

The circular economy as a strategic catalyst

The potential of the circular economy in key technologies of the Austrian
Industrial Strategy 2035

Briefing – Task Force Circular Economy – May 2026	2
Overview:	2
1 Current situation and strategic context	3
2 The contribution of the circular economy to the industrial strategy objectives	4
2.1 Raw material resilience and strategic autonomy	4
2.2 The circular economy is a competitive advantage in key sectors	4
2.3 Decarbonisation of industry	5
3 Strategic framework: National strategies working in tandem	6
3.1 National Circular Economy Strategy (KWSAT, 2022)	6
3.2 Austrian Bioeconomy Strategy (2019, Action Plan 2022)	7
3.3 Government Programme 2025–2029: Relevant Measures	7
4 EU framework	9
5 Potential for synergies and recommendations for action	10
5.1 Establishing strategic coherence	10
5.2 ‘Made in Austria’ secondary raw materials hub	10
5.3 Digital infrastructure as an enabler	10
5.4 Bioeconomy and life sciences as a dual strategy	11
5.5 Strengthening binding commitments	11
6 Sector-specific analysis	12
7 Overarching conclusions and action matrix	25
7.1 Conclusion	26
8 Sources and references (selection)	27
Created by:	28

Briefing – Task Force Circular Economy – May 2026

Overview:

The nine key technologies form a portfolio comprising traditional high-tech sectors, knowledge-intensive cross-cutting technologies and medium-to-high-tech industrial sectors that are strategically crucial for Austria's industrial transformation.

The reasons why the circular economy is crucial for the nine key technologies can be summarised along three axes:

- 1. Raw material resilience** — The EU relies on imported raw materials for the production of technologies for renewable energy, digitalisation, mobility, aerospace and defence; a circular economy can mitigate this critical dependency through local recycling and remanufacturing. Particularly relevant for Austria: around 68 per cent of the raw materials used to manufacture smartphones, tablets and laptops are considered critical — so in the case of chips and electronics, one of the nine key sectors, the leverage effect of recycling is enormous.
- 2. Strategic coherence exists but is incomplete** — The further development of a circular economy is not only a challenge for Austria, but also a major opportunity; the FTI Monitor 2025 attests to Austria's significant competitive advantages in this future-oriented field. At the same time, the commentary warns that binding transparency requirements, clear legal obligations and publicly accessible data are still lacking.
- 3. The Government Programme provides the regulatory levers** — The 2025 Government Programme aims to create an expanded market environment by removing structural disadvantages facing secondary raw materials and is receiving a boost from the EU Circular Economy Act, scheduled for the end of 2026. The use of digital technologies for the circular economy, including digital product passports and digital raw materials exchanges, provides fertile ground for innovation within the context of digitalisation.

1 Current situation and strategic context

The **'Austrian Industrial Strategy2035'**, presented in January 2026, marks a turning point in domestic industrial policy. The strategy comprises six overarching objectives, explicitly including the **'promotion of sustainable and circular production methods'** – a clear commitment to the circular economy as a core principle of industrial policy.

For the first time, the Federal Government has defined **nine key technologies and areas of strength**, for which a funding budget of **2.6 billion euros** has been allocated **in the FTI Pact until 2029**:

1. Artificial intelligence and data innovation
2. Chips, electronic components and systems,
3. Advanced production technologies and robotics,
4. Quantum technology and photonics,
5. Advanced materials
6. Life sciences and biotechnology,
7. Energy and Environmental Technologies,
8. Mobility technologies,
9. Space and aerospace technologies

The stated aim is to rank Austria amongst the **top 10 OECD countries** in the Industrial Production Index by 2035 and to increase the share of industry in economic output from the current 16.9 per cent to over 20 per cent.

2 The contribution of the circular economy to the industrial strategy objectives

2.1 Raw material resilience and strategic autonomy

The key structural problem facing high-tech sectors – particularly chips/electronics, AI hardware, mobility and energy technologies – is their dependence on critical raw materials (CRMs). The EU imports almost all strategic materials such as lithium, cobalt, rare earths and gallium, predominantly from China.

This link is well documented in the scientific literature: Baldassarre (2025, *Ecological Economics*) shows that a circular economy can significantly mitigate this critical dependence through local recycling and remanufacturing – but this requires new supply chain configurations. Another study (Baldassarre & Carrara, *Resources, Conservation and Recycling*, April 2025) analyses how EU policy instruments – in particular the Critical Raw Materials Act (CRMA), the EU Battery Regulation and the Ecodesign for Sustainable Products Regulation (ESPR) with digital product passports – are shaping secondary supply markets for battery-related metals (lithium, cobalt, nickel, copper, rare earths).

This has direct implications for Austria: **Austria is one of the leading countries in the EU in terms of recycling** (516 kg per capita, recycling rate 62 per cent), which provides a strong foundation for the development of secondary raw materials markets.

According to a ScienceDirect study (2024), around **68 per cent of the raw materials** used in the manufacture of smartphones, tablets and laptops are **classified as critical** in the **electronics and chips sector**. Improved collection and recycling technologies for waste electrical and electronic equipment (WEEE) could significantly strengthen the critical raw materials (CRM) supply chain for high-tech applications. (Urban mining)

2.2 The circular economy is a competitive advantage in key sectors

The FTI Monitor 2025 highlights Austria's significant competitive advantages in circular economy technology, which should be utilised more consistently in industrial strategy. The strategy itself highlights that decades of experience in environmental and circular economy technologies create favourable conditions.

Chart 1: Specific links with the nine key technologies

Key technology*	Contribution of the circular economy
Chips & Electronics	Recovery of rare metals from WEEE; design for disassembly
AI & data innovation	Digital product passports, AI-optimised recycling processes, material tracking
Advanced production technologies	Additive manufacturing using secondary materials; zero-waste production
Energy & environmental technologies	Battery recycling, wind turbine recycling, circular systems for PV modules
Mobility technologies	Recycling of lightweight construction materials, second life for batteries, vehicle remanufacturing
Space & Aviation	High-quality material recovery (Ti, Al, carbon fibre composites)
Life sciences	Biopolymers, bio-based medical technology materials, circular pharmaceutical packaging

* For further details, see Chapter 6

2.3 Decarbonisation of industry

The Austrian Circular Economy Strategy (2022) emphasises that **45 per cent of the necessary GHG reductions can only be achieved through changes in the production of raw materials and goods**. Circular production processes – material substitution, extended product life cycles, remanufacturing – are therefore an indispensable lever for achieving the goal of climate neutrality by 2040.

3 Strategic framework: National strategies working in tandem

3.1 National Circular Economy Strategy (KWSAT, 2022)

The Circular Economy Strategy, adopted by the Council of Ministers on **7 December 2022**, sets out **the** following **vision**: to transform the Austrian economy and society into a climate-neutral, sustainable circular economy by **2050**. It identifies six key areas for action:

1. Legal and regulatory framework
2. Smart market incentives
3. Funding and support
4. Research, technological development and innovation (RTDI)
5. Digitalisation and information
6. Knowledge and collaboration

The seven **key areas of transformation** (based on the EU Circular Economy Action Plan) include, amongst others, electronics, mobility, construction, textiles and plastics – all of which are directly relevant to the key high-tech sectors of the industrial strategy.

The **first progress report (June 2024)** documents initial successes: a deposit-return scheme, a repair bonus (over 1 million vouchers redeemed), FFG research funding (€68.2 million for 2022–2023 in the key sector), and the establishment, **pursuant to Section 8 of the Federal Ministry of the Environment (BMG), of the inter-ministerial task force** (comprising science, business, administration and civil society) for the joint implementation of the circular economy strategy and the bioeconomy strategy. At the time of writing, the second progress report is undergoing political consultation.

Action required: The progress report shows that **binding transparency requirements and clear legal obligations for companies** are still pending. This is a **critical gap that needs to be closed for the implementation of the industrial strategy**.

3.2 Austrian Bioeconomy Strategy (2019, Action Plan 2022)

The Bioeconomy Strategy – adopted in 2019, with an action plan comprising 112 measures across 11 thematic areas finalised in 2022 – is a **complementary framework** to the Circular Economy Strategy. The bioeconomy is explicitly identified as **one of the key technologies for the defossilisation of the economic system**.

Key links to the industrial strategy:

- **Substitution of fossil raw materials** with bio-based materials in the chemical, paper, textile and plastics sectors
- **Biorefineries and bio-based industrial clusters** as new anchors of value creation (currently approx. €52 billion in turnover, 350,000 employees)
- **Industrial biotechnology** as an enabler for the life sciences and speciality chemicals
- **Use of biogenic waste and residual materials** as a raw material base – linking this to the circular economy principle
- **FTI capacity building** in nine defined thematic areas that overlap with the key technologies of the industrial strategy (including new biomaterials, fermentation and enzymatic processes)

The national bioeconomy network ‘**Bioeconomy Austria**’, launched in 2022, brings together regional clusters and research institutions – a model for the implementation architecture of the industrial strategy.

3.3 Government Programme 2025–2029: Relevant Measures

The coalition’s Government Programme contains a series of measures of direct relevance to the circular economy in an industrial context:

Regulatory:

- Evaluation and amendment of **the Waste Management Act (AWG)** to strengthen the market position of secondary raw materials
- Reform of standards and regulations to promote **circular business models** (including the sharing economy and end-of-waste regulations)
- New **EPR** (Extended Producer Responsibility) **schemes** for textiles; evaluation of incentives for used batteries
- Advocacy for clear, workable EU regulations on by-products and secondary raw materials

Digital & Innovation:

- Introduction of **digital product passports** and raw materials exchanges as infrastructure for the circular economy
- New calls for **proposals for research and demonstration projects** in the circular economy and production technologies
- **The circular economy as a “breeding ground for innovation in the context of digitalisation”**

Raw material resilience:

- Strengthening **domestic resilience** through greater independence in strategically important primary and secondary raw materials
- Ensuring the **availability of renewable raw materials** for the bioeconomy to strengthen international competitiveness

Sector-specific:

- Lifting the ban on CO₂ storage (**CCS/CCU**) – enabling **industrial carbon utilisation and cycles**
- **Renewable Gas Act** – a framework for biomethane and hydrogen as circular energy carriers

4 EU framework

Austria's national strategies are embedded in the applicable EU regulatory framework:

- **Critical Raw Materials Act (CRMA, 2024):** Mandatory recycling targets for strategic raw materials; as Europe's recycling champion, Austria has a structural opportunity to become the European hub for secondary raw materials.
- **EU Battery Regulation (2023):** Binding minimum recycling content targets for lithium, cobalt and nickel; directly relevant to key sectors in mobility and energy technology.
- **Ecodesign for Sustainable Products Regulation (ESPR) with digital product passports:** Creates traceability and market incentives for secondary materials in high-tech production.
- **Net-Zero Industry Act (NZIA):** Promotes clean-tech manufacturing and requires a secure supply of critical raw materials – directly complementary to the Austrian industrial strategy.
- **EU Action Plan for the Circular Economy (2020):** A blueprint for sectoral priorities on which the Austrian circular economy strategy is based.
- **EU Bioeconomy Strategy (2025):** Promotes the sustainable use of renewable raw materials to enhance Europe's resilience.
- **EU Biotech Act:** The first draft bill has been presented and is expected to be adopted in 2027. The focus is on accelerating the development, scaling up and industrial application of biotechnologies.
- **EU Circular Economy Act (planned for late 2026):** Strengthens the circular economy and resource security by establishing a single market for secondary raw materials and promoting circular value chains.

The scientific consensus (Galen et al., ChemSusChem, 2025; Baldassarre & Carrara, 2025) emphasises that government incentives for recycling activities, mandatory recycling targets and minimum quotas for secondary materials in manufacturing are the most effective tools for promoting a circular economy in the high-tech sector.

5 Potential for synergies and recommendations for action

5.1 Establishing strategic coherence

The Industry Strategy 2035, the Circular Economy Strategy, the Bioeconomy Strategy and the Government Programme 2025–2029 are highly compatible in terms of content but **are not yet sufficiently integrated at an institutional level**. The Austrian Productivity Council (Brief Analysis 01/2026) calls for an adaptive governance framework that continuously reviews measures in terms of their effectiveness and contribution to objectives.

Recommendation: The inter-ministerial **Circular Economy Task Force** (BMWET & BMLUK, as well as BMIMI, BMS, BMFWF and BMB) should be structurally linked to the new **Industry Task Force** (Industrial Strategy) to ensure genuine cross-sectoral coordination.

5.2 ‘Made in Austria’ secondary raw materials hub

Austria’s leading position in European recycling (516 kg per capita, recycling rate 62 per cent) is an underestimated locational advantage. By establishing **local recycling and processing clusters** for high-tech materials (particularly battery recycling, WEEE and CFRP composites), Austria can close supply chains for its own key technology production whilst simultaneously creating an export product.

Recommendation: Targeted funding for pilot plants for high-value recycling in key technology sectors as part of the FTI Pact 2027–2029; use of the ‘regulatory sandboxes’ in the industrial strategy for circular business models.

5.3 Digital infrastructure as an enabler

Digital product passports (enshrined in the Government Programme and the ESPR) and **AI-supported material flow analyses** are key to linking **AI/data innovation** with the circular economy. Austria has the opportunity here **to develop two key technologies in a synergistic manner**.

Recommendation: Establishment of a national digital raw materials exchange (provided for in the Government Programme) as a pilot project; integration into the FFG programme portfolios.

5.4 Bioeconomy and life sciences as a dual strategy

The interface between the bioeconomy strategy and the key technology of life sciences remains largely untapped. Bio-based materials, enzymes and biopolymers for medical technology, as well as bio-based speciality chemicals, offer considerable export potential.

Recommendation: Integrate Bioeconomy Austria with life sciences R&D funding; utilise the BOKU Bioeconomy Centre as a scientific hub.

5.5 Strengthening binding commitments

The FTI Monitor and independent analyses (A&W Blog, 2026) warn that the circular economy measures in the industrial strategy **require binding transparency requirements and clear legal obligations** in order to go beyond mere declarations of intent.

Recommendation: introduce binding minimum quotas for secondary raw materials in public procurement; this also reinforces the 'Made in Europe & Partner Countries' guiding principle of the Industrial Strategy.

6 Sector-specific analysis

Methodology: For each of the eight key technology and strength areas of the Industrial Strategy 2035, the following were analysed: (1) the sector-specific raw material and dependency issues, (2) the state of the circular economy in research and practice, (3) the links to the national circular economy strategy (KWSAT 2022), the bioeconomy strategy and the 2025–2029 Government Programme were analysed, and (4) sector-specific recommendations for action in Austria were drawn up.

Sector 1: Electronic components and systems (chips & semiconductors)

Raw material dependency and circular economy challenges

The semiconductor sector is one of the most raw-material-intensive high-tech sectors of all. Over 60 different elements from the periodic table are used in the manufacture of chips – including gallium, germanium, indium, tantalum, hafnium and rare earths for phosphors and magnets. The geopolitical concentration is extreme: more than 80 per cent of the global supply of rare earths, as well as crucial processing capacities, are concentrated in just a few countries, predominantly China. In 2025, the SEMI/imec consortium presented its first inventory of 69 prioritised materials for the circular economy in semiconductor manufacturing and launched the Circular Semiconductors Research Network – a clear indication of the growing strategic importance of this issue.

Scientific evidence (Springer Nature, Journal of Material Cycles and Waste Management, 2025) shows that the rising demand for rare earth elements (REEs) in semiconductor and chip technologies is leading to increased production costs and significant environmental impacts. Hydrometallurgical recycling processes are regarded as the preferred solution due to their lower environmental impact. Similarly, the Circular Economy Journal article (2025) on ‘Circularity of Semiconductor Chip Value Chains’ raises the profile of the topic in a geopolitical context.

Circular approaches:

- **WEEE recycling as a primary source:** Around 68 per cent of the raw materials used in smartphones, tablets and laptops are classified as critical. Recovery from waste electrical and electronic equipment (WEEE) is the most important lever. The European Commission is currently evaluating the WEEE Directive with a view to revising it as part of the announced Circular Economy Act.
- **Design for Disassembly:** The EU Ecodesign for Sustainable Products Regulation (ESPR, in force since July 2024) is gradually introducing requirements regarding the

reparability, disassemblability and recyclability of electronic products across all product groups.

- **Digital product passports:** Explicitly provided for in the 2025–2029 Government Programme; these enable material tracking throughout the entire life cycle and are a fundamental prerequisite for industrial secondary raw materials management.
- **Germanium cycle:** Germanium, a key semiconductor material, is already sourced from recycled optical glass for 20 per cent of its global production – evidence of the technical feasibility of high-quality recycling cycles.

Austria-specific points of reference:

The industrial strategy plans a ‘market exploration for the Important Project of Common European Interest (IPCEI) for advanced semiconductor technologies’ – the circular economy should be explicitly enshrined as a dimension here. The reorientation of the FFG within the FTI Pact 2027–2029 offers the opportunity to establish recycling research for electronic materials as a separate funding module. Austria’s strength in precision engineering (relevant to manufacturing equipment for the chip industry) is a **locational advantage for the development of automated disassembly and sorting technologies**.

Recommendation: Establish an Austrian node within the SEMI/imec Circular Semiconductors Research Network; link this to the IPCEI process and the Task Force Circular Economy.

References:

- SEMI & imec (2025): Circular Semiconductors Research Network – Inventory of 69 Materials. SEMI, San Jose. <https://discover.semi.org/rs/320-QBB-055/images/Material-Circularity-Report.pdf>
- Springer Nature, Journal of Material Cycles and Waste Management (June 2025): Rare earth element recycling: a review on sustainable solutions and impacts on the semiconductor and chip industries. <https://doi.org/10.1007/s10163-025-02276-7>
- Schröder, P., Charter, M., Barrie, J., Journal of Circular Economy (April 2025): Circularity of Semiconductor Chip Value Chains: Advancing AI Sustainability Amid Geopolitical Tensions. <https://circulareconomyjournal.org/ojs/JoCE/article/view/136>

Sector 2: Artificial Intelligence and Data Innovation

The AI infrastructure challenge: resource intensity as a systemic risk

AI is itself a driver of resource consumption, yet at the same time it is the most powerful tool of the circular economy. This dual role is strategically crucial.

Resource consumption by AI infrastructure: Global electricity consumption by data centres stood at around 415 TWh in 2024 and, according to projections, could rise to approximately 945 TWh by 2030 – around 3 per cent of global electricity consumption (Environmental Science & Engineering, Harvard/Boston University, 2025). AI hardware (GPUs, TPUs) contains significant quantities of gallium, indium, cobalt and rare earth elements. The production of AI hardware is the largest single component of the lifecycle CO₂ footprint.

Circular economy through AI: At the same time, AI is the most effective lever for optimising recycling processes, material flows and product design. A framework published in 2025 (Ranpara, Marwadi University, arXiv 2025) demonstrates that AI-supported circular economy systems achieve a 25 per cent reduction in energy consumption, an 18 per cent improvement in resource recovery and a 20 per cent improvement in sorting accuracy for municipal waste compared with conventional methods.

Chart 2: Specific areas of AI application in the circular economy

AI application	Benefits for the circular economy
Predictive maintenance	Extended service life of industrial plant; reduced waste due to unplanned breakdowns
Automated sorting (computer vision)	Increased purity levels of recycled fractions; cost-effective processing of mixed fractions
Material passport management	Digital product passports; traceability of materials throughout their entire life cycle
Optimisation of reverse logistics	AI-driven return logistics for end-of-life products, batteries and WEEE
Simulation models for product and material design	Design for Circularity right from the development phase
Digital raw materials exchanges	Matching supply and demand for secondary raw materials (envisaged in the 2025–2029 Government Programme)

Austria-specific points of reference:

The 2025–2029 Government Programme explicitly sets out the “use of digital technologies for the circular economy” and the “establishment of digital raw materials exchanges” as measures. This represents a direct intersection between the key technologies of AI and data innovation and the KWSAT. With the Austrian Institute of Technology (AIT) and the

universities (Vienna University of Technology, Johannes Kepler University Linz), Austria possesses strong R&D capacities in AI and data sciences.

Recommendation: Launch a specific FFG flagship initiative entitled ‘AI for the circular economy’ in the next possible RDI Pact; pilot a national digital raw materials exchange in cooperation with AIT and the recycling sector.

References:

- Huang, J. & Gopal, S. (2025): Green AI – A multidisciplinary approach to sustainability. Environmental Science & Engineering. <https://doi.org/10.1016/j.es.2025.100536>
- Ranpara, R. (2025): Energy-Efficient Green AI Architectures for Circular Economies Through a Multi-Layered Sustainable Resource Optimisation Framework. https://www.researchgate.net/publication/392735469_Energy-Efficient_Green_AI_Architectures_for_Circular_Economies_Through_Multi-Layered_Sustainable_Resource_Optimization_Framework
- [Anon.] (2025): The Environmental Impact of AI Servers and Sustainable Solutions. <https://arxiv.org/pdf/2601.06063>

Sector 3: Advanced production technologies and robotics

Remanufacturing as an industrial growth market

This sector is the most direct enabler of the circular economy: advanced production technologies and robotics form the operational basis for remanufacturing, automated disassembly and closed-loop production cycles.

The scientific literature clearly demonstrates this synergy: the International Journal of Advanced Manufacturing Technology (Daneshmand et al., 2022, cited in the special issue ‘Autonomous Remanufacturing for Sustainability’) characterises robotic assembly and disassembly as critical enablers of the circular economy within the context of the Fourth Industrial Revolution. Remanufacturing – the restoration of used products to as-new condition – creates up to eight times more jobs than traditional recycling because it requires knowledge-intensive processes. In many cases, this would also necessitate the revision of technical standards to enable the closing of the loop.

Another study (Mora-Contreras et al., Sustainable Development, Wiley, 2025) demonstrates empirically that the simultaneous implementation of the circular economy, eco-innovation and Industry 4.0 technologies significantly improves the sustainability performance and competitiveness of manufacturing companies.

Specific technology areas:

- **Robotic disassembly:** Automated dismantling of end-of-life products (vehicles, electronics, machinery) for high-quality material recovery; a key focus area within the SEMI/imec network and in the European battery supply chain strategy.
- **Additive manufacturing (3D printing) using secondary materials:** Enables the use of recycled plastics, metals and composites; reduces material waste to virtually zero.
- **Cobots for remanufacturing:** Collaborative robots carry out a wide variety of dismantling steps that previously required manual labour. This makes remanufacturing economically viable even for small batch sizes.
- **Digital twins for zero-waste production:** Virtual replication of production processes allows for continuous optimisation of material usage in real time.

Austria-specific points of reference:

Austria is a major player in advanced production technologies thanks to companies such as AVL, Anton Paar, Engel and its strong mechanical engineering cluster. The “Federal Climate and Transformation Initiative” (anchored in the implementation of KWSAT) aims to make industrial production processes climate-neutral – remanufacturing is a key element of this. The industrial strategy provides for “regulatory sandboxes” for new technologies and business models, which should be utilised for pilot projects in remanufacturing.

Recommendation: Support for a flagship project, the ‘Austrian Remanufacturing Hub’, in collaboration with the Federation of Austrian Industries; incorporation of remanufacturing standards into the FFG’s ‘ ’ call for proposals under the FTI Pact; utilisation of regulatory sandboxes for novel product-service systems (PSS).

References:

- Mora-Contreras et al. (2025): Revealing the Effects of Circular Economy, Eco-Innovation and Industry 4.0 on Sustainability Performance and Competitive Advantage. Sustainable Development (Wiley). <https://doi.org/10.1002/sd.70075>
- Daneshmand et al. (2022): Industry 4.0 and Prospects of the Circular Economy: A Survey of Robotic Assembly and Disassembly. Int. J. Advanced Manufacturing Technology. <https://doi.org/10.1007/s00170-021-08389-1>
- Discover Sustainability (2024): Realisation of circular economy principles in manufacturing: obstacles, advancements, and routes. Springer Nature. <https://doi.org/10.1007/s43621-024-00689-2>

Sector 4: Energy and environmental technologies

The circular paradox of the energy transition

The energy transition requires enormous quantities of materials – whilst at the same time generating new waste streams: lithium-ion batteries, photovoltaic modules, wind turbines. The circular economy is not an optional extra here, but a systemic necessity.

Battery technology: The EU Battery Regulation (2023) – the first piece of EU legislation to adopt a holistic life-cycle approach to a product – will gradually introduce CO₂ footprint declarations from 2025, minimum recycled content requirements from 2027, and mandatory recycling targets for cobalt, lithium and nickel from 2030. According to an EPA/IEA report (published in May 2026), international patent families in the field of battery circular economy recorded an average annual growth rate of 42 per cent between 2017 and 2023 – far exceeding the growth in battery patents overall (16 per cent). This signals rapid technological development in recycling and second-life applications.

By 2030, around 1.2 million EV batteries could reach the end of their service life, rising to 14 million by 2040. Today's supply chains for battery minerals are highly concentrated – circular technologies are key to security of supply.

Wind and PV technologies: The EU ban on the landfill disposal of wind turbine blades by 2025 has massively accelerated the development of recycling solutions for fibre-reinforced plastics (FRP). Globally, annual production of carbon fibres exceeds 150,000 tonnes; the market for recycled carbon fibres is estimated to be worth USD 500 million by 2025.

Austria-specific points of reference:

- The Graz-based start-up ProtectLiB (University of Graz, founded in 2024) is developing innovative lithium-ion battery recycling solutions – a concrete example of Austrian innovation at the interface between mobility and energy technology.
- Austria has strong industrial and R&D&I players in energy technology (AVL, Fronius, Siemens Energy). The combination of strength in energy technology and recycling expertise presents a strategic opportunity.
- The 'regulatory sandboxes' planned as part of the industrial strategy can be utilised for second-life battery applications (stationary storage systems using end-of-life EV batteries) – a business model with high potential.
- The Renewable Gas Act (in the 2025–2029 Government Programme and the Industrial Strategy) establishes the framework for biomethane and hydrogen as circular energy carriers – a direct link to the Bioeconomy Strategy.

Recommendation: Austria could position itself as a European hub for battery second life and recycling; establish a battery competence centre (similar to the Swiss Battery Technology Centre) in Styria or Upper Austria; actively participate in the EU Battery Partnership Programme under Horizon Europe.

References:

- EPO/IEA (April 2026): Battery Circularity – Innovation trends for a future source of critical materials, [https://iea.blob.core.windows.net/assets/b54b919a-51ea-4094-a8d9-24607d636d52/EPO IEA Study BatteryCircularity final.pdf](https://iea.blob.core.windows.net/assets/b54b919a-51ea-4094-a8d9-24607d636d52/EPO_IEA_Study_BatteryCircularity_final.pdf)
- Zhou, H, et al. (2024): The EU's recycled content targets for lithium-ion batteries are likely to compromise the circularity of critical metals. Cell Reports Physical Science. <https://www.sciencedirect.com/science/article/pii/S259033222400321X>
- Gaalen, M. van et al. (2025): From Critical Raw Materials to Circular Raw Materials. ChemSusChem. <https://doi.org/10.1002/cssc.202401170>
- European Commission (2023): EU Battery Regulation (EU) 2023/1542. Official Journal of the EU.

Sector 5: Mobility technologies

Transformation of the automotive value chain

Austria is a major hub for mobility, with companies such as AVL, Magna, BRP-Rotax, ZF and the strong supply industry in Upper Austria, Styria and Vienna, employing around 350,000 people in the sector. The transition to electric mobility and new propulsion concepts makes circular approaches an economic necessity.

The Austrian mobility sector is undergoing a 'triple transition' (digital – human-centric – green), with the circular economy potentially serving as its unique selling point in Europe, as experts emphasised at Zukunft.Mobilität 2025 (Linz, June 2025). Battery recycling was explicitly described there as “the start of a new value chain and an opportunity for Austria”.

Circular economy in the mobility value chain:

Battery life cycle: Traction batteries account for 10–15 per cent of an electric vehicle's weight. In Austria, at least 95 per cent of an end-of-life vehicle by weight has been required to be recycled since 2015. As EV penetration rises – the proportion of newly registered electric passenger cars in Austria is growing steadily – the demand for circular solutions is increasing.

The 'second life' concept (end-of-life EV batteries → stationary energy storage systems → recycling) is the most efficient strategy for preserving valuable materials: with the appropriate energy input, up to 99.5 per cent of battery metals can theoretically be recycled. The EU Battery Regulation 2023 stipulates minimum recycling content targets (lithium, cobalt, nickel, lead) from 2030 onwards.

Lightweight construction and composite materials: carbon fibre-reinforced polymers (CFRP) are becoming increasingly important in vehicle manufacturing. Recycling processes (pyrolysis, solvolysis, mechanical recycling) enable the recovery of 90–95 per cent of the carbon fibres. This is directly linked to Sector 6 (aerospace).

Vehicle remanufacturing: The remanufacturing of powertrain components, gearboxes, electric motors and power electronics is an established yet growing market with high added value.

Austria-specific points of connection:

- The Austrian automotive supply industry is under fundamental pressure to transform; the circular economy and remanufacturing can open up new business models and repurpose existing capacities.
- Incentives for the return of used batteries (explicitly earmarked for evaluation in the 2025–2029 Government Programme) are a direct means of ensuring the return of raw materials.
- Austria should actively use the EU Battery Regulation as an opportunity to strengthen its position as a business location: a planned national battery recycling centre could link Austria's excellence in recycling with the mobility cluster.

Recommendation: Establishment of an Austrian 'Automotive Circular Transition Fund' as a public-private partnership; integration of remanufacturing support into existing aws programmes; development of a national battery second-life standard in cooperation with E-Control and the automotive industry.

References:

- Austrian Federal Environment Agency (2023): Reuse and Recycling of Batteries for Electric Mobility – Technical Fundamentals. REP-0847. Vienna.
<https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0847bfz.pdf>
- EPA & IEA (2026): Batteries and the Circular Economy: Patent Landscape 2017–2023.
<https://www.iea.org/reports/battery-circularity>

Sector 6: Space and aerospace technologies

High-quality materials, complex cycles

The aerospace sector uses the most sophisticated materials in industry: titanium, aluminium alloys, nickel superalloys (engines), carbon fibre-reinforced polymers (CFRP) and speciality ceramics. These materials are expensive, energy-intensive to manufacture and difficult to recycle – yet highly attractive from an economic perspective.

Carbon fibre recycling: CFRP composites are the most important structural material in modern aviation. The global market for recycled carbon fibres from aerospace composites was valued at USD 142.6 million in 2024 and is set to grow at a CAGR of 12.1 per cent to reach USD 447 million by 2034. Airbus plans to recycle 95 per cent of the CFRP waste generated by its production. Recycling processes such as pyrolysis and solvolysis enable the recovery of 90–95 per cent of the carbon fibres with minimal degradation of properties (ScienceDirect, 2025).

A peer-reviewed article in the Journal of Composites Science (2025) confirms that recycled CFRP composites can meet the stringent structural requirements for aircraft components (wing spars) – a breakthrough for their acceptance in safety-critical applications. The EU ban on the landfill disposal of wind turbine blades by 2025 has also massively accelerated the development of FRP recycling infrastructure in Europe, from which the aviation sector also benefits.

Rare metals in engines: Nickel superalloys and cobalt alloys in engines are high-value materials for which specialised recovery processes are well established. Platinum group metals from industrial applications are already routinely recycled due to their high value.

Austria-specific points of reference:

- Austria is active in the aerospace sector through the Austrian Space Forum (OeWF), the University of Graz (IWF/Austrian Academy of Sciences), AVL, FACC and Industry 4.0 expertise.
- The space and aerospace sector is a pioneer in the circular economy for composite materials: the calls for proposals for research and demonstration projects in the circular economy and production technologies, as envisaged in the 2025–2029 Government Programme, should explicitly include CFRP recycling.
- The bioeconomy strategy offers an indirect link: bio-based Covalently Adaptable Networks (CANs) as a matrix for recyclable CFRP composites are an emerging field of research (US DOE, 2024) – Austrian RDI strengths in wood and bio-based chemistry (BOKU) could be brought to bear here.

Recommendation: Inclusion of CFRP recycling technologies in the RDI Pact 2027–2029 as an explicit funding module; cooperation with FACC and AIT to develop an Austrian centre of excellence for recycled high-performance composites; integration into the ESA programme for sustainable space infrastructure.

References:

- Mamat, R. et al., ScienceDirect (2025): Carbon fibre for applications in aerospace: A review. <https://www.sciencedirect.com/science/article/pii/S294991782500077X>
- MDPI, Journal of Composites Science (July 2025): Advancing Sustainability in Aerospace: Evaluating the Performance of Recycled Carbon Fibre Composites in Aircraft Wing Spar Design. <https://doi.org/10.3390/jcs9080384>
- Carbon Fibre Recycling from Aerospace Composites Market 2025–2034. <https://www.gminsights.com/industry-analysis/carbon-fiber-recycling-from-aerospace-composites-market>

Sector 7: Life Sciences / Biotechnology

Biotechnology as the link between the bioeconomy strategy and the circular economy

Life sciences and biotechnology are the sector in which the Austrian bioeconomy strategy is most closely intertwined with the circular economy. Biotechnological processes are not only central to the circular economy (waste prevention, sustainable production), but also act as enablers (enzymes for recycling processes, bio-based materials as substitutes for non-recyclable plastics).

Four strategic dimensions:

1. **Bio-based material innovations:** The Austrian bioeconomy strategy explicitly prioritises the development of bio-based materials as substitutes for fossil-based raw materials. Biopolymers (PLA, PHA, cellulose derivatives) and bio-based speciality chemicals are compatible with the circular economy and compostable. This addresses a core aspect of the circular economy – the replacement of fossil-based raw materials with biogenic ones.
2. **Sustainable pharmaceutical and medtech packaging:** The pharmaceutical industry is a sector that consumes large quantities of single-use materials and specialised packaging. The circular economy in the life sciences encompasses sustainable (biodegradable, compostable, recyclable) packaging, drug take-back programmes, the remanufacturing of medical devices and bio-based refrigerants. Biotech-driven packaging innovations, in particular temperature-stable systems using vacuum insulation panels, enable the circular economy to be applied even to sensitive biologics such as vaccines and insulin.

3. **Enzymatic recycling:** Industrial enzymes (produced through fermentative biotechnology) are key catalysts for the chemical recycling of plastics (enzymatic depolymerisation of PET) and for the biorefinery processing of lignocellulosic waste. Austria possesses excellent R&D capacities in this field through BOKU Vienna (Centre for Bioeconomy) and the Austrian Centre of Industrial Biotechnology (acib).
4. **Industrial Symbiosis:** The Danish Kalundborg model (Novo Nordisk, Ørsted and others as a networked industrial community exchanging resources) is the benchmark model for industrial symbiosis. Austria has great potential for this at industrial sites in Styria and Upper Austria.

Current state of the art: A study (Kharat et al., 2025) identifies 24 barriers to the transition to a circular economy in pharmaceutical companies at operational, strategic and tactical levels – with technological, financial and regulatory factors, as well as stakeholder management and reverse logistics, being the key hurdles. This could serve as a direct call to action for the regulatory reforms set out in the 2025–2029 Government Programme.

Austria-specific points of reference:

- The availability of renewable raw materials for the bioeconomy (explicitly listed as a measure in the 2025–2029 Government Programme) directly supports the life sciences circular economy approach.
- The BOKU Centre for Bioeconomy and the acib are natural anchors for Austrian R&D&I programmes at the interface between biotechnology and the circular economy.
- Life Sciences Austria (LISA) and Pharmig should be involved as stakeholders in the further development of the KWSAT Task Force.

Recommendation: Development of an Austrian ‘BioCircular Valley’ concept as a supra-regional network of life sciences companies, Bioeconomy Austria and recycling technology providers, taking into account existing structures (e.g. the ‘Circular Bioengineering’ Cluster of Excellence); Use of the BOKU Centre as an R&D&I hub; pilot projects on enzymatic plastics recycling within the framework of FFG calls for proposals.

References:

- Kharat, M. G., Kapoor, S., Parhi, S., Kharat, M. G. & Pandey, S. (2025): Operationalising sustainability in pharmaceuticals: Green supply chain metrics for the circular economy. *Sustainable Futures* (Elsevier B.V.), Vol. 9, p. 100413.
<https://www.sciencedirect.com/science/article/pii/S2666188824002612>
- Springer Nature (January 2025): Sustainable Practices and the Circular Economy in Pharmaceutical Sciences in India and Abroad. https://doi.org/10.1007/978-981-97-5177-8_23

Sector 8: Security Technologies

An underestimated field of strategic importance

In the Austrian industrial strategy, security technologies encompass both civilian security systems (cybersecurity hardware, sensor technology, communication systems) and security infrastructure, as well as – implicitly – dual-use technologies with defence relevance. The circular economy plays a role here in two dimensions: as a raw material resilience strategy and as a sustainability dimension of procurement.

Raw material resilience as security policy:

The EU relies on imported raw materials for the manufacture of defence and security technologies; a circular economy can mitigate this critical dependency through local recycling and remanufacturing – though this development is currently limited to a few selected supply chains, primarily lithium-ion battery technology.

A UK position paper by the Circular Economy Hub (CE-Hub, December 2024, University of Exeter) explicitly analyses the link between the defence sector and the circular economy. Key finding: defence equipment contains high concentrations of critical materials (Ti, Co, Ni, rare earths in permanent magnets); the remanufacturing and recycling of defence equipment are an underestimated lever for securing the supply of raw materials. In 2024, the British company Babcock entered into a partnership with Uplift360 to develop recycling solutions for composite materials from defence equipment – a model for Austria.

Specific aspects for Austria:

- Security technology hardware: Surveillance systems, sensors and communications infrastructure contain significant quantities of critical materials (gallium for GaAs chips, indium for displays, cobalt for energy storage). Circular procurement and the remanufacturing of this hardware are relevant from both an economic and a security policy perspective.
- Circular economy as a procurement principle: The industrial strategy enshrines the 'Made in Europe & Partner Countries' principle for public procurement. This should be supplemented by circular economy criteria (minimum recycled content, reparability, product passports) – including for the procurement of security technology.
- Security Innovation Ecosystem: The industrial strategy envisages a new Security Innovation Ecosystem. The circular economy should be integrated as a cross-cutting dimension – both for the material efficiency of devices and as a field of application (AI for material tracking, digital product passports for security-sensitive equipment).

- Cybersecurity for circular economy infrastructure: Digital raw materials exchanges, material passport systems and automated recycling processes are, in their own right, critical infrastructures that require cybersecurity protection – a direct link between these two key technologies.

Recommendation: Integration of circular economy criteria into the Austrian Action Plan for Strategic Public Procurement (envisaged in the Industry Strategy 2035), including for the procurement of security technology; a ‘Circular Security Procurement’ pilot project with the Federal Ministry of the Interior (BMI) and the Federal Ministry of Defence (BMLV) as a reference project.

References:

Sector 8 – Security Technologies:

- CE-Hub / University of Exeter (December 2024): Engaging with Defence and Security on the Circular Economy – Position Paper. Circular Economy Research Hub, Exeter. <https://ce-hub.org/wp-content/uploads/2024/12/Open-Source-CEctor-CEHub-defence-and-circular-economy-position-paper-2024.pdf>
- Baldassarre, B. (2025): Circular economy for resource security in the European Union. *Ecological Economics*, 227. <https://doi.org/10.1016/j.ecolecon.2024.108345>

7 Overarching conclusions and action matrix

Chart 3: Strategic prioritisation by urgency and readiness for implementation

Sector	Core circular action	Priority	National link
Electronics / Chips	High-value recycling of WEEE; digital product passports	High	KWSAT, Government Programme 2025
AI & data innovation	AI for the circular economy; Digital raw materials exchange	High	Government Programme 2025, FFG
Production Technologies	Remanufacturing Hub; Robotic Disassembly	High	KWSAT, Regulatory Sandboxes
Energy & Environment	Battery Recycling Centre; Second-Life Framework	Very high	EU Battery Regulation, Government Programme
Mobility	Battery cycle; automotive remanufacturing	Very high	AWG, Government Programme
Aerospace	CFRP recycling; FRP recycling	Medium	Bioeconomy Strategy, R&D&I Pact
Life Sciences	BioCircular Valley; Enzymatic Recycling	Medium	Bioeconomy Strategy, BOKU
Security technologies	Circular Procurement; Material Passport	Medium-high	Public procurement strategy

Recommendations for institutional action:

Consistent implementation requires a cross-cutting framework, which is currently lacking:

1. Linking the task forces: The Circular Economy Task Force must be structurally integrated with the new Industry Task Force under the Industrial Strategy.
2. R&D&I Pact with a circular economy dimension: All nine key technology funding programmes in the R&D&I Pact 2027–2029 should include a mandatory circular economy component.
3. Binding secondary raw material quotas: In public procurement (under the ‘Made in Europe’ guiding principle), minimum proportions of secondary raw materials should be introduced as an award criterion.
4. Monitoring: The Productivity Council’s Competitiveness Radar (anchored in the Industrial Strategy) should explicitly include circular economy indicators (proportion of secondary raw materials, value added from remanufacturing, WEEE recycling rate).

7.1 Conclusion

The circular economy is not a niche issue in Austrian industrial policy, but a fundamental structural pillar of competitiveness in key high-tech sectors. It simultaneously addresses three of the six strategic objectives of the Industrial Strategy 2035: competitiveness, economic resilience and sustainable transformation.

This **three-pronged strategic framework** – the Industry Strategy 2035, the Circular Economy Strategy 2022 and the Bioeconomy Strategy 2019/2022 – creates a sound political foundation. The 2025–2029 Government Programme provides the regulatory levers. What is still lacking is the **consistent institutional integration** of these strategies and the translation of declarations of intent into binding, measurable measures with clear responsibilities – entirely **in line with the adaptive governance architecture** recommended by the Productivity Council.

8 Sources and references (selection)

National strategy and policy documents:

- Austrian Federal Government: Austria's Industrial Strategy 2035 – Shaping the Future Together (January 2026), BMWET/BMIMI
- Austrian Federal Government: Austrian Circular Economy Strategy – Austria on the Path to a Sustainable and Circular Society (December 2022), BMK
- Austrian Federal Government: First Progress Report on the Circular Economy Strategy (June 2024), BMLUK
- Austrian Federal Government: Bioeconomy Strategy for Austria (March 2019) + Bioeconomy Action Plan (November 2022), BMK/BML/BMBWF
- Austrian Federal Government: Government Programme 2025–2029 – Doing the right thing now. For Austria. (February 2025)

Analyses and assessments:

- Austrian Productivity Council: Brief Analysis 01/2026 – Austria's Industrial Strategy 2035: From Strategy to Implementation (March 2026)
- Work & Economy Blog (A&W Blog): Austria's Industrial Strategy 2035: An Ambitious Roadmap – Implementation Will Determine Success! (February 2026)
- ARA/Senate for the Circular Economy: Austria's 2025 Government Programme: Implications for Businesses and the Circular Economy (March 2025)
- FTI Monitor 2025 <https://forwit.at/fti-monitor-2025-oesterreichs-wettbewerbsfaehigkeit-in-fti/>
- FTI Monitor 2026 <https://fti-monitor.forwit.at/de/B/C.3>

EU documents:

- European Commission: New Circular Economy Action Plan (2020)
- Regulation (EU) 2024/1252: Critical Raw Materials Act (CRMA) (April 2024)
- Regulation (EU) 2023/...: EU Batteries Regulation (2023)
- Regulation (EU) 2024/1781: Ecodesign for Sustainable Products Regulation (ESPR)
- Net-Zero Industry Act (NZIA) (2024)

Academic publications:

- Baldassarre, B. (2025): Circular economy for resource security in the European Union: Case study, research framework, and future directions. *Ecological Economics*, 227, 108345. <https://doi.org/10.1016/j.ecolecon.2024.108345>
- Baldassarre, B. & Carrara, S. (2025): Critical raw materials, circular economy, sustainable development: EU policy reflections for future research and innovation.

Resources, Conservation and Recycling, 215, 108060.

<https://doi.org/10.1016/j.resconrec.2024.108060>

- Gaalen, M. van et al. (2025): From Critical Raw Materials to Circular Raw Materials. ChemSusChem. <https://doi.org/10.1002/cssc.202401170>
- [Anon.] (2026): Circular Economy Pathways for Critical Raw Materials: European Union Policy Instruments, Secondary Supply, and Sustainable Development Outcomes. Sustainability (MDPI), 18(2), 562. <https://doi.org/10.3390/su18020562>
- [Anon.] (2024): Analysis of critical raw materials policy for electrical and electronic equipment: Planning for a truly circular economy. Resources Policy. <https://doi.org/10.1016/j.resourpol.2024.105...> [ScienceDirect]
- [Anon.] (2024): Stakeholder Perspectives on EU Regulatory Frameworks: Navigating Critical Raw Materials, Battery Innovation, and Recycling Challenges. PMC/NIH.
- European Environment Agency / EEA-ETC: Accelerating the Circular Economy in Europe: State and Outlook 2024.

Created by:

Task Force Circular Economy

Created on: 5. October 2026