Advancing circularity with services and software

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Foreword

Skyrocketing energy prices, volatile resource markets, and global supply chain constraints paired with dying ecosystems, biodiversity loss, and ever increasing social inequalities pose major challenges for our planet, our society, and our economic system. Business as usual is no longer an option – neither from an economic nor from an environmental perspective.

Businesses, especially manufacturing companies, need to adapt quickly. But quick does not mean short-term. It means being innovative, collaborative, and it means creating a sustainable impact.

The decarbonization of all economic activities is one part of the story – energy efficiency and decarbonization are essential building blocks of the pathway toward keeping global warming below 1.5 degrees Celsius and they must be further accelerated. However, the energy transition alone can only solve half of the climate problem.

Transforming how industry uses materials is the other part of the story: Here, the keywords are resource efficiency and circular economy. The latter can contribute to the reduction of emissions by fundamentally transforming the way we make and use products.

At Bystronic, we are applying our strong collaborative drive to help our customers and partners gain a sustainable edge. We want to lead the way and inspire collaboration with customers, value chain partners, and even competitors to enable and implement future-oriented circular solutions.

At Bystronic, we pursue collaborations to enable the sheet metal processing industry to become fit for the future. How can we assist you in your sustainability journey towards decarbonization and resource efficiency?

We look forward to collaborating with you to innovate and transform the sheet metal processing sector into a sustainable industry that is fit for the future.

Alex Waser, CEO Bystronic Group

We cannot continue like this

Growing geopolitical tensions, a worldwide pandemic, and unforeseeable natural disasters have disrupted the stability of the markets and supply chains and are affecting the availability and prices of resources. The past few decades of stable economic growth and expansion appear to have come to an end.

In the 21st century and the new era of volatility, economic and environmental objectives are not mutually exclusive, but rather serve in combination as a prerequisite for successful entrepreneurship. Mitigating climate change and limiting global warming to 1.5 degrees Celsius is essential if we want to break out of the negative spiral of environmental degradation (Science Based Targets Initiative, 2021). Technically, a 1.5-degree pathway is achievable (McKinsey, 2020) but it requires a dramatic reduction of emissions and a new approach towards how we manufacture and towards how we use products and materials.

There has been a great deal of talk about the decarbonization of all economic activities. Yet, this can only contribute 55% towards the required reduction of emissions. 45% will have to come from how industry uses materials and how it designs its products (Ellen MacArthur Foundation, 2021). Emissions need to be eliminated during the design phase before they are created, before production even begins. Redesigning production processes and products is essential to eliminate waste and pollution and to reestablish a resilient economy. The circular economy will provide the necessary resource efficiency strategies to further reduce emissions in line with the 1.5-degree pathway.

A circular transformation is necessary

Industry must find smarter and more efficient ways to utilize energy and materials. Manufacturing companies must identify innovative solutions that ensure economic viability with enhanced capabilities while simultaneously restoring natural resources and generating a positive environmental impact. Every business must contribute towards the protection of the environment.

Transforming the economy is a huge objective, but it is possible if we all collaborate and take joint action. To achieve this, the circular economy offers a range of solutions based on three guiding principles (Ellen MacArthur Foundation):

1. Eliminate waste and pollution
2. Circulate products and materials
3. Regenerate nature

The first two principles are directly applicable to the sheet metal industry. While the guiding principle "regenerate nature" primarily offers strategies for agriculture, whereas industry can still provide indirect support.

Eliminating waste and pollution starts with the design phase. Ensuring from the outset that products and machinery are designed for a long service life, for example by means of design that incorporates repairability, disassembly, and modularity. Materials that are too hazardous to reuse (e.g. toxins) or composite materials that render recycling (economically and technically) unfeasible must be designed out of the process. Circular design must be coupled with business models and services that enable longevity and the cycling of materials and products. Services such as repair, maintenance, upgrading, and refurbishment are essential components of a strategy that prolongs material use and product life and eliminates waste.

The reuse of products or machinery can only be achieved by means of circular design and appropriate business models, service offers, and data. Reusing products and components serves as a major lever, since this preserves the embodied energy and other valuable resources used during initial manufacturing. In the automotive sector, the remanufacturing of spare parts can save as much as 80% of the energy by eliminating the production of new parts and end-of-life disposal (Renault, 2020). Substantially increasing the utilization rates of assets is an essential strategy to achieve material and energy savings. By keeping materials in use, businesses can decouple economic activity from the consumption of raw materials – which are vulnerable to external factors such as supply chain constraints – and thereby increase flexibility.

In addition to addressing the design and utilization of products, the production process itself must be transformed. Waste generation can be minimized throughout the entire value chain by reducing the amount of material lost during the production process. For example, half of the aluminum produced each year ends up as scrap without ever reaching the final product, while 15% of building materials are lost during construction (Ellen MacArthur Foundation, 2021). Leveraging process optimization by means of new technologies (for example 3D printing) and data-enabled software can reduce waste and emissions during production. Digital technology is essential to map, organize, control, and ensure data exchange within companies and throughout the value chain.

Today, the sheet metal processing industry has high recycling rates, which reduces the demand for virgin material and the emissions associated with their production. However, the recycling of materials should be the final step after the reuse, repair, and refurbishment of products, since recycling does not preserve the energy and labor embedded in the product.

Decarbonization and energy efficiency at Bystronic

Bystronic has a strong heritage of innovation and pioneering and a track record of helping its customers thrive in spite of the challenges they face. We are dedicated to continuing this strong customer support in these challenging times and we are committed to the 1.5-degree pathway. The company has set strong energy efficiency targets for its own operations. Scope 3 emissions are addressed by means of technologies and solutions that are more energy efficient. To ensure the sheet metal processing industry and the materials it uses are fit for the future, Bystronic is pursuing value chain partnerships to co-create new processes.

However, since the energy transition alone is not sufficient, Bystronic is focusing on services and software solutions that support resource decoupling strategies. These measures can be divided into two categories: “decarbonization and energy efficiency” and “circular economy and resource efficiency”.

Bystronic has set an ambitious decarbonization strategy for its own global operations. The company is installing photovoltaic systems and implementing e-mobility concepts for its fleets and employees. Where applicable, Scope 2 emissions are to be reduced by shifting to renewable energy sources. The goal is to achieve climate neutral production in line with the 1.5-degree pathway.

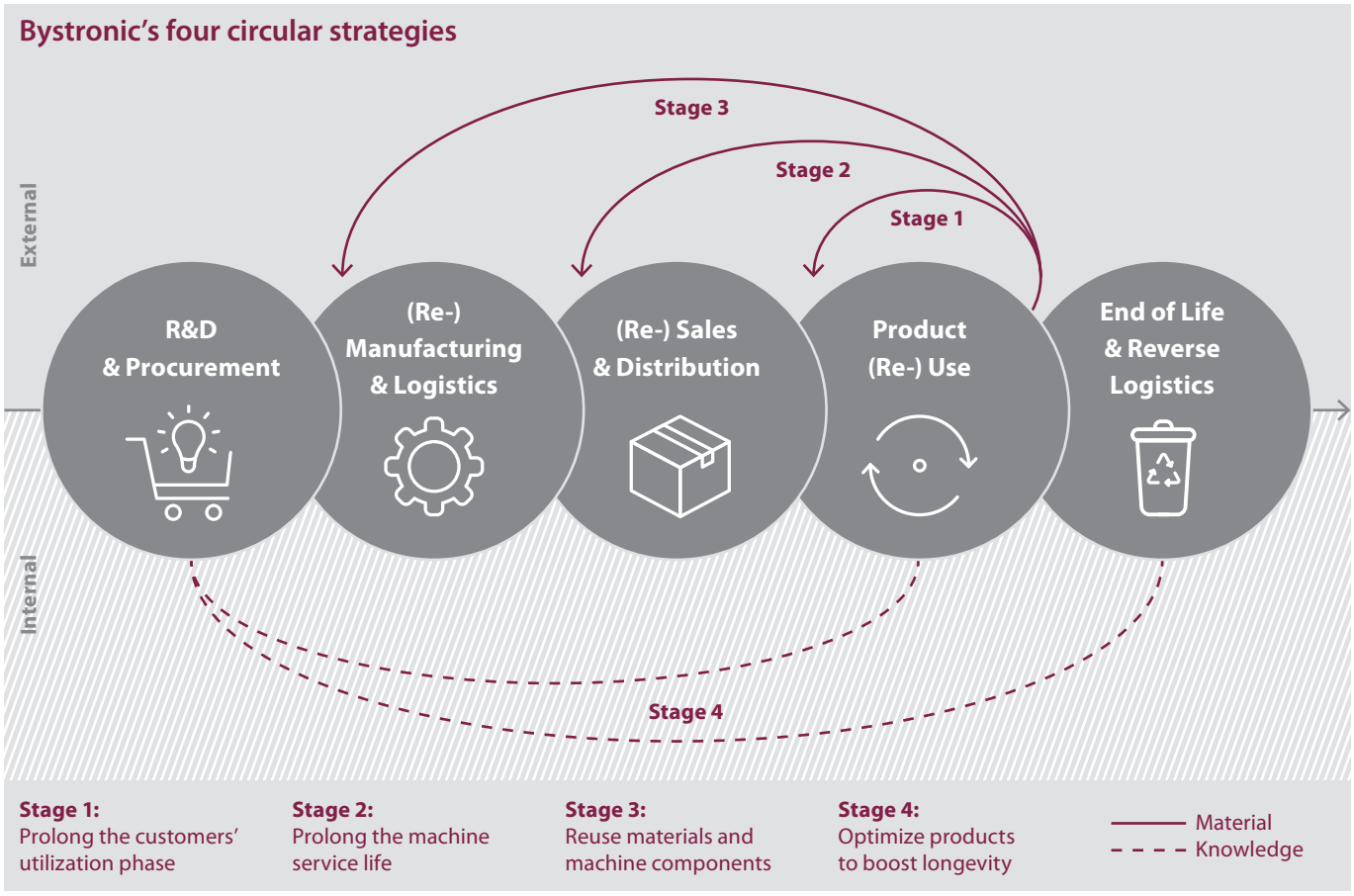
Circular economy and resource efficiency at Bystronic

One of Bystronic's core promises to its customers is lifetime support. This customer-centric claim not only makes economic sense, but also prolongs material utilization and improves the material intensity of Bystronic's machines and solutions. And contrary to what many may expect, this starts with the design phase.

"Our modular design enables 90% of our upgrades and repairs to be carried out on site at the customer's premises. This is a key element that allows us to significantly prolong the service life of our machines."

Michael Jost, Global Head of Service Operations, Bystronic Laser AG

Bystronic's modular design approach – incorporated in all product lines – creates the foundation for a range of circular strategies. The objective is to simultaneously boost material productivity, reduce the customers' energy consumption, and increase customer satisfaction by means of extended machine service life and longer material utilization. The following chart provides an overview of Bystronic's four circular strategies enabled by service and software solutions: (1) Prolong the customers' utilization phase, (2) Prolong the machine service life, (3) Reuse materials and machine components, and (4) Optimize products to boost longevity.



Stage 1: Prolong the customers' utilization phase

Stage one focuses on keeping machines in use for as long as possible to conserve both the embedded materials and the energy and labor used during the production of the machines.

Training customers on how to use machines in precisely the way intended minimizes breakdowns and consequently the need for spare parts, repairs, and replacement machines. On average, Bystronic carries out more than 2000 training courses for its customers every year, either on site at the customers' premises or at one of Bystronic's dedicated training centers.

The precise customization and adjustment of the machines to the customers' specific needs has the potential to reduce the energy footprint and maintenance costs and thus to boost the performance of the asset and overall equipment effectiveness. For example, Bystronic's implementation and tracking of the "power on/cutting" KPI reminds customers that a machine that is switched on is a power guzzler. The lower the KPI, the more energy efficient the customer is.

The optimal setup of the machines by Bystronic also includes the programming of algorithms that save material and reduce waste, such as the nesting optimization function and a crash-prevention function (tilt prevention). Bystronic's in-house laboratory constantly optimizes cutting parameters and provides remote updates, for example for new steel-based composites. To reduce offcuts, an algorithm-based management system calculates possible offcuts and their suitability for future projects.

As maintenance and revision are the most efficient ways to retain or restore machines at their desired level of performance, Bystronic offers its customers a range of care packages.

"Almost all our machines are sold with a care package. In future, we plan to expand our service portfolio to further extend the service life and minimize the downtime of our machines and enhance customer satisfaction."

Michael Jost, Global Head of Service Operations, Bystronic Laser AG

The appropriate maintenance and revision of machines protects them from damage, improves the safety of operators, and prevents waste and pollution (Ajukumar & Gandhi 2013). Remote software maintenance further saves emissions by eliminating travel and ensuring broken-down machines are rapidly up and running again.

"Our care packages and proactive maintenance enables us to reduce our customers' downtime by 20 to 30%."

Innovation in cleantech solutions

Energy-efficient lasers	Energy-saving bending	Nitrogen generation	Intelligent software	Remanufacturing
40% increase in energy efficiency switching from CO_2 lasers to fiber laser technology	Energy Saver function (start-stop)	Zero-carbon in-house nitrogen generation, including PV systems	Waste reduction	Bystronic pre-owned program
		Cost reduction & carbon-neutral solutions	Nesting optimization	Reuse, reduce, recycle
		Supporting clients with green financing & public funds	Optimized workflows	Circular economy

Stage 2: Prolong the machine service life

While maintenance and revision are key to maximizing uptime and minimizing malfunctions, all machines sometimes need repair. Being able to repair assets quickly and easily is one of the central elements of circular products, as this can greatly extend their service life.

"The capacity to repair quickly is one of Bystronic's primary differentiators. This takes more than well-trained technicians. The process of rapid repair involves almost all of Bystronic's departments. What is more, our remote repair capabilities and our regionalization strategy enable Bystronic to be close to its customers all around the globe while also reducing travel."

Here too, research, development, and design are essential. Products designed for easier repair coupled with the appropriate repair services and well-established internal feedback loops make the extension of the service life a lot more economically viable, thereby boosting the positive environmental impact. Bystronic has several KPIs that seek to enhance remote repair capabilities (to further save resources and emissions) and decrease the mean time to repair while increasing the mean time between two breakdowns.

Upgrade services allow customers to optimize the functionalities of older Bystronic machines and thus eliminate the need to purchase a new machine, thereby significantly reducing the use of virgin material and the resource impact. Upgrades can be software- or hardware-based and can include new automation modules, operating systems, cutting heads, or nitrogen generators.

Stage 3: Reuse materials and machine components

To be truly circular, a company must consider the resources and tools required to repair products and parts and/or remanufacture these products and parts for further use. This is precisely what Bystronic's "pre-owned" service does – for spare parts as well as for entire machines. At the end of a product's normal service life, the machines are returned to one of Bystronic's three refurbishment centers in the Netherlands, Romania, or the USA. Here, they are completely refurbished to allow a successive life and prolong material life by another 5 to 15 years depending on the technology.

"Over the past few years, we have refurbished many machines in our factories in Europe and the US. A refurbished machine requires approximately 2% new materials, since all the main and heavy components can be reused, in comparison to a new machine, which uses 100% virgin material."

In addition to refurbishing entire machines, the refurbishment of spare parts plays a central role in Bystronic's circular service strategy. Key components with a certain material value are returned to Bystronic at the end of their regular service life, where they are refurbished, stored, and reassembled when needed. The modular design approach forms the basis for the economically viable refurbishment of spare parts.

Stage 4: Optimize products to boost longevity

Designing for circularity stands at the beginning of the process – but also at its end. Data captured throughout the entire lifecycle of the product can impact the first principle of designing out waste by means of data-based changes of the product design. The R&D and design process is never finished. It is an ongoing process that continuously improves and optimizes the product. The circular economy requires well-defined feedback loops, making digital technology essential in order to map, organize, control, and ensure consistency throughout the process. Bystronic has implemented a well-structured process to collect and analyze big data and field service data and subsequently feed it back into the R&D and design process. The data not only allows existing machines to be optimized but also flows into innovative new products and solutions.

"Laser technology has evolved. Fiber lasers have made cutting more than 40% more energy efficient compared to conventional CO_2 laser technology. Bystronic's ambition is to help its customers make the transition to innovative and efficient new technologies."

The service and software landscape already supports circular solutions. However, there is still room for internal improvements and further expansion. Similar to the design process – the transition to a circular economy is never finished. It requires constant reassessment and optimization. Our environment needs the transformation of the whole industry, the value chain, and beyond – and we will not succeed if we tackle it alone.

Transformation is teamwork

We are all facing the same problems – our customers, our partners, but also our competitors. Change is needed fast: Emissions must be drastically reduced to remain on the 1.5-degree pathway (IPCC, 2022). Achieving the 1.5-degree target is essential for our planet – and also for our economy – and circular strategies offer opportunities to increase business resilience, maintain a competitive advantage, while simultaneously regenerating natural capital. It is the main challenge of our modern time – and it cannot be achieved alone. We need a new form of ecosystem collaboration. But how? Overarching value chain software can help close material loops by providing information on the availability, location, and condition of products. It can enable more efficient processes within companies, help minimize waste, promote longer product service life, and minimize transaction costs.

Bystronic wants to inspire and motivate, and together with our customers, value chain partners, and even competitors, we intend to enable and implement circular solutions that are fit for the future. In times of rising complexity, companies that can work in partnership throughout the entire value chain gain a significant competitive advantage. Bystronic will leverage its close proximity to its customers and its co-creation strengths to help its customers and partners gain a sustainable edge. Pre-competitive cooperation with customers is a critical topic, however, only joint movements of the entire industry can make real transformation possible.

Bystronic issues an open call to collaboration: How can we work together to make our industry fit for the future? And how can Bystronic support you in your sustainable journey towards decarbonization and resource efficiency?

Over the years, Bystronic has evolved from a manufacturer of individual machines into a supplier of end-to-end solutions covering automation, software, and smart factory solutions.

Bystronic looks forward to innovating with others to make the sheet metal processing industry sustainable and fit for the future.

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