THE CIRCULAR ECONOMY

10 innovative business solutions and how to go further

AmCham EU
SPEAKING FOR AMERICAN BUSINESS IN EUROPE

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Introduction

Our global economy has long relied on a 'linear' economic model – natural resources are extracted and used in making products and when those products are of no further use, they are disposed of. This model is based on the assumption that there are large or unlimited supplies of cheap, easily accessible raw materials and energy sources. The reality is that most resources are finite. Rapid economic and demographic growth around the globe determined that an alternative economic model was needed to reduce waste, reuse precious and limited resources, and shift towards renewables. No longer could the focus be on meeting the needs of the present at the expense of future generations.

To respond to this need, the concept of circular economy was developed a few decades ago to ensure production is more sustainable in its practices by using resources more efficiently and responsibly. Simply using less is not enough. The aim is to maximise the use and value of not only raw materials, but also products and waste. Production processes are made more efficient, products last longer by being made more durable and repairable, and an increasing amount of waste is collected and reused or recycled. As a result, the circular economy is a driver for innovation and the development of new business models.

Moving from a linear to a circular economy is obviously a colossal enterprise. From design, production and consumption to waste management and the market for secondary raw materials, all sectors and aspects of our economy are impacted. This transition requires profound political, economic and psychological change in our society, and the involvement of all stakeholders is necessary for its success.

The American Chamber of Commerce to the European Union (AmCham EU) represents US companies operating and investing in Europe and is committed to making Europe more competitive in the global marketplace. Its membership reflects various sectors and many of its member companies have been active in introducing business models and practices that reflect the circular economy. In seeking out circular economy business models among its member companies, AmCham EU found encouraging developments.

Ten examples are included in the following pages which demonstrate the innovative ideas developed and the noticeable progress that has been made over the past 20 years in a myriad of sectors such as IT, aviation, oil refining, packaging, healthcare, construction equipment and tyres. But much more can be done. This will require close collaboration between business and government to ensure that policies are in place which further encourage sustainable business solutions. It will need to include clever and pragmatic policy changes as well. Only by balancing economic, social and environmental factors can we achieve true sustainability and a truly circular economy.

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Plant-based materials: the future of sustainable plastics

The industry is constantly seeking ways to develop new innovative packaging design and materials. Much progress has already been made in finding ways to use less material – lighter plastics bottles, sleeker cans, ultralight glass material – all while ensuring that packaging is completely recyclable.

One example of a more recent innovation is PlantBottle™ packaging, which combines the benefits of recyclable pack design with the use of renewable material. Instead of using oil-based material for polyethylene terephthalate (PET) plastic components, the bottles are made using partially renewable, plant-based material, which is then combined with recycled content. Today, there are more than 35 billion recyclable PlantBottles™ in circulation around the world for water, juices, sodas and teas.

Plant-based packaging is mostly made of sugarcane-based ingredients, but packaged goods producers are continuously working to source plastic from other plant residues. These technological developments require the continual assessment of agricultural products that have a low environmental impact and protect food security.

The use of renewable plant-based technology is also expanding to other industries including the apparel, automotive and wider food sectors.

Did you know?
Since the introduction of PlantBottle™ packaging, **315,000 metric tons of CO_2 emissions** have been eliminated from the production process. This is equivalent to the amount of CO_2 emitted when burning **743,000 barrels of oil**.

➤ How to go further?

The use of plant-based recyclable materials has the potential for a promising future but current market conditions are holding them back. Obstacles include subsidy schemes favouring biofuels, a lack of infrastructure for the sourcing of plant-based materials, and imposed EU import tariffs for bio-based material components, even though these products are currently not produced inside the Union.

Another important element is strengthening the implementation of Extended Producer Responsibility (EPR). Minimum operating requirements are critical to ensuring a level playing field and fair competition between EPR schemes, as well as greater transparency.

Recycling superalloys: ensuring sustainable production of high performing aircraft engines

The aviation industry is developing the next generation of high performing aircraft and engines to improve sustainability and reduce emissions. To achieve this, these new engines require materials that can withstand extreme temperatures without melting. Alloys, a mixture of elements with the characteristics of metal, are among such materials and engineers are continually looking to develop them into more advanced alloys or 'superalloys'.

An example of a superalloy is rhenium, which has unique properties such as strength and heat resistance. However, rhenium is a rare chemical element that is only produced as a by-product of copper and molybdenum refining. The industry is therefore developing ways to reduce both its use and waste through what is called the four-pillar strategy of 'reducing, reverting, recovering and recycling':

- Reducing: Develop new alloys, which contain less rhenium.
- Reverting: Re-melt scrap material containing rhenium.
- Recovering: Remove rhenium from superalloy dust produced during cutting.
- Recycling: Remove used components from engines, send them back to the manufacturer to be re-melted and cast into new components.

Reducing, reverting and recovering are relatively straightforward procedures that are already embedded in standard manufacturing processes. Recycling superalloys components, however, can prove challenging as they are often used in other efforts like making stainless steel, rather than recycled and used anew. This is because superalloys contain high concentrations of nickel and chromium, two of the main components of stainless steel and rhenium therefore is lost.

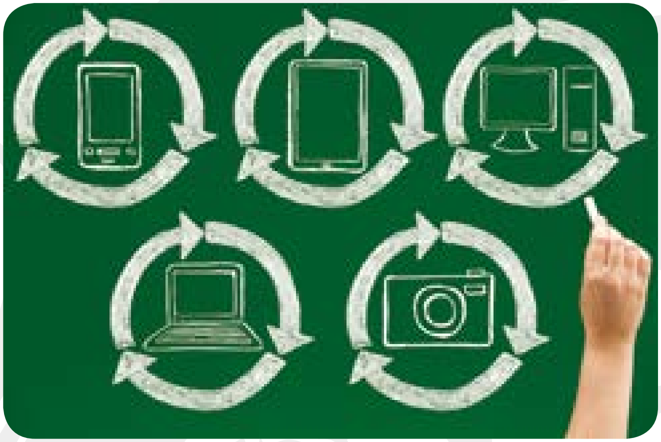
➤ How to go further?

Industry has the expertise to determine the design and materials necessary to increase production and performance while maintaining product integrity. As competition for the world's resources increases, it is crucial that recycled materials are used in new products. Recycling policies should therefore be developed and maintained in cooperation with industry to maximise the best use of scarce elements.

Closed loop recycling and reuse: towards a circular IT industry

In an effort to maximise how long and often products such as notebooks, desktops, monitors, toners, ink cartridges and printers as well as their components and materials are used, the information technology (IT) industry invests heavily in efforts to recycle and reuse materials and products' parts.

While no-longer functioning IT products could simply be thrown away, the IT industry prefers to recycle plastic parts in these items. Once these products are broken into pieces, the plastics are sorted, cleaned, and used again in a new product. This 'closed loop' recycling means that plastics extracted from no-longer functioning products are collected in a return system and processed for use in a new product. These plastics therefore remain in a 'loop' of use. This process produces fewer carbon emissions than manufacturing new plastics for every new product and has allowed the IT sector to recycle millions of pounds of plastic.



Another way to draw on fewer resources in production, accrue less waste, and reduce carbon footprint, is to ensure that functioning IT equipment parts are used for as long as possible. This reuse of materials means smaller parts and components ranging from servers, personal computers, printers, to storage equipment are extracted and tested. Provided they work as new, they are fitted into equipment that needs to be repaired, as well as used in products manufactured from scratch.

Did you know?
Lifecycle analysis, which assesses the environmental impacts associated with all the stages of a product's life, has shown that the production of closed loop recycled plastics emits **10% less CO_2** compared to newly-created plastic.

➤ How to go further?

EU-wide recycling and reuse policies must operate smoothly across borders to be effective. Currently, various obstacles hinder this including national differences in requirements for transboundary shipments; requirements for repair facilities; diverging methodologies to calculate waste targets; and differences in calculation methodologies. Therefore, harmonising these requirements at the EU level is critical.

Industrial compressors: resource efficiency opportunities across the life cycle

Industrial compressors are very large energy-producing devices used in refrigeration, as well as heating and cooling by a wide range of industries including food production and petrochemicals. They play a critical role in optimising energy resources to provide for large-scale operations most of us take for granted.

The manufacturing of industrial compressors involves considerable amounts of iron and aluminum, and the final product often counts a weight of over 1,700 kilogrammes. The manufacturing process also results in a lot of metal waste, often as much as half the weight of the final product. Due to the volume of iron and aluminum in industrial compressors, they make excellent candidates for the circular economy throughout their lifetime. Waste leftover from the production process, replaced parts during a product's use and no-longer functioning compressors can all be recycled. Both environmental and economic benefits are to be had, as manufacturers have access to cheaper recycled metal and transportation and society as a whole benefits from a significant reduction of waste and CO_2 emissions.

However, various obstacles exist. The lifespan of an industrial compressor can exceed 25 years and as the manufacturer does not retain the responsibility for servicing a device throughout this time, it is not always possible to recuperate the equipment for reuse and recycling.

➤ How to go further?

Better traceability of the equipment should be ensured during a compressor's lifespan. Equipment purchasers should be required to inform the manufacturer of ownership changes, as well as when compressors reach the end of their life. The overall cost of recycling various equipment should also be considered when assessing best waste management options as there are significant differences between products with components that are screwed or welded and those with components melted into each other, for example.

Improving recyclability of healthcare plastics: a value chain approach

Due to the amount of plastics used in hospitals, there is great potential for increased recycling of healthcare plastics. In hospitals, a substantial amount of materials such as sterilisation wrap, gowns, intravenous therapy (IV) bags and packaging materials are being tossed into trash bins and recent studies report that hospitals generate over 15 kilogrammes of waste per day, per occupied bed. Much of this waste is plastic and ends up in landfills or incinerators despite the fact that up to 85 percent of it is non-hazardous.

However, barriers to recycling healthcare plastics exist across the entire value chain. It starts with product design and manufacturing where the variety of plastics and additives on the market and product design features inhibit recyclability. Lack of training among hospital staff and limited space and infrastructure within hospitals to sort recyclable materials further impede the recycling of healthcare waste. Obstacles facing healthcare plastics disposal also include recyclers' varying demands and availability to collect materials by geographic location.

The creation of private, technical consortia of industry peers[1] across healthcare, recycling and waste management industries allows for a multi-stakeholder approach to address existing obstacles. Such a group brings together the necessary stakeholders to effectively develop innovative solutions and leverage market opportunities to tackle an ever-growing and complex waste management issue.

[1] An example is the Healthcare Plastics Recycling Council (HPRC).

Did you know?
Recycling one ton of plastic saves **16.3 barrels of oil, 22 cubic meters of landfill space** and enough energy to power an average house for six months.

➤ How to go further?

Governments and the private sector must develop sustainable solutions for effective recycling. This includes harmonisation of labelling and the development of automated sorting processes to increase the ease, efficiency, and cost-effectiveness of recycling. It is also important to implement incentives to increase the inclusion of recycled plastics in goods sold on the market.

Up-cycling: going beyond recycling

Perfluorinated polymers are materials with unique strength and durability. Although we are not always aware of it, they play a crucial role in many daily products and services: coating in pans and bakeware, building materials, automobiles, telecommunications and electronics. In short they make our lives cleaner, safer and easier.

But what happens when these products reach their end of life? Too often, they end up in incinerators or landfills and very valuable materials are lost. Chemical recycling is possible for perfluorinated polymers but is not efficient since materials are transformed into very fine powder or wax with limited usability. More sustainable solutions must be developed and implemented not only to ensure that valuable materials are not wasted, but also to address the issue of overflowing landfills and increasingly expensive waste management.

Manufacturing companies are developing new solutions to enable the reuse of precious materials without sacrificing their capability characteristics. One of these solutions is up-cycling. Up-cycling means reusing materials or an object to create a product of higher or equal value. In this case, up-cycling can restore products made of perfluorinated polymers into starting material with 100% of its original performance qualities to be used in a new product. The environmental relief provided by up-cycling solutions is also significant in terms of emissions, energy and waste savings.

Did you know?
The production of one metric ton of up-cycled perfluorinated polymers eliminates **10 metric tons of acid waste and 10 metric tons of CO_2 emissions** from the overall production process.

➤ How to go further?

Given the many aspects of up-cycling, it should fully be included in the EU's waste hierarchy guide, which consists of five steps to prevent and process waste. The EU should also encourage and support similar examples of industrial symbiosis, through fostering collaboration between industries to buy and sell residual products, resulting in mutual economic and environmental benefits.

Long-lasting catalysts: cleaner fuels for the future

The oil refining industry uses hydroprocessing catalysts (HPC) to remove over 99% of contaminants, such as nitrogen and sulfur from fuel oils, contributing to cleaner and more efficient final use fuels. These catalysts typically contain valuable metals such as nickel, cobalt, molybdenum and/or tungsten which can be recycled and used again, provided the secondary materials are of sufficient quality.

However, catalysts' efficiency decreases over time due to the accumulation of impurities. To address this and save valuable materials, the industry has invested significant resources into developing processes to maximise the lifespan of HPCs, thereby maximising the use of precious resources.

To achieve this, HPCs are first treated for regeneration and reuse. Their lifespan is therefore extended, reducing the need to purchase new catalysts and use new raw materials. Second, HPCs are recycled. When catalysts' properties no longer meet required standards and their performance cannot be brought up again to the desired level by regeneration, catalysts are recycled. The valuable metals contained in catalysts are recovered and reused for further catalyst preparation or other use.

Did you know?
The use and reuse of catalysts have helped remove over **50,000 tons of sulfur** from diesel fuel over the last 5 years. This greatly improves air quality and helps vehicles to comply with stringent emissions regulations worldwide.

➤ How to go further?

The reuse of catalysts will increase only if secondary products can be traced and perform to specific norms and standards. It is therefore crucial that regulation foresees rules guaranteeing the market availability of high quality and effective secondary products.

Built to last: silicones and long-lasting buildings

Buildings are built to stand for many decades. It is therefore essential their environmental impact is reduced and their components last as long as possible. In both new buildings and renovation projects, silicones are used to protect, strengthen, preserve, and provide innovative high performance features including insulation, energy-saving facades, smart windows, protective coatings and lighting.

In particular, silicone sealants and adhesives exhibit outstanding durability. They resist high temperatures, ultraviolet light, oxygen and ozone; are less susceptible to mechanical fatigue and seismic risks; and less prone to absorb water. After 40 years of outdoor weathering in sunny climates, silicones show comparatively little change in physical properties. Meanwhile, thanks to their durability, silicone products can significantly reduce the carbon footprint of commercial construction. A recent Global Silicone Council life cycle assessment study shows that the use of silicone products can help save on average 9 times the amount of greenhouse gases required to manufacture them.

Beyond durability, silicones further contribute to the circular economy by reducing raw material needs. In the manufacturing of windows, bonding glass directly to the frames makes it possible to reduce the height of the profile, which in turn leads to more incoming light, less raw material used and lighter windows.

Did you know?
The use of silicone technology extends the lifespan of buildings while also reducing energy consumption.
Using silicones in window manufacturing saves **15% in energy** compared to when using other materials.

➤ How to go further?

Because all stages of a product's life present an opportunity to improve resource efficiency, the EU should not focus solely on traditional product end-of-life and recycling policies. Rather, policies should also be developed to encourage lengthening a product's lifespan, as well as evaluating production and use policies to ensure the product is as resource-efficient as possible throughout its life.

Remanufactured products: as good as new

Remanufacturing, or 'reman', is an exchange business: customers return their components that have reached the end of their lives to the original manufacturer and get a remanufactured one in exchange. End-of-life components are called cores, and can range from engines, turbines, gas compressors, locomotives and railcars to hydraulics, drivetrains and fuel systems. Remanufacturing restores these cores to their original specifications or higher, allowing them to serve another lifecycle.

This is advantageous to both customers purchasing remanufactured products and the environment. Customers receive a refund equal to the value of the returned core as well as a remanufactured product that performs and is warranted the same as a new part, yet costs a fraction of the new part price. The environment benefits from the process as fewer raw materials are required and energy is saved.

Remanufacturing has been officially recognised in Europe as an initiative with high potential to promote innovative industrial processes. Unfortunately, not all customers around the world can benefit from the significant sustainability benefits that remanufactured products deliver since some countries have laws and customs regimes that prohibit the ability to sell remanufactured parts.

Did you know?
Over the past 10 years, more than **500,000 tons of components** – equal to five Eiffel Towers per year – have been remanufactured. This has cut CO_2 emissions by more than **one million tons** compared to when new products are manufactured.

➤ How to go further?

Regulation must support remanufacturing processes. It is essential that cores are not classified as waste material. Moreover, policy-makers around the globe should continue to promote remanufacturing and remove trade barriers on remanufactured products, for example by following in the footsteps of the Trans-Pacific Partnership (TPP) and the EU-Vietnam Free Trade Agreement.

Retreaded tyres: lasting longer, going further

Tyres are currently designed and manufactured so they can easily be adapted for reuse, saving raw materials and reducing the industry's environmental footprint. To extend the life of tyres, the industry has introduced a process whereby the worn-out tread of a used tyre is replaced with a new layer of tread compound. The retreaded tyre can then be put back on the road without compromising either safety or quality.

Retreading is now being successfully applied to commercial truck and aircraft tyres and occasionally to off-the-road and farm tyres. At this time the economic feasibility of retreading is very limited for car tyres. The process may be repeated as long as the casing is intact and can increase the normal lifespan of a truck tyre by as much as three times, equivalent to up to one million kilometres using the original casing.

Despite being a successful process, the current truck tyre retreading rate in Europe is only about 40% and declining. The lack of a harmonised EU non-waste status for casings suitable for retreading needs to be addressed to help support this activity.

Did you know?
Retreading can increase the normal lifespan of a truck tyre by as much as three times, which saves up to **100 kilogrammes of materials** per tyre.

➤ How to go further?

The EU should recognise successful activities that promote reuse, like retreading, and harmonise end-of-waste criteria to avoid national distortions on the EU market for secondary goods. Furthermore, activities that promote reuse and extend the life of products, like retreading, should be supported by green public procurement schemes.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Conclusion

The circular economy is not a new concept, as Europe has been pushing for higher resource efficiency for more than 20 years. AmCham EU members have already positively assessed the circular economy's potential and have started developing new products and business models. However, various obstacles exist, as outlined in the preceding examples, and prevent industry from fully implementing more sustainable initiatives. The commitment of all stakeholders is therefore necessary to both continue to produce and enjoy products on a large scale, as well as foster energy savings and emissions reduction.

In December 2015, the European Commission published its long-awaited Circular Economy Package, which includes revised legislative proposals on waste. The release of this package by the Commission's First Vice-President, Frans Timmermans, and Vice-President, Jyrki Katainen, made very clear that circular economy is not only an environmental policy agenda. It is also a cross-sectorial strategy designed to boost growth and jobs in Europe and support new and sustainable business models.

Industry has a critical role to play in Europe's transition to a circular economy and its capacity to encourage other regions of the world to follow its lead. The Commission, Members of the European Parliament and Member States have shown a keen interest in learning more from industry experience and proposals on how they can shape policy to support the transition from a linear to a circular economic model. With these business cases, AmCham EU encourages an open dialogue with decision-makers highlighting that while progress has been made, policy changes are needed to effectively transform our economy and secure Europe's competitiveness.

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AmCham EU speaks for American companies committed to Europe on trade, investment and competitiveness issues. It aims to ensure a growth-orientated business and investment climate in Europe. AmCham EU facilitates the resolution of transatlantic issues that impact business and plays a role in creating better understanding of EU and US positions on business matters. Aggregate US investment in Europe totalled more than €2 trillion in 2015, directly supports more than 4.3 million jobs in Europe, and generates billions of euros annually in income, trade and research and development.

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