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**BE-Rural: Bio-based pop-up store
in Latvia**

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Bio-based strategies and roadmaps for enhanced rural and regional development in the EU (The BE-Rural Project)

European regions are diverse – economically, ecologically and culturally. These areas are home to a wealth of ecosystems and resources, where the bioeconomy carries the promise of opportunities for rural employment and sustainable growth. This transition towards a new, bio-based regional economy requires the active involvement of a broad spectrum of stakeholders and the sustainable use of agricultural, forest and marine ecosystems. Building on this idea, BE-Rural will explore the potential of regional and local bio-based economies and support the development of bioeconomy strategies, roadmaps and business models. The bio-based pop up stores are organised to accompany these activities and to show that bioeconomy is not just an abstract concept, but already part of our everyday life.

Burger



Enjoy your food with insects

In recent years, several insect based foods, such as insect burgers have entered the market. With a high protein and unsaturated fat content as well as a drastically reduced resource consumption in comparison to conventional beef, insect burgers are a healthy and sustainable alternative. Growing insects produces up to 100 times less greenhouse gas emissions and uses 10 times less feed compared to beef production. The burger displayed in the bio-based pop-up store is made of buffalo worms.



Pasta



High protein pasta

This macaroni shaped pasta is made of three ingredients: buffalo worm powder, durum wheat and eggs. Thanks to the buffalo worm, which are beetle larvae, this pasta contains 18,7 % natural protein and in addition nutrients such as iron, B-vitamins, fibre and essential fatty acids. Also available from the same company: barbeque-flavoured mealworms, curry-flavoured grasshoppers or cereal bars made from crickets.



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Country: **Netherlands, Germany and other**

Country: **France**

Drink



Drinking algae

Helga is a vegan soft drink based on Chlorella algae. Chlorella contains a variety of valuable ingredients, such as vitamins, minerals and vegetable protein. What is notable about algae in general: it grows ten times faster than land plants and contains 60 % protein. Further, this green multi-talent has a high vitamin B12 content, which is good for the metabolism. The exhibited drink is produced in Austria; the company behind has sold more than 600,000 bottles already, mainly in Germany and Scandinavia.

Country: **Austria**



Snack



Chocolate snack with crickets

Edible insects are increasingly capturing the mainstream market. Dried house crickets – which are the bioeconomy ingredients in these milk chocolate snacks – have high quality protein and nutrients such as iron, calcium, vitamins A, E, B, essential fatty acids and more.

Country: **Germany**



Spoon



Cutlery from cocoa shell

The fibres of the cocoa shell form the basis of this ice cream spoon. They accrue as residues in food processing and are usually discarded as waste. Inside the spoon they ensure the stability and add a chocolate taste. The spoon can be bought on the market since April 2019 – since then the product has succeeded to replace almost 1 million plastic ice cream spoons.



Country: **Germany**

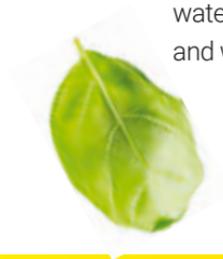


Mayo and ketchup



Vegan mayo and ketchup

These vegan treats are made from vegetables that would otherwise have been discarded. A UK company has made it its mission to save crops that supermarkets reject based on their appearance – providing a practical solution to food waste. The vegan mayo is made with aquafaba as a substitute for eggs. Aquafaba is the protein-rich water left over from cooking chickpeas and would normally be thrown away.



Country: **United Kingdom**



Ice cream



Plant based ice-cream with lupine proteins

Lupines are green multi-talents. As nitrogen fixers they are great fertilisers for German soil. In addition, their seeds are rich in protein, which is why they have come to the attention of food manufacturers as an alternative source of protein. Lupine seeds are usually very bitter-tasting due to their high alkaloid content, which is why blue sweet lupines came into play. In contrast to other types of lupine, they have a low content of bitter-tasting alkaloids. First, the lupine seeds are peeled and processed into paper-thin flakes. The flakes are then de-oiled and unwanted aromas are extracted. Only then do the experts isolate the proteins. The dairy-free product contains neither lactose nor gluten and is suitable for allergy sufferers.



Country: **Austria**



Crackers



Crunchy mealworm snacks

Edible insects are a rapidly growing new protein source on the market. These crackers are made of whole mealworms (10%), which are naturally high in complete protein and other nutrients such as Iron, calcium, fibre and several vitamins. The mealworms are fed exclusively with ingredients from organic farming. Additionally, all other ingredients – such as the sesame seeds or the oatmeal – are farmed organically.



Country: **France**



Beer



From bread to beer

Two million tons of baked goods end up in the garbage every year, although they are still perfectly edible. This beer saves bread from the bin. The start-up producing this beer uses slices of bread – mostly sourdough bread – to replace the malt. 700 litres of beer equal about 2000 slices of “saved” bread. Currently, the beer is only produced small-scale and regionally available. The inventors of this beer have already received several prizes for their innovation.



Country: **Germany**



Rust remover



Eliminating rust with bacteria

In nature, there is a mechanism to eliminate rust. Rust is simply atoms of iron which have reacted with oxygen. And then there are some microorganisms, such as bacteria, that eat iron. In order to obtain this important element, the bacteria produce siderophores, protein molecules that can trap iron atoms and incorporate them into their structure. Which is why siderophores are used as biodegradable rust removers. In order to use siderophores to remove rust, a company has developed a procedure that uses the bacteria of the species *Streptomyces olivaceus*.

Country: **Germany**



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Brick



Growing a brick

What about saving CO2 emissions by 'growing' a brick instead of firing it? After all, more than a trillion bricks are produced worldwide every year – releasing 800 million tonnes of CO2 into the atmosphere annually. bioMASON employs bacteria to 'grow' a durable cement. At the start of the procedure, sand is packed into rectangular moulds. Afterwards, bacteria (*Sporosarcina pasteurii*) are added, which wrap themselves around the grains of sand. Calcium carbonate crystals begin to form around the grains while an irrigation system feeds nutrient-rich water. The crystals grow larger and after three to five days, they are ready for use. This process was inspired by corals, which grow in all kind of formations and can withstand water and erosion.

Country: **United States**

Paint



Material change from root vegetables

Curran – which is Gaelic for carrot – is a material made from nano-cellulose fibres of root vegetables. It can be used for different applications such as paints, coatings or even cosmetics. Its raw material base is waste streams produced by the food industry. Because the discarded products such as carrots or sugar beets would otherwise be thrown away, there is no direct competition with food crops for scarce land. The manufacturing of Curran leads to a lower carbon footprint, as it uses vegetable waste and less water, requires fewer chemicals and does not emit toxic gases. While the exact method of production is secret, nano fibres are extracted from the vegetables and then combined with high-tech resins. The paste can be moulded into different shapes.

Country: **Scotland**



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Detergent

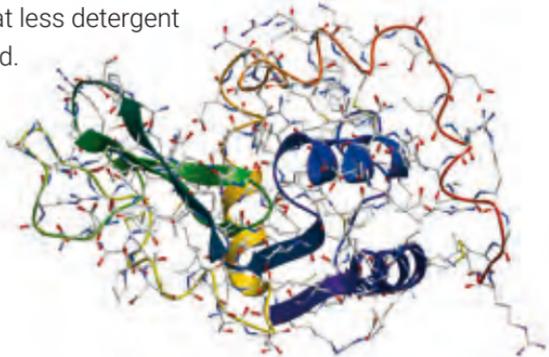


Cleaning with the power of enzymes

Manufacturers of cleaning products such as detergents have been using the power of enzymes for many years.

The biocatalysts accelerate biological processes and are active even at low temperatures. There are several classes of enzymes. Some remove dirt particles, while others work by preventing the fabrics from pilling. The use of enzymes means that less detergent and energy are required.

Industrial enzymes for cleaning products and detergents have the biggest market share.



Country: **Belgium**

Football



A partly bio-based ball

This ball was the official football of the World Cup 2018 and contains Keltan Eco, a bio-based ethylene-propylene-diene monomer (EPDM) rubber. The rubber is the basis for a sponge rubber layer underneath the ball's outer cover. It serves as a mouldable cushion for the ball. It is the world's first EPDM rubber manufactured using bio-based ethylene extracted from sugarcane.



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Country: **Germany**

Smartphone



Trouble-free display

This smartphone has a bio-based plastic smartphone display made from plant-derived isosorbide (chemically produced from sugar). The material shows a higher resistance to impact, heat and weather than conventional plastics. The new bioplastic can be used as an industrial material for applications including automobile sunroofs, headlights, transparent highway noise barriers, and exteriors of electronics such as smartphones.



Country: **Japan**

Laptop case



Alternative materials based on bacterial cellulose

The material ScobyTec BNC (Bacterial Nano Cellulose) is a metabolic product of symbiotic bacteria and yeast cultures which is produced during the fermentation of carbohydrates. According to the manufacturers, standardised test procedures have shown that it has high mechanical strength and is non-combustible. The material is suitable for the production of vegan leather, bioplastics, viscose threads or speciality papers.



Country: **Germany**

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Scarf



Textiles based on citrus residues

The start-up follows the vision to turn orange and citrus waste into sustainable fabrics. In Italy alone, about 700,000 tonnes of waste materials from citrus production are produced every year. To use this waste, the cellulose is extracted from the fibres that are then – using nanotechnology techniques – enriched with citrus fruit essential oil. The idea was developed by two students from Sicily and has already won several awards at the national and international level. The innovation was also presented at the Expo Gate in Milan in 2015.



Country: **Italy**



Shirt



Clothes from wood

Tencel or Lyocell fibres are environmentally friendly semi-synthetic fibres produced from renewable raw materials. They are made from cellulose from wood from sustainably managed forests and plantations. A special advantage of the material is its water absorption capacity, which is 50 % higher than that of cotton. Besides the renewable raw materials base, no harmful chemicals are used during the production process. The special feature of the production of Lyocell is the almost complete recycling of the solvent used. Due to its good water mixing capacity, it can be easily removed from the fibre and is biodegradable.



Country: **Austria**



Dress



Dressing in milk

Milk is a popular food product, but not all milk proteins are actually used. Every year, millions of tonnes of milk are accrued, which cannot be used for consumption. Two companies have started to use the milk protein Casein for the production of textile fibres and clothing such as dresses or underwear. These are silky to the touch, naturally antibacterial and can be easily dyed. It has long been known that Casein can be spun into fibres. However, not only a lot of water, but also a lot of chemicals were required for this: now beeswax and zinc have been added. 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.

Country: **Germany**



Shoes



Walking on pineapple leaves

The pineapple leaf fibres which provide the raw material base for these shoes have been produced by an English company that works with local farmers in the Philippines. Only pineapple leaves from pineapples that are consumed are used for these products – hence focusing on the leftovers from the production process. The pineapple fibres are waterproof and breathable. To further reduce waste and litter, the sole of the shoe is made of recyclable compounds, which are in turn made up of 20% chewing gum.

Country: **Portugal**



Dress



Dressing in roses

A dress that smells like roses? The new fabric innovation has emerged out of a cooperation between a German designer and a Portuguese fabric manufacturer. It is a creation of viscose fibres from roses. The fibre is extracted from the leaves of organically grown roses and processed with cotton to a silky, low-maintenance blended fabric. The precious raw material gives the garments a soft rose scent.



Country: **Germany**



Bathing shoe



Algae-based shoes

Algae bloom is a worldwide ecological threat to the ecosystems in our seas. An abundance of algae remove oxygen and do not allow sunlight to pass through – a problem for many aquatic species. For this shoe, algae biomass was harvested from fresh water sources at high risk of algae bloom. The algae-based material can replace petroleum-based materials which are still used in many modern products. The “amphibian shoe” is flexible, durable and lightweight. According to the producers, each pair of shoes prevents the equivalent of 40 balloons of CO² from entering the Earth’s atmosphere.



Country: **United Kingdom**



Bag



A bag tanned with olive leaves

Tanning agents based on heavy metal salts such as chromium (III) sulphate are usually used in the industrial production of leather. Olive leaves are a natural and environmentally friendly alternative. They contain secondary compounds which the plants use as a pest defence. This forms the basis for a biodegradable tanning agent, which was used for this bag. It not only protects the environment but also makes the leather extremely skin-friendly. Tonnes of olive leaves fall every year at harvest time in the Mediterranean, and until now, most of it has been burned as green waste. Two companies have developed a process that extracts the tannins from the olive leaves in an aqueous solution. This eliminates the use of toxic acids and salts during the procedure.

Country: **Germany**



Underwear



Underwear originating from the sea

This underwear is made from four different components, including Icelandic algae, beechwood and medical zinc. Dried and ground seaweed, zinc powder and cellulose are mixed and processed into natural fibres. According to the producers, the production of this fibre uses 97% less water and causes 90% less CO₂ when compared with cotton products.



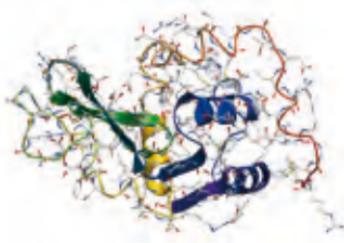
Country: **Iceland, Germany**

School uniform



Enzymes for clothes:

Kids can be rough on their clothes, especially when they wear the same school uniform day in and day out. A British and a Danish company have developed schoolwear that is produced with a special enzyme technology that keeps the kids' uniforms looking like new longer. At the same time, the production process is more sustainable. The enzymes are produced by industrial microorganisms. As the enzymes are added during the textile bleaching and dyeing process, the whole industrial process saves water and reduces energy. The enzymes work as bio and help the fibres strengthen from the inside out, helping to eliminate fibre ends that can stick out from the surface. This keeps the surface smooth, reduces pilling and ensures consistent bright colours.



Country: **United Kingdom**

Shirt



Wearing algae

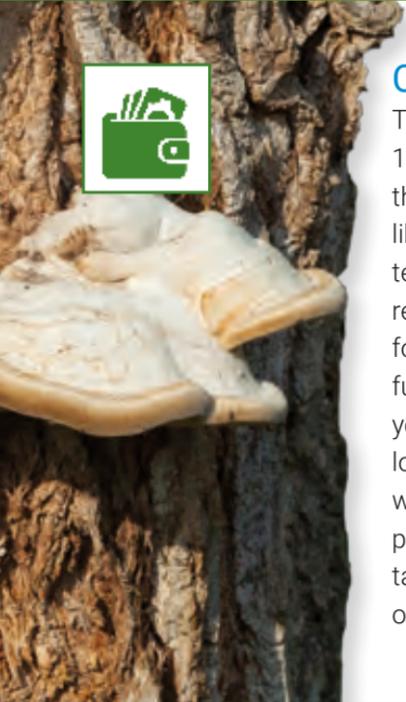
This plant and algae t-shirt emerges from pulped eucalyptus and beech from sustainably managed forests and algae grown in bio-reactors. This t-shirt is made from nature and returns to nature: The t-shirt biodegrades in the earth in 12 weeks and turns into food for all animals living in the soil – you can hence either bury it in your garden or put it out with the compost.

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Country: **United Kingdom**

Wallet



Carrying your money in fungus

Tinder fungus rediscovered! Already in the 18th century, small family businesses used the tinder fungus to produce a soft, leather-like material that was further processed into textiles or hats. A Berlin-based designer now revived the old craft. The tinder fungus used for the wallet comes from Transylvania. The fungi are harvested naturally, dried for up to a year, peeled and then processed. Although it looks like animal leather, it is a vegan product with absorbent, antibacterial and antiseptic properties. The Berlin-based founder attached great importance to the complete use of the tinder product thereby avoiding waste.

Country: **Romania, Germany**



Dishes



Eating from wheat bran dishes

The dishes are produced by a Polish company selling disposable and biodegradable wheat bran tableware products in all forms and sizes. Also part of their product range: biodegradable PLA bio-plastic and wheat bran cutlery. According to the company, all products can be composted in 30 days. From 1 ton of edible wheat bran the company claims to be able to produce up to 10,000 units of plates or bowls. The production process does not require significant amounts of water or mineral resources, or chemical compounds. The company currently produces 15 million pieces of biodegradable disposable plates or bowls a year.



Country: **Poland**



Backpack



A backpack from apple residues

What about carrying your things in a backpack that consists of 50 % apple residues? The base material here is apple skin. First the apple remnants are dried, then milled to a fine powder and mixed with 50 % polyurethane. The mixture is placed on a tear resistant roll of cotton fabric and then heated to produce a weather resistant and durable fabric. The apple bag is 100 % vegan and Öko-Tex Standard 100 certified.



Country: **Germany**



Purse



A purse from salmon leather

The main material behind this purse – salmon leather – is a by-product of the food industry and has its origin mostly in organic fish farms. Skins are received from both German and Icelandic tanning factories. The products are designed in Norway and produced in Krakow, Poland.



Country: **Norway, Poland**



Chewing gum



A biodegradable and plastic free chewing gum

Nowadays, most chewing gums still contain plastics, artificial sweeteners and synthetic antioxidants. This also explains why spit-out chewing gum hardly rot on the streets. The exhibited chewing gum tastes nice, is 100 % biodegradable and vegan. The producers use the juice of the sapodilla tree instead of a conventional plastic-filled rubber base. The gum is sweetened with natural sweeteners such as stevia and xylitol (taken from Finnish birch trees).

Country: **Denmark**



Coffee cup



Transform old coffee into new products

A German company manufactures coffee cups and saucers that consist of used coffee grounds. Up to 40 % of the product is made from recycled coffee grounds. Each cup is made of 60 grammes of coffee grounds, which is equivalent to eight espressi. The recycled material, called Kaffeform, consists not only of coffee grounds, but also of plant fibres, cellulose and a resin made of biopolymers. For the manufacturing process, the company uses an injection moulding procedure. The resulting products are stable, washable and can thus be easily reused.



Country: **Germany**



Skin care



Face cream with fish collagen

This skin care is made of 100 % natural fish collagen, which contains biologically active tertiary collagen hydrate. It is a natural hydrate of connective tissue protein obtained from freshwater and marine fish. The face cream is free of artificial dyes and fragrance additives. According to its producers, the product slows down the ageing process and does not cause allergic reactions, irritation or other side effects.

Country: **Poland**



Nail polish



Nail polish made of spider silk proteins

Nail polish in its current form first emerged in the 20's of the last century and was inspired by the invention of the automobile lacquer. Since then the demand has changed. Nail polish should not only look beautiful, but also care for the nails. One of the latest innovations is a nail polish made of spider silk proteins. In contrast to conventional nail polish, which seal the nail so that no oxygen can pass through, biotechnologically produced silk proteins form a breathable protective film that is permeable to both water and oxygen. In addition to the spider silk proteins, the nail polish contains micro-algae active ingredients, which have an antibacterial, antiviral and cell regenerating effect.

Country: **Germany**



Day cream



A cream made from roses and snail extract

This cream includes Bulgarian rose oil, Rose absolute and 100 % snail extract. The Rose oil and Rose absolute are natural products derived from the fresh colours of the Rosa damascene. The extract contains many natural proteins, amino acids and vitamins. According to its creators, this combination of ingredients has a powerful anti-aging and regenerating effect due to its proteins, vitamins and enzymes. They accelerate the skin's ability to recover and improve the skin structure and texture.



Country: **Bulgaria**



Clock



Using egg shell residues

This clock is made from egg shells – 100 % biodegradable plastic based on egg and nutshells and coloured using food pigments. The shells are bonded with organic and biodegradable substances, which can be handled through different production techniques such as extrusion, pressing and injection moulding. All shells are cleaned, dried, ground, hammered and combined with other bio adhesives. This clock will decay if buried in the garden.



Country: **Germany**



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Plant pod



Biodegradable plant pod

Plants in plastic cups are a thing of the past. The exhibited flower pots are made out of natural fiber-reinforced bio-degradable material grades. The raw material behind: bamboo fibers and rice husks – natural fibers that biodegrade in soil. Besides not contaminating the soil, the pots act as organic fertilizer once the natural ingredients break down. And – as the traditional pots – they protect the plant from garden pests.



Country: **Slovenia**



Puzzle game



A puzzle game with willow wood

Tic Tac Toe is an old and simple game that requires strategic thinking. The game is suitable also for young kids and helps to develop logical thinking. It is entirely made from willow wood. The producer of the puzzle covers the full cycle of willow plantation management starting from land preparation works to harvesting and selling of the crop.



Country: **Latvia**



Floorboard



Floorboard made of grass:

You wouldn't expect it when looking at the delicate stalks, but meadow grass contains a number of nutrients and is held upright by its robust fibres. A Hessian company uses these features for an innovative production cycle. The procedure is that of a 'green biorefinery', in which wet, fibrous biomass is separated into a liquid phase and a solid phase. Subsequently, the fibres are mixed with bio or recycled plastic at a ratio of 3 to 1. What emerges: a robust and lightweight material that can be processed into – among things – floorboards for terraces. The residues are used for the production of biogas or plant fertilizer. In this way, all parts of the plant are utilised in the best way and the cycle can start again.

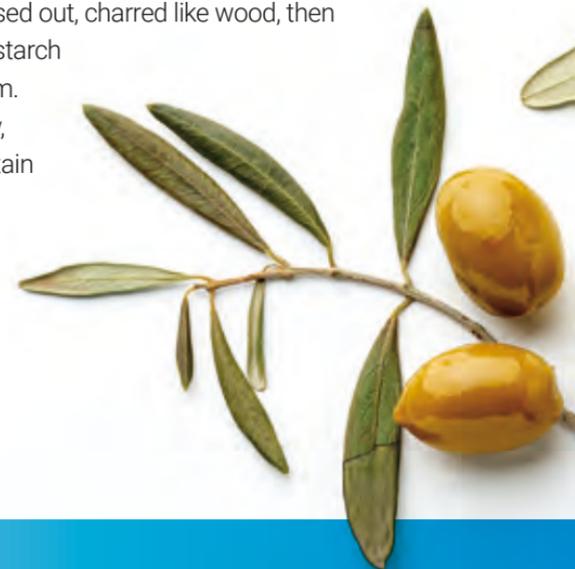


Charcoal



Coal from olive pomace:

For these Greek briquettes, olive pomace – kernels, skins and residues are collected during the industrial production of olive oil. They are first completely pressed out, charred like wood, then mixed with water and natural starch and brought into briquette form. These briquettes ignite quickly, burn for a long time and maintain the heat for hours. They are odourless and make little smoke.



Country: **Germany**

Country: **Greece**

Hairbrush



Hairbrush with wild boar skin:

These bristle brushes are made of wild boar bristle and 100 % chemical free wood. Boar bristles have been used for centuries and according to the producers they give hair strength, suppleness and remove static electricity. Boars are numerous in Latvian forests and hunted for their meat, to control the population and to allow agriculture. The fur is a by-product and would otherwise be thrown away.

Country: **Latvia**



Firelighters and grillbox



FSC certified firelighters and grillbox:

The Fire Cones are eco-friendly firelighters for lighting a stove, a grill, a fireplace or a campfire. They are FSC certified and made of dried pine cones and wax. The lighters burn 3 to 7 minutes. The exhibited grill box contains dry alder firewood for BBQ.



Country: **Latvia**



Snacks



Protein-rich bean snacks

In many countries, pulses (beans, peas, lentils) have been among the most important basic food for thousands of years. They usually contain potassium, iron, phosphorus, magnesium, little fat and several vitamins. This snack is called pupuchi – roasted beans rich in essential amino acids – with 32% protein content.



Country: **Latvia**



Healthy drinks and treats



The forest as resource for a diversity of products

A Latvian company has turned towards forest biomass – mainly spruce and pine needles – to produce high-quality and environment-friendly bio-active products. Its goal: to replace synthetic products with natural products derived from renewable plant materials. Needles of evergreen trees have the potential to be used in a variety of different sectors, such as food production, pharmaceuticals or agriculture.

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Country: **Latvia**



Gasoline from straw



Producing gasoline from straw

Biomass can be decomposed thermo-chemically in several stages. Hydrogen and carbon monoxide emerge as the smallest chemical components, which can then – using chemical catalysts – be build up into clean fuels and other basic chemical substances. Residual materials from agriculture and forestry are particularly suitable for this process.

Country: **Everywhere**



Packaging



Mushroom packaging

This Mushroom Packaging is made from mycelium – the vegetative root structure of a mushroom – and the agricultural by-product of hemp. More precisely, growth trays are filled with a mix of substrate (hemp), nutrition (flour), and mycelium. The mixture is then sealed to grow for 6 days. The mycelium acts as the “glue” to bind the agricultural waste together. The final stage is to dry the parts to prevent future growth. In contrast to conventional foams this packaging is 100 % home compostable.



Country: **United States**



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Paper and packaging



Write on agricultural waste

Why burn agricultural waste when it can be processed into paper? The exhibited paper is made from cellulose from agricultural waste – stems and leaves – using 100 % green energy. The amount of agricultural waste replaces the amount of tree fibre, so these trees no longer need to be processed into paper, but can continue to grow and convert CO₂ into oxygen. Besides the paper, the company also produces carbonboard with agricultural residues.

Country: **The Netherlands**

Packaging



Turning bio-waste into bio-material

This idea comes from a Polish company that takes agricultural waste and weaves it into a biodegradable packaging material. This packaging can then serve as a wrap for soap or a sachet for spices. Although it consists of pure cellulose and no fossil fuels or other non-biodegradable substances are added, it has a two year shelf life. If not needed any more, the nutritious membrane can be eaten or composted – serving as natural fertiliser.

Country: **Poland**

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