



European  
Commission

# CIRCULAR ECONOMY RESEARCH AND INNOVATION

Connecting  
economic &  
environmental  
gains



*Research and  
Innovation*

## CIRCULAR ECONOMY RESEARCH AND INNOVATION - Connecting economic & environmental gains

European Commission  
Directorate-General for Research and Innovation  
Directorate A – Policy Development and Coordination  
Unit A1 - Communication

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## FOREWORD



*Jyrki Katainen*



*Carlos Moedas*

As citizens across the globe aspire towards a better standard of living, competition for resources is growing rapidly, with subsequent immense and unsustainable pressure on our natural environment. Major organisations across the world are reacting to this pressure. The UN has implemented Sustainable Development Goals (SDGs) and the Paris Agreement on Climate Change, which every Member State in the EU has fully committed to and must now fulfil.

This is a priority for Europe. For this reason the European Commission adopted an ambitious Circular Economy package covering the whole cycle: production, consumption, waste management and secondary raw materials.

The Circular Economy has high economic potential; it is a driver for a modernised economy with high environmental relevance while contributing to the SDGs. This policy ambition needs to be underpinned by a strong research and innovation (R&I)

support to make sure we have the right solutions to transform its potential into reality and become global leaders in technological, regulatory, social and business-model innovation. To achieve a circular economy, we need incremental and ground-breaking innovations.

For this reason, nearly 1 billion from Horizon 2020's final Work Programme (2018-2020) will be invested into research, innovation and financing of projects and initiatives that will support our circular economy ambitions.

With this R&I funding, we will ensure the development of new business models and innovative solutions. We will link different industrial sectors to enable industrial symbiosis with the support of public bodies. We will encourage enabling regulatory frameworks and mobilise additional public and private investment. We will engage civil society and citizens with the new reality of a circular economy.

The transformation from a linear to a circular economy is ambitious, that we know. But together, we can make the circular economy a reality for a better world for all.

**Jyrki Katainen,**  
*European Vice-President for Jobs,  
Growth, Investment and Competitiveness*

**Carlos Moedas,**  
*Commissioner for Research, Science and Innovation*

# INTRODUCTION

## FROM VISION TO REALITY

**T**he circular economy makes both environmental and business sense. In the circular economy, growth no longer requires an increasing extraction and consumption of resources, energy, water and primary raw materials. There is less waste, and products and resources maintain their value in the economy for as long as possible.

The European Commission's ambitious Circular Economy package<sup>1</sup> is supported by initiatives such as the EU Raw Materials Initiative<sup>2</sup>, the upcoming Plastic Strategy, sustainable consumption and production<sup>3</sup> and initiatives to develop a non-toxic environment.

The circular economy needs more than traditional R&D or a piecemeal approach to technologies: it needs changes in entire systems and joint efforts by researchers, technology centres, industry and SMEs, the primary sector, entrepreneurs, users, governments and civil society. It needs enabling regulatory frameworks, and additional public and private investments.

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1) *Closing the loop - An EU action plan for the Circular Economy, COM(2015)614 final*

2) <http://ec.europa.eu/environment/circular-economy/>

3) <http://ec.europa.eu/environment/green-growth/>

The circular economy also needs support through the right regulatory framework: the new Innovation Deals will provide legal clarification and certainty in areas relevant to the circular economy. The European Commission is also working with the European Investment Bank (EIB) and businesses to promote the business logic of the circular economy and attract investors to circular economy projects.

Besides broad innovation efforts and regulatory initiatives, fundamental research is crucial in order to address the complex transition to a circular economy, which will be supported through the European Research Council (ERC).

Europe is still in a strong position when it comes to innovation in the circular economy. But we need new business models, changes in entire systems and new technologies. And we need industry and SMEs to adopt innovative solutions. We need to link different industrial sectors and public bodies to enable industrial symbiosis. And we need society and consumers to engage with these ideas.

EU R&I funding for a circular economy will be open to partners from across the world – not just in EU Member States – to ensure that the EU can develop sustainable businesses, which is one of the UN's SDGs.

Our mission is to support Europe in developing an economy that minimises waste and pollution and uses its resources efficiently to enable technologies, including digitisation, cross-sectorial efforts, systemic innovation and demonstrators targeting high-technology readiness levels.

And we need effective policy.

This booklet showcases how several different areas of R&I policy are already supporting the transition to a circular economy through projects with a high impact on our daily lives and on the overall health and well-being of the environment.

# FROM VISION ... TO REALITY

Europe's prosperity depends on resource availability. Moving to a more circular economic model would secure Europe's access to high-quality and affordable raw materials, boosting competitiveness.

**17%-24%** reduction in material inputs by 2030 – if the EU improves resource efficiency along product value chains

**3.9%** – boost for EU GDP if significant material cost-saving opportunities are realised from circular economy approaches

**€600 billion** – potential annual net savings per year for European industry through waste prevention, ecodesign, reuse and similar measures

**2-4%** – reduction in total annual greenhouse gas emissions due to circular economy measures

## SOME TARGETS

boost reuse and recycling of municipal waste to a minimum **65%** by 2030

increase the recycling rate for packaging waste to **75%** by 2030

**a binding landfill** reduction target of 10% by 2030 promote further development of markets for high-quality secondary raw materials

**promote** further development of markets for high-quality secondary raw materials

### Current actions include:

**€650 million** under Horizon 2020 and **€5.5 billion** under the Structural Funds

actions to cut **food waste** in half by 2030 to meet the global Sustainable Development Goal

quality standards for **secondary raw materials** to increase business confidence

**measures to promote** reparability, durability and recyclability of products, along with energy efficiency

rules to boost use of **organic and waste-based fertilisers** and support the role of bio-nutrients

a strategy on **plastics to** address issues of recyclability, biodegradability, hazardous substances, and the Sustainable Development Goals to significantly reduce marine litter

a series of actions on **waste water reuse**

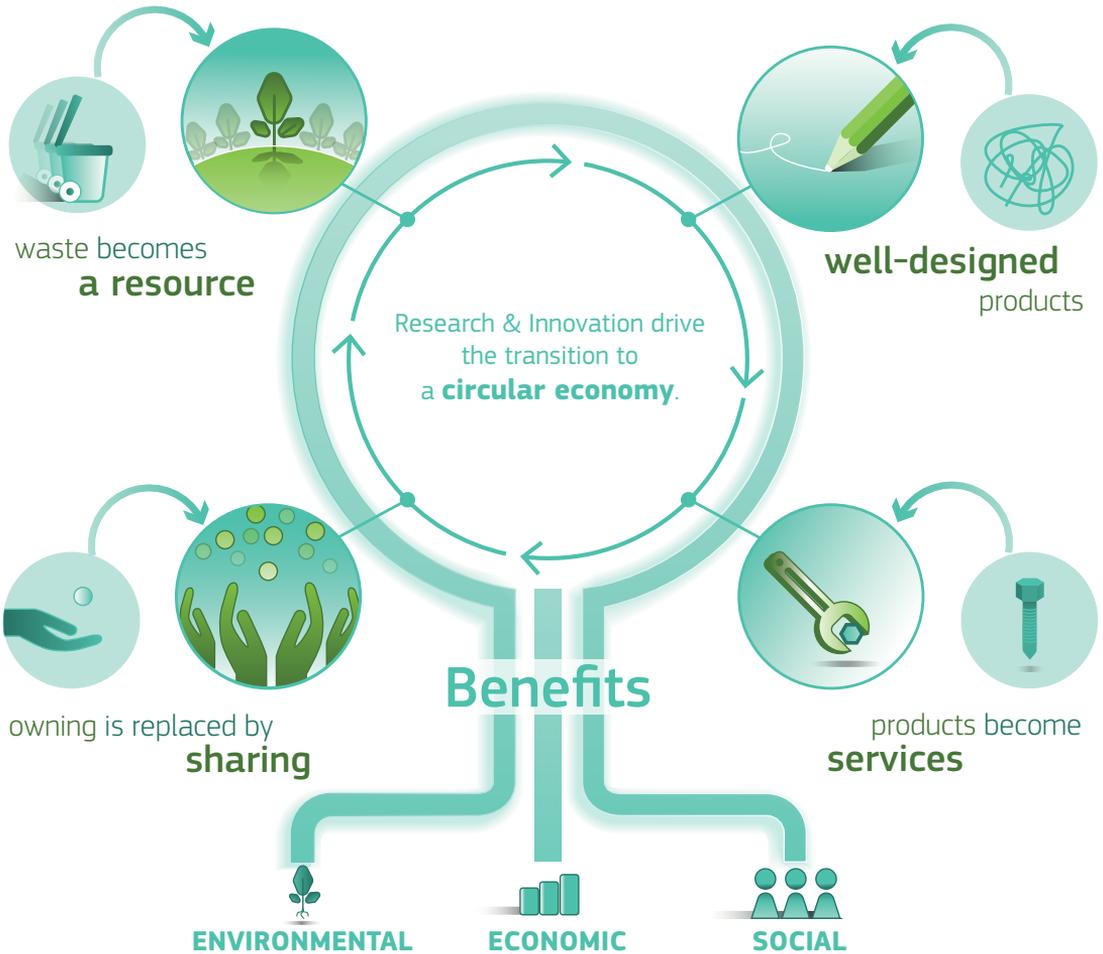
# PRACTICAL SOLUTIONS

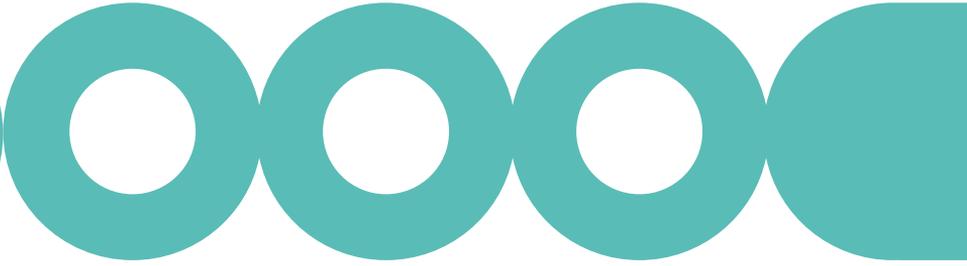


use resources more efficiently



reduce waste





Catalysis is a key means of making the world's economies more sustainable. Many current industries are based on a model of consuming raw materials then discarding waste and old or broken products. Production processes often rely on toxic input and fossil fuels, adding to this pollution.

Catalysis uses chemicals – catalysts to speed up a chemical reaction. With appropriate inputs, this process can break down waste into clean components quickly, regenerate used materials or provide new, non-polluting chemicals for agriculture and industry.

The progressive substitution and reuse of products derived from fossil fuels at all steps along the industrial value chain plays a crucial role in successfully decarbonising industrial processes.

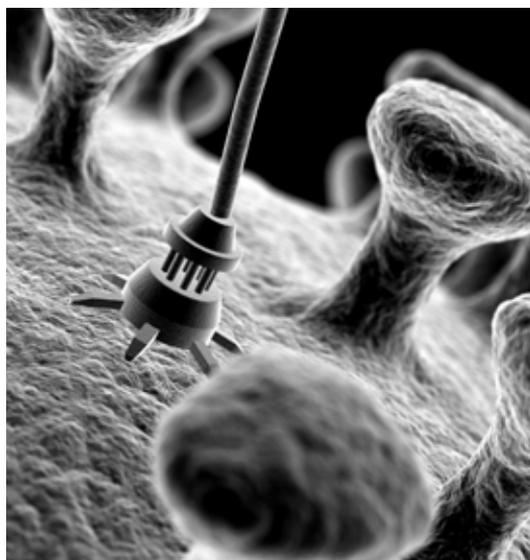
For example, catalytic technology can make it possible to recycle plastic waste or help it biodegrade quickly. Catalysis can also convert waste CO<sub>2</sub> into chemicals for industry or new fuels, and help generate low-carbon energy from renewables.

Many of the reactions that turn CO<sub>2</sub> and other waste products into valuable building blocks are still at the dream stage. Future research activities will help make the circular economy an industrial reality, and will help decarbonise industry. By making processes more efficient and sustainable, R&I will also boost European competitiveness.

To implement this vision, the European Commission has developed a catalysis roadmap. Based on inputs from across Europe – including from national governments, academia, industry and other organisations – the roadmap offers concrete proposals on how catalysis can help achieve a circular economy.

*“Catalysis is a key means of making the world's economies more sustainable... Future research will help make the circular economy an industrial reality, and help decarbonise industry.”*

# CATALYSIS TO ELIMINATE POLLUTANTS AND TO CONVERT CARBON DIOXIDE



## LIMPID

The Limpid project developed innovative materials that harness the Sun's power to clean up air and water. These safe and cost-effective materials could be especially useful in ridding treated wastewater of hard to remove and harmful toxins – such as pharmaceuticals and endocrine-disrupting chemicals – to make our environment cleaner and safer.

**WEB:** [www.limpid-fp7.eu](http://www.limpid-fp7.eu)

**COORDINATOR:** Consiglio Nazionale Delle Recherche

**TOTAL COST:** EUR 5 120 223

**EC CONTRIBUTION:** EUR 3 299 469

**START/END:** January 2012 to November 2015

**OTHER COUNTRIES:** Italy, Spain, Germany, Switzerland, Malaysia, Thailand, Canada, United Kingdom



## Eco<sup>2</sup>CO<sub>2</sub>

The Eco<sup>2</sup>CO<sub>2</sub> project has developed a low-cost method to turn carbon dioxide into fine chemicals for products such as perfume or flavourings. This process avoids expensive noble metals or precious materials and the need for continuous inputs. Instead, it mimics photosynthesis, adding sunlight and water to a plant-waste-based reactor for long-lasting, green, low-emission, chemicals production.

**WEB:** [www.eco2co2.org](http://www.eco2co2.org)

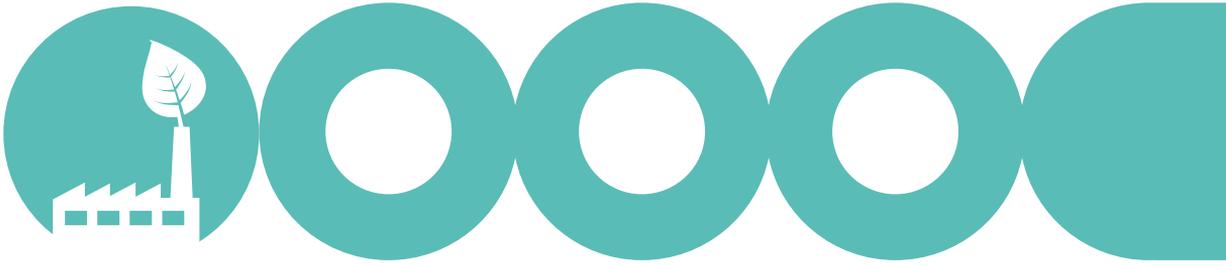
**COORDINATOR:** Politecnico di Torino

**TOTAL COST:** EUR 4 711 872

**EC CONTRIBUTION:** EUR 3 424 438

**START/END:** December 2012 to May 2016

**OTHER COUNTRIES:** Italy, Netherlands, Belgium, Spain, Switzerland



Industrial biotechnology uses enzymes and micro-organisms to improve industrial processes and create products while generating little or no waste. Applications cover many sectors, from chemicals to food and feed, and from healthcare to detergents, paper, textiles and energy. Also known as ‘white’ biotechnology, it enables a circular economy by transforming renewable raw materials such as agricultural products, CO<sub>2</sub> and organic waste and effluents into useful – often novel – value-added goods.

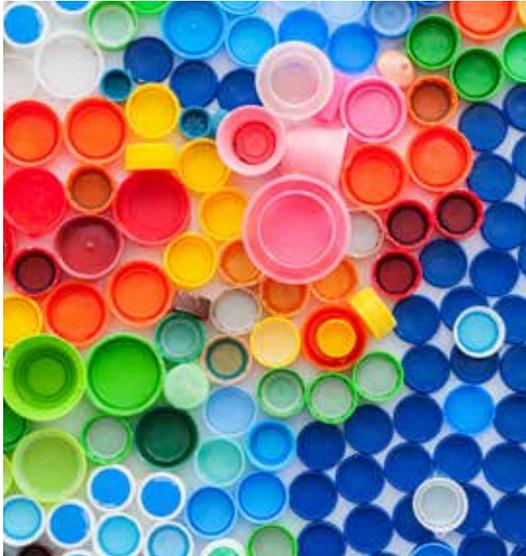
One result of industrial biotechnology is a lower-carbon atmosphere. Just as plants capture CO<sub>2</sub> from the atmosphere, which is then fixed in the final products made from them, industrial biotechnology enables recycling of carbon at the end of a product’s life by creating products based on renewable resources.

Other white biotechnology processes eliminate pollutants or avoid waste. For example, it is possible to biodegrade plastics using micro-organisms to produce high-value added compounds. And industrial biotechnology can make it possible to bake bread in less time than traditional methods or use less energy to wash laundry or make textiles, saving on resources.

Looking further ahead, industrial enzymes could create new, high-value industries in a sector that is growing fast. The latest research is exploring bacteria-based power, green insulating fluids for electrical equipment and self-repairing concrete. Through EU investment in innovation, European companies are ready to exploit white biotechnology’s potential for growth.

*“It enables a circular economy by transforming renewable raw materials such as agricultural products, CO<sub>2</sub> and organic waste and effluents into useful – often novel – value-added goods.”*

# INDUSTRIAL BIOTECHNOLOGY



## P4SB

The P4SB project uses synthetic biology to make plastic-eating bacteria. Other bacteria then process the resulting chemicals to produce ingredients for bio-based plastic. This added value for plastic waste aims to increase plastic recycling and strengthen Europe's recycling industry, through new revenue streams for waste-processing firms and demand for green plastic from innovative businesses.

**WEB:** [www.p4sb.eu](http://www.p4sb.eu)

**COORDINATOR:** Rheinisch-Westfaelische Technische Hochschule Aachen

**TOTAL COST:** EUR 7 056 968

**EC CONTRIBUTION:** EUR 7 056 968

**START/END:** April 2015 to March 2019

**OTHER COUNTRIES:** Germany, Spain, Ireland, United Kingdom, France



## BHIVE

Plant fibres could one day produce renewable materials using enzymes and proteins from the BHIVE project. The project identifies products from micro-organisms that are active on the fibres and process materials such as cellulose within the plant. Its products could boost the biochemical and bioplastics markets, particularly for packaging, while providing high-value opportunities to the forestry and agricultural sectors from plant-based waste.

**HOST ORGANISATION:** Aalto-Korkeakoulusaatio

**TOTAL COST:** EUR 1 977 781

**EC CONTRIBUTION:** EUR 1 977 781

**START/END:** September 2015 to August 2020

**OTHER COUNTRIES:** Finland



Europe can lead the way in developing an economy that produces no waste and no pollution and uses resources more efficiently. In collaboration with the European process industry, the SPIRE cPPP (contractual public-private partnership) is a key player in the transition towards a circular economy.

Typical energy-intensive industries include the cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, steel and water sectors. All of these require large amounts of heat and power to drive reactions and heavy machines. And although many European process industries are already world leaders, growing competition from emerging countries is a constant driver of innovation for leaner and low-waste production.

For example, new energy-saving processes, process intensification, sustainable water management, cogeneration of heat and power, and the introduction

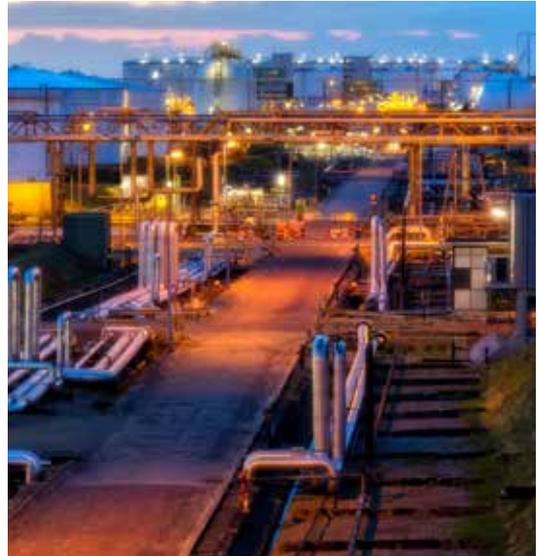
of renewable energy sources can all reduce reliance on fossil fuels. Technology to increase yields from non-renewable primary raw materials, along with processes that switch to secondary or renewable raw materials, make better/optimal/more efficient use of scarce resources.

*“Technology to increase yields from non-renewable primary raw materials, along with processes that switch to secondary or renewable raw materials make fuller use of scarce resources.”*

This makes sense both from a business as well as societal and environmental perspectives. Benefits include: increased resource efficiency leading to increased global competitiveness, decoupling of economic growth (and jobs) from resource consumption, better security of supplies as less resources have to be extracted and less waste produced. At the same time,

it is a crucial step in the process to reach the COP21 objectives.

# SUSTAINABLE PROCESS INDUSTRY (SPIRE PUBLIC-PRIVATE PARTNERSHIP)



## SHAREBOX

When manufacturing companies share resources, such as plant, energy, water or residues, they can reduce inefficiencies and waste. The SHAREBOX project is developing IT tools that plant managers can use to identify synergies in a network of different processing industries. Businesses then manage resources together to produce greener products and services.

**WEB:** [sharebox-project.eu](http://sharebox-project.eu)

**COORDINATOR:** Innovacio i Recerca Industrial i Sostenible SL (IRIS)

**TOTAL COST:** EUR 5910047

**EC CONTRIBUTION:** EUR 5416544

**START/END:** September 2015 to August 2019

**OTHER COUNTRIES:** Spain, United Kingdom, Netherlands, Switzerland, Germany, Turkey

## MefCO2

The MefCO<sub>2</sub> project is making methanol from captured CO<sub>2</sub> using surplus electricity. Traditionally produced from natural gas, methanol is one of the most widely used chemicals in industry. The innovative method captures and processes waste CO<sub>2</sub> and energy. It puts both to good use while preventing new emissions from methanol production, for a cleaner climate.

**WEB:** [www.mefco2.eu](http://www.mefco2.eu)

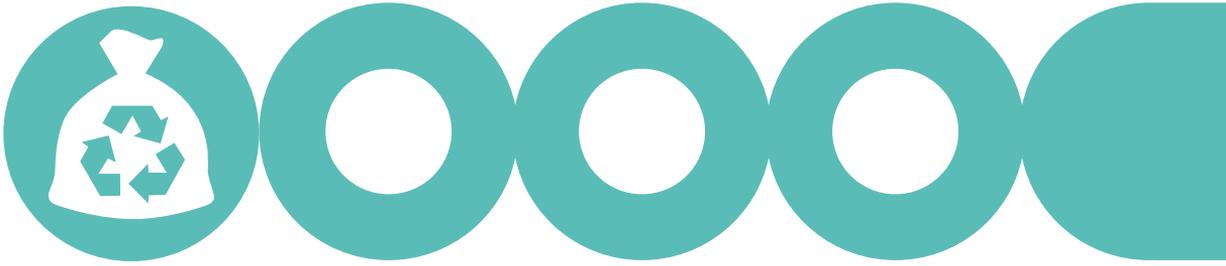
**COORDINATOR:** I-Deals Innovation & Technology Venturing Services SL

**TOTAL COST:** EUR 11041537

**EC CONTRIBUTION:** EUR 8622292

**START/END:** December 2014 to November 2018

**OTHER COUNTRIES:** Spain, Slovenia, Germany, United Kingdom, Iceland, Italy, Belgium



Turning unwanted materials and products that have reached the end of their life into a new resource is a central part of a circular economy. To make all these happen, we must reinforce circular-economy-related R&I at the European scale in order to demonstrate the economic and environment feasibility of these models and measures.

In a circular economy, R&I for re-manufacturing, reusing and recycling can make fundamental steps towards waste minimisation and efficient and sustainable use of resources; one industry's waste would become another's raw material.

European legislation has also been a driver of government and industry action to improve waste management, stimulate innovation, limit the use of landfilling, and create incentives to change consumer behaviour. The European Commission has recently made proposals to revise EU legislation on waste to set clear targets for recycling and establish an ambitious and credible long-term path for waste management in the European Union.

Key elements of the proposal include EU-wide targets to recycle 65% of municipal waste and 75% of packaging waste and reduce landfill to no more than 10% of municipal waste, all by 2030.

It also recommends a landfilling ban for separately collected waste, economic instruments to discourage landfilling and simpler definitions and harmonised calculation methods for recycling rates.

But a comprehensive and ambitious revision of EU waste legislation and technologies alone is not enough. The circular economy requires R&I for new economic and business models

and measures, such as the promotion of reuse and industrial symbiosis, setting up economic incentives to bring greener products to market, and financial rewards for companies that support reuse, recovery and recycling schemes.

*“In a circular economy, it would be routine to re-manufacture, reuse and recycle; one industry's waste would become another's raw material.”*

# WASTE AND RESOURCE MANAGEMENT



## ProSUM

Data on sources of secondary raw materials, which manufacturers could use as a complement to primary raw materials, is fragmented across Europe. The ProSUM project is developing an urban mine and mining waste secondary raw materials inventory that will make these resources easier to locate.

**WEB:** [www.prosumproject.eu](http://www.prosumproject.eu)

**COORDINATOR:** Waste of Electrical and Electronical Equipment Forum AISBL

**TOTAL COST:** EUR 3 704 327

**EC CONTRIBUTION:** EUR 3 051 577

**START/END:** January 2015 to December 2017

**OTHER COUNTRIES:** Belgium, France, United Kingdom, Netherlands, Czech Republic, Sweden, Switzerland, Slovenia, Denmark, Germany, Japan



## BAMB

BAMB will help reduce construction and demolition waste and cut the consumption of primary resources by developing tools to increase the value of materials used in buildings. Through the use of 'materials passports' and reversible building design, buildings will function as banks of valuable materials. The tools will be supported by new business models, policy propositions and management and decision-making models. Six pilots will demonstrate innovative concepts across Europe.

**WEB:** [www.bamb2020.eu](http://www.bamb2020.eu)

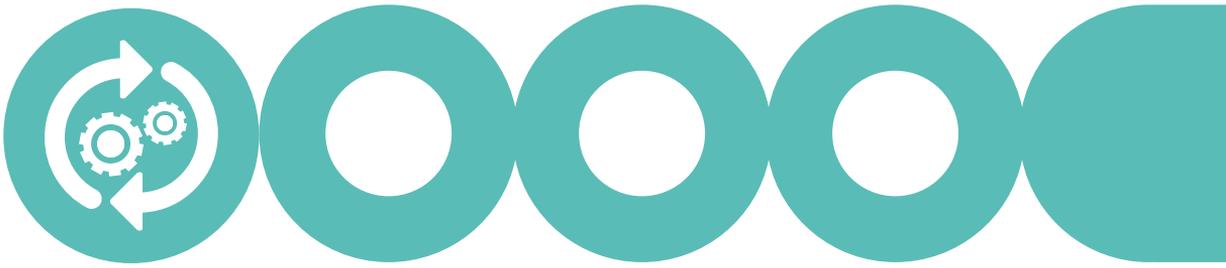
**COORDINATOR:** Institut Bruxellois pour la Gestion de l'Environnement

**TOTAL COST:** EUR 9 950 389

**EC CONTRIBUTION:** EUR 8 858 766

**START/END:** September 2015 to February 2019

**OTHER COUNTRIES:** Belgium, Bulgaria, Bosnia and Herzegovina, Germany, Netherlands, Portugal, Sweden, United Kingdom



**S**ustainable product management is at the core of a circular economy. Closed-loop manufacturing reincorporates waste or old products into new production through reuse, repair and recycling. This efficient strategy both minimises waste and pollution and benefits business. It enables companies to extract maximum value from products, raw materials and resources – protecting against resource scarcity and price volatility – and creates new business opportunities.

A truly circular economy has to focus on retaining end-of-life products or components and putting them back into the value chain. R&I are needed to redesign the value chains to close material and resource loops. End-of-pipe technologies are not enough.

Today, recycling to recover materials is the most common strategy for closing the loop. Although this reduces landfills and provides a source of valuable

raw materials, it is not sufficient to achieve a circular economy where the value of products, materials and resources is maintained in the economy for as long as possible. Material losses are significant even at high recycling rates. In addition, effort and energy are required to sort, separate, re-melt and reprocess the recycled materials. And since up to 85% of the manufacturing value of a product is associated with labour, energy and equipment, this significant intangible value is lost in the process.

For an overview of European Commission proposals on how closed-loop manufacturing can drive a sustainable, low-carbon, resource-efficient, competitive economy, see Closing the loop – An EU action plan for the circular economy.

*“This efficient strategy both minimises waste and pollution and benefits business. It enables companies to extract maximum value from products, raw materials and resources.”*

# CLOSED-LOOP MANUFACTURING SYSTEMS



## RESYNTEX

RESYNTEX uses an innovative recycling approach to design a complete value chain for textiles. From waste collection through to the generation of new feedstock for chemicals and textiles, the project identifies ways to recycle unwanted textiles. This reduces the industry's environmental impact and promotes wider acceptance of products made from textile waste.

**WEB:** [www.resyntex.eu](http://www.resyntex.eu)

**COORDINATOR:** Soex Textil-Vermarktungsgesellschaft

**TOTAL COST:** EUR 11 432 356

**EC CONTRIBUTION:** EUR 8 787 749

**START/END:** June 2015 to November 2018

**OTHER COUNTRIES:** Germany, Slovenia, France, Austria, Belgium, Italy, Switzerland, Greece, United Kingdom

## ResCOM

The ResCoM project has developed an innovative framework to help industrial companies to design and implement closed-loop manufacturing systems. A life-cycle management software platform supports the framework. It analyses resource efficiency, CO<sub>2</sub> production and energy use, as well as business and regulatory metrics, to recommend production processes that are both profitable and green.

**WEB:** [www.rescoms.eu](http://www.rescoms.eu)

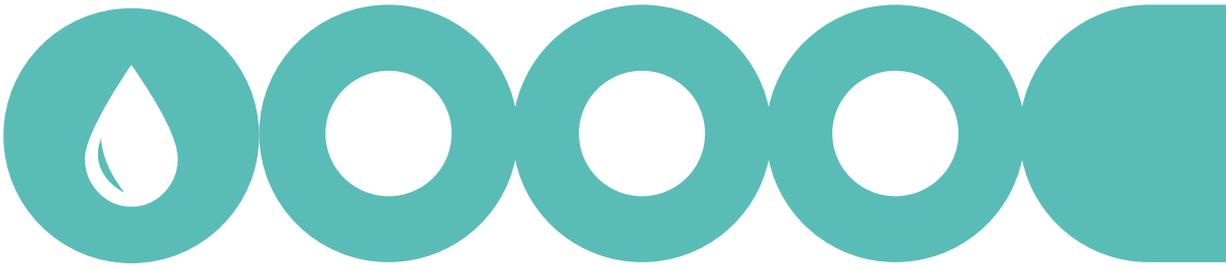
**COORDINATOR:** Kungliga Tekniska Högskolan

**TOTAL COST:** EUR 5 991 952

**EC CONTRIBUTION:** EUR 4 367 380

**START/END:** November 2013 to October 2017

**OTHER COUNTRIES:** Sweden, Germany, Netherlands, France, United Kingdom, Slovenia



**P**reserving water is not only about environmental protection, health and well-being; it is also about economic growth and prosperity. Primarily, it can ensure that all economic sectors have the water they need to create growth and jobs. But it is also a source of potential new business opportunities and can contribute to the circular economy.

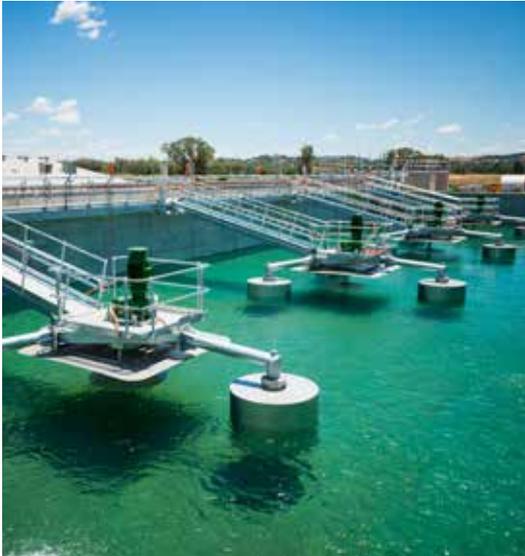
Water-management models and technologies are central for European society and economies. The water sector is very diverse. This leads to duplications in investment and gaps in delivery that can limit the sector's potential – for customers and the industry. Growth can arise from innovative technologies, more efficient business models, new water systems and services, reuse of reclaimed water and recovery of valuable resources from treated water.

At a fundamental level, improved water systems can ensure that everyone has continued access to this resource. Urbanisation, increased competition between various uses, economic sectors and extreme weather events are all putting pressure on water supplies. To protect and improve access to water, it is necessary to consider the whole water-use production chain by adopting circular economy solutions that enhance the economic, social and environmental performance of water systems.

*“It is necessary to consider the whole water-use production chain and identify solutions that enhance the economic and environmental performance of the system.”*

In its Circular Economy Action Plan, the European Commission identified a series of actions to enhance the role of water in a circular economy and facilitate water reuse. This includes the setting up of minimum quality requirements for water reuse, guidance on the integration of water reuse in water planning and management, and actions to promote water reuse in industrial activities (via relevant BREFs). R&I actions to ensure that enough good-quality water is available throughout the EU – for people, the economy and the environment, and to support further investments in water reuse – are also part of the Circular Economy Action Plan. All these actions shape a concrete and ambitious EU mandate implementing a circular water economy in Europe. R&I targets focus on new approaches and business models for industrial and urban water systems and services, making full use of digitalisation, improving water management and reuse in Europe and beyond, addressing water scarcity, ensuring high standards of health and environmental protection, and contributing to the SDGs.

# WATER IN THE CIRCULAR ECONOMY



## ECOWAMA

The ECOWAMA project has developed an innovative model for treating heavily contaminated wastewater from the metal and plastic surface-processing industry. It uses a combination of advanced technologies that also create some of their own energy. The model produces very pure water while recovering valuable metals and energy, benefiting the environment and business alike.

**WEB:** [www.ecowama.eu](http://www.ecowama.eu)

**COORDINATOR:** Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung

**TOTAL COST:** EUR 5 145 470

**EC CONTRIBUTION:** EUR 3 869 999

**START/END:** October 2012 to September 2016

**OTHER COUNTRIES:** Germany, Spain, Netherlands, France

## R3Water

The R3Water project is testing new technologies that could make water-treatment plants more efficient. These technologies would not only prevent pollution from entering the environment, but they could clean water for reuse, provide energy and recover valuable resources such as nutrients. Successful technologies could be added to existing plants to make them more profitable and use resources more wisely.

**WEB:** [r3water.eu](http://r3water.eu)

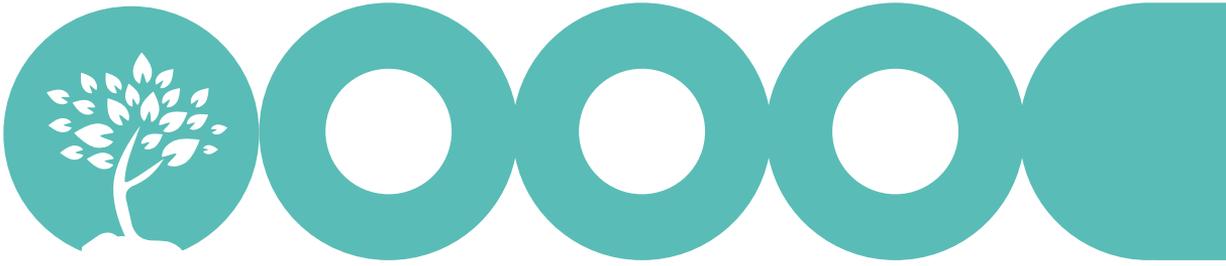
**COORDINATOR:** IVL Svenska Miljoeinstitutet

**TOTAL COST:** EUR 7 775 951

**EC CONTRIBUTION:** EUR 5 282 867

**START/END:** January 2014 to June 2017

**OTHER COUNTRIES:** Sweden, Finland, Spain, Germany, Belgium, United Kingdom, Norway



Europe is a global leader in developing the bioeconomy, focused on ensuring the sustainability of agriculture, strengthening food security and protecting natural resources and the environment.

A fully functioning bioeconomy is a key enabler of a competitive, circular and sustainable economy: it is Europe's response to the major environmental challenges the world is facing today.

In the coming decades, the world will face increased competition for limited and finite natural resources. World food demand is expected to increase by 70% by 2050 as the world's population grows to 9 billion, intensifying pressure on agriculture, land use and the environment. Although agriculture's share of total greenhouse gas emissions has declined to about 10% in the EU, globally the percentage is set to increase to 20% by 2030.

EU bioeconomy investments aim to reduce dependence on natural resources by transforming manufacturing. They also promote the sustainable production of renewable resources from land,

fisheries and aquaculture and their conversion into food, feed, fibre, bio-based products and bio-energy.

Bioeconomy projects will play a key role in achieving the Europe 2020 strategy and its Innovation Union and Resource Efficient Europe flagship initiatives.

EU funding will serve to strengthen the links between rural, coastal and urban resource flows, and foster more diverse farming models. Land and sea residues and other organic waste streams also have considerable potential. The bioeconomy aims to make efficient and smart use of them. Furthermore, it will tackle the major issue of food waste as part of efforts to promote the circular economy, where social innovation is particularly important in providing solutions.

At the heart of the European Commission's approach are three complementary lines of action: developing new technologies and processes; developing markets and competitiveness in sectors linked to the bioeconomy; and encouraging policymakers and stakeholders to work more closely together.

# THE CIRCULAR BIOECONOMY

*“A fully-functioning bioeconomy is a key enabler of a competitive, circular and sustainable economy: it is Europe's response to the major environmental challenges the world is facing today.”*

The Commission's newly established Bioeconomy Knowledge Centre will promote the development of a bioeconomy by acting as an interface between science and policy, making relevant knowledge accessible to all stakeholders and fostering their cooperation.

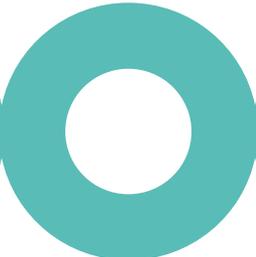
Like much of the circular economy, this targeted growth in Europe's bioeconomy has economic and strategic benefits. It is an important source of potential new jobs, especially at a local and region level and in rural and coastal areas. Possible new high-value industries include bio-fuels from waste products, innovative foods and bio-based products that can replace carbon-based equivalents.

These industries can also accelerate the EU's move to a more sustainable energy system while

strengthening Europe's industrial base and building a deeper and fairer internal market.

Under the Horizon 2020 Societal Challenge 2 and the Bio-based Industries Joint Undertaking (BBI-JU), European Commission contributions to bioeconomy initiatives have reached EUR 300 million.

In the Horizon 2020 Work Programme 2018-2020, the European Commission will continue to foster the transition towards a sustainable and circular bioeconomy with a dedicated financial contribution of EUR 100-160 million.



**DiscardLess**

The project is working to eliminate waste in European fisheries by exploring ways to avoid unwanted catches and to use unavoidable unwanted ones. It is providing knowledge, tools and technologies to eliminate discarding, while working with stakeholders such as fishermen to achieve this goal. These tools will become part of the project’s proposed Discard Mitigation Strategies, cost-effective ways to eliminate waste fish along the seafood supply chain.

Two proposed tools are already online. An online atlas is linking and mapping discard data from scientific monitoring of European fisheries by the European Commission and established fisheries management organisations. A catalogue of properties that can be modified for various fishing vessel components is accompanied by

factsheets describing equipment modifications tested in European fisheries to avoid unwanted bycatches.

DiscardLess will also assess the impacts of discarding on the marine environment, the economy and society. It will evaluate them before, during and after the landing obligation is phased in, an EU Regulation obliging all regulated species to be landed and counted against fishing quotas.

The project covers nine regions across European waters. By comparing the intended outcomes to the real results, it will help to develop and implement the EU Common Fisheries Policy.

By combining practical assistance and evidence for policymaking, DiscardLess is guiding industries to use fish stocks more sustainably. This protects global biodiversity and ultimately safeguards jobs, on sea and on land.

**WEB:** [www.discardless.eu](http://www.discardless.eu)

**COORDINATOR:** Technical University of Denmark

**TOTAL COST:** EUR 5 551 125

**EC CONTRIBUTION:** EUR 5 000 000

**START/END:** March 2015 to February 2019

**OTHER COUNTRIES:** France, Spain, Norway, United Kingdom, Denmark, Italy, Iceland, Ireland, Greece, Portugal, Belgium, Norway, Canada

# THE CIRCULAR BIOECONOMY



## REFRESH

The REFRESH project is focusing on reducing food waste, including packaging, by developing an innovative approach to understanding the drivers of food waste to support better decision-making by industry and consumers. The project will also guide legislators and policy-makers towards more effective policy to counter food waste.

The project's 'Framework for Action' model targets the entire food supply chain. This goes beyond existing initiatives to develop, evaluate and spread social, technological and organisational insights and practices related to food waste.

In the producer to consumer chain, the project is aiming to limit losses in production and along supply chains. It is also examining how to cut

the cost to businesses of managing waste and to maximise value from unavoidable food waste and packaging.

It is developing ways to change behaviour as well as new technologies to reduce food waste, ranging from new food-processing methods to IT tools that support strategies to use food more efficiently.

REFRESH's researchers are developing strategic agreements with governments, businesses and local stakeholders in four pilot countries – Spain, German, Hungary and the Netherlands – to test policies that can be replicated elsewhere. They are also drawing up EU policy recommendations and supporting national governments to implement food waste policy frameworks.

REFRESH's imaginative solutions for wiser food use are contributing to a more sustainable, resource-efficient food system based on circular economy principles.

**WEB:** [eu-refresh.org](http://eu-refresh.org)

**COORDINATOR:** Stichting Dienst Landbouwkundig Onderzoek

**TOTAL COST:** EUR 9 444 757

**EC CONTRIBUTION:** EUR 8 999 757

**START/END:** July 2015 to June 2019

**OTHER COUNTRIES:** Netherlands, United Kingdom, Italy, Sweden, France, Austria, Germany, Kenya, Spain, China, Belgium, Slovenia, Denmark, Hungary

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The Circular Economy has high economic potential; it is a driver for a modernised economy with high environmental relevance while contributing to the UN's Sustainable Development Goals. The European Commission adopted an ambitious Circular Economy package covering the whole cycle: production, consumption, waste management and secondary raw materials. This policy needs to be underpinned by a strong research and innovation support to make sure we have the right solutions to transform its potential into reality and become global leaders in technological, regulatory, social and business-model innovation. To achieve a circular economy, we need incremental and ground-breaking innovations. Nearly 1 billion from Horizon 2020's final Work Programme (2018–2020) will be invested into research, innovation and financing of projects and initiatives that will support our circular economy ambitions.

*Research and Innovation policy*

