



Bio-based industries made for European citizens

Getting Europe ready for the post-petroleum era



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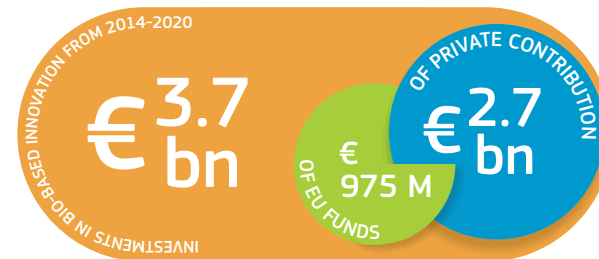
The Bio-Based Industries Joint Undertaking (BBI JU)

The BBI JU initiative is a € 3.7 billion public-private partnership between the European Union (EU) and the Bio-based Industries Consortium (BIC). It is an autonomous body operating under Horizon 2020 rules and procedures.

BBI JU was created to increase investments in the development of bio-based industries in Europe. It does this by de-risking investment and keeping knowledge and jobs in the EU, especially in rural areas. This brings added-value to citizens and leads the transition to a post-petroleum society.

BBI JU is dedicated to act as a catalyst for sustainable bio-based industries in Europe, by helping to enable long-term stability and predictability for a sustainable European bio-based industries sector. This sector will be responsible for turning biological residues and wastes into greener everyday products through sustainable innovative technologies and biorefineries.

The BBI JU initiative is about connecting key sectors, creating new value chains and producing a range of innovative biobased products to ultimately create a new bio-based community and economy.



A MAJOR PUBLIC AND PRIVATE EFFORT



Produces locally sourced renewable plant raw materials



Tests and develops bio-based processes and materials to bring to market



Creates jobs and investments in a range of sectors, triggering rural growth across regions



Places sustainability, smart and efficient use of resources at the heart of industrial, business and social activities

MISSION

BBI JU's mission is to implement the Strategic Innovation and Research Agenda developed by the Biobased industry Consortium (BIC) in collaboration with the European Union, using Horizon 2020 rules and procedures. BBI JU organises yearly Calls for proposals to support research, demonstration and deployment activities enabling the collaboration between stakeholders along entire value chains, covering primary production of biomass, processing industry and final use.

VISION

Our vision is a competitive, innovative and sustainable Europe leading the transition towards a post-petroleum society while decoupling economic growth from resource depletion and negative environmental impacts. Together with pan-European and cross-sector industries/SMEs, research organisations, universities, regions, and countries, we will develop a bio-based economy for Europe.



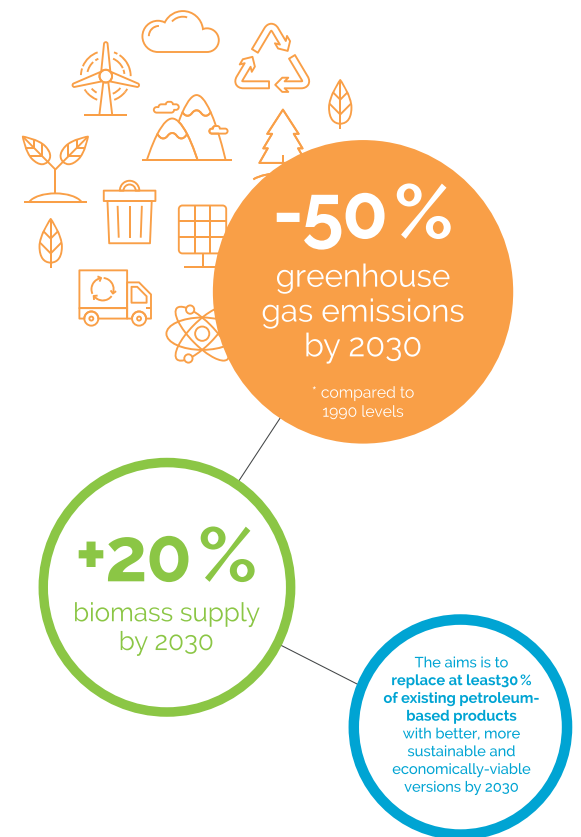
Benefits for European citizens

Overall, everyone benefits from a strong European bio-based industrial sector which can significantly reduce Europe's dependency on fossil-based products. It will help the EU meet its climate change targets, and lead to more sustainable and more environmentally-friendly growth, preparing the EU for a post-petroleum era.

BBI JU has as its guiding principle the need to maximise and valorise the complexity of nature so that developed products and applied processes make the most of materials' natural properties. This results in the development of a sustainable sector, and goes a step further in improving the environment and our quality of life.

More concretely, bio-based industries are capable of delivering sustainable everyday products that are comparable or superior to fossil-based ones by their outstanding performance, competitive price and availability.

BBI JU AIMS FOR:



BBI JU's projects will develop the potential of waste as well as agricultural and forestry residues. They are perfect examples of the circular economy in action, meaning sustainable, resource-efficient and largely waste-free utilisation of Europe's renewable raw materials for industrial processing.

The creation of a competitive bio-based infrastructure in Europe is expected to significantly boost employment, as well as support regional development by expanding local economies. This will result in new, higher and more diversified revenues for farmers and cooperatives and create up to:

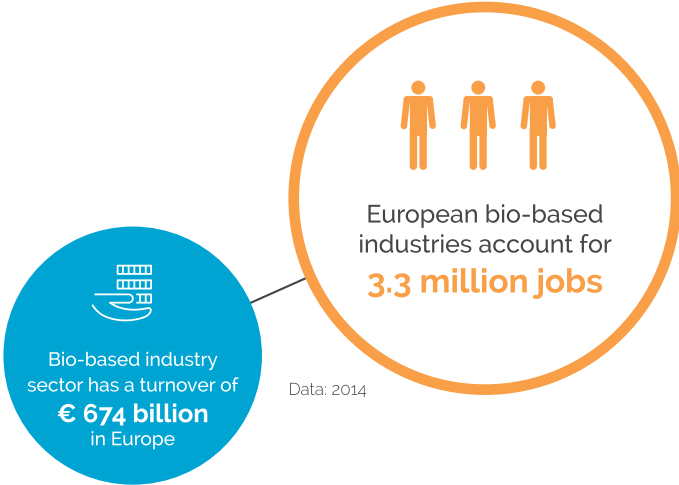
400.000 skilled jobs by 2020

rising to **700.000 skilled jobs by 2030**



80% of which will be in rural areas

Data: 2014





Bio-based products in our everyday life

The bio-based economy proposes concrete solutions to major societal, environmental and economic challenges. European industry has adopted some of these solutions and found new, innovative and resource-efficient ways of developing services and goods, contributing to an industrial economy that is low carbon, high value and locally sourced. The EU, national, regional, and local governments, industries, individual companies, workers and consumers will all need to contribute to the changes the bioeconomy and these bio-based products offer.

This brochure will guide you through new and innovative solutions for renewable raw materials and waste – clothes made of milk waste, cups made of used coffee waste, rackets made of flax fibres, dandelion sap turned into tyres...





BIO-BASED ECONOMY IN SPORTS

Bio-based products in the sports sector demonstrate that an eco-friendly production process doesn't compromise on performance or design! Be it trainers, bikes or skateboards, there are already lots of different types of applications "made in Europe" available today. Some examples of natural resources used range from sugar beet pulp, castor oil, wood and flax fibres.

SKATEBOARD

Turning agricultural waste such as sugar beet pulp into high-value products: that's the aim of the BBI JU funded project Pulp2Value. Together, the researchers from science and industry developed an innovative, lightweight material as a bio-based alternative to glass fibre-reinforced composites. This can be used for components of skateboards, amongst others.

High-value product from agricultural waste

With some 13 million tonnes produced annually in Europe, sugar beet pulp is a major residual stream from the sugar beet industry. Currently, it is valorised as low value feed or as green gas.

Together with colleagues from companies such as Royal Cosun and Orineo, researchers from the Netherlands at the University of Wageningen have now developed a method that converts the agricultural waste into a highly valued product. By fractioning the beet pulp into cellulose microfibrils they create a bio-based, functional additive that helps to create an eco-friendly composite material, that additionally supports improved mechanical damping properties. For this reason, the microfibre-based composite is suitable as lightweight material for diverse application fields, be it for



the production of components for sports equipment, such as skateboards or for use in the automotive or aviation sector.

Better ecological footprint

Compared to traditional composites based on glass and carbon, the microcellulose fibres made from sugar beet pulp save energy in the production process and over the course of product lifetime, offering advantages in end of life solutions and, thus, leaving a much better ecological footprint than current lightweight materials. In the prototype for the skateboard, almost half of the new material consists of the bio-based component.

BBI JU project: Pulp2Value

Sugar beet microfibrils are in the focus of the 'Pulp2Value' consortium. Led by agro-industrial cooperative Royal Cosun, the four-year project is a collective venture of seven partners collaborating within the scope of the Bio-Based Industries Joint Undertaking (BBI JU). Pulp2value aims to demonstrate an integrated and cost-effective cascading biorefinery system and to produce value chains for microcellulosic fibres and other products using side streams from the agro-food industry. The main applications for the microcellulosic fibres are as rheology modifier and in fibre reinforced composites. The project partner Orineo is working on both of these applications in the development of flooring (composites, Touch of Nature) and bio-based adhesives (rheology modifier). Pulp2value has a total budget of €11.5 million with €6.6 million coming from the BBI JU.



BIKE

Until now, using European wood as a green starting base for a multi-layer, composite material is still a niche approach in the construction industry. The German company Lignotubes wants to change this. It has developed resource-saving, lightweight hollow tubes made from beech and other European woods to serve as bio-based replacements for aluminium or carbon. One of the application fields is that of bicycle production.

Construction material made from European wood

In the construction industry, materials such as aluminium, stainless steel, carbon or plastics are the most used materials. However, in Europe there are sufficient amounts of European woods that could be an alternative resource for a more eco-friendly approach. German inventors at Dresden-based startup Lignotube Technologies fill this gap and aim at establishing a bio-based alternative in the market. By using European wood, such as beech combined with an innovative processing technology as a starting point for a robust and lightweight construction material. At Dresden Technical University the process engineers developed a resource-saving procedure for lightweight hollow tubes called lignotubes. In 2013, the spin-off was founded to offer the new multi-layer composite material of wood veneers to the market.



Highly efficient raw material use

The individual layers of veneer are glued crosswise so that the new material offers many different possibilities for structure, texture, and colour. According to the company, engineered wood has also caught up in terms of strength and processability. Additionally, this wood is combinable with other common construction materials, making them suitable for different application fields in the construction area. The first product is a designer bicycle built by using a Lignotubes frame. Due to this special technology, the new material also helps to save more raw materials and weight, compared to a solid, wooden frame.

The company attaches importance to a highly efficient production process, so that a minimal amount of real wood is used. Nevertheless, the thin-walled tubes are as robust as needed.



TENNIS RACKET

Flax is a common European plant that only needs a little water. French company Lineo has developed flax fibre as a bio-based composite material for sports goods like this tennis racket, offering better performance and diverse use for this fibrous European staple.

A complementary fibre with new properties

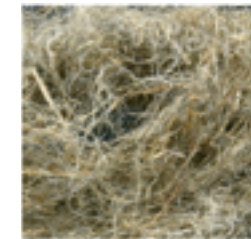
Flax is an old, cultivated European plant that is grown today primarily in Belgium, the Netherlands, France and Russia. However, flax is enjoying increasing popularity as a renewable resource. With 81,300 hectares of fibre flax cultivated in 2014, Europe is responsible for 80% of the global production. One of the best known applications is as linen in the textile industry.

The French company Lineo uses flax fibres in combination with a resin as a bio-based structural component for hybrid, composite material. The flax fibres are incorporated into the frame making it lighter, and with a higher performance as it absorbs shocks. The flax fibre can be considered a complementary fibre to glass or carbon, which can bring new properties to sporting goods such as tennis rackets. It is a good example of advanced applications providing enhanced performance in the end product. Thanks to the vibration-damping effect, a flax content of 8% to 25% provides effective results that reduce the risk of tennis elbow.

Better for the environment

The use of flax for advanced applications brings benefits for the environment. While growing, flax does not require irrigation and little to no fertilizers or pesticides. Very little energy is needed to process flax.

The plants are also carbon neutral. In other words, they absorb the same amount of carbon dioxide that they produce. During the transformation from stem to fibres, mainly organic wastes are generated and these can be used to produce electricity or make ecological products. Additionally, flax fibres are 100% bio-degradable.



TREKKING SHOES

Replacing oil-based, high-performance plastics with a bio-based and sustainable alternative is one of the major goals of the chemical industry. Dutch company DSM has developed a polyamide that is made from tropical castor beans that do not compete with food production. One of the applications is as a building block in the material for the high performance sole in mountaineering shoes.

Green alternative to oil-based polymers

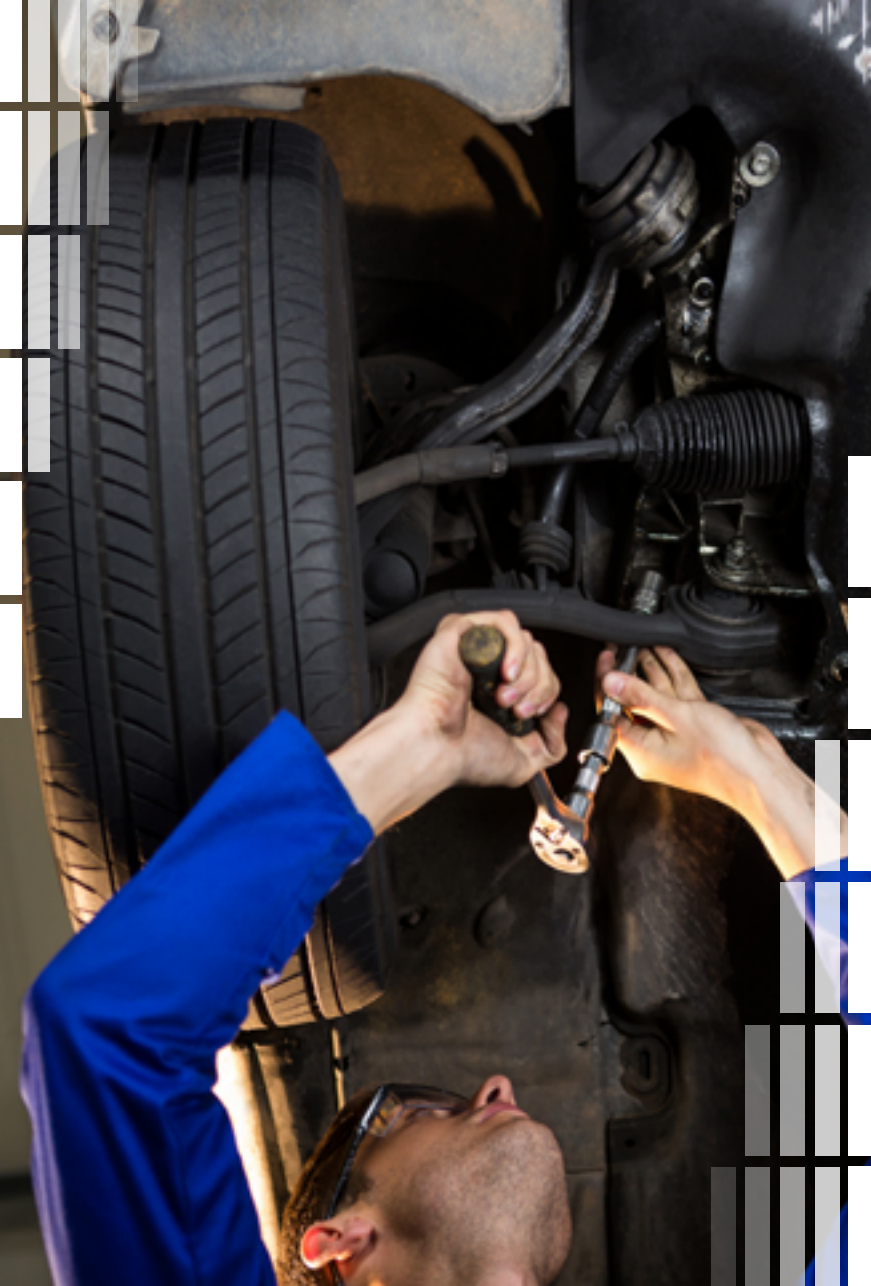
Once upon a time, plastics were perceived as oil-hungry, unsustainable materials. There are now green alternatives with the same properties on the market – among them a bio-based polyamide called EcoPaXX that was developed by the Dutch chemical company DSM. Up to 70% of the material is made from castor beans (*Ricinus communis*) oil. This is a non-food crop and is a suitable replacement for oil-based polymers without compromising in material performance. EcoPaXX offers properties such as chemical resistance and low moisture absorption, combined with a very high melting point and a high crystallization rate. Similar to its oil-based counterparts, the bioplastic can be used in several application fields. The French sporting goods producer Salomon used this material for the edging along the sole of these mountaineering shoes, amongst others.



Carbon neutral from cradle to gate

For applications in the consumer sector, the flexibility and impact resilience of EcoPaXX makes it ideal for all kinds of dynamically loaded applications, whether it's sports shoes, ski and snowboard bindings, or stiffeners and fasteners. The material also has a suitable surface for painting, which is needed for applications where aesthetics can make all the difference. Additionally, the amount of carbon dioxide emitted during the production of EcoPaXX is off set by the amount absorbed in plant growth, and, in particular, by castor beans. That's why EcoPaXX is certified 100% carbon neutral from cradle to gate and helps to establish sustainable processes in the sporting goods industry.





BIO-BASED ECONOMY IN ENGINEERING

The need to cut down carbon emissions and make vehicles more fuel and cost efficient has never been greater. High performing advanced bio-based materials offer a broad range of properties ranging from low creep and outstanding mechanical performance to high-heat resistance. Environmentally-friendly materials can replace traditional ones and European companies are at the forefront of these advances.

CAR TYRE

What can you do with a dandelion? They are weeds for most people. In the right sort of quantity, dandelions are an alternative source for a raw material in high demand: natural rubber, the fundamental ingredient in products, such as car tyres. Until now, the European rubber industry has been dependent on fluctuating Asian supplies or synthetic rubber. Today, producers have developed the first prototypes of dandelion tyres.

Modest plant as a new rubber provider

Natural rubber from European dandelions? If you process the sap from the roots you can make a bio-based polymer that mimics rubber from the rubber plant. The dandelions are grown in Europe. This cuts down the cost and environmental footprint and uses less energy to make than synthetic rubber. The resulting tyre has low rolling resistance, lower fuel consumption and tyres can be used in both summer and winter seasons. 85% of the environmental impact of a tyre comes from the rolling resistance, so improving this, significantly reduces the impact. Using dandelion rubber as the basic raw material replaces petroleum-based synthetic rubber. And, dandelion production fits in crop rotation



systems and reduces the dependence on the rubber tree production system which is responsible for a decrease biodiversity and waste water disposal, amongst others. It also lowers the risk associated with rubber tree monocultures

Enough for commercial use

Dandelion farming and processing into a natural rubber means that new supply chains will be created, offering all those involved added value, from seed production right through to end production. There is no dandelion or natural rubber production in Europe presently which means new jobs will be created. Adding to that, dandelion can be farmed in the north, northwestern and northeastern part of Europe and on marginal or under-utilised land not used for food production.

This innovative application for an everyday plant has been the focus of the EU-PEARLS consortium, supported by the European Commission's 7th research and innovation Framework Programme (FP7). Partners include KeyGene (who extract and process the rubber from dandelions), Apollo Vredestein (a tyre manufacturer), Wageningen University (looking for advanced extraction technologies and use of by-products for food and bioplastics for inulin byproduct).





SECOND GENERATION BIOETHANOL FUEL

In the BBI JU funded project BIOSKOH, eleven partners from seven European countries aim to establish the largest second generation biorefinery in Europe. The production of bioethanol from non-food biomass opens up huge opportunities for enhancing sustainability and ultimately making bioethanol affordable as a fuel.

Largest second generation biorefinery in Europe!

The BBI JU funded BIOSKOH project is setting up the largest second-generation biorefinery in Europe. It will be built on a brownfield site in the eastern part of the Slovak Republic, demonstrating a first-of-its-kind, full-scale commercial plant. As a first step, it will produce 55 kton of cellulosic ethanol per year for EU bio-fuel mandates. Aside from biofuel, bioethanol can be used for a range of products such as for the bioethylene production.



Making bioethanol sustainable and competitive

The BIOSKOH project will demonstrate new technology for second generation biorefineries for Europe. Developing brownfield sites and new value chains is one way the BIOSKOH project will demonstrate that second generation bioethanol can be produced at a lower and economically viable price within the current market context with the additional potential for further cost reduction.

The flagship research project is based on four Innovation "stepping stones": superior bio-refinery technology, a brown-field approach, improving regional infrastructure and creating jobs, industrial symbiosis and energy autonomy, abundant, secure and sustainable biomass. BIOSKOH will also explore emerging bio-based materials, such as lignin byproducts created during the process.



BBI JU project: BIOSKOH

The BIOSKOH project will pave the way for a second generation European circular bioeconomy by showcasing how a number of innovation stepping stones can realise a breakthrough in techno-economic viability of lignocellulosic biorefineries. Partners include the full value chain starting from land owners and feedstock producers, supply chain experts, technology providers such as Biochemtex, Novozymes and Lesaffre, as well as an agronomical research partner, to set-up a new biomass value chain exploiting large amounts of currently unused crop residues, and developing newly grown dedicated crops on marginal land, as such revitalising the regional economy. The BIOSKOH project has a BBI JU contribution of around €21m.

OIL & LUBRICANTS

Producing high-value bio-based chemicals or biolubricants with low input oilseed plants such as thistles is what BBI JU funded consortium First2Run is currently doing in its reconditioned biorefinery in Sardinia, Italy. Coordinated by Italian producer Novamont, the partners from science and industry will revitalise the local rural economy and put marginal lands to use adding value for local farmers.

Thistles as sustainable raw material

The project will show how using arid, marginal wasteland and a reconditioned petro-chemical refinery to process thistles can deliver low-impact, bio-based vegetable oils. Cardoon was selected as the most fitting, underutilised crop for the production of bio-based monomers.

A dryland farming crop, cardoon naturally grows in areas that are normally unsuitable for traditional crops and produces high yields without irrigation.



Using advanced processes, the cardoon seeds go through a unique low impact oxidative cleavage process that will deliver around 10 kton/year of Azelaic and Pelargonic acid and other co-products such as Glycerol.

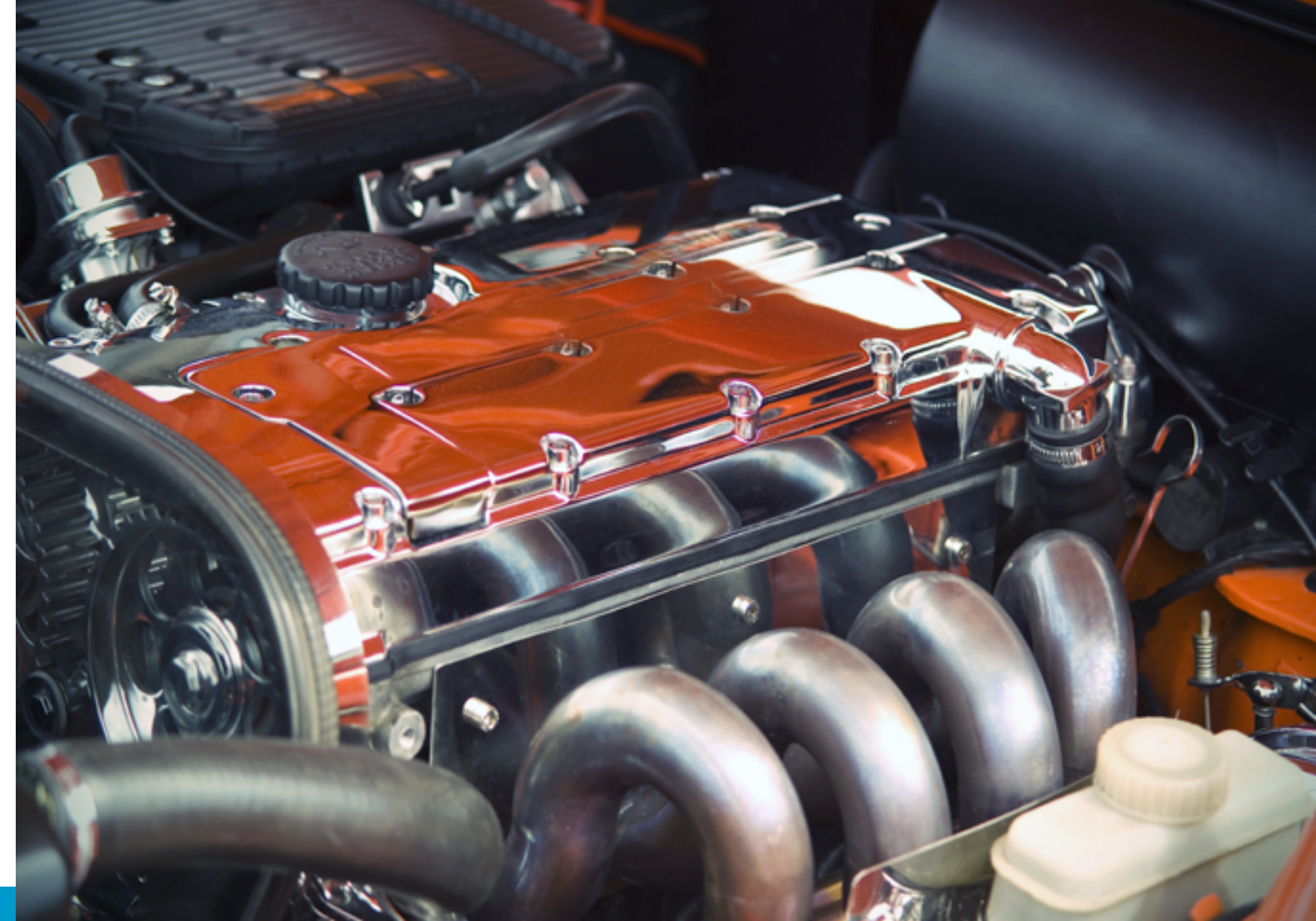
Establishing a circular economy infrastructure

There is potential for added value from using the products for several other applications, including energy, animal feed and chemical production for the by-products of the bio-based processes. The project's biorefinery model can be considered an example of a system economy and a starting point from which supporting actions to further sustainable innovations could be successfully implemented. Standardisation, certification, and dissemination activities will also help to support the market penetration of the produced, bio-based products.



BBI JU project: First2Run

The First2Run project aims at demonstrating the technological, economical and environmental sustainability at the industrial scale of a first-of-its-kind value chain, where low input and underutilised oil crops (i.e. cardoon), grown in arid and/or marginal lands not in competition with food or feed, are exploited for the extraction of vegetable oils to be further converted into bio-monomers (mainly pelargonic and azelaic acids) as building blocks for high, added-value bioproducts, biolubricants, cosmetics, bioplastics, and additives through the integration of chemical and biotechnological processes. The consortium is coordinated by Novamont. Further partners are SIP in the UK, SoliQz in the Netherlands, Biophil in Slovakia, Matrica in Italy, and the University of Bologna in Italy. The BBI JU contribution for the project is €17m.





BIO-BASED ECONOMY IN

BUILDING & DECORATING

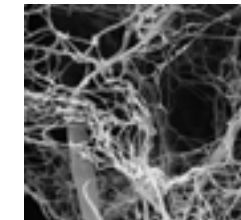
The use of bio-based building materials may reduce emissions and contribute to sustainability. Many applications in construction are relatively new but these materials offer an opportunity to exploit nature's properties to give better performance. In the comfort of your home, innovation comes from nature. Imagine wood, plants and grass are among the building materials of the future.

PAINTS

Until now, most additives in exterior paints were based on synthetic polymers sourced primarily from oil. Within the BBI-funded project Exilva, Norwegian biorefinery specialist Borregaard has developed Microfibrillated Cellulose (MFC) as a natural paint additive. In doing so, it not only improves the CO₂ footprint of the product, but also strengthens the anti-cracking properties of paints.

World's first commercial plant for microfibrils

By using wood as a raw material, the Exilva project produces environmentally friendly and sustainable biochemicals, biomaterials and biofuel that can replace oil-based products. The fibres in the wood are converted into advanced grades of specialty cellulose for products in the construction and oil industries, and for the production of foodstuffs, cosmetics, hygiene products, paints and



much more. Textiles such as viscose and rayon are wood-based and can be good alternatives to synthetic fabrics or cotton. The field of Microfibrillated Cellulose (MFC) has existed since the early 1980s. However, research has been confined to small laboratories and pilot plants, due to constraints in technology and production feasibility. Norwegian biorefinery specialist Borregaard has developed its proprietary technology, Exilva, that helps to provide high quality MFC for several applications. Supported by BBI JU funding, the experiences from a pilot plant are now scaled up to a viable commercial plant.

BBI JU project: Exilva

The objectives of the Exilva project, coordinated by Norwegian biorefinery specialist Borregaard, stretches over the entire value chain bringing together six partners from industry and academia in five European countries among which Unilever from UK and CHIMAR from Greece. By constructing and running the world's first MFC plant the partners want to secure both environmental and economic incentives for advanced market segments so that European industries have the tools to produce more sustainable products. A major scope of the project is the successful transfer of technologies from the pilot plant to the flagship plant and the attainment of a stable production output of at least 1,000 tons of MFC per year of sufficient quality. The project has a BBI JU contribution of €27m.

Better performance from paints

The nanocellulose material Exilva MFC has a unique set of characteristics including plasticity, stabilisation, texture modification and water retention. As a component in paints this material is able to change the flow behaviour so that the final product offers improved anti-cracking resistance, better functionalities in colder conditions as well as an improved resistance against syneresis (phase separation) and settling. In addition, by using Exilva MFC paint producers can also reduce the CO₂ footprint of the end-user paint and advance its sustainability profile.



FURNITURE AND FLOORING

“Touch of Nature” is the name of the innovative bio-based material that can be used to make furniture, moulded objects and flooring systems. Its origin? Residues from agriculture, the food and catering industry. Not only “Touch of Nature” is made with annual plant feedstock but it is also designed for longer lifespan applications making it an effective carbon sink material.

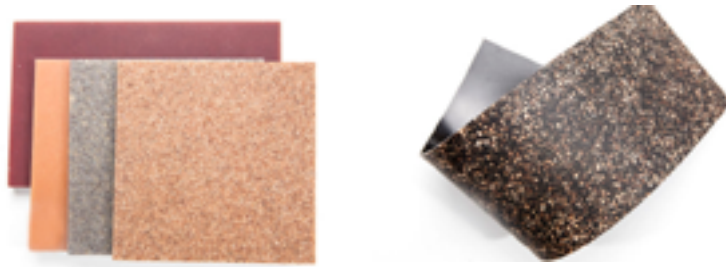
Agro-food residues turn into aesthetically beautiful materials

“Touch of Nature” provides aesthetic bio-based materials obtained through the incorporation of agro-food residues such as coffee grounds, cranberry seed press cakes or olive leaves. The final product does not only have a warm and resilient touch to it but a number of other properties such as being water and abrasion resistant, fire-retarding and having an anti-slip feel to it. Developed by the company Orineo, that is also participating to one of BBI JU's projects Pulp2Value, “Touch of Nature” uses exclusively EU sourced feedstock most of which is located within 300 km of range. Based on renewable resources and with a low energy requirement the developed product fits in the local economy trend offering man-made, bio-based authentic products that can be also customised.



Creating a true bio-based inter-sectorial connection

“Touch of Nature” puts circular, bio-based economy into practice! Let's take the case of berries for instance: the fruit juice industry buys the berries necessary for the preparation of the juice. However these have a residue: the berry seeds. As these are unsuitable for consumption they are sold to an oil extractor for the extraction of the cosmetic oil. Here again a residue is produced: the berry seed press cake. The cake is sold as an aesthetic filler to a material producer who will develop the material that goes to the furniture maker and finally to the consumer. What used to be considered waste or residue is now creating a whole new value chain and economic activity.





BIO-BASED ECONOMY IN

EVERYDAY CONSUMER PRODUCTS

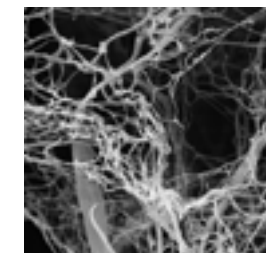
Consumers today want products which are high performing, environmentally-friendly and sustainably produced. Bio-based ingredients are already found in many everyday personal care products like face creams and cosmetics, super-market bags, coffee capsules and...dresses!

PERSONAL CARE

Bio-based ingredients are not a novelty in the personal care industry. They have been around and used extensively to slow down aging and improve skin condition. Innovation now lies in the use of cellulose fibres as the next generation of personal care products. The BBI-JU funded project Exilva aims at building a commercial production plant for cellulose microfibrils that could be the next generation of natural enhancer for personal care systems.

Microfibrils as natural performance enhancer

Cellulose fibres are built up of fibril bundles, which consist of smaller elements called microfibrils. Through a fibrillation process, the cellulose fibres are converted into a three dimensional network of microfibrils with an ultra-high surface area. These microfibrils are called Microfibrillated Cellulose (MFC). Norwegian biorefinery specialist Borregaard has developed a technology to produce MFC in commercially relevant amounts. One aim is



to establish MFC as a next generation of natural per-formance enhancers for personal care systems such as face creams. In tests, the Exilva MFC shows the ability to reduce wrinkles and improve the sensory characteristics of oil-in-water creams. At the same time it helps to reduce the CO2 footprint of production processes.

BBI JU project: Exilva

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Perfect combination of soluble and insoluble characteristics

These micro fibres which come from sustainably sourced wood give the end products a number of additional characteristics. By adding it to cosmetics it provides a 'soft focus' or matt effect on the skin and has anti-wrinkle effects in the short-term. It gives an improved spray effect and stabilises cosmetic formulations while at the same time it can be used in sun-sprays, body-lotions, facial creams, etc. as it gets easily absorbed.





COSMETICS

Consumers these days are looking for products which perform well and provide an alternative to traditional petrol-based chemicals and additives. Italian manufacturer Novamont coordinates the BBI JU funded project First2Run to provide a sustainable raw material based on thistles which can be used as an additive in lip-sticks among others.

Building a sustainable value chain

Underutilised oil crops such as thistles, could offer a sustainable solution as a natural resource in a circular economy. That is why manufacturers try to establish an efficient infra-structure to exploit commercially relevant components from these plants, as raw material for diverse applications fields such as cosmetics.

Coordinated by Italian producer Novamont, the BBI JU funded consortium First2Run will build a first-of-its-kind value chain that uses not only low input oil crops such as thistles for raw material but also all the byproducts of the process. Vegetable oils are extracted and converted with biotechnological processes into biomonomers that serve as building blocks for high-added value products such as ingredients for lipsticks and other cosmetic products.



No competition with food production

By-products of the process are valorised for energy, animal feed and added value chemicals production in order to increase the sustainability of the value chain. The advantage of the First2Run approach is the use of modest plants grown in arid or marginal lands that are not competing with food production. In addition, the consortium aims to revitalise former industrial plants to establish new business fields and jobs at regional level.



BBI JU project: First2Run

The First2Run project aims to demonstrate the technological, economical and environmental sustainability at industrial scale of a first-of-its-kind value chain, where low input and underutilised oil crops (i.e. cardoon) grown in arid and/or marginal lands not in competition with food or feed are exploited for the extraction of vegetable oils. These are further converted into bio-monomers (mainly pelargonic and azelaic acids) as building blocks for high-added value bioproducts, biolubricants, cosmetics, bioplastics, and additives through the integration of chemical and biotechnological processes. The consortium is coordinated by Novamont. Further partners are SIP in the UK, SoliQz in the Netherlands, Biophil in Slovakia, Matrica in Italy, and the University of Bologna in Italy. The BBI JU contribution for the project is €17m.



CLOTHING

Spinning milk protein casein into fibres is an old technique from the 1930s. It worked but it used a lot of chemicals and water. Now a German company established an eco-friendly production process to turn milk waste into silky fibre, providing the basis for modern textiles with advanced performance properties.

Building a sustainable value chain

Milk is a popular food product, but not all milk proteins are actually used. Every year, millions of tonnes of milk are accrued and cannot be used for consumption. In Germany alone around 1.9 million tons of milk are lost to the food industry. For instance, if milk has gone sour it cannot be sold anymore and would otherwise go to waste.

Qmilch uses the milk protein casein for the production of textile fibres and clothing. These are silky to the touch, naturally antibacterial and easily dyed. The casein is extracted from dried milk powder and then heated up in a type of meat-mincing machine with other natural ingredients. The fibre comes out in strands and



is then spun into yarn on a spinning machine. It takes about 6 litres of wasted milk to produce an entire dress. The automotive industry is now interested in using the fibre for car upholstery.

Eco-friendly production process

The T-shirt fabric made from high concentrations of the milk protein casein is the first man-made fibre produced entirely without chemicals.

The production of the organic fibre is carried out in line with the Global Organic Textile (GOT) standard. Compared to the conventional wet spinning process significantly fewer resources are consumed.

No chemical additives are added and the fibre is tested for harmful substances. Due to its anti-bacterial qualities the milk fibre can also be used in medicine and makeup.



COFFEE CUP

Transform old coffee grounds into new products: that is the idea of German company Kaffeeform. The Berlin start-up manufactures cups and saucers created from used coffee grounds.

A second life for coffee grounds

What actually happens with all the coffee grounds we consume every day? Is there a way to find an afterlife for this natural raw material? These were some of the questions coming to Kaffeeform's product designer, after intense coffee consumption during his university studies. In 2015, the right recipe was found and the first coffee cup was produced.

Six cups of espresso preparations have to be recycled in order to create a new cup and saucer from the waste. To make the cups long lasting and strong enough for daily use, Kaffeeform adds bio-polymers, plant fibres and wood grains together with the recycled coffee.



The company uses an injection moulding procedure to manufacture the goods and the resulting products are stable and re-usable.

Sustainability at the heart of new business models

The coffee grounds are collected from local coffee stores in Berlin and dried, packed, and shipped by disabled people employed in a sheltered workshop.

As an example of the different possibilities for the coffee waste, Kaffeeform has been developing new products, such as a cappuccino cup.

Characteristics like the marbled surface, the wood-touch, the smell of coffee, the light weight and the possibility of washing it endlessly have been attracting new consumers since it was launched in 2015.





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