Innovation, highlighting its commitment to sustainability and industry leadership.	**Reduction of Virgin Plastic Production:** By facilitating the use of recycled plastics, Cirplus contributes to decreasing the demand for virgin plastic production, thereby reducing associated greenhouse gas emissions.	**Waste Diversion:** The platform promotes the recycling of plastic waste, diverting it from landfills and incineration, which mitigates environmental pollution and carbon emissions.
Standardization of Material Data: The company has been instrumental in developing standards such as DIN SPEC 91446 and DIN SPEC 91481, which standardize material data for recycled plastics. This facilitates easier matching of supply and demand by ensuring consistent quality and specifications.	**Cost-Efficiency:** By digitizing transactions and reducing intermediaries, Cirplus lowers transaction costs, making the procurement of recycled plastics more cost-effective for businesses.	**Compliance Facilitation:** The platform aids companies in adhering to regulations related to recycled content and waste management by providing access to compliant materials and standardized data.	**Trust and Transparency:** By providing a transparent marketplace with standardized quality controls, Cirplus builds credibility and trust among stakeholders, enhancing its reputation in the industry.		
Quality Control Mechanisms: Cirplus implements robust quality control protocols to ensure that the recycled plastics traded on its platform meet industry standards, thereby building trust among market participants.	**Support for Various Industries:** The platform caters to multiple sectors—including packaging, automotive, construction, home appliances, and agriculture—facilitating the integration of recycled plastics across diverse applications.				

Case: Cirplus
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Inconsistent Data Quality Across Suppliers: While Cirplus promotes standardized material data, ensuring consistency in quality, format, and accuracy from a diverse range of global suppliers remains a challenge. **Limited Adoption of Standards:** Not all market participants have adopted the DIN SPEC standards, creating gaps in the interoperability and usability of the platform.	**Market Price Volatility:** Prices of recycled plastics can fluctuate significantly, driven by global supply and demand dynamics, which may deter long-term commitments from buyers and sellers. **Competition with Virgin Plastics:** Virgin plastics often remain cheaper due to subsidies and economies of scale, making it difficult for recycled plastics to compete, particularly in price-sensitive markets. **Limited Supplier Engagement:** The platform's success depends on the active participation of recyclers and suppliers. Limited buy-in from key market players can constrain its effectiveness.	**Compliance Costs:** Ensuring compliance with diverse regulations, such as those governing chemical safety or recycled content requirements, can increase costs for both suppliers and buyers.	**Trust Issues in Emerging Markets:** Building trust among stakeholders in regions with less established recycling industries can take time, as concerns over the reliability of material quality and delivery schedules persist.	**Carbon Intensity of Logistics:** Transporting recycled plastics across regions to meet supply and demand may increase carbon emissions, offsetting some environmental benefits.	**Waste Collection Infrastructure Gaps:** Inadequate waste collection and sorting systems in certain regions limit the availability of high-quality recycled plastics on the platform.

Case 10

Igus

DTU Circularity

Case: Igus

The igus® chainge program creates a closed-loop system by recycling plastic components into high-quality granulates for sustainable production.

Mixed plastics | Plastics manufacturer | Innovation, recycling, marketplace

ABOUT	The igus® chainge program is a global recycling initiative aimed at creating a closed-loop system for plastic components, such as energy chains and other industrial materials. By enabling customers to return used products, igus® processes these materials into high-quality granulates that are reintroduced into production for new products. With a focus on sustainability, advanced recycling technologies, and customer engagement, the chainge program exemplifies igus®'s commitment to driving the circular economy and reducing plastic waste worldwide.
ENABLERS	From a supply chain perspective, the igus® chainge program is enabled by an efficient global collection system for used energy chains, supported by partnerships with logistics and recycling facilities. The integration of advanced recycling technologies allows igus® to process returned plastics into high-quality granulates that can be reused in new products. On the product side, igus® ensures that its energy chains are designed for recyclability, simplifying disassembly and material recovery. From a customer perspective, the program incentivizes participation with vouchers and provides an accessible way to reduce environmental impact, aligning with growing demand for sustainable industrial solutions.
BARRIERS	From a supply chain perspective, barriers include the complexity of recovering and processing mixed or contaminated plastics, the high initial investment required for advanced recycling infrastructure, and challenges in scaling the program globally in regions with underdeveloped recycling systems. On the product side, achieving consistent quality and material properties with recycled granulates can limit their applicability for certain high-performance uses. From a customer perspective, logistical challenges in returning used energy chains, limited awareness of the program, and potential perceptions of recycled materials as inferior may hinder widespread participation. Additionally, price competition with cheaper virgin plastics and fragmented recycling regulations across regions add further challenges to the program's scalability and adoption.

Picture from Igus

Case: Igus

Picture from igus

Case: Igus
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Advanced Recycling Processes: igus® employs sophisticated recycling techniques to process returned energy chains and other plastic components, converting them into high-quality granulates suitable for manufacturing new products.	**Incentive Structures:** The program offers customers vouchers in exchange for returning used energy chains, encouraging participation and fostering customer loyalty. **Cost Reduction:** Utilizing recycled materials helps lower production costs, enabling igus® to offer competitively priced products.	**Alignment with Environmental Regulations:** The program supports compliance with regulations aimed at reducing plastic waste and promoting recycling, such as the European Union's Circular Economy Action Plan.	**Sustainability Commitment:** The chainge program underscores igus®'s dedication to environmental responsibility, enhancing its reputation as a leader in sustainable practices.	**Reduction of Carbon Footprint:** Recycling plastic materials consumes less energy compared to producing virgin plastics, leading to lower greenhouse gas emissions.	**Waste Diversion from Landfills:** By recycling used energy chains, the program reduces the volume of plastic waste destined for landfills, mitigating associated environmental hazards. **Promotion of Circular Economy Principles:** The chainge program exemplifies a shift from a linear to a circular economy model, encouraging sustainable consumption and production patterns.

Case: Igus
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Limited Compatibility of Recycled Granulates: Some applications may demand specific material properties that are harder to achieve with recycled plastics, limiting the range of products that can incorporate recycled granulates.	**High Initial Investment:** Setting up and maintaining advanced recycling facilities and the infrastructure for collection and processing involves significant upfront costs.		**Perceptions of Recycled Materials:** Customers may perceive products made with recycled granulates as inferior in quality, impacting their willingness to adopt.	**Energy Intensity of Recycling Processes:** While recycling reduces raw material usage, the energy required for advanced recycling processes can offset some climate benefits if not powered by renewable energy sources.	**Limited Consumer Participation:** The success of the chainge program relies on consumers actively returning used energy chains, which may be hindered by logistical challenges or lack of awareness.
Infrastructure Challenges: Expanding the recycling program globally may face logistical and technological barriers in regions with underdeveloped recycling infrastructure.	**Price Competition with Virgin Plastics:** Recycled plastics often face challenges in competing with virgin plastics, which may be cheaper due to subsidies or economies of scale.			**Transportation Emissions:** The collection and transportation of used energy chains across regions for centralized recycling add to the carbon footprint of the program.	**Residual Waste Challenges:** Not all collected materials may be recyclable, leaving a fraction of waste that needs to be disposed of, potentially undermining the program's environmental goals.
	Customer Adoption Hurdles: While incentives like vouchers are offered, some customers may still be unwilling or unable to participate in the return program due to logistical complexities or lack of awareness.				**Recycling Infrastructure Gaps:** In regions with less developed recycling networks, establishing collection and processing facilities can be costly and time-consuming.

Case 11

Transportation packaging products

DTU Circularity

Case: Transportation packaging products

Cabka is a Dutch recycler and manufacturer, that produces transportation packaging products of almost entirely recycled plastic.

Mixed plastics

Packaging Manufacturing

Mechanical recycling and take-back scheme

ABOUT

Cabka is a plastics recycling company working to turn post-consumer and post-industrial plastic waste into reusable transport packaging products, including pallets, containers and boxes. They procure some virgin plastic, so the share of recycled plastic in their products ranges from 70-90%.

They are the recycler, and work with customers to procure plastic and ensure product buyback, effectively managing a closed loop.

ENABLERS

The primary driver of Cabka's success is that it designs and produces a product that is economically beneficial for its customers, because the cost of ownership of a Cabka product is lower than that of a conventional product (boxes or pallets), due to reusability and Cabka's buyback schemes. Furthermore, Cabka has been able to secure long-term framework agreements with large companies, including Tesla and BMW, demonstrating there is a demand for the product. From a supply-chain perspective Cabka uses a mix of post-consumer and post-industrial plastics and recycles much of it in its own plants, meaning it is less reliant on other recyclers.

BARRIERS

From a supply-chain perspective, Cabka states in its reporting that feedstock availability and prices are a growing challenge, because more and more companies need access to recycled plastics in order to meet their own targets and regulatory requirements. While Cabka sources plastic waste and recycles on its own, it also needs to procure recycled material from other recyclers to secure enough feedstock. The prices of these materials are rising, due to limited supply and increasing demand. From a product perspective, demand for their product is sensitive to the price of substitutes, so they are challenged when wood prices fall, and a wood pallet becomes a more attractive choice for potential customers.

Picture from Cabka

Case: Transportation packaging products

Picture from Cabka

Case: Transportation packaging products
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Mechanical recycling: Cabka is using mechanical recycling and producing its products through injection moulding and extrusion.	**Economically beneficial product:** The product is economically beneficial to customer. The cost of ownership for a Cabka pallet is lower than a traditional pallet.	**Packaging Regulation:** The EU's Packaging and Packaging Waste Regulation is expected to be a major driver of further commercial success.	**Positive reputation and customer perception:** Producing products from recycled plastic is the company's core business. Its reputation is thus strongly linked to the commitment to circularity and a major driver of its success.	**Climate footprint reduction:** Customers' desire to reduce the carbon footprint from their packaging is a driver of their choice to purchase Cabka products.	**Reduction in plastic disposal:** Cabka's products help divert mixed household plastic waste from incineration, reducing pollution and resource extraction.
Automation and digitilisation: Cabka is increasingly automating waste sorting processes and other logistics, making use of digitilisation and AI to recycle more effectively.	**Supply chain integration:** The company itself is the recycler and the manufacturer, allowing for relative control over the supply chain.	**Green finance:** The company is engaged in Taxonomy-eligible activities, and reports that 48% of revenues are Taxonomy-aligned. As a publicly listed company, this provides an opportunity for investment.		**Climate and LCA data:** Cabka combines its product offerings with climate and LCA data services for customers, to help them better understand the climate impact in their supply chains.	**Reduction in water use:** Limited amounts of water are needed in mechanical recycling, and the company has implemented closed loop water recycling at most facilities.
	Commercial agreements: Cabka procures plastic, sells its products, and has buyback schemes with large and small commercial partners. The company has framework agreements with BWM and Tesla, for example.				

Case: Transportation packaging products

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
No significant technological barriers.	**Low prices of substitutes:** When wood prices drop, the demand for Cabka pallets drops. **Feedstock availability:** Availability of recycled materials is generally unstable and expected to be increasingly unstable as requirements for recycled content become more prominent. **Energy prices:** Mechanical recycling, injection moulding and extrusion require energy. Higher energy prices lead to higher costs, so the company reports that margins have been squeezed in recent years, due to higher European energy prices.	**EU regulatory requirements:** Requirements for recycled content will lead to increasing demand for recycled plastic, potentially limiting the available supply for Cabka.	**Use of virgin plastics:** While the company strives to achieve 100% recycled content, it still relies on some virgin inputs.	**Energy use:** Recycling, injection moulding and extrusion processes require energy. Cabka still uses energy inputs from non-renewable sources, leading to operating emissions.	No significant barriers regarding other climate considerations.

Case 12

Re:Mix blender

DTU Circularity

Case: Modular mixer made with recycled content

Made from 100% recycled plastic sourced from items like cosmetic containers and car parts, the re:Mix embodies circular economy principles.

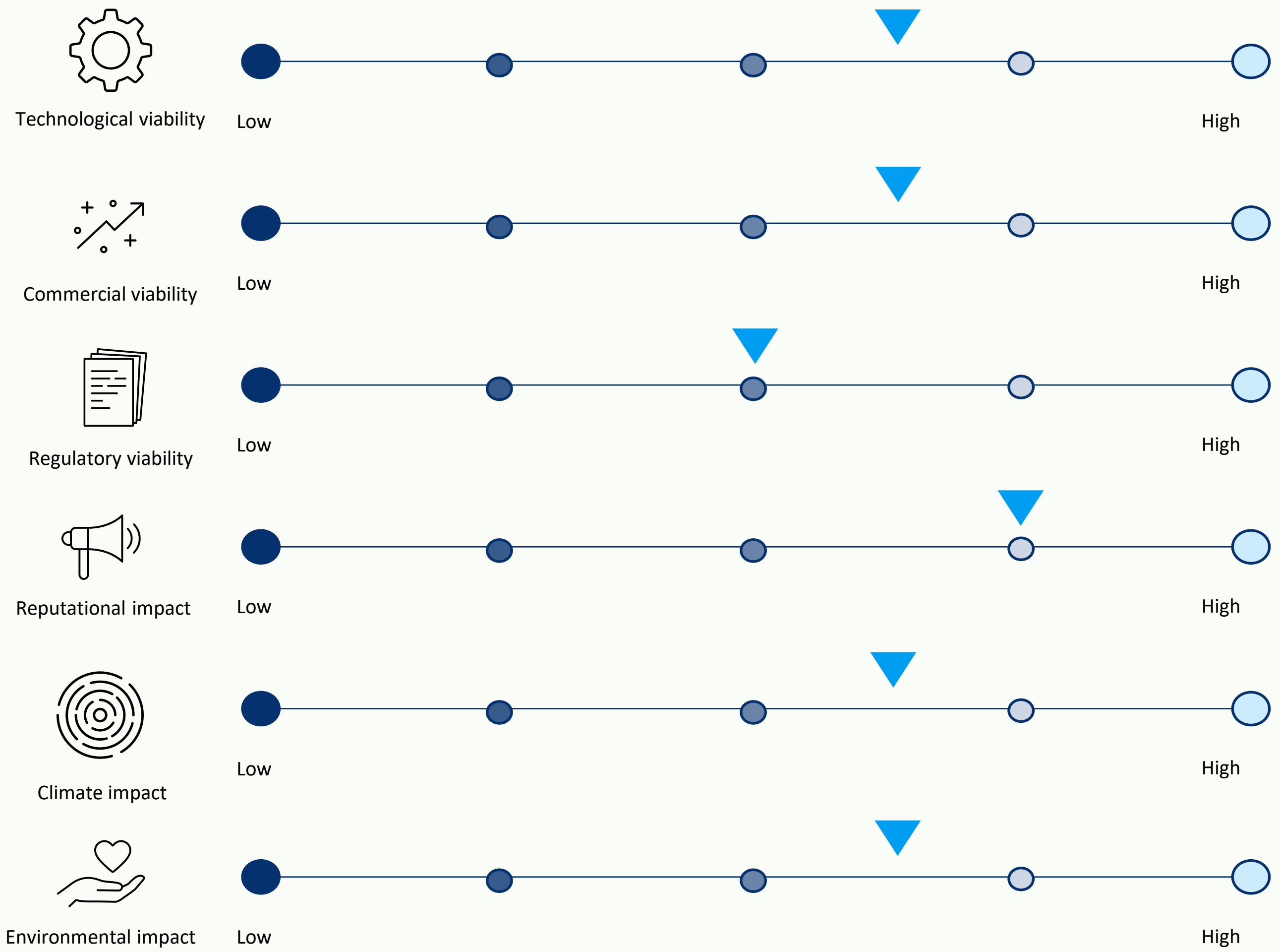
Mixed plastics | Consumer electronics | Recycling & design for circularity

ABOUT	Open Funk is a Berlin-based company focused on sustainable and modular kitchen appliances. Their flagship product, the re:Mix blender, features a modular design that allows for easy repairs and upgrades, significantly extending its lifespan. Made from 100% recycled plastic sourced from items like cosmetic containers and car parts, the re:Mix embodies circular economy principles.
ENABLERS	From a supply chain perspective, Open Funk's re:Mix blender is enabled by the use of 100% recycled plastic sourced locally from items like car parts and cosmetic containers, combined with 3D printing technology for efficient and low-waste manufacturing. On the product side, the modular design of the blender ensures easy repairability and extended lifespan, reducing waste and aligning with circular economy principles. From a customer perspective, the re:Mix blender offers customisable color panels and high-quality sustainable materials, appealing to eco-conscious consumers looking for durable and personalised kitchen appliances.
BARRIERS	From a supply chain perspective, barriers include the limited availability and variability of recycled plastic feedstock, which can affect the quality and consistency of the re:Mix blender's components. Additionally, reliance on 3D printing for production may face scalability challenges when expanding beyond local manufacturing. On the product side, the modular design, while sustainable, requires robust systems for part recovery and recycling to ensure end-of-life materials are effectively reused. From a customer perspective, the higher cost of recycled plastic products and lingering perceptions about the durability of recycled materials could hinder broader market adoption, despite growing interest in sustainability.

Picture from OpenFunk

Case: modular mixer made with recycled content

Picture from OpenFunk



Case: modular mixer made with recycled content
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Use of 100% recycled plastic: The outer casing of the re:Mix blender is made entirely from recycled plastic, sourced from items like discarded cosmetic containers and automotive parts. This demonstrates effective use of post-industrial and consumer plastic waste in product design.	**Market differentiation with recycled plastics:** By emphasising the use of recycled plastic, Open Funk appeals to eco-conscious consumers seeking sustainable kitchen appliances.	**Compliance with circular economy goals:** The extensive use of recycled plastic aligns with European Union policies and directives aimed at reducing plastic waste and promoting recyclability.	**Highlighting recyclability in marketing:** The use of recycled materials and focus on sustainability has earned re:Mix recognition, such as being shortlisted for the Dezeen Sustainability Awards 2022, enhancing its reputation as an eco-friendly brand.	**Carbon footprint reduction through recycled plastics:** Replacing virgin plastics with recycled materials reduces the carbon emissions associated with raw material extraction and processing.	**Waste reduction:** The modularity and repairable design ensure that fewer plastic components are discarded, extending their lifecycle and reducing environmental waste.
Modular structure: The modular design allows individual components, including plastic parts, to be replaced or repaired, ensuring that plastics remain in the product lifecycle longer and reducing the need for virgin materials. **3D printing with recycled plastic:** Open Funk uses 3D printing to manufacture components from recycled plastic.	**On-demand manufacturing:** The use of 3D printing minimises excess production, ensuring that recycled plastics are used efficiently and only as needed.		**Transparency:** Open Funk's open-source approach to sharing design and manufacturing details reinforces its credibility as a leader in sustainability.	**Local recycling supply chain:** Sourcing and processing recycled plastics locally further minimises transportation-related emissions.	**Buy-back programs:** Open Funk's buy-back programme ensures that EOL elements can be looped back into the system and used for new production.

Case: modular mixer made with recycled content

Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other environmental
Quality variability of recycled plastics: The performance and appearance of recycled plastic can vary depending on the source, potentially affecting the consistency and durability of the final product.	**Higher costs of recycled materials:** Sourcing and processing recycled plastic is often more expensive than using virgin plastics, particularly when ensuring consistent quality.		**Perception of recycled plastics:** Some consumers may associate recycled plastic with lower quality or durability, particularly for appliances subjected to regular use.	**Energy-intensive recycling process:** Converting waste plastics into usable feedstock and producing components through 3D printing may consume significant amounts of energy, potentially offsetting the environmental benefits if renewable energy is not used.	**Consumer incentives:** The buy-back and repair services are dependent on consumers' willingness to return elements or EOL products.
	Economies of scale: Producing the re:Mix blender locally with a focus on recycled materials and 3D printing may struggle to achieve cost efficiency compared to mass production using virgin materials.			**Global sourcing emissions:** While local manufacturing reduces transportation emissions, limited access to high-quality recycled plastic feedstock in some regions could lead to increased sourcing emissions.	.
	Niche market: While eco-conscious consumers are growing in number, the broader market might prioritize price and performance over sustainability, limiting potential demand.				

Case 13

Gomi

DTU Circularity

Case: Gomi

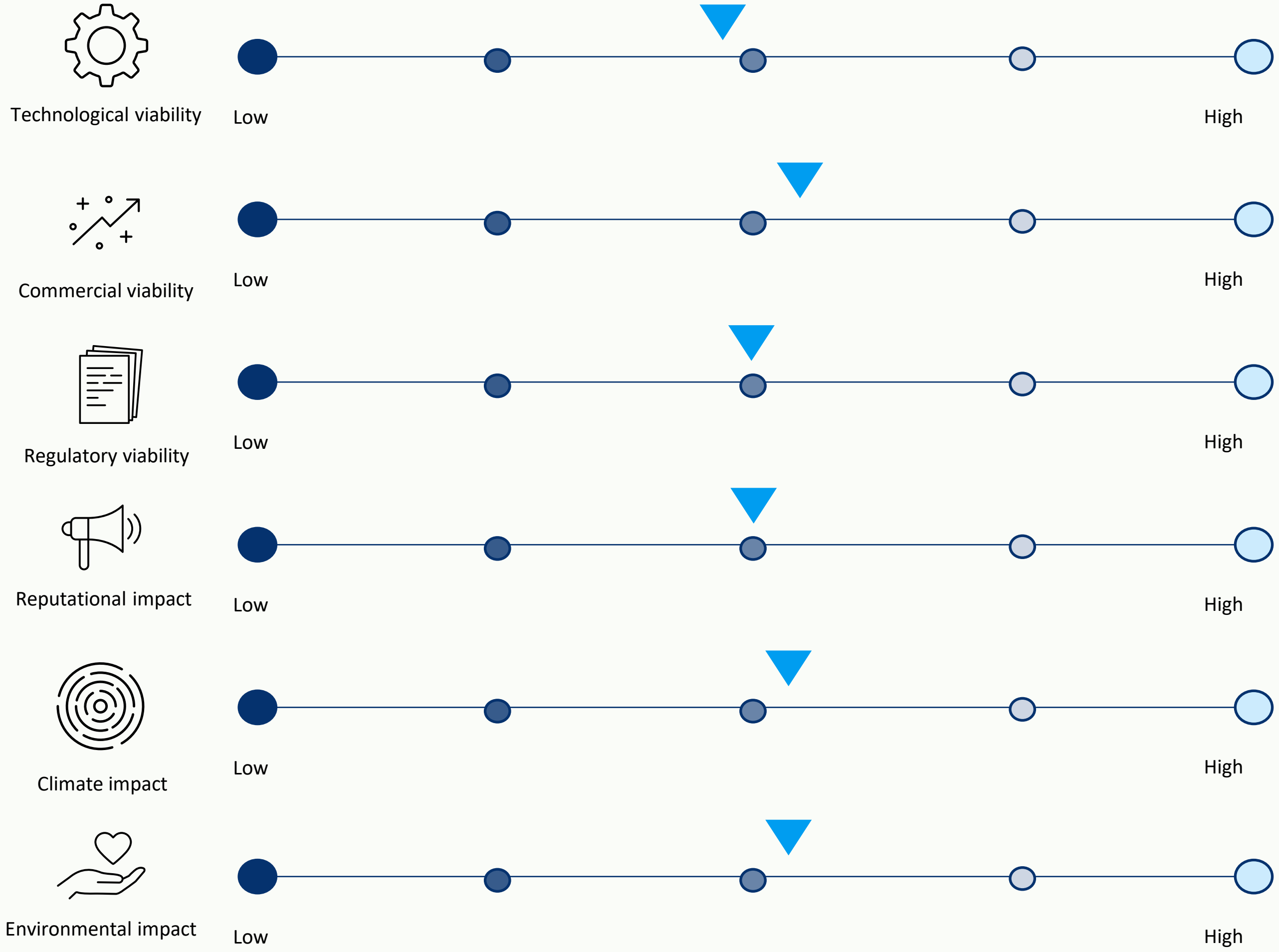
By integrating circular economy principles, Gomi transforms waste into high-quality, durable, and innovative audio solutions.

Mixed plastics | Consumer electronics | Design for recycling, modularity, take-back

ABOUT	Gomi is a Brighton-based company dedicated to creating sustainable products by recycling flexible plastics that are traditionally non-recyclable. Their speaker products are crafted using 100% recycled materials, such as shopping bags and bubble wrap, and are powered by repurposed lithium batteries from damaged e-bikes.
ENABLERS	From a supply chain perspective, Gomi's speakers are enabled by the use of 100% recycled flexible plastics, such as shopping bags and bubble wrap, and repurposed lithium batteries from damaged e-bikes, creating a sustainable material loop. On the product side, the innovative design integrates recycled materials without compromising quality, offering a durable and sustainable alternative to traditional speakers. From a customer perspective, Gomi's speakers appeal to eco-conscious consumers by delivering high-performance audio products while promoting waste reduction and environmental responsibility.
BARRIERS	From a supply chain perspective, barriers include the inconsistent quality and contamination of flexible plastic waste, which can complicate the recycling process, as well as challenges in sourcing sufficient quantities of suitable materials. On the product side, integrating recycled plastics and repurposed batteries can result in higher production costs and technical challenges, such as ensuring the durability and safety of components. From a customer perspective, barriers include potential concerns about the perceived quality and longevity of products made from recycled materials, as well as limited market awareness or willingness to pay a premium for sustainable alternatives.

Picture from Gomi website

Case: Gomi



Picture from Gomi

Case: Gomi
Enablers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Innovative Recycling Process: Gomi has developed a method to recycle flexible plastics—such as shopping bags, bubble wrap, and industrial packaging—that are typically deemed non-recyclable by UK councils. This process transforms these materials into unique raw materials for their products.	**Cost-Effective Material Sourcing:** By utilizing waste materials like flexible plastics and e-bike batteries, Gomi reduces raw material costs and creates a unique selling proposition centred on sustainability.	**Alignment with Environmental Policies:** Gomi's practices support governmental and international initiatives aimed at reducing plastic waste and promoting recycling, potentially facilitating compliance with current and future regulations.	**Sustainability Commitment:** Gomi's dedication to recycling non-recyclable plastics and repurposing batteries enhances its reputation as an environmentally responsible company.	**Reduction of Carbon Footprint:** Recycling plastics and repurposing batteries reduce the need for new raw materials, thereby lowering greenhouse gas emissions associated with production and disposal	**Waste Diversion:** Gomi's processes divert significant amounts of plastic and electronic waste from landfills, contributing to environmental conservation.
Battery Repurposing: The company sources healthy lithium batteries from damaged e-bikes, which are often discarded due to the high cost of repairing battery packs. Gomi tests these cells and repurposes them to power their products, effectively diverting them from landfills.	**Market Differentiation:** The use of recycled materials and a commitment to sustainability appeal to environmentally conscious consumers, providing a competitive edge in the market.		**Transparency:** By openly sharing their materials and processes, Gomi builds trust with consumers who value ethical and sustainable practices.		

Case: Gomi
Barriers

Technology	Commercial	Regulatory	Reputation	Climate	Other Environmental
Complexity of Recycling Non-Recyclable Plastics: Recycling flexible plastics like shopping bags and bubble wrap is challenging due to contamination, mixed materials, and degradation during processing, which may impact the quality of the recycled output.	**Cost of Processing Flexible Plastics:** Recycling non-recyclable plastics can be more expensive compared to traditional materials due to the need for specialized equipment and additional processing steps.	**Lack of Policy Incentives:** Limited government incentives for recycling hard-to-process plastics or repurposing batteries may place Gomi at a competitive disadvantage compared to businesses using traditional materials.	**Perception of Recycled Materials:** Some customers may perceive products made from recycled plastics or repurposed batteries as less durable or lower quality, which could affect market acceptance.	**Energy-Intensive Recycling Processes:** Transforming flexible plastics and testing lithium batteries require energy, which could offset some of the environmental benefits if renewable energy is not fully utilized.	**Availability of High-Quality Waste Plastics:** Ensuring a consistent and clean supply of flexible plastics for recycling can be difficult due to limited collection systems and contamination issues.
Battery Safety and Testing: Repurposing damaged lithium batteries involves safety risks, such as overheating or short circuits, and requires meticulous testing processes that can be time-intensive and resource-heavy.	**Economic Viability of Repurposed Batteries:** While Gomi repurposes e-bike batteries, the cost of testing, repairing, and integrating them into new products could outweigh the savings compared to sourcing new batteries.		**Transparency Risks:** While Gomi emphasizes sustainability and transparency, any issues with material sourcing, quality, or safety could damage its reputation.	**Logistical Emissions:** Collecting and transporting waste plastics and batteries for recycling could increase Gomi's overall carbon footprint, especially for decentralized sources.	**End-of-Life Challenges for Products:** Gomi's products, although made from recycled materials, must eventually be recycled themselves. Creating efficient systems to collect and recycle these products post-use could be a barrier.
Scaling Recycling Technology: While Gomi has developed innovative recycling processes, scaling these methods to meet higher production demands may require significant investment in infrastructure and technology.	**Niche Market:** Gomi's reliance on eco-conscious consumers may limit its market reach, as mass-market buyers often prioritize cost over sustainability.				