

3. PATHWAYS TO AN INNOVATIVE CIRCULAR ECONOMY



Innovation has a crucial role to play in turning the circular economy's promises into reality. The concept is currently generating countless innovative projects, but assessing their potential and long-term durability is not easy. What do circular innovations look like? What potential do they have to go beyond local experiments to create economic and ecological value as well as jobs? What partnerships and actors are emerging in relation to this topic? How are these innovative processes put in place and what are the obstacles to their success? These are the questions we ask in Part 3 of this issue as we explore circular economy pathways. To answer them, we have chosen to give a platform to actors that have implemented proven projects providing a good indication of the variety of topics that circular innovations tackle: closed-loop recycling of electric vehicle batteries; creating a reuse and repair economy; online platforms specializing in reuse and second-life products, and the functional economy and circular transition within companies.

THE IMPORTANCE OF CLOSED-LOOP ELECTRIC VEHICLE BATTERIES RECYCLING

Recycling electric vehicle batteries is a major ecological, health and economic issue with the anticipated expansion of this market worldwide. These batteries are composed of toxic substances that must be cleaned up under appropriate conditions, but also of metals - particularly strategic metals - that have a high economic value and could be recovered. Recycling these metals in a closed loop means avoiding the polluting extraction of virgin materials, reducing greenhouse gas emissions and avoiding dependence on a small number of producing countries for supplies. Veolia has launched this new activity in Europe and China through the development of advanced recycling technologies. After describing the challenges associated with the development of this activity, the article presents the main technical stages of the recycling process and the business models to be built. It concludes with a discussion of the strategic potential associated with the development of this activity.

THE POTENTIAL FOR CREATING JOBS AND VALUE THROUGH REPAIR AND REUSE

In terms of strong circularity, reuse and repair are seen as priority strategies for extending product lifespans and reducing the material footprint linked to consumption. Envie, a fast-growing network of businesses working in the social and solidarity economy with a 40-year track record in France, illustrates the potential for creating jobs and economic value these strategies have in the field of waste electrical and electronic equipment. Working in partnership with extended producer responsibility schemes and retailers, Envie has emerged as a go-to industrial, economic and social actor, complementing the solutions offered by private sector actors.

THE ROLE OF ONLINE PLATFORMS IN BOOSTING THE GROWTH OF REUSE AND SECOND-LIFE PRODUCTS

Two major obstacles hamper growth in the market for reused and second-life products: the dispersed nature of the actors and doubts about the quality of the products on offer. Online platforms are now emerging as a way to overcome these hurdles. The best known is Back Market, which offers refurbished and secondhand products in 15 countries around the world. But Back Market is more than simply a marketplace. It plays a far broader role, assigning

a quality rating to each product on sale in the form of a 12- or 24-month warranty designed to create trust between buyers and sellers. This approach is key to overcoming consumer reticence and scaling up markets of this type.

THE IMPORTANCE OF CREATING ACTOR ECOSYSTEMS

It is often difficult to measure the potential offered by recycling and reuse due to a lack of detailed information about regional sources and outlets. The construction industry is a case in point. In Europe, hundreds of millions of metric tons of construction materials and equipment are sent to landfill every year, even though a large proportion could undoubtedly be used at other work sites. Matériaupôle provides an example of the rollout of a shared strategy for work site management that is used to recover these resources. We are now seeing the emergence of new reuse actors and physical platforms at the local level to meet the demand from urban projects and work sites keen to use recycled materials and second-life equipment.

FROM PRODUCT TO PRODUCT-AS-SERVICE

One of the pathways to strong circularity is to intensify the total use made of a product. This is the functional economy strategy, which aims to transition from selling a product to selling a product-as-service paired with a performance commitment. Signify, formerly Philips Lighting, has taken this route, opting to sell its professional clients lighting services rather than lightbulbs. The challenge of this type of strategy is both economic and technical: it entails pivoting to an entirely new business model and a complete shake-up of the company's specialties and structures.

CIRCULAR TRANSITION WITHIN A COMPANY

Beyond trialing changes in specific areas of business activities, what does implementing a company-wide circular transition entail? Interface Inc., the global leader in carpet tiles, has had just such a strategy in place for the past 25 years in order to limit its environmental footprint as much as possible while simultaneously transforming the company's business model. This systemic strategy, covering every facet of the business, from production to design, sales, maintenance and skilling, is presented here.

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RECYCLING ELECTRIC VEHICLE BATTERIES:

ecological transformation and preserving resources

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Dismantling a battery - ©Veolia

Veolia develops innovative models for materials circularity on behalf of customers from a wide range of sectors, including agriculture, with soil fertilization and bioconversion to convert farm waste into animal feed, renewable energies, with recycling solutions for photovoltaic panels and wind turbine blades, and the textile industry. Recycling electric vehicle batteries is a major component of Veolia's innovation drive.

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The market for electric vehicles is currently experiencing unparalleled growth in many parts of the world. This expansion is supported by a range of policies designed to boost electric mobility. As a result, vehicle and battery manufacturers are significantly ramping up their production, which is now growing exponentially and incorporates materials that are often crucial and can pose risks to human health and the environment.

This in turn makes recycling electric vehicle batteries essential from both an ecological and strategic standpoint. Veolia offers solutions in this field that leverage its experience in hazardous waste processing, recycling expertise, and network of partners, specifically vehicle manufacturers and chemicals specialists. The aim is to protect the resources needed for ecological transformation.

INTRODUCTION

Electric vehicle batteries will become a major problem in the near future if they are not managed correctly. This is because they contain highly toxic chemicals that represent a threat to ecosystems as well as to the people who handle them. In addition to plastics, solvents and electronic components, the active parts of battery cells also contain strategic metals such as copper, nickel, lithium and cobalt. This means that recycling these components is an environmental and strategic imperative.

The market for recycling electric vehicle batteries is growing exponentially: from 200,000 metric tons of EV batteries eligible for recycling in 2021 to 7 million metric tons in 2035, representing metals with a value in excess of €15 billion. The market is particularly buoyant in China while it is expanding in Europe and should follow suit in the USA in a few years' time. The phenomenon is underpinned by rapidly changing regulations that increasingly require recycled metals to be used in the production of new batteries. Veolia plays an active part in this ecological transformation which boosts the mobility of tomorrow.



“Black mass” extracted from the grinding of battery cells, containing mainly a mixture of carbon, nickel, lithium and cobalt - ©Veolia

RECYCLING ELECTRIC VEHICLE BATTERIES: AT THE CROSSROADS OF ENVIRONMENTAL, HEALTH AND STRATEGIC CHALLENGES

ELECTRIC VEHICLES: A BOOMING MARKET

The market for electric cars is booming. In 2018, the global fleet accounted for over 5.1 million vehicles and is projected to exceed 130 million by 2030 according to Global EV Outlook 2019. This trend is rooted in the desire to reduce the numbers of cars that use internal combustion engines (ICE) in favor of electric vehicles, which are more environmentally friendly. China and Europe have set targets for electric vehicle rollouts paired with stringent emission regulations for ICE vehicles. For example, China now requires vehicle manufacturers operating on its domestic

market to offer a complete range of electric vehicles. In November 2020, the United Kingdom announced a ban on the sale of new ICE vehicles on its market by 2030. A similar ban is likely to be in place across the European Union by 2035. These ambitious policies aim to:

- provide local answers to a pressing health problem caused by transport-related pollution, particularly in built-up areas. Tailpipe emissions from ICE vehicles contain particulates and gases from the nitrogen oxide (NOx) family that are particularly damaging to health;
- combat greenhouse gas emissions during the time vehicles are in use, and reduce dependency on fossil fuels. According to a lifecycle analysis by France’s ADEME agency in 2016, full-life CO₂ emissions from an EV are three to four times lower than for a comparable ICE vehicle, and atmospheric pollution is very largely reduce.

EXAMPLES OF COUNTRIES THAT HAVE SET TARGETS FOR BANNING ICE VEHICLES

Country	Target date	Goal
USA	2030	50% of vehicles sold are electric or hybrid
California	2025	Ban on ICE cars
Canada	2040	Ban on ICE cars
Quebec	2035	
Norway	2025	All vehicles sold will be carbon neutral
UK	2030	Ban on sale of ICE cars
Singapore	2030	Ban on ICE cars
Israel	2030	Ban on ICE cars
Europe	2030	Ban on sale of ICE and hybrid cars
Sweden, Ireland, Netherland	2035	
	2050	Reach carbon neutrality
China	2025	20 % vehicles are electric or hybrid
	2035	>50 % vehicles are electric or hybrid
Japan	2035	Ban on sale of ICE cars
India	2035	30% of vehicles are electric

TAKING ACCOUNT OF THE ENVIRONMENTAL IMPACTS OF ELECTRIC VEHICLES

Electric vehicles are clearly not impact-free in terms of the environment: manufacturing, extracting materials to make batteries, and emissions generated by electricity production all need to be taken into account when assessing environmental footprints. This means that rising EV uptake must go hand in hand with greater production of electricity from renewable sources. But it also requires limiting resource use with solutions such as eco-design and recycling. Any massive shift to EV also entails planning end-of-life management for these new vehicles. They contain different components to ICE vehicles and include pollutants, particularly in the batteries. Recycling ensures that these hazardous materials cause no major ecological damage owing to a lack of processing capabilities.

Recycling activities make it possible to reduce carbon emissions by one metric ton of CO₂ equivalent per metric ton of recycled batteries, and they avoid the extraction of virgin metals, with mining activities having critical impacts on biodiversity and water resources

The extended producer responsibility approach has already generated a considerable volume of regulation governing end-of-life vehicles of all types. EU directive 2000/53/EC, dated September 18, 2000, sets environmental performance targets for end-of-life vehicles, including a requirement to reuse and recycle at least 85% of the weight of end-of-life vehicles, and reuse or recover at least 95% of weight per vehicle, as required by the extended producer responsibility policy. Japan, South Korea and China have adopted similar regulations. It is worth noting that batteries represent 30% to 50% of vehicle weight and that, since 2006, European regulations have required that 50% of total battery weight is recycled (directive 2006/66/EC). The European Commission plans to increase this recycling requirement to 70% in 2030. A minimum of 90% of components classed as crucial owing to their toxic or strategic nature will have to be recovered.

Recycling activities deliver significant environmental advantages: they make it possible to reduce carbon emissions by one metric ton of CO₂ equivalent per metric ton of recycled batteries, and they avoid the extraction of virgin metals, with mining activities having critical impacts on biodiversity and water resources.

COMPOSITION OF BATTERIES: STRATEGIC RESOURCES

Another key issue to add to these environmental and regulatory considerations is the availability of raw materials. A battery is an assembly of ten or so modules, each made up of 10 to 15 cells. A new battery weighs an average 500 kg for a capacity of 50 kWh and costs around €7,500. Three distinct categories of materials are used in the composition of batteries, classified by value:

- low-value components (30%), plastic used to make the outer casing, electronics, volatile components and steel;

- intermediate-value components (40%), primarily aluminum used to make casings for modules;
- high-value components (30%), used in the composition of battery cells, such as lithium, cobalt, nickel and copper.

Prices for these metals on the open market can reach several thousand euros per ton and, for some of them, speculation constantly drives prices higher.

The supply of a number of these metals poses significant risks to importing countries. Since 2011, the European Union has regularly published a list of critical raw materials. Lithium was added to the list in 2020 and the European Commission says it is keeping a close watch on nickel, bearing in mind the growing demand for raw materials used to manufacture batteries, even though it is not yet judged “critical”. Some metals are extracted

in chronically unstable countries; for example, over 60% of cobalt is sourced from the Democratic Republic of the Congo. Recycling makes it possible to lock in a portion of the raw material supplies needed for electric vehicle batteries and countless other industrial applications. It is a real lever for achieving strategic independence.

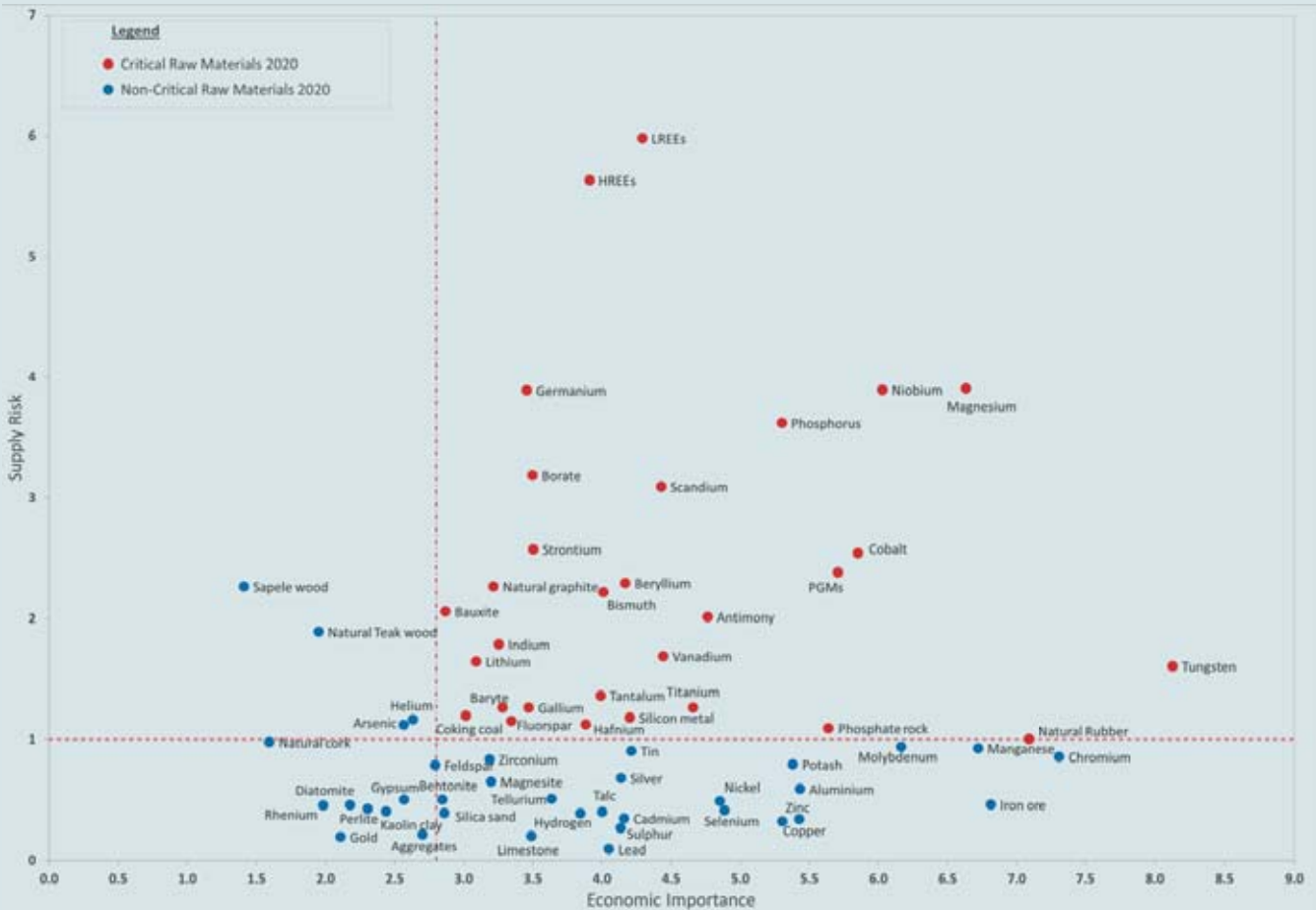
CLOSING THE LOOP: PRODUCING BATTERIES FROM RECYCLED MATERIALS

The medium-term aim is to arrive at a circular economy for batteries by developing closed loop recycling. The European Commission is currently working on drafting a regulation that will incrementally impose the use of recycled materials in the composition of electric vehicle batteries. Threshold levels for recycled materials will concern all batteries sold into the European market, irrespective of their place of manufacture. Starting in 2025, it will be mandatory to declare levels of recycled materials. In 2030, the levels demanded will be 12% for cobalt, 4% for lithium and 4% for nickel. These will rise to 20%, 10% and 12% respectively in 2035. Although these levels may at first glance appear fairly unambitious, in reality they will require a considerable increase in the amount of recycled material produced, and a major shift so that recycled by-products are re-routed back into new battery production processes. The overall efficiency of recycling rates will also be controlled via mandatory thresholds (2025: 90% for cobalt, copper and nickel, and 35% for lithium; rising to 95% and 70% respectively in 2030).

Veolia intends to play a major role in the emergence of this new sector of the circular economy.

List of critical raw materials established by the EU according to their economic importance and supply risk

2020 list of critical raw materials (in bold: newly added since 2017)		
Antimony	Hafnium	Phosphorus
Barite	Heavy rare earth elements	Scandium
Beryllium	Light rare earth elements	Silicon metal
Bismuth	Indium	Tantalum
Borate	Magnesium	Tungsten
Cobalt	Natural graphite	Vanadium
Coking coal	Natural rubber	Bauxite
Fluorspar	Niobium	Lithium
Gallium	Platinum group metals	Titanium
Germanium	Phosphate rock	Strontium



Source : European Commission, Study on the EU's list of Critical Raw Materials - Final Report (2020)

Figure 1

VEOLIA: SUPPORTING ECOLOGICAL TRANSFORMATION IN THE MOBILITY SECTOR

SOLUTIONS FOR RECYCLING THIS HAZARDOUS FORM OF WASTE

Recycling electric vehicle batteries is a major challenge that Veolia is ready to meet. In Europe, Veolia works via SARP Industries and its subsidiaries Euro Dieuze Industrie (EDI), specialists in the management, making safe, electric discharge and mechanical processing (grinding) of batteries

and capacitors, and CEDILOR, a center for chemical processing (purifying) and recovery. In China, Veolia has recently started production at a new high-capacity plant (25,000 metric tons), a joint venture with local actors from the battery ecosystem. Work to develop additional projects is under way, including in the United States and Europe.

Stages in recycling electric vehicle batteries

Collection

Making safe

Dismantling

Mechanical recycling

Chemical recycling

Production of precursors

Figure 2



Composition of an electric vehicle battery - ©Veolia

Since 2013, Veolia has been leveraging its expertise in processing hazardous waste to develop recycling processes for EV batteries. The main stages are described below.

- **Collection and making safe.**

Before any recycling can take place, batteries have to be removed from the vehicle where they were installed. They then have to be fully electrically discharged and made safe so that they can be handled securely at every step of the process. These stages are of great importance as it is possible to damage the batteries. They contain highly inflammable materials and chemicals that are harmful to humans and the environment.

- **Dismantling.**

The protective plastic or aluminum casing, electronic components, wires, connectors and the cooling system are all removed to locate the separate modules that comprise the battery. This part of the process is accomplished manually by trained operators. Next, the aluminum protection around the modules is removed to uncover the battery cells.

- **Mechanical recycling.**

The battery cells are then ground up to separate the elements with less value from those that are more valuable. Cell grinding takes place under high humidity to avoid all risk of fire or explosion. The ground materials are then mechanically separated to obtain three primary materials: paper and plastics; aluminum, copper and steel; and “black mass”, a powder containing mostly a mixture of carbon, nickel, lithium and cobalt.

- **Chemical recycling.**

The black mass is then processed chemically to separate and purify the materials it contains. Two main technologies are used to achieve purification: hydrometallurgy and pyrometallurgy. Although pyrometallurgy is simpler to use, it requires large amounts of energy and does not deliver high levels of purification. This means that it often needs to be followed by a hydrometallurgical process that allows materials to be extracted selectively. Veolia applies a hydrometallurgy process directly to purify lithium, nickel and cobalt and separate them from the black mass.

- **Production of precursors.**

If the by-products produced by hydrometallurgy units are sufficiently pure, they can be used in the production of precursors and materials for anodes and cathodes. This closes the recycling loop as it means recycled lithium, nickel and cobalt can be used in the production of new batteries.



Dismantling a battery - ©Veolia

SARP INDUSTRIES: VEOLIA'S OPERATIONAL EXPERIENCE IN EUROPE

Euro Dieuze Industrie (EDI), a subsidiary of SARP Industries located near Metz in north-east France, processes over 6,000 metric tons of batteries annually, recycling up to 80% of them. Carbon can be used in the metallurgy industry for de-rusting metals. Recovered metals are sold for use in the manufacture of alloys and chemical salts. EDI carries out the initial stages of recycling, from collecting batteries to producing black mass. The plant currently processes 1,000 metric tons of EV batteries a year and will double its capacity to 2,000 metric tons in 2022 then to 5,000 metric tons in 2023.

Also located close to Metz, CEDILOR uses hydrometallurgy to chemically purify black mass from EDI into nickel and cobalt salts. The process is currently being upgraded to allow the use of recycled cobalt and nickel salts in the manufacture of new batteries. By 2023, the plant should be able to process 4,000 metric tons of black mass a year, equivalent to almost 15,000 metric tons of electric vehicle batteries.

VEOLIA CHINA: TWO BOOMING JOINT VENTURES

Veolia's battery recycling activities in China center on two joint ventures with Fang Yuan (a local producer of battery precursors), Pand (a specialist in reusing batteries), BTR (a leading global supplier of anode materials) and Dele (a local supplier of environmental services).

The first joint venture is operated by Veolia and carries out the initial stages of recycling, from collecting batteries to producing black mass. The plant has an annual capacity of up to 20,000 metric tons of batteries. It entered service during Q4 2021.

The second joint venture will purchase black mass produced by the first joint venture, as well as by other recyclers. The technology used will be developed and operated by Fang Yuan. The process will first use hydrometallurgy to purify the metals, then produce battery precursors that can be used for the production of new electric vehicle batteries. Work on building this second plant is not yet under way.

SUPPORTING AN EXPANDING NEW MARKET

The estimated volume of equivalent batteries available for recycling was 180,000 metric tons in 2020. This figure will rise to 7 million metric tons by 2035. These volumes will initially come from China, which is leading the way in electric vehicle adoption. More generally, the majority of battery (LG, Samsung) and EV manufacturers (BYD, Toyota) are historically also Asian. A second wave of material for recycling will come from Europe, which is currently significantly ramping up battery production. Lastly, the market in North America should develop along the same lines around 2030. All this means that the electric vehicle battery recycling industry needs to scale up as of today in order to keep pace with exponential growth in the market.

Battery waste requiring processing can be divided into two types

- **Production waste from battery manufacturing** currently accounts for over half the volume of material to recycle. Waste from the battery production process includes high value materials containing lithium, nickel and cobalt lost at various stages during the process (production of cells, assembling the modules, assembling the batteries, testing, etc.). The overall volume of waste generated by the battery production process is currently estimated to be equivalent to 5 to 10% of the total capacity of

a standard factory. Despite the fact that the relative size of this waste stream will probably diminish as manufacturing processes are improved, the exponential increase in production means it will remain the primary source of material for recycling over the coming years.

- **End-of-life batteries** correspondent correspondent correspond to the overall volume of batteries available for recycling after a service life of 10 years (end of first life) and up to 15 years (for second-life batteries). This means there is a direct correlation between available volumes and the volume of batteries manufactured 10 years ago. This stream of waste batteries is therefore very limited at present since very few EVs were sold in 2010. It will progressively account for most of the material available for recycling in the years after 2030.

Veolia works non-exclusively with manufacturers of vehicles and batteries (gigafactories) alike. For example, Veolia has signed a deal with Renault that covers construction of a battery recycling plant in France, using streams of materials sourced from Renault vehicles. Discussions have also taken place with gigafactory operators with a view to establishing partnerships for recycling their production waste.

THE JOB-CREATION POTENTIAL OF BATTERY RECYCLING ACTIVITIES

Developing battery recycling activities is also about promoting new skills and encouraging an ecological shift that creates employment. There are several estimates of the job-creation potential of battery recycling. According to a recent study into how to achieve a well-balanced transition in the French automobile industry, conducted by the Fondation Nicolas Hulot (June 2021), battery recycling will create 9,000 jobs in 2030-2035. An earlier study by the Centre for European Policy Studies (Prospects for Electric Vehicle Batteries in a Circular Economy, Eleanor Drabik and Vasileios Rizos, July 2018) estimates that collecting, dismantling and recycling batteries creates 15 jobs for every 1,000 metric tons of lithium-ion battery waste. For example, the Euro Dieuze Industries site acquired by Veolia employed five people in 2000; 40 people work there today recycling batteries of all types, including from EVs. Veolia's teams closely monitor this aspect as part of the group's multi-faceted performance, which measures social impacts in the territories where it operates.

Recycling makes it possible to lock in a portion of the raw material supplies needed for electric vehicle batteries

LOOKING AHEAD: MOVING TO ENHANCED CIRCULARITY

Veolia is already working to deliver the constant improvements to processing procedures needed to obtain secondary raw materials of the highest possible purity. Significant advances in hydrometallurgical technologies will make it possible to meet the closed loop recycling requirements set out in forthcoming European regulations. The goal is to produce batteries from materials recycled from other batteries. In late 2020, Veolia unveiled a partnership with chemicals specialist Solvay for assessing alternatives to the processes for purifying metal salts currently used by Veolia.

Veolia is also examining ways to reuse electric vehicle batteries in other applications, such as energy storage for renewable energy, fast chargers for EVs and smart grid services, activities that offer synergies with Veolia's current operations. Projects are under study in the UK and France. This approach aims to offer solutions that leverage enhanced circularity to cut the carbon footprints of Veolia's customers.

CONCLUSION

Recycling electric vehicle batteries is a strategically important growth area for Veolia. It is a concrete response to the urgent need for ecological transformation among all actors in the electric vehicle value chain. Through its activities, Veolia contributes directly to exploiting urban mines and to increasing the mineral self-sufficiency and independence of its partner territories and businesses. Growth in recycling electric vehicle batteries also creates long-term employment opportunities for technicians: green jobs for the 21st century!

REPAIR, REUSE AND JOB CREATION

Jean-Paul Raillard
Chairman of Fédération Envie



Envie Orleans - ©Alain Goulard

Jean-Paul Raillard is a trained economist who began his career as a teacher of economic management techniques. He joined the Syndex consultancy in 1983, becoming managing director in 2008 and helping to turn it into a productive cooperative (SCOP) in 2011.

He has been chair of the board of Envie 44 since February 2016 and was appointed chair of Fédération Envie in June 2019. He also chairs the supervisory board of Envie Autonomie, a public interest cooperative. He is the administrator of *Alternatives Économiques* magazine and member of the French national CSR platform as well as the National Council for Inclusiveness.

Fédération Envie comprises some fifty organizations employing 2,860 people, 2,011 of them on employment integration schemes, and generating approximately €81 million in turnover across France. Envie's mission is threefold: social (socio-professional inclusion and integration of people excluded from the workforce), environmental (encouraging repair and reuse), and economic (giving regions an economic boost).

Envie's development since the 1980s demonstrates the remarkable source of employment the circular economy can represent at the local level, initially focused on electronics and household appliances then, more recently, expanding to include medical devices. In addition, the shift in public policies and the perceptions of the general public, elected politicians and industry players opens the door to new forms of collaboration with the potential to help make the circular, local economy a dominant model in the years to come. Following France's 2020 law on the circular economy, the role of local authorities and ecobodies will be decisive in building a circular economy that recreates economic and social value at the local level while protecting natural resources.

INTRODUCTION

Fédération Envie currently comprises 52 local employment integration businesses operating throughout France and active in various areas of the circular economy: collecting household appliance waste, sorting, logistics and processing in the value chain, refurbishing and resale to the public.

The Envie network was built on four main activities. First is refurbishing household appliances, covering everything from repairs, to sales and after-sales services. Second is transport and logistics, an activity that began in the 1990s as part of the waste electrical and electronic equipment (WEEE) system. Envie then developed ultimate waste processing activities for items that cannot be refurbished: they are sorted before being crushed and recycled for recovery. In 2015, Envie Autonomie created a fourth activity in Angers, centering on renovating medical devices, particularly wheelchairs for people living with disabilities.

FROM EMPLOYMENT-LED INTEGRATION TO THE CIRCULAR ECONOMY

Envie's core mission is rooted in a project focused on finding smart opportunities for creating employment integration posts. It all started in 1984 in Strasbourg with a meeting between a social worker from Emmaüs and a senior manager at electrical retailer Darty. They set out a plan to employ young people from disadvantaged districts to repair electrical and electronic products. This was our initial mission, and we set up our first company in Strasbourg in 1984, the first in France to develop activities centering on refurbishing and selling large household appliances like washing machines. At that time, Emmaüs used to check if appliances worked but did not refurbish or sell them. The other major innovation Envie introduced was a one-year guarantee for its refurbished products, proof of our capacity to repair equipment on a lasting basis.

The switch to a circular economy began when we industrialized collection and refurbishing processes by forging key partnerships with Darty and Emmaüs, which really helped us to get going. This phase involved regular meetings and discussions between the various actors to establish a development path in line with Envie's mission. New branches set up in Marseilles and other major French cities meant the network really began to take shape. This phase saw Envie gradually beginning to gain independence from Darty and Emmaüs, its historical partners.

This was when the nonprofit Envie Développement was created to support the new organizations Envie was setting up in different regions and to build what are now Fédération Envie and its network. We operate under market conditions and 80% to 90% of our resources come from selling the goods and services we produce. Our management staff have technical and educational skills. And our business, with its constant focus on increasing product quality and staff skills, can deservedly be called a learning organization. We aim for excellence in everything we do, from providing socio-professional support to our management choices and how we sell our products, including online.

The Envie network makes use of various legal forms:

- household appliance renovations are usually subject to regulations governing nonprofits;
- transport, processing and storage are generally handled by simplified joint stock companies (SAS) owned by the nonprofits to enable them to respond to calls for tenders;
- a public interest cooperative (SCIC) provides the cooperative framework for implementing the national project for renovating medical devices.

All Envie businesses are approved social benefit enterprises (ESUS), i.e. have to serve the public interest, be governed democratically and reinvest the majority of their profits

To become a dominant model, the circular economy cannot simply impact the environment; it also needs to impact the local economy and to have a social impact



Envie - Nord

in their own development. Local organizations retain their autonomy and run their repair, reuse and logistics activities in their specific catchment area, while Fédération Envie provides network support for communication, management tools and advocacy. It can also help set up systems in areas with no geographical coverage and provide support for existing installations with specific needs. For example, in the Paris region the unit in Trappes runs a store selling refurbished household appliances in central Paris, while the unit in Gennevilliers has successfully built up a waste processing collection business.

Since the late 1990s, several Envie organizations have developed waste logistics and transport activities to supplement the revenue they generate from refurbishing, as well as improving control over collection flows. This trend was boosted with the introduction of extended producer responsibility (EPR) schemes following the creation

of ecobodies in the 2000s. As the waste electrical and electronic equipment schemes were being put in place, an eco-body called Ecosystem issued various invitations to tender for waste collection and transport services, which the Envie organizations began to bid for. Certain organizations even specialized in the entire chain of logistics and processing activities. Today, we want to scale up quantity and quality in terms of the number of refurbished and repaired products, production of spare parts, and securing our supply sources. Achieving this goal involves adopting a collective approach to our processes and business models at the national level.

But we should not forget that, historically, at the heart of Envie is a social mission rooted in integration through



Envie - Rhone-Alpes ©Bernard Langenstein

employment, aiming to help people excluded from the workforce to find possible points of entry. After staff have worked at the company on an integration contract that can last up to two years (in 2020, the average time spent at the company was 11.5 months), we always do everything we can to help them find long-term employment. Last year, 74% of people who left Envie found either a permanent job, a fixed-term contract of at least six months, or skills training to build on their work experience. The environmental dimension offered by the circular economy, pioneered by Envie back when it started repairing and refurbishing household appliances and electronic products to give them a second life, is deeply embedded in our social mission and permeates all our new activities. In other words, Envie aims to create jobs that help improve the environment. The economic, social and environmental dimensions have been successfully incorporated and are also important issues for regions.

To become a dominant model, the circular economy cannot simply impact the environment; it also needs to impact the local economy and to have a social impact. With this in mind, in 2015 we set up a workshop in Angers to refurbish and sell medical devices, focusing mainly on the

social aspects: providing low-wage earners with medical devices restored to full working order and complying with all standards, since brand-new equipment can be a heavy financial burden for people who cannot afford the copayment. For example, we sold a refurbished wheelchair to a young man suffering from a degenerative disease at a price fully covered by the national health insurance scheme, whereas a new wheelchair would have cost him far more. This is the sort of case that led us to launch our project nationally.

Creating the organization from scratch has been a real adventure, including lots of work to gradually convince health insurance administrators and CNSA (French national funding agency for the elderly and handicapped) to support the project. Following these discussions, the social security authorities agreed to reimburse medical devices “restored to good working order” and included the provision in the 2020 social security funding law. While the creation of our activities shakes up the existing market, which essentially revolves round selling new products, we are convinced it is a win-win situation for everyone involved, primarily the people who need these specialist devices.

THE CIRCULAR ECONOMY, A SIGNIFICANT SOURCE OF EMPLOYMENT

Even though we lost the battle for industrial jobs in the household appliance sector several years ago, when production was almost entirely relocated to Eastern Europe, Turkey, Asia and North Africa, the development of the circular economy now represents a valuable source of employment, particularly on the booming market for second-life products. These are jobs that cannot be relocated, and being geographically closer to day-to-day uses makes it an economic activity with deeper local roots. A new virtuous circle is possible based on eco-design, durability, reuse and repair. The challenge facing us now is to find new solutions and create new conditions that encourage the sector to develop.

Cities and regions too have a major role to play in building local ecosystems centered on waste reuse and management

The sources of employment that have disappeared from the repair sector need to be restored. In the 1990s, a large number of household appliance and television repairers were working in France. The gradual drop in the purchase price of these products over recent years seriously weakened these businesses. This phenomenon is linked in particular to lower production costs after production plants were relocated, damaging the repair sector's competitiveness. This economic difficulty makes it hard to recruit the necessary labor in France, represents an obstacle to repairs, and fosters a form of obsolescence encouraged by manufacturers of low-cost products. It is time to change this.

The demand is already there: currently, 45% of consumers would like to be able to repair their products.¹ Costly spare parts that are hard to obtain also represent a major obstacle to the growth of repair activities. To tackle this problem, we want to become a key actor in the sale of spare parts for reuse, which would also bring down repair costs, as is the case in the automotive sector where manufacturers are legally obliged to offer their customers second-hand spare parts. The same legal provision should also be applied to electronic products and household appliances in the years to come.

Usability and eco-design must be included in the production of television sets, washing machines and care beds so that they last longer and are easier to repair and recycle. These new fields are very attractive to young engineers, who are actively looking for activities of these types.

The benefits in terms of employment are vital, because a metric ton of buried waste only creates the equivalent of one local full-time job, or three jobs if incinerated.² In contrast, it can generate 30 jobs when materials are sorted and recycled, and with reuse can provide full-time work for 85 to 130 people. We can therefore see that all the

ingredients are in place for creating a real local ecosystem. A host of actors from the social and solidarity economy and for-profit sectors are getting onboard. For example, Darty has just announced its decision to recruit 500 repairers, and all the retailers are looking at business models for the secondhand market. The Envie network has defined an action plan aiming to create over 1,000 jobs in three years, with a view to going much further to avoid waste building up.

The goal is to revise our production processes and move away from non-selective massive waste collection and processing, toward selective upstream collection so that everything repairable is separated from everything that is not.

While this type of selective waste sorting can be more costly than throwing everything into garbage trucks, we know that it has far greater potential to create jobs and protect the environment. Ecosystem supports our efforts to achieve this goal.



Envie - Toulouse ©PH Jacob

1 ADEME (2020). *Les Français et la réparation - Perception et pratiques (French people and repairs - perception and practices)*: <https://librairie.ademe.fr/cadic/249/rapport-francais-reparation-perception-pratique-2020.pdf>

2 Rémy Le Moigne (2018). *L'économie circulaire (The circular economy)*, DUNOD



Envie - Gennevilliers ©Benoit Haesen

KEY ROLE FOR LOCAL AUTHORITIES

Cities and regions too have a major role to play in building local ecosystems centered on waste reuse and management. We need new methods to structure these emerging sectors and ecosystems, including a focus on partnerships with districts and cities, as already happens in Nantes and Lyon, for example. Nantes and Lyon helped fund reuse and repair projects with social and solidarity economy organizations like Envie as well as conventional actors. The projects are designed to manage initial sorting points at waste collection centers and transport recoverable goods to reuse points where they are sorted more methodically and then dispatched to the different schemes. Public actors play a vital role in this type of project, a role that helps to build a new economic model. A public interest cooperative, Iloé, was set up two years ago in Lyon to coordinate the project. Envie has a 25% share in the cooperative with the remaining shares held by industry actors and public bodies.

We also team up with traditional waste recovery businesses like Veolia, Suez and Derichebourg Environnement to manage collection, sorting and reuse activities. For example, in Rennes we have been involved in waste sorting from construction sites in cooperation with Legendre and Veolia since 2019. Even though these activities struggle to make money, we are establishing worthwhile partnerships for creating work insertion jobs that often result in staff being employed directly by our partner companies.

We sometimes have to resolve contradictions. For instance, incinerating waste to supply district heating networks

is highly beneficial in terms of limiting CO₂ emissions. However, it is sometimes detrimental to reuse, which reduces the overall volume of waste. We feel that the development of local reuse schemes and ecosystems devised in consultation with all stakeholders represents a truly virtuous path, both socially and environmentally. In the big cities, local politicians very often share this vision, but we also have to convince cities' technical departments. They have a big say in how policies are implemented operationally and do not always see the value of developing reuse as it makes the chain more complicated. As a general rule, we work primarily with cities that have a global vision of how to prevent waste and how it moves across their territories, then the movement spreads to smaller cities and towns as the actors become aware of the importance of the issues at stake.

PROMISING PROSPECTS FOR RETAIL CHAINS

Electrical goods and electronics chain retailers have spotted the potential of the market for second-life goods, which is growing rapidly every year. The trend is driven by consumers who are increasingly green-aware and convinced by the idea of buying secondhand. Their purchasing practices express a quest for economic value as well as, increasingly, the desire to reduce their environmental impact. Major chain retailers in France, like Darty and Boulanger, are already thinking about the stores of tomorrow. They have taken action and entered the second-life market by installing departments specifically

for these products in their stores, going far beyond the refurbished smartphones that are found everywhere these days. But they are not alone. Other chains, such as But and Conforama, are also interested in launching services to repair and sell refurbished products.

The market that most interests chain retailers is for customer returns, where customers return practically new products that do not live up to their requirements or failed the first time they were used. This market is also very attractive to Envie, with good quality products retrieved from Cdiscount or Rue du Commerce before being repaired then resold through Envie stores. Products of this type can expand the ranges available in our stores, but refurbishing them creates less work, and thus fewer jobs, than waste sorting.

However, some chain retailers are looking for ways to lean into the secondhand market to increase sales of new products, for example, by offering discount coupons to customers who bring in products for repair but where the repair cost is not economically viable. One of the risks posed by approaches of this type is that they restrict extensions to product lives, and actually tend to accelerate the product renewal phenomenon encouraged by marketing campaigns and trends.

In terms of negative side-effects, the market for smartphones is an interesting case. Numerous new actors have entered the refurbishment market, attracted by fast growth and high profits. But this fast growth is not necessarily positive from the environmental or social perspective. A good illustration is the emergence of major players in refurbishment, capable of bulk buying batches of secondhand smartphones, less than six months old, in the USA and Japan where renewal rates are very high, sending them to Asia or to low-cost economies nearer to Europe for repair before selling them in France. This system primarily props up the market for new products and creates very few jobs regionally. What is the true benefit in terms of resource exhaustion and CO₂, and in raising consumer awareness that more sustainable lifestyles are possible? Certain observers have underlined the risk that the market for second-life products will be co-opted by manufacturers that have forecast a fall in sales of their new products and will therefore seek to offset it by capturing a larger share of the growing market for secondhand products.

This one-dimensional perception of the circular economy as simply a new market to conquer is not the vision we believe in. We aspire to the creation of a new economic model in its own right, one that combines inclusiveness, fewer inequalities, environmental sensitivity and local development, ushering in new ways to produce and consume. This is why actors from the social and solidarity economy proposed that French parliamentarians include a financing fund for reuse in the February 2020 law on the circular economy and combatting waste. The idea was very

Electrical goods and electronics chain retailers have spotted the potential of the market for second-life goods, which is growing rapidly every year

well received by the Senate and approved by the Assembly before being included in the law. The new legislation will also make it possible to set up a repair fund to be managed by eco-bodies to finance activities that will create local jobs by lowering repair costs.

Preparations for setting up these two funds are currently the subject of intensive lobbying by some of the new actors in the market that are attempting to convince the authorities they are legitimate recipients for the millions of euros that will be distributed by these reuse and repair funds. While the debates on the new law showed that parliamentarians

were generally in favor of providing significant support to local economic initiatives rooted in the social and solidarity economy, the government is very anxious to ensure free competition. The issue of employment will be partly settled by the final decisions taken in this regard.

CONCLUSION

The circular economy can become a major source of job creation in the future, provided it can develop local reuse activities supported by public policies and regional networks committed to genuine efforts to extending the working life of products. The experience built up by Fédération Envie over the past 40 years in the field of work integration centering on repairs, reuse and recycling is helping to create this new and more virtuous economic model. We have never stopped innovating and proving that this path forward is possible.

Eco-bodies and local authorities will be pivotal in determining how the circular and local economy will develop, particularly when it comes to electrical and electronic equipment. Envie plans to build lasting partnerships. There are plenty of partners ready and willing to join us in this adventure, even though the economic limitations remain unclear—an approach that typifies social and solidarity entrepreneurship. So we need to be ambitious!

The second-life market will continue to grow and we want to play our part by pursuing our goal to ramp up our business fivefold over the next ten years. The market is opening up to competition, which should stimulate it. But we are absolutely determined to tie the circular economy to the creation of inclusive, local jobs. This is the only possible sustainable path forward.

INTRODUCING MATERIALS FROM THE CIRCULAR ECONOMY INTO THE CONSTRUCTION INDUSTRY

Arnaud Bousquet, Director of Matériaupôle

With 40 million metric tons of waste (75% inert, 23% non-hazardous and 2% hazardous), the construction industry is one of France's largest scale producers of waste¹ and has been identified by policymakers as one of the major challenges for the circular economy. It is an issue being addressed at the national level via the February 10, 2020 law on the circular economy and combatting waste, which created an Extended Producer Responsibility system for the construction industry, and at the local level with, for example, the Paris region making construction one of the priorities for its 2020-2030 circular economy strategy.² At the same time, work on the 2024 Paris Olympics and the Grand Paris project has greatly increased the number of construction sites and quantity of construction waste in the Paris region. It is thought that work on the Grand Paris Express will generate around 43 million metric tons of spoil (50% from tunneling, 50% from creating stations and ancillary structures) at 267 separate sites.³

In an effort to address this issue, and with encouragement from national policymakers, new actors are trying to develop practices centering on eco-design, reuse and recycling in the construction industry. However, although certainly on the increase, the place of materials from the circular economy in the construction industry remains peripheral. The industry started by focusing its efforts on recycling concrete from demolitions as a source of subgrade backfill for roads or as aggregate for making more concrete. However, faced with the limitations of recycled concrete that loses some of its physical-chemical properties, such as its compression strength, the industry is increasingly looking into new solutions such as biomaterials (timber constructions, hempcrete and bio-sourced insulation), and recovering and reusing second-life materials, including concrete, plaster, glass, wood and metal. Although at the time of writing these solutions remain marginal in terms of the overall construction industry, they do offer hope for the future.

Business models in the construction industry have changed in recent years, leading to new construction and demolition practices. The Paris region has a profusion of initiatives, projects and experiments

designed to set in place new regional ecosystems that will create loops for materials to circulate between various work sites across the region. One of the best examples is Plaine Commune, an authority comprising several municipalities from Seine-Saint-Denis, north-east of Paris.

In 2014, Plaine Commune launched an "urban metabolism" project designed to kick-start mechanisms for reusing construction materials across its territory, based on five pillars: developing synergies between work sites; providing locations where materials reuse platforms could be set up; structuring local recovery and reuse schemes (identification, listing and supporting actors involved in reuse); developing an IT tool to raise the profile of sources of materials and put them in contact with construction and renovation sites, and, finally, supporting businesses to learn more about the problems associated with reuse (types of materials, legal framework, etc.) via individual and collective training sessions.

Taking account of factors such as the volume of available sources and their potential outlets, Plaine Commune opted to focus on several types of materials: bricks and terracotta tiles; concrete; doors and windows in PVC, aluminum or wood; wooden construction components, and metals and metal elements. The local authority has also begun to develop a platform to aid reuse of terracotta, metal components, metalwork, PVC, aluminum and wood, and plans to recover demolition concrete to be transformed into recycled aggregate for subsequent use in the production of structural concrete components.

It is also worth mentioning the Cycle Terre project,⁴ which has led to the creation of a plant at Sevran, east of Paris, that makes unfired clay bricks on a 6,000-square-meter site adjacent to a source of excavated earth. The plant has circularity designed in and can be moved to wherever the sources are. The idea behind the project is to use unpolluted earth excavated from city construction sites to manufacture unfired clay bricks that can then be used in the construction of new districts for the Grand Paris project. At present, the project aims to process

¹ Ademe (2018) - *Déchets du Bâtiment, Optimiser les matières premières, renforcer le tri, le réemploi et la valorisation des déchets du bâtiment (Construction waste, optimizing raw materials, strengthening reuse and recovering building waste)*: <https://www.ademe.fr/dechets-batiment-0>

² Région Ile de France (2020) - *Stratégie Régionale en Faveur de l'Economie Circulaire (Regional Strategy to Promote the Circular Economy)*: https://www.iledefrance.fr/sites/default/files/medias/2020/11/strategie_economie_circulaire_2030.pdf

³ ORDIF (2016) - Paris region waste figures: <https://www.ordif.com/publication/tableau-de-bord-des-dechets-franciliens-2016>

⁴ Projet Cycle Terre: <https://www.cycle-terre.eu/>



Timber-framed house with solar power, Bouray-sur-Juine, 91 - ©AREC

25,000 metric tons of earth a year, a modest goal when you remember the 43 million metric tons that will be produced by work on the Grand Paris Express, and the 400 million metric tons that work on the entire Grand Paris project will produce by 2030.

In reality, companies that want to use recycled or reused materials face numerous difficulties. To start with, processes for designing and transforming materials are usually cross-functional within organizations and also impact the countless contractors that construction professionals rely on to deliver their site works. This means that a change in materials involves changes to an entire ecosystem, which can be very complex to put in place. The widespread adoption of building information modeling (BIM), which makes it possible to fully digitalize the building design process, may offer the beginnings of a response to this problem.

Companies also face issues surrounding the quality, quantity and durability of sources of reused materials. The logistical arrangements between the removal, reconditioning (where needed) and reinstallation of components or materials have to be totally fluid, and operator training is needed. The companies also need access to storage depots in the event that an operation or site is delayed, and remain hampered by legal restrictions and uncertainties relating to the status of the waste, approval from insurers and obtaining environmental impact records.

Countless local synergies are possible to overcome these hurdles, but this also involves setting up new industrial ecosystems where some companies can use local waste or resources generated by other companies as inputs for their production process. Inter-organization cooperation of this type requires building relationships of interdependency between companies, in turn requiring the collective establishment of a system of rules and conditions for cooperation in order to access shared infrastructure and resources. A whole host of clusters already exist in France, like Matériaupôle, with the capacity to bring actors together from across a region (businesses, researchers, authorities, etc.) to organize the pooling and sharing of the tools, technical installations and infrastructure that can support the setting up of these new ecosystems. Matériaupôle is a multi-actor cluster operating as a registered nonprofit and located in Vitry-Sur-Seine. It was co-founded by the Val-de-Marne department and the Grand Orly Seine Bièvre inter-municipal authority. Its goal is to bring together companies (small businesses, startups and large corporates), research and teaching centers (laboratories, universities and schools), local authorities and creatives (designers, artists and makers). Since it was established in 2009, Matériaupôle has helped breathe new life into the materials and processes sectors in the Paris region.

USING DIGITAL TO DEVELOP THE MARKET FOR REFURBISHED PRODUCTS

Camille Richard
Head of CSR at Back Market

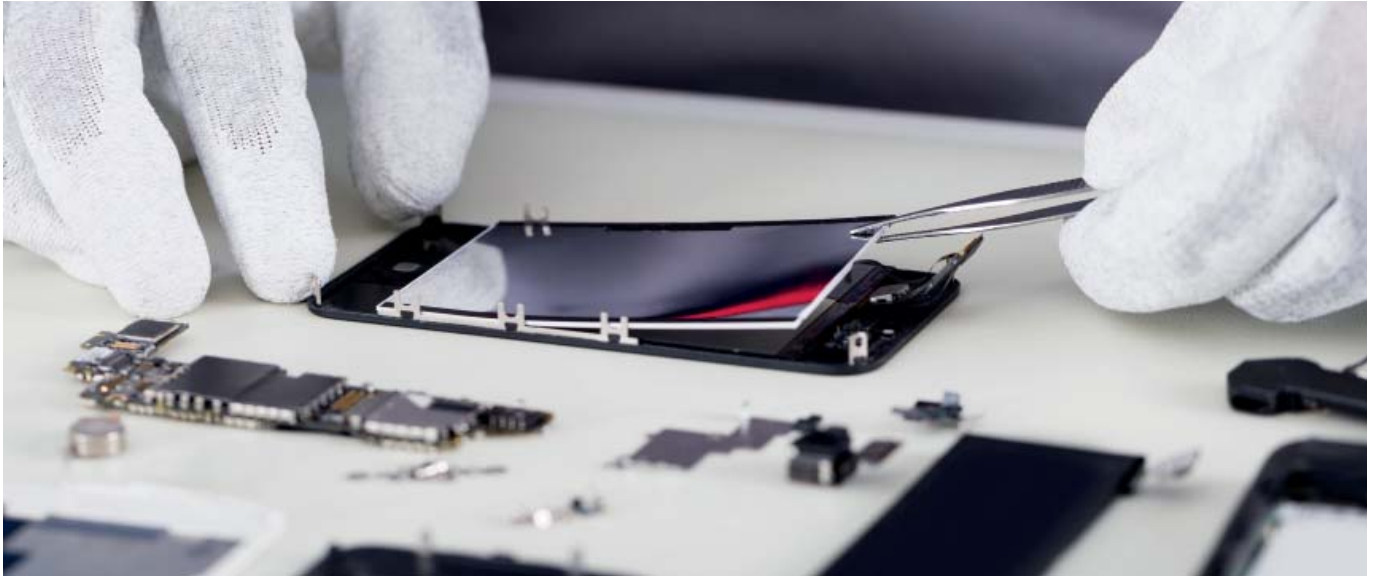


Back Market's advertising campaign in Paris underground

Camille Richard has been Head of CSR at Back Market since 2020. After several years spent with the sustainable development department at Suez, she joined Back Market to pilot the rollout of its sustainability strategy. She is a graduate of Sciences Po Bordeaux.

Back Market is a pioneering online marketplace for refurbished electronic devices and household appliances. Operating in the USA and several European countries, Back Market has designed a digital platform that helps put buyers, refurbishers and sellers of refurbished devices in touch with each other. The Back Market platform fosters the creation of new sectors of the circular economy, which in turn help promote the emergence of more responsible consumer habits.

Aside from its commercial activities, Back Market is also committed to being a socially and environmentally responsible actor, evaluating the social and environmental impact of selling refurbished products, whether in terms of job creation or the reduction of greenhouse gas emissions.



Can you give us a quick overview of Back Market and its main activities?

Camille Richard: Back Market is an online marketplace that puts consumers in touch with refurbishers of electronic products and household appliances. We have no bricks and mortar infrastructure; instead, we provide our clients and partners with a digital platform for organizing the sale and refurbishment of second-life products. Consumers can buy or sell warranted secondhand products (smartphones, computers, washing machines, etc.) via our online site.

The company was founded in 2014 and has a 500-strong workforce, based mostly in Paris, Bordeaux, Berlin and New York. We have a commercial presence in 15 countries, including France, Germany, Italy, Spain, Belgium and the USA.

Who are your main suppliers and partners?

CR: They are a very varied bunch. We work with specialists that can handle high volumes of products for repair, refurbishment and sale, as well as intermediaries such as high street pawnbrokers with access to large numbers of second-life products. These are stores that let individuals sell their used products (household appliances, clothes, books, and so on) and purchase secondhand products too, if that's what they want.

Our business model is based on a 10% commission on sales made via our platform, home to 1,500 suppliers in 184 product categories, mostly phones and computers as well as games consoles and televisions.

To ensure that our customers enjoy the best possible service, we have set up a carefully calibrated procedure for selecting our suppliers. Before gaining full access to our

platform, suppliers have to go through a screening process that allows us to assess them for the first month or so. During this probationary stage we limit them to no more than 10 sales a day and keep a close watch on a range of indicators, such as their product breakdown rates, delivery times and the levels of service they offer customers.

With uncertainty about product quality being one of the main factors holding back consumers from acquiring a second-life product, how do you set about reassuring your clients?

CR: In France, we offer customers a 12- or 24-month warranty. We have also created a quality charter that our suppliers have to follow if they want to use our platform. On top of that, we place lots of anonymous orders to test the quality of our refurbishers and check that the services they offer comply with our requirements and quality charter.

What is your strategy for persuading consumers to change their buying habits?

CR: Back Market was born of the realization that there was a supply of and demand for refurbished products, but that bringing the two together was tricky, particularly because of issues linked to warranties and after-sales service.

So we decided to tackle the problem by putting in place detailed monitoring of a range of indicators. We pay special attention to the breakdown rate of products sold on Back Market and do our utmost to ensure that they are as close as possible to equivalent new products.

But consumer behaviors are changing too. Price remains the most important consideration when making a purchase, but we reckon that around a quarter of our buyers use the platform for environmental reasons, tribute to the growing importance consumers place on these issues.

The work we have put in to boost trust in refurbished products has also helped win over consumers. We have spent heavily on advertising, with posters in the metro and advertisements on TV to give refurbished products a more attractive image. Then there is the high price of new goods, which increasingly leads buyers to turn to the secondhand market.

What we need now is for manufacturers to supply spares at affordable prices, bearing in mind we don't accept spares that fall below our quality threshold. This is one reason why we paid such close attention to the details of France's law on the circular economy and combatting waste (AGEC), which proposes to use a reparability index to make access to spare parts easier.

We are seeing demand outstripping the supply of refurbished products in certain categories, such as smartphones and laptops, providing that the purchase price is not too steep. An ADEME study has shown that if the cost of a repair exceeds 35% of the new product price, consumers prefer to buy the new

We reckon that around a quarter of our buyers use the platform for environmental reasons, tribute to the growing importance consumers place on these issues

product.¹ But at the moment it is not necessarily in most manufacturers' best interests to make accessing spare parts and repairs any easier.

What role does digital play in your strategy?

CR: We are a fast-growing company, but all we do is provide refurbished products to as many people as we can, something made possible by digital technologies. Since it was founded, five million consumers have purchased at least one product via the Back Market platform.

Our warranty system is made possible thanks to digital, which offers us an accurate overview of the quality of service provided by repairers and refurbishers.

Digital also helped us design an algorithm to improve the way sellers and buyers are put in touch with each other, with the aim of making sure that buyers obtain the best possible product that meets their needs and offers the best value for money.

¹ ADEME (2016), Marie Hervier. Etude relative à la perception des réparateurs sur leur activité et les possibles évolutions de cette activité (Study of repairers' perceptions of their activity and possible changes to it)



In addition, the platform has been designed to make it possible and easy for private sellers to sell their secondhand products. It lets them provide a small amount of information about the product (purchase date, brand, etc.) that any interested refurbishers then use to make an offer to buy it.

Our platform plays an important role because we feel that refurbished products contribute to reducing the ecological impact of our consumer habits. It is important to bear in mind that half the impact of digital occurs when devices are manufactured.²

In a more general sense, what role do you think digital can play in the circular economy?

CR: Digital can help cut the environmental impacts of consumer goods by promoting the emergence of new buying habits that focus on second-life products. This is an important issue because not all ecological problems are solvable by developing eco-designed products.

We are hearing more and more about digital's energy impact due to the massive increase in data usage, but the ecological impact of manufacturing devices is a problem that is not taken seriously enough. And there is often a discrepancy between the data on reparability and use of recycled materials claimed by certain manufacturers and their actual practices.

To gain a better understanding of the issues, we rely heavily on research into extending device lifetimes published by ADEME. For example, one of its reports examines the environmental impact reduction obtained depending on when repairs occur during the product's lifetime.³

What are the biggest difficulties holding back the development of Back Market?

CR: The main difficulty we face is in the supply of second-life products. We have trouble sourcing sufficient quantities. To solve this problem, we are trying to improve the collection of electronic devices, offering solutions via our website as well as exploring the possibility of working with eco-bodies.

We also try to incite people to sell their old devices and appliances rather than leave them lying in the back of a drawer. A report from the French senate estimated that only 15% of smartphones sold are actually collected once

they're no longer in use and that around "100 million telephones are 'sleeping' in our fellow citizens' drawers" (Senate report 850, 2015-2016). It is vital that people are encouraged to alter their behavior and change their habits when it comes to these issues. We also think that the tax system could be a good way to encourage consumers to choose refurbished products.

And then there is the fact that businesses are not incentivized to look into second-life products when renewing their computers.

Access to spare parts remains difficult. This issue is addressed by the AGECE law and is an area where our interests coincide with those of refurbishers.

As the Head of CSR, can you talk to us about the sustainable development challenges facing Back Market?

CR: Back Market is keen to formalize its sustainability strategy and assess the environmental impacts of refurbished products versus new products.

For example, we have set up a carbon footprint assessment to track our greenhouse gas emissions, and we are taking part in an ADEME study on the lifecycle analysis of refurbished products, the first of its kind to be carried out nationally. The study will be released in the fall of 2021.

We have also run a study of our socio-economic footprint to assess Back Market's impact in terms of job creation, whether directly within the company or indirectly, at our partner companies in the countries where we operate. We used a methodology developed by the Utopies consultancy to run the study, which is aimed at policymakers and consumers. Initial results show that refurbishers on the Back Market platform represent around 5,000 jobs.

What is your strategy for growing your international activities?

CR: We are trying to reflect the differences between each country, because buying habits and behaviors do vary slightly. For example, we offer longer warranties in Germany because German consumers are more used to them than in other countries.

In the USA, Goldman Sachs' acquisition of a minority stake in our company has given us access to a powerful network that is consolidating our strong growth in a country where more and more customers are looking for ways to buy electronic goods that are cheaper, more respectful of the environment, and offer a better warranty, particularly for secondhand products.

² ADEME (2021). La Face cachée du numérique. Réduire les impacts du numérique sur l'environnement (*The hidden face of digital. Reducing the impact of digital on the environment*) <https://www.ademe.fr/sites/default/files/assets/documents/guide-pratique-face-cachee-numerique.pdf>

³ ADEME (2018). Quantification de l'impact environnemental d'une action de réparation, réemploi, réutilisation (*Quantification of the environmental impact of repairs or reuse*) <https://www.ademe.fr/quantification-limpact-environnemental-dune-action-reparation-reemploi-reutilisation>

CIRCULAR LIGHTING TO PROTECT VALUE

Francois Darsy
Head of Office & Industry Marketing, Signify France



Lighting renovation - ©Signify

Francois Darsy is a trained engineer and expert in smart lighting. He is head of office and industry marketing at Signify France, formerly known as Philips Lighting. He is also president of the indoor lighting commission at the French Lighting Syndicate and of the joint commission put in place by the French Lighting Association and the Smart Building Alliance.

He is at the forefront of changes in the French lighting market as it moves to roll out new business models, particularly light-as-a-service, selling the function not the product.

He is a fervent advocate of an ambitious and planned policy for rapidly renovating existing installations in buildings.

Light has impacts that are environmental, economic, social and cultural. Our aim is develop solutions that align with actions worldwide to protect the climate and promote the circular economy, health, well-being, safety and security.

Lighting currently accounts for 14% of electricity use around the world, making it an issue of major concern. Designed with and for users, our products, systems and services contribute to boosting the environmental performance of buildings. LED lighting, which uses less electricity, can deliver energy savings of 50% to 90% compared to conventional lighting technologies.

To guarantee long-term performance in use, we now offer a circular lighting service where clients purchase lighting services for their premises rather than lamps and fittings. This focus on use over ownership delivers warranted performance in terms of lux output, electricity use, and availability. At the end of a contract, Signify is responsible for recovering products for reuse, reconditioning and recycling.

INTRODUCTION

Philips Lighting is now called Signify. This new name evokes the fact that lighting has become an intelligent language, providing connections and meaning.

Sustainability is key to everything we do. Our clients and employees expect us to work toward delivering positive impacts. Operational sustainability is what we aim for as we build our competitive advantage and our future.

This new identity is also closely tied in to the step-change in technology in the lighting market that is redefining how we will light the spaces where we live and work.

LED technology coupled with the Internet of things is delivering massive savings in terms of energy use, as much as 90%, as well as lifespans that far exceed those offered by conventional solutions.

These developments led Signify to pivot to a new way of thinking about its offering: the company now offers a circular lighting service where clients buy a lighting service rather than lights.

Transitioning toward a new business model inevitably has far-reaching implications, requiring a change in our perspective on how we create value for our clients, on our offering of products and services, and on our relationships with our partners.

THE CIRCULAR ECONOMY: DO MORE WITH LESS

Humanity currently uses 1.6 times more resources than our planet can support. Every day sees 1,440 truckloads of plastic waste swept into our oceans. Today's linear model, extract-manufacture-use-discard, is broken and needs to change.

This is more than just a question of ethics. As a responsible company, doing more with less is a wholly rational attitude. While the world continues to overexploit its precious and finite resources, ever scarcer materials will become ever costlier and ever harder to find. We owe it to our clients, and to the wider world, to do better.

START BY REDUCING OUR WASTE

In the circular economy, the first thing that often comes to mind is improving how waste is managed. In 2016, we committed to zero waste to landfill or incineration at our production sites, a target we met at the end of 2020 as planned.

The next phase of our roadmap is now underway. Signify is committed to stripping out plastics from all its packaging by the end of 2021. This amounts to a saving of 2,500 metric tons of plastic every year. Using packaging that is recyclable and, crucially, more compact has another major advantage: it weighs less and is cheaper to ship, which cuts our transport and materials carbon footprint.

We have committed to doubling our earnings from circular products, systems and services by 2025 so that they account for 32 % of sales

REVOLUTIONIZING OUR PRODUCTS AND SERVICES OFFER

Switching from a linear model to a circular model implies a commitment to far-reaching change. The switch cannot be undertaken lightly, requiring a new way of thinking about our products, business models, and relationships with our ecosystem of partners and supply chain.

This transition is underway and we have committed to doubling our revenues from circular products, systems and services so that they account for 32% of sales by 2025.

PROTECT VALUE AND MINIMIZE WASTE

In the conventional linear model, customer-supplier relationships focus on one transaction: the product purchase. Value for money becomes central to this relationship. Structurally, pressure on product prices forces companies to optimize their product, which can lead to lower performance and — often — downgraded durability, in the case when it is not directly perceived and valued by the market. Customers essentially invest on the

basis of the value they perceive, but suppliers have trouble leveraging value from the durability of a product or service. Additionally, this durability is often simply a promise, the transaction and the transfer of product ownership imposing little or no obligation on the supplier in terms of long-term real-life performance and costs. While reparability, reliability and even recycling are all aspects that are rarely valued.

In every sector, we see products that are less and less durable and only diminish trust in the brands that sell them. Turning the market dynamic around and moving away from this race to the bottom is an end in itself. For a business like Signify, which sells the world's finest lighting brands such as Philips, this is a major challenge in its quest to protect the value of its market.

A major disruptive technology in the lighting market is revolutionizing the structure of the market and the way that we will consume light. The transition to LED can deliver in-use energy savings of up to 90% along with far longer lifespans. The energy savings are massive. Lighting's share of global electricity use fell from 19% in 2006, prior to the market's transition, to 14% in 2018, and should continue to decline to 8% by 2030. All of this is despite a forecast 35% increase in the number of lighting points in use between 2006 and 2030, as a result of the growing global population, rise in middle classes and ongoing urban expansion. Gains in lifespans are also promising, signifying a shift from a market for consumables, where lamps have to be changed regularly, to a market for investment goods where LED fittings have operational lifespans of up to 20 years, or longer if designed properly.

In this new paradigm, creation of value is inextricably linked to the phase when the product is in use. A product that lasts longer and uses less will be an excellent investment.

The circularity of our offering is essential for a transition toward a circular economy model. There are two areas where major change has to occur:

- **Product design:** the aim is no longer to make a product that is "not too costly" and therefore easier to sell, but one optimized to minimize the amount of value destroyed. In practice, this means products with sustainability designed in, making them traceable, repairable, reconditionable, recyclable or upgradeable so that their energy efficiency can be enhanced or they can be adapted to enable associated uses and services such as connectivity.
- **Business model:** moving from a transactional relationship to a contractual relationship with a performance commitment. The product is no longer central to the relationship; the quality of the service provided is what defines client satisfaction. In practice, a client purchases a light level (in lux), a rate of availability for the fittings and a guarantee covering energy use. This is a model for the long-term, currently 10 years, and it requires an ecosystem of financial partners, installers, maintainers, recyclers, etc.

SUSTAINABLE PRODUCT DESIGN

Over the past few years, we have developed a sustainable product design program intended to protect value and avoid waste. Environmental lifecycle analysis, as per the ISO 14040 standard, shows that the impact of a lighting product occurs predominantly during use, meaning that the most efficient strategy for protecting resources is to:

- minimize impact during periods the product is in use via lower energy consumption;
- increase time in use by maximizing the product’s lifespan, reparability and upgradeability.

Our circular portfolio is divided into three categories: lighting fixtures, circular components and smart systems.

- **Circular light fittings** are lights that consume significant less energy than market average, are easy to repair, maintain and update. They are also connectable, offering total traceability throughout their lifecycle. Their specifications include end-of-life planning via reuse, reconditioning or recycling.
- **Circular components** are interchangeable and include parts that can be recycled, particularly electronic drivers and LEDs. Their specifications stipulate lifespans and failure rates that meet the most rigorous standards on the market.
- **Smart systems** constantly monitor light fittings and allow preventive maintenance by predicting when and where maintenance is needed. This helps to cut costs,



Repairable & upgradable product: Philips PacificLED - ©Signify

outages and labor time. These systems make it possible to understand how lighting is used in practice and to adapt uses during the life of the product. For example, by adapting lighting levels and management modes to constantly optimize comfort and energy savings.

It is essential to design products that generate a minimum of waste and that can be improved, maintained, reused, restored or recycled.



Interact Industry - ©Signify- Pilkington

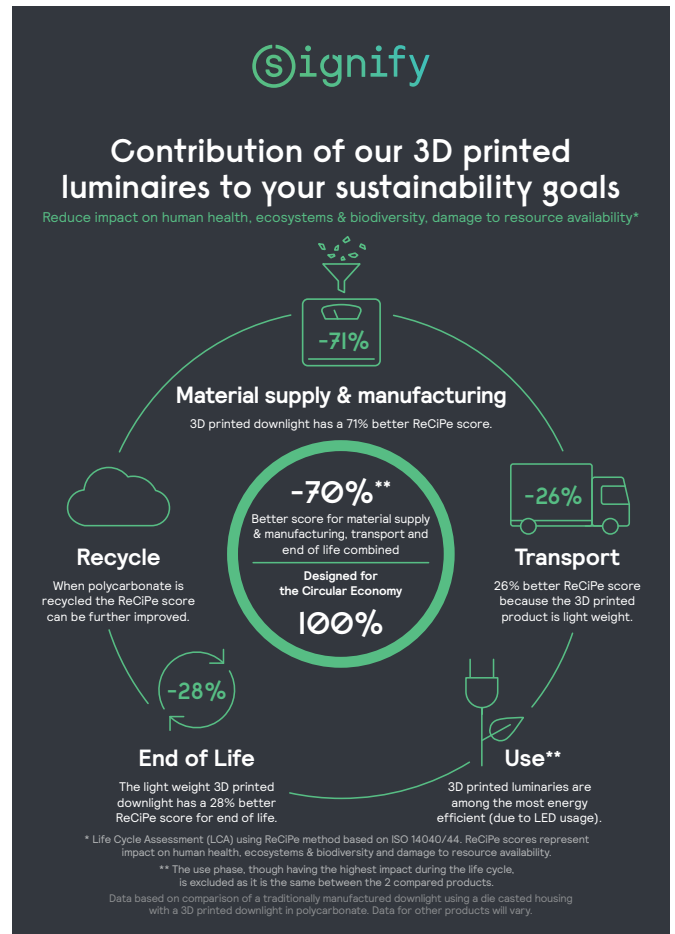
3D PRINTING, AN INNOVATION ACCELERATING TRANSITION

One example of this commitment is the launch of new generations of light fittings designed for a circular economy. Our 3D-printed fittings are an excellent illustration.

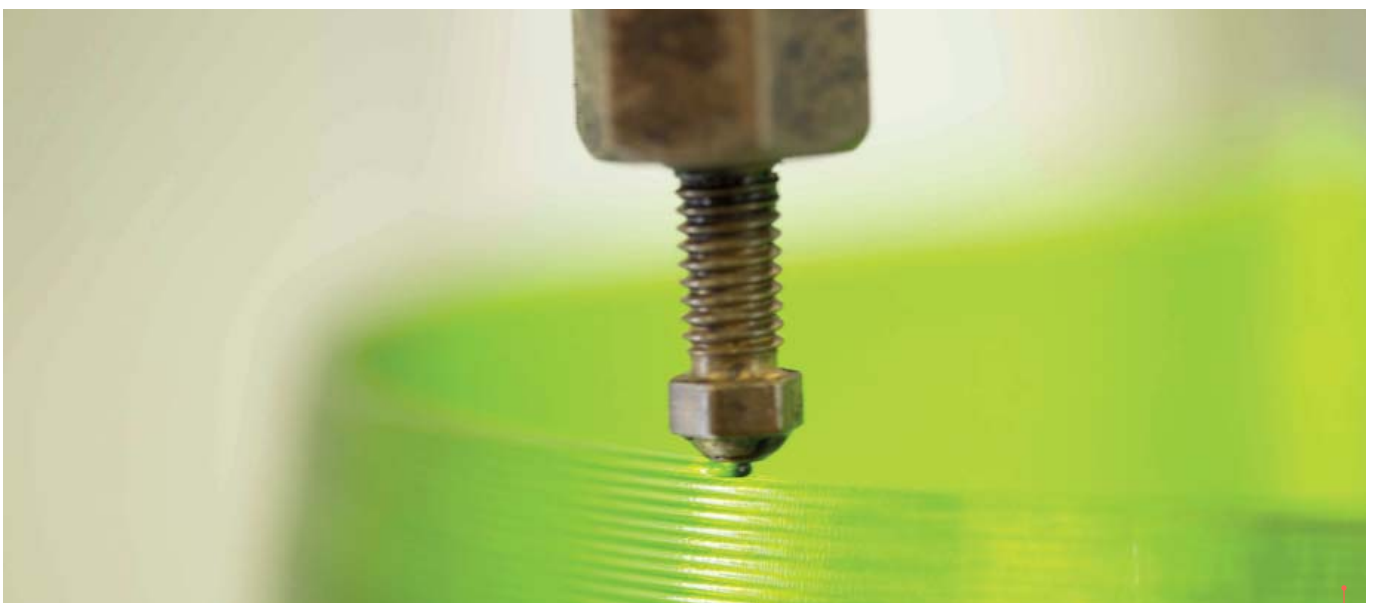
3D printing is a powerful tool that helps us to design and manufacture custom products for every client. The fittings are designed to be modular and parts for 3D-printed light fittings are less numerous, less complex, single material, and lighter in weight. By varying materials, shapes, appearance, transparency and texture, our designers offer a virtually unlimited variety of models. Modularity makes it possible to change the apparent design of a product during its lifecycle in response to new needs expressed by clients. Instead of replacing the entire fitting, modules can be swapped or added, helping to protect value and avoid waste. Close examination of lifecycles shows that a 3D-printed light fitting has an environmental footprint up to 70% lower in terms of materials, manufacture and logistics than its conventional equivalent.

This additive manufacturing method is flexible and sustainable, allowing us to manufacture on demand and close to where our clients are located, further reducing the carbon footprint of our transport operations. We also use a fully recyclable polycarbonate to minimize resource wastage. Almost every part of 3D-printed light fittings that we recover at the end of their lives are then recycled. It is even possible to print from materials such as discarded CDs that all too often end up in landfill.

3D light fittings can be made on demand to suit the tastes and preferences of each client, and delivered very rapidly, without in any way compromising performance or durability. We now have five 3D production facilities in operation around the world and an ever-larger portion of our ranges are 3D printed.



Lifecycle analysis using the ReCiPe method based on the ISO 14040-44 standard - ©Signify



3D printing of a light fitting - ©Signify



3D-printed light fitting made from recycled CDs - ©Signify

SERVICE IS CENTRAL TO VALUE IN USE

Having products that last longer and use less electricity is the first step, but to go all the way requires a commitment over the long term and the ability to provide warranted performance in use at all stages of the product lifecycle.

In-use performance and durability are more important than the actual fittings. Ultimately, our product is light itself. As the Dutch architect Thomas Rau said, “I’m interested in buying light not lamps.” Specifically, switching from supplying a product to performing a contracted service means this change of paradigm also shifts where the risks lie. The designer and manufacturer of a system are best-placed to anticipate how it will work, minimizing failures and optimizing long-term performance. It is natural that they assume risks relating to the use of their product and those relating to potential impacts on their client’s operations.

This has led Signify to pivot to a new way of thinking about its offering: we now offer a circular lighting service where clients no longer buy lights but a lighting service for their premises, delivering warranted long-term performance in terms of lux output, electricity use, availability, etc. Rather than becoming the owner of a lighting system, clients simply pay for the amount of light that they use.

Our innovations thus extend to include the business model. Our Light-as-a-Service (LaaS) offer covers the design, financing, installation and maintenance of lighting in a single contract. We deal with the lighting, leaving our clients completely free to concentrate on running their business.

At the end of a LaaS contract, the equipment can be returned to Signify. In this case, we are responsible for recovering value from end-of-contract products, primarily via reuse or recycling. Having originally designed the product and monitored its actual use throughout its in-service life, we have all the data we need to choose the best scenario for each product.

THE COVID-19 AND FINANCIAL CRISIS: DRIVING THE PACE OF TRANSITION

The transition toward this service-led model is occurring fairly rapidly as it has been shown to create value for all parties. In the case of renovation of an existing & conventional lighting system, the energy savings are always massive and often cover the entire cost of the lighting service. This delivers instant cost reductions with no upfront investment.

In order to deal with the current situation brought about by Covid-19, our clients need to optimize their expenses and ringfence their investment capacities. Lighting for buildings is a major cost to control, with significant potential for optimization if existing installations are out of date. In practice, around 80% of lighting needs renovation.

By offering a financing mechanism, LaaS makes it possible to renovate lighting without any investment and often leads to immediate reductions in running costs. This makes it a solution of particular interest in the current financial situation.

We estimate that for services contracts like LaaS in 2020, over 40 % of industrial lighting projects were financed via energy savings without any need for clients to make a front-end investment. And this is just the beginning.

WORKING WITH THE SUPPORT OF AN ECOSYSTEM OF PARTNERS

Maximizing value involves minimizing risk. It is important to master all the skills involved in a turnkey lighting service designed for the long term, requiring specific know-how for:

- plan lighting design that meet the client's needs;
- installing the lighting system;
- creating a financing plan tailored to each client's profile;
- supervising the lighting system;
- operational maintenance;
- coordinating these functions.

Every client has a different environment, meaning that to be effective it is important to work with complementary partners and foster long-lasting synergies. This allows each partner to focus on their own added value, thereby minimizing costs and risks over time.

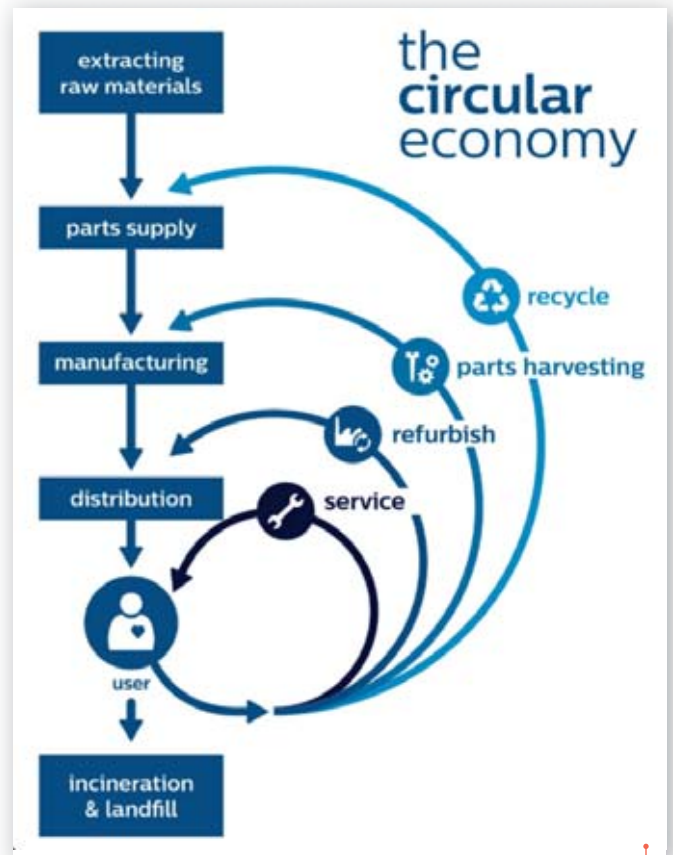
LESSONS & CONCLUSIONS

The transition to a circular economy must create value for our clients, partners and ourselves if it is to be genuinely sustainable in the long term. Our circular transition focus on a simple principle: minimizing the destruction of value at every stage.

Looking carefully at the butterfly diagram produced by the Ellen MacArthur Foundation, we note that the shorter the loop the greater the value retained. Keeping a light fitting operational for longer consumes less resources and energy than dismantling and reconditioning, and even less than partial recycling of the raw materials. In fact, recycling a light fitting destroys most of the value. The value of the raw material recovered via recycling represents just a few percent of the total value. Circular services are designed to extend lifespans, which means that it is in all parties' interests to use efficient products whose quality optimizes the efficiency and lifespan of a lighting installation.

This is a total change of paradigm from the linear transactional model. Cost and in-service performance become keystones of the client relationship. Uses may alter over the service life of the system, performance requirements too, but the service simply adapts.

The key to the sustainability of this business model is a commitment to the long term.



Circular economy (graphic from the Ellen McArthur Foundation) - ©Signify

This is why circular products, modular and upgradeable, make perfect sense. Items such as occupancy sensors can be used for other functions besides turning lights on and off to save energy: when connected, they provide a real-time record of how each space is used. This in turn identifies spaces that are under-used and are, as such, major sources of potential operational optimization. Transitioning to a service-led model opens the doors to new value streams that were undreamed of at the start. They are identified through client insights resulting from long-term service-led relationships.

This transition to a service-led model is similarly beneficial for the stability and long-term prospects of the provider, as it is able to better anticipate changing needs in its market.

Innovation is part of who we are. Our teams love to express their creativity and to experiment, to iterate and improve, and this is the approach that has allowed Signify to lead the lighting industry for over a century. The key to this transition lies in our capacity to innovate, not just in terms of products but also in relation to what our clients need and in the development of new circular business models.

LEADING A CORPORATE ECOLOGICAL TRANSITION

Eric Rampelberg

Vice-President of Interface, Inc. for Southern Europe,
India and South-East Asia



© Interface

Eric Rampelberg studied economics and management and holds an MBA from EM Lyon Business School. He has over 20 years of experience in business development, international trade and sustainable industry.

Eric Rampelberg joined Interface in 2018. He is in charge of defining and rolling out the company's growth strategy in France, Southern Europe, India and South-East Asia. His role includes creating development plans for legacy products such as carpet tiles while launching new flexible floorings like LVT (Luxury Vinyl Tile), rubber floorings, and other products currently in the pipeline. He also leads the Mission Zero corporate project, shares Interface's experience and results as part of the previous Interface's mission to achieve carbon neutrality by 2020 and promotes Climate Take Back, Interface's new mission to help reverse global warming.

Interface was founded by Ray Anderson in 1973 and specializes in manufacturing carpet tiles for commercial clients, a sector where it is world leader with 2019 revenue of 1.2 billion dollars. The company became aware of the scale of its environmental impacts, and of the fact that it is part of the problem, as early as 1994. At the time, Ray Anderson instigated a top-to-bottom review with the company's various stakeholders to transform the company mission and focus on transitioning to a more sustainable approach. In 1996, the company adopted Mission Zero, a new corporate project targeting the year 2020: the goal was to move to zero environmental impact by 2020. A new and even more ambitious roadmap, called Climate Take Back, has been put in place for the period up to 2040.

In terms of circularity, a range of targets and actions have progressively emerged: incorporation of recycled and bio-sourced materials when designing products, and development of products with designed-in sustainability that are longer-lasting and easier to reuse. In addition to actions in the product design sphere, the company's circular strategy also covers its business models, with the development of service-led solutions such as reuse and a function-led model based on usage rather than product-led solutions based on volumes.

Interface has the reputation of being one of the pioneers of the ecological and circular transition. Can you talk us through the key stages of this transition?

Eric Rampelberg: In 1996, when the company adopted its new Mission Zero strategy, the question we asked ourselves was "where do we start when trying to tackle this?" We began by analyzing the life cycles of our carpet tiles to identify where our environmental impacts were.

This process led us to rethink how our products were designed (Does carpet really have to be glued down? Can we change materials to reduce the impacts?), but also the manufacturing, logistics chain and end-of-life processes (How can we give our products a second life? How can they be recycled?). When you have an eco-design mindset, you have to consider the total lifecycle all the way to the end: you must be able to dismantle the product, sort it and recover the material. For example, we created self-grip pads to replace the use of adhesives, so that carpet tiles could be easily removed for reuse or recycling.

We then included a series of quantified commitments as part of the Mission Zero roadmap, designed to combine innovation with our mission (to reduce environmental impacts). We painstakingly worked to reduce our environmental footprint at every stage in the lifecycle, not just within the company but also with our suppliers and those responsible for end-of-life management. Over 25 years,

this has allowed us to cut the amount of waste we produce, our water use and CO₂ emissions by 90% or more.

Our business model centers on occupying a premium position selling high quality products. The products we sell are long-lasting, good to look at and innovative, backed by quality services and respect for the environment. Everything is linked. The environment is not our customers' number one criterion when making their choice, but it is becoming an increasingly important factor, especially in France, as people become more and more aware of the climate emergency.

What is your strategy for the circular economy?

ER: Many of our stakeholders think the circular economy is simply a question of recycling. This is far from the truth. We've established a ranking of the most environmentally friendly circular solutions. If you mean what you say about environmental impact then you have to make certain that your products will last. Our carpet tiles are designed to last at least 15 years, and they can last twice as long. But customers change their carpets on average every seven years. Our carpets can be repaired and reused. From a circular standpoint, the best strategy is to reuse them locally. Other local customers may want to reuse them. We are trying to develop this strategy because the modular and removable design of our carpet tiles makes it a deliverable solution. The trickiest aspect of reuse is to get the entire industry in alignment so that flows can be managed. We will be able to recover our products now that an extended producer responsibility system operates in France's construction sector.

We are also training our customers to make sure they look after their carpet correctly, as this is one of the factors that ensure their durability. If a product is damaged, we will take it back and recycle it. It is returned to our factory. This is one of our commitments. We try to do everything possible to prevent any of our products going to a landfill site.

What do you hope to do to take this circularity approach to another level?

ER: You need to think about product and process innovations as a whole if you are interested in the circular economy. In terms of product innovation, our top priority is randomized design inspired by biomimetics. This is not simply a matter of aesthetics; it is also designed to minimize environmental impacts, since the patterns can be laid in any direction. Which is a tremendous advantage in terms of reuse because a damaged tile can be replaced by any other tile without having to swap out the entire carpet, as happens in hotels, for example, where most of the carpet used comes in rolls. In this case, as soon as a fault appears, a stain for example, then the entire carpet is changed.

Synthetic fibers account for 69% of our carbon footprint. We are working to introduce bio-sourced materials, as they have a far lower impact and also help to capture carbon. They will be coming on sale next year. The challenge this



© Interface

innovation poses lies in improving our sourcing to reduce the environmental impacts. The idea is to increase the possibilities for them to be reused. We are also working on adding recycled material sourced from shredding our carpets to the backing layer, with the aim of closing the loop.

These product innovations make the production process more complex as they are far more difficult to master. For our new-generation products, we will be moving from using weaving machine technologies to fusion-extrusion production lines. This is a radical change.

We are also on the point of shifting from a transaction-based approach, where we sell products in terms of square meterage, to a use-based approach where we sell a service, a function-led model. Reuse really comes into its own with a function-led model in B2B. This involves a totally different business model because we have to pivot to a new position where we operate lease or management systems for our products. We need to train our staff, particularly our sales people, so they can adapt to the change of model. And we need to change our management and incentive systems as well as the entire value chain (logistics, maintenance and site work). You have to prepare at least three years in advance to be able to put all these changes in place and adjust to the shift from a transactional model to a model based on recurring revenue.

What are your projects and goals for the future?

ER: We have set out a new roadmap for 2040, called Climate Take Back. Its goal is to play a regenerative role and help improve the state of the planet. Doing this requires a networked approach to developing innovations. An example of this is carpets that capture carbon, part of a new approach we're calling Love Carbon. For example, we pinpointed the fact that the nylon 6 we use to make our carpets is the same material used to make fishing nets. And fishing nets drifting in the oceans are a major source of pollution. We have set up a partnership with local nonprofits in Africa and the Philippines to recover old fishing nets that we then reuse completely. We have recovered 250 metric tons so far, but we hope this is just the start.

Our goal is very much to take our regenerative strategy, recently honored with a 2020 UN Global Climate Action Award, to new levels.