BIOSWITCH

BIOSWITCH GLOSSARY

of terms and definitions

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BIOSWITCH Glossary of terms and definitions

In order to establish a data collection framework for the bioeconomy, it is first necessary to agree on the subject of discussion. The following glossary therefore provides a common understanding of the terms, parameters and units needed to describe the bioeconomy. Definitions have been taken – whenever possible – from official policy documents. In some cases, where no official documents were found, other sources such as academic studies or dictionaries have been used as well.

Click corresponding letter to see the terms:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

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A

Agriculture

Agriculture is the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products. (Merriam Webster)

Agricultural residue

Agricultural plant parts, primarily stalks and leaves, not removed from the fields with the primary harvest, such as corn stover (stalks, leaves, husks, and cobs), wheat straw and rice straw. (AllThings.Bio, 2021)

Agro-industries

Production systems that transform products from crop cultivation and livestock, forestry and fisheries, commonly into food and feed. (Gomez San Juan et al., 2019)

Agro-industrial residues

Wastes and by-products from the industrial processing of crops or livestock, such as olive stones, waste from slaughterhouses etc.

Anaerobic digestion

The breakdown of organic material by micro-organisms in an environment without oxygen. This process is used to generate biogas, used as fossil fuel replacement for electricity and heat generation as well as conversion into gas. (WBCSD, 2021)

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B

Bio-based / biobased

Composed or derived in whole or in part of biological products issued from the biomass (including plant, animal, and marine or forestry materials). (Vert et al., 2012)

Note 1 to entry: The term "biomass-based" or "bio-based" refers to the origin of the raw material. Biomass can have undergone physical, chemical or biological treatment(s). The prefix "bio" can refer to different functionalities (biodegradable, biocompatible, etc.) or processing (biological or biotechnological processes). To ensure transparent and non-misleading information to consumers, the prefix "bio" should be substituted by more accurate and more informative equivalents and should refer to a European or International Standard. (CEN/TC 411 2014)

Note 2 to entry: Concerning the hyphen in "bio-based" in comparison to "biobased": In the US nomenclature, all terms including "bio" are not hyphened in official documents, but in the EU they are. However, in common usage it is sometimes spelt without a hyphen.

Bio-based carbon / bio-carbon

Carbon derived from biomass (CEN/TC 411, 2014)

Bio-based carbon content

Fraction of the carbon derived from biomass. (CEN/TC 411, 2014)

Note to entry: Normally expressed as a percentage of the total mass of the product.

Bio-based content / biomass content

Fraction of a product derived from biomass (CEN/TC 411, 2014)

Note to entry: The crucial point about the bio-based content in contrast to the bio-based carbon content is that this includes the total biomass content including oxygen, hydrogen and other molecules coming from the biomass and not only the carbon. Having this in mind, the bio-based content for many products makes up a larger share than the bio-carbon content.

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Bio-based drop-in chemicals

Bio-based drop-in chemicals are bio-based versions of existing petrochemicals which have established markets. They are chemically identical to existing fossil-based chemicals (BIO-TIC 2014).

> *Note 1 to entry: The term drop-in is usually used in relation to commodity chemicals and polymers with large production volumes. Bio-based drop-in chemicals usually differ from their petrochemical counterparts in price (mostly more expensive) and in environmental footprint (mostly lower). Regarding the ease of implementation, bio-based drop-in chemicals are easy to implement technically, as existing infrastructure can be used. However, due to their usually higher price compared to their fossil counterparts they are often not competitive. (Carus et al, 2017)*

> *Note 2 to entry: The pathways leading to bio-based smart drop-in chemicals are advantageous combinations of novel/dedicated and conventional chemical pathways. This means, for example, that the biomass is processed in a new way up to a certain status, and is then at a later stage fed into the conventional pathway, making the overall process shorter and more efficient. One example of a smart drop-in is epichlorohydrin, a precursor of epoxy resins. Being produced from glycerol makes it much smarter than its conventional fossil-based manufacture. In this case, almost all mentioned criteria are fulfilled. The term drop-in is usually used in relation to large commodity chemicals. In the case of smart drop-ins, this will probably apply to commodities of smaller volume (but still larger than specialty chemicals). Other examples of smart bio-based drop-in chemicals: Acetic acid, acrylic acid, adipic acid, aniline, butadiene, 1,4-butanediol, isoprene, PA (6,6), polybutylene succinate, 1,3-propanediol, succinic acid. (Carus et al, 2017)*

Bio-based industry

The bio-based industry is the part of economy formed by companies that use biological input (feedstock) to produce material, products and services. The biological input can be the biomass extracted from natural environment and purpose grown biomass (e.g. from agriculture and forestry, fisheries and aquaculture), as well as different forms of biological waste, side streams and residues.

Bio-based Industries Consortium (BIC)

Europe's leading bioeconomy industry organisation, with more than 240 industry members (of which approximately 80% are SMEs), and over 200 associate members (academia, research organisations, trade associations, etc.). BIC is the private partner in a public-private partnership with the EU Commission - the Bio-based Industries Joint Undertaking (BBI JU) (Vos et al, 2021).

Bio-based Industries Joint Undertaking (BBI JU)

Public-Private Partnership between the EU and the Bio-based Industries Consortium (BIC) operating under the Horizon 2020 research framework programme, creating new value chains with bioeconomy actors across Europe. (Vos et al, 2021). As of 30 November 2021, Circular Bio-based Europe Joint Undertaking (CBE JU) is the formal successor of BBI JU.

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Bio-based innovation

Bio-based innovation is a novel concept, technology, process, material or product based on the use and transformation of biological input. The benefits of bio-based innovation include one or more of the following: increased energy or material efficiency of production process, new properties of produced material or product, ability to use and valorise waste, and elimination of pollution (EC, 2021b)

Bio-based material

Bio-based materials are the intermediate products that are used to make bioproducts. Traditional bio-based materials include wood for the production of furniture and construction materials, and textiles, such as leather, cotton, linen and fish skin. Novel bio-based materials include a range of intermediate materials (e.g. building blocks and polymers) that are used to produce a wide range of bio-based products, including bio-based plastics, biolubricants and solvents (Müller et al., 2015).

Bio-based plastic

Bio-based plastics are fully or partly made from biological raw materials as opposed to the fossil raw material (oil) used in conventional plastics. (EEA, 2020). They are not necessary biodegradable (see also "Biodegradable plastics").

> *Note to entry 1: Bio-based plastics can be produced to have similar functionality to or the same functionality as conventional plastics. Examples of the latter are bio-PE and bio-PET which can be used for the same purposes as fossil-based PE (PolyEthylene) and PET (PolyEthylene Tterephthalate) because they are molecularly identical, despite being made from different raw materials. These bio-based plastics are known as "drop-ins". Another examples of bio-based plastics that are biodegradable:*

- *Polyhydroxyalkanoates (PHAs), polyesters produced by numerous microorganisms, including through bacterial fermentation of sugars or lipids.*
- *PolyLactic acid (PLA), a transparent plastic produced from maize or dextrose.*
- *Poly-3-hydroxybutyrate (PHB, a polyester produced by certain bacteria processing glucose, corn starch or wastewater.*

> *Note to entry 2: The sustainability of bio-based plastics, just as of fossil-based plastics, depends on production practices, the products' lifetime and end-of-life treatment.*

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Bio-based product

Product completely or partly derived from biomass and other biological resources, which are not used for food, feed and fuel.

> *Note to entry: Some bio-based products are not new innovations, such as, pulp and paper, timber for construction, bio-based cosmetics and fibres for clothing. However, there are many new kinds of bio-based products that are emerging. These include bio-based materials and biochemicals with new functionalities and properties, new substances used for medicinal purposes, and new ingredients used for cosmetics and functional food ingredients. According to the European Standard EN 16575, if the term 'bio-based product' is used to refer to a product, which is partly bio-based, the claim should be accompanied by a quantification of the bio-based content, normally expressed as a percentage of the total mass of the product. (CEN/TC 411, 2014)*

Biocatalyst

Molecule or molecular complex consisting of, or derived from, an organism or cell culture (in cell-free or whole-cell forms) that catalyses metabolic reactions in living organisms and/or substrate conversions in various chemical reactions. (Vert et al., 2012)

Biodegradability

Biodegradability refers to a process in which microorganisms convert the material into substances such as compost, carbon dioxide, methane or water through metabolic or enzymatic processes. The ultimate condition is the complete transformation of organic compounds into reduced simple molecules (such as carbon dioxide/methane, nitrate/ammonium, and water) and new biomass. Under aerobic conditions, carbon dioxide is the primary gas emitted while in the case of anaerobic conditions it is methane. The term "biodegradable" should always be associated with the type of medium (e.g. soil, water, in vitro medium), the conditions (e.g. temperature and humidity) and the duration of the biodegradation. For instance, among currently marketed bioplastics, PLA is always claimed as "biodegradable" while in reality, PLA is only industrially compostable (e.g. at 58°C and controlled conditions of humidity). Without this, PLA packaging, despite being made from renewable resources, is a plastic that will persist in our environment for a hundred years. (GLOPACK 2020)

Biodegradable plastics

Biodegradable plastic means a plastic capable of undergoing physical, biological decomposition, such that it ultimately decomposes into carbon dioxide, biomass and water, without leaving behind any residue, and in accordance with European standards for packaging recoverable through composting and anaerobic digestion. Biodegradable plastics are designed to biodegrade in a specific medium (water, soil, compost) under certain conditions and in varying periods of time. (EEA, 2020) Therefore the label "biodegradable" must always have a clear sign of the environment in which the test was performed. (based on GLOPACK 2020)

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Biodegradation

Breaking down of a substance by microorganisms. (EEA, 2021)

Biodiversity

The variability among living organisms from all sources, including, 'inter alia', terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems." (UNEP, 1992)

Bioeconomy

The production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy" (EC, 2012).

> *Note to entry: The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. / * Biomedicines and health biotechnology are excluded. (EC, 2021)*

Bio-based economy

The bio-based economy is a subset of the bioeconomy that is concerned with the production of bio-based products and the generation of bioenergy (i.e. all bioproducts except food and feed) (Dubois et al. 2016 and Gomez San Juan et al. 2019).

> *Note 1 to entry: According to the most recent estimates, the bioeconomy of the EU post-Brexit (i.e., EU-27) created up to €614 billion of value added in the EU-27 in 2017, which represents 4.7% of the GDP. Around 35% came from the food, beverages and tobacco industry, and 31% from agriculture. Using turnover as an indicator, the bioeconomy created €2.2 trillion in the EU-27 in 2017. Half of this was generated by the food, beverages and tobacco industry, 19% by agriculture. In 2017, the bioeconomy employed 17.5 million people in the EU-27, which represents 8.9% of the total labour force. More than half worked in agriculture (53%) and a quarter in the food, beverages and tobacco industry (25%). (Ronzon et al, 2020)*

> *Note 2 to entry: The bio-based industries made a total contribution of €780 billion in 2018, a more than 20% increase compared to 2008. Figures for the bio-based chemical industry (including plastics) alone reveal a turnover of around €54 billion with the bio-based share relatively stable at around 15%, up from 7.5% in 2008. (Porc et al, 2021)*

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Bio-based value chain

A value-chain is defined as a set of interlinked activities that deliver products/services by adding value to bulk material (feedstock). In a *bio-based value chain*, the feedstocks tend to be biomass drawn from an existing primary production route (e.g., agriculture, forestry and livestock), or of a novel (e.g., microalgae) or secondary origin (e.g., sludge, industrial wastewater and household organic waste). (Lokesh et al, 2018)

Bioenergy

All energy derived from biofuels whereas biofuels are fuel[s] produced directly or indirectly from biomass. Fuel is defined as an energy carrier intended for energy conversion. (FAO 2004)

Biofertiliser

A substance which contains living micro-organisms which, when applied to seeds, plant surfaces, or soil, colonise the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant.

> *Note to entry: Biofertilisers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphorus, and stimulating plant growth through the synthesis of growth-promoting substances. The micro-organisms in biofertilisers restore the soil's natural nutrient cycle and build soil organic matter. Through the use of biofertilisers, healthy plants can be grown, while enhancing the sustainability and the health of the soil. Biofertilisers can be expected to reduce the use of synthetic fertilizers and pesticides, but they are not yet able to replace their use.*

Biofuel

A fuel produced from organic matter or combustible oils produced by plants. These fuels are considered renewable as long as the vegetation producing them is maintained or replanted, such as firewood, alcohol fermented from sugar, and combustible oils extracted from soybeans. (UNFCCC, 2021) Biofuel can be liquid, solid or gaseous. (FAO, 2004)

Biogas

The gaseous product of the decomposition of organic matter in the absence of oxygen.

Biogenic

Produced by living organisms. (Merriam Webster)

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Biological cycle

The processes - such as composting and anaerobic digestion - that together help to regenerate natural capital. The only materials suitable for these processes are those that can be safely returned to the biosphere. (EMF, 2021)

Biological resources

Material of biological origin. They do not include organic material that has been embedded in geological formations and fossilised (e.g. fossil fuels, such as coal, petroleum and natural gas). (Gomez San Juan et al. 2019)

Biomacromolecules

Biomacromolecules are large biological polymers, such as nucleic acids, proteins, and carbohydrates, that are made up of monomers linked together. (EMBL-EBI, 2021),

Biomass (see discussion)

All organic matter that derives from the photosynthetic conversion of solar energy. (EEA, 2021)

Biomass-based value web

A term coined to describe the extension of the concept of the biomass value chain to encompass the links that are created within and between value chains as a result of the cascading use and the joint use of biomass.

> *Note to entry: As the degree of recycling and the cascading use of biomass in the bioeconomy increases, especially during the processing stage and the marketing of bioproducts, the point of 'zero waste' will be approached. As this happens, different value chains will merge and it will no longer be sufficient to analyse value chains by using a conventional, linear approach that largely focuses on a single product. There is a range of cross-cutting activities that apply to all stages of the biomass value chain. (Gomez San Juan et al. 2019)*

Biomass feedstocks

Biomass resources that are available on a renewable basis and are used for producing bio-based products (food, feed, chemicals, materials) and/or bioenergy (biofuels, power and/or heat).

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Biomass potential

A resource which is generally being tapped and sometimes unused (Thrän et al, 2015).

> *Note to entry: when considering its use as feedstock for bio-based products, including bioenergy, a distinction is usually made between different types of biomass.* ***Theoretical potential****: The maximum over time non-declining amount of biomass which can be theoretically extracted on a long term basis within fundamental bio-physical limits.* ***Technical potential****: Biomass potential which is available under the current infrastructure conditions and with the current technological possibilities. It can be in the short term temporarily higher than the theoretical potential, it must however respect its constraints.* ***Economic potential****: Fraction of technical potential which meets the criteria of economic profitability within the given framework conditions using existing infrastructure and technology available in that location.* ***Implementation potential****: The potential that can be implemented within a certain time frame and under concrete socio-political framework conditions, including economic, institutional and social constraints and policy incentives. It can be higher than the economic potential; it must respect the constraints of the theoretical potential. (EC, 2021)*

Biomass processing and use

Processing refers to any kind of processing of biomass in small-, medium- or large-scale processing facilities. Use can range from the use of unprocessed biomass or biomass that has undergone very limited processing to the use of highly processed bioproducts. Therefore, biomass processing and use can be grouped as one stage; yet, depending on the context, they can refer to two separate stages.

The processing and use stage of the value chain involves activities that are critical for the successful implementation of the bioeconomy, such as local value addition, logistics and transportation, marketing, awareness-raising campaigns geared to consumers and manufacturers, and commercialisation.

Biomass producer

Anyone who is engaged in crop production, livestock production, forestry, and fisheries and aquaculture. Examples include crop farmers or cattle producers. (Gomez San Juan et al. 2019)

Biomass production and collection

Biomass is produced through agriculture, which encompasses crop production, livestock production, forestry, and aquaculture and fisheries. Biomass can also be collected from residues, waste and by-products generated at all three stages of the biomass value chain. Biomass collection also includes the small-scale gathering of indigenous plants for food, feed, fuel and bio-based products, such as cosmetics and healthcare products. (Gomez San Juan et al. 2019)

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Biomass residues

Biomass residues include agricultural residues from crop and livestock production and fisheries; wood residues from forest harvesting, forest plantations and wood processing as well as agro-industrial residues from food processing and bio-industrial residues from the processing of other bioproducts. (based on Gomez San Juan et al. 2019)

Biomass value chain

The valorisation of biomass feedstock, such as organic, wood, and crop material or residues, as well as of municipal organic wastes and manure for the production of bioenergy and innovative bio-based products.

Biomaterial

Synthetic or natural material suitable for use in constructing artificial organs and prostheses or to replace bone or tissue. (Oxford dictionaries)

Bioplastic

Bioplastic refers to a variety of materials that "are either bio-sourced, derived from biomass, either biodegradable or features both properties". A bio-sourced (or bio-based) packaging can be partially or totally made of biomass, e.g. from dedicated crops such as sugarcane, corn, etc. or from organic waste and residues resulting from primary or secondary transformations, e.g. cellulose, ligno-cellulosic residues. A bioplastic can be also made of fossil resources and classified as biodegradable (e.g. PBAT), while bio-sourced bioplastics developed to substitute current plastics such as bio-PET, bio-PE, bio-PP are not biodegradable at all. A bioplastic could be biodegradable without being bio-sourced, bio-sourced without being biodegradable or biosourced and biodegradable! (GLOPACK 2020)

> *Note to entry: The term bioplastics is being used for plastics that are either bio-based or biodegradable, or both. Given that these have very different properties, consumers could misunderstand the rather vague term 'bioplastics'. The term is furthermore misleading because it suggests that any polymer derived from biomass is environmentally friendly. Therefore the use of the term "bioplastics" should ideally be avoided. It is preferable to use the term "bio-based plastic" if it is a plastic derived from biomass or biodegradable plastic if it biodegrades. Both categories overlap but there also are bio-based plastics that are not biodegradable as well as biodegradable plastics that are not bio-based.*

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Biopolymer

Biopolymers are naturally occurring polymers, which are produced by living organisms. They are distinct from synthetic biodegradable polymers. Some of the first modern biomaterials made from natural biopolymers include rubber, linoleum, celluloid and cellophane. The latter two are made using cellulose, which is the most naturally abundant biopolymer and the most abundant organic material on Earth. (Matmatch, 2021)

Note 1 to entry: Biopolymers are distinct from biodegradable polymers. Biopolymers are materials produced from natural or renewable resources, as opposed to 'standard' polymers that are produced from oil. Biopolymers might be biodegradable, but not always; similarly, some oil-based plastics are biodegradable.

Note 2 to entry: Biopolymers can be classified broadly into three categories based on their monomeric units and structure:

- *Polynucleotides: DNA (deoxyribonucleic acid) and RNA (ribonucleic acid)*
- *Polysaccharides: cellulose, chitosan, chitin, etc.*
- *Polypeptides: collagen, gelatine, gluten, whey, etc.*

Note 3 to entry: Biopolymers can also be categorised by other criteria such as their base materials (animal, plant or microbial), their biodegradability, their synthesis route, their applications or their properties. Examples of some commercially-produced biopolymers include:

- *Bio-based polyesters such as polylactic acid (PLA), polyhydroxybutyrate (PHB), polybutylene succinate (PBS), polybutylene succinate adipate (PBSA), polytrimethylene terephthalate (PTT)*
- *Bio-based polyolefins such as polyethylene (Bio-PE)*
- *Bio-based polyamides (Bio-PA) such as homopolyamides (Bio-PA 6, Bio-PA 11) and copolyamides (Bio-PA 4.10 – Bio-PA 5.10 – Bio-PA 6.10, Bio-PA 10.10)*
- *Polyurethanes such as Bio-PUR*

Polysaccharide polymers such as cellulose-based polymers (regenerated cellulose, cellulose diacetate) and starch-based polymers (thermoplastic starch, starch blends) **Bioproducts**

All products made from biological resources, and includes food, feed, biofuels and bio-based products (Gomez San Juan et al. 2019)

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Biorefinery / biorefining

Biorefining is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat) (De Jong et al, 2020). This concept is analogous to today's petroleum refinery, which produces multiple fuels and products from petroleum.

Biosolids

Organic matter recycled from sewage, especially for use in agriculture. (Oxford dictionaries)

Biosolvent

Solvent derived from biomass; whereas **solvents** are liquids in which a solute is dissolved to form a solution. (Oxford dictionaries)

Biosurfactant

Surfactant derived from biomass; whereas surfactants are substances that tends to reduce the surface tension of a liquid in which it is dissolved. (Oxford dictionaries). Surfactants may act as detergents, wetting agents, emulsifiers, foaming agents, or dispersants. The word "surfactant" is a blend of surface-active agent.

BIOSWITCH

A EU-funded project (bioswitch.eu) that aims to bring Europe to the forefront of the bio-based economy by encouraging and supporting brand owners from different sectors to switch to bio-based approaches. It addresses three challenges: (a) Respond appropriately to brand owners' perceptions of the potential risks of the 'switching to bio-based'; (b) Identify advantages, incentives, motivations and best practices that may drive brand owners to switch and (c) Provide frameworks able to incentivise, motivate and drive brand owners to 'switch to bio-based'. The project has received funding from the Bio-Based Industries Joint Undertaking under the European Union´s Horizon 2020 research and innovation programme under grant agreement No 887727.

Biotechnology *(see discussion)*

Integration of natural sciences and engineering in order to achieve the application of organisms, cells, parts thereof, and their molecular analogues for products and services (Vert et al. 2012)

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Biowaste / bio-waste

Biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants.

Note to entry: It does not include forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood. It also excludes those by-products of food production that never become waste. (EC, 2021a)

Building blocks

Building blocks are the bio-based materials needed to manufacture some of the most common bioproducts.

> *Note to the entry: For example, ethylene, which can be made from sugar cane, is a building block used in the manufacturing of the polymer polyethylene (PE). A polymer is a chemical compound consisting of repeating monomers, a class of molecule that can bond in long chains. Along with PE, there are a number of other polymers used in the production of commodity plastics, such as polystyrene (PS), polypropylene (PP), polyvinyl chloride (PVC) and polyethylene terephthalate (PET). Examples of polymers used in the production of specialty or engineering plastics include polytetrafluoroethylene (PTFE, also known as Teflon), polycarbonate (PC, also known as Lexan) and polyesters and polyamides (Nylon). (Gomez San Juan et al. 2019)*

Business to Business (B2B)

Describes transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer. (EC, 2021)

Business to Consumers (B2C)

Describes transactions between business and consumers, such as between retailers and consumers. (EC, 2021)

By-product

A material or substance created when processing or manufacturing something else. (WBCSD, 2021) A by-product can be useful and marketable, or it can have negative ecological consequences. (US EPA, 2021)

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C

Carbon

Carbon (from Latin: carbo = coal) is the chemical element with the symbol C. Carbon is highly prevalent in the biosphere, with almost any living being on Earth is made up of carbon, including humans and animals. It is essential for growth and reproduction and the major building block of life, for organic chemistry and derived materials such as plastics. *See also: Renewable Carbon.* (RCI, 2021).

Carbon capture and storage, also known as carbon capture and sequestration (CCS)

The process of capturing carbon dioxide before it enters the atmosphere, transporting it, and storing it for centuries or millennia.

Carbon capture and utilisation, also known as carbon capture and use (CCU)

The process of capturing carbon dioxide to be recycled for further usage. CCU is a broad term that covers all established and innovative industrial processes that aim at capturing carbon dioxide– either from industrial point sources or directly from the air – and at transforming the captured carbon dioxide into a variety of value-added products such as chemical building blocks, food/feed, synthetic fuels or materials. (CO_2 Value Europe, 2021)

Carbon capture, utilisation and storage (CCUS)

Technologies that involve the capture of carbon dioxide from fuel combustion or industrial processes, the transport of this carbon dioxide via ship or pipeline, and either its use as a resource to create valuable products or services or its permanent storage deep underground in geological formations. CCUS technologies also provide the foundation for carbon removal or "negative emissions" when the carbon dioxide comes from bio-based processes or directly from the atmosphere. (IEA, 2021)

Carbon debt

The initial emission of biogenic-CO_2 from forest bioenergy when it is higher than the emissions from a reference fossil system. It is called debt because the forest re-growth combined with the continuous substitution of fossil fuels may, in time, repay the "debt".

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Carbon dioxide (CO_2)

A molecule made of one carbon atom double bonded to two oxygen atoms (one of each side of the carbon). It is a colourless, odourless gas at standard temperature and pressure and is widely implicated as one of the major causal agents in greenhouse warming. Carbon dioxide is a colourless, odourless gas, denser than air that occurs naturally in the earth's atmosphere. It is slightly soluble in water, forming carbonic acid. Carbon dioxide has many uses, such as a coolant, fire extinguishing gas and preservative. The gas is also used to provide the bubbles in fizzy drinks. A minor use of the solid (frozen) form is to produce smoke effects in TV, film and theatre (EEA, 2021)

Carbon footprint

The full quantity of greenhouse gases that can be attributed to an individual, a plant, a company, a product or a whole economy. (EC, 2021)

Carbon monoxide (CO)

A colourless, odourless poisonous gas. It is formed when fuels containing carbon are burnt in conditions where oxygen is limited. It is slightly lighter than air. Carbon monoxide can form explosive mixtures with air. (EEA, 2021)

Carbon-neutral

Balancing the amount of carbon released – by burning fossil fuels or biomass, or the decomposition of plant biomass, for example – with an equivalent amount put into and stored in soils, plant and animal tissues, or other material such as the ocean floor. (AllThings.Bio, 2021)

Cascading

Cascading use is the efficient utilization of resources by using residues and recycled materials for material use to extend total biomass availability within a given system. In a single-stage cascade, the wood is processed into a product and this product is used once more for energy purposes. In a multi-stage cascade, the wood is processed into a product and this product is used at least once more in material form before disposal or recovery for energy purposes. (EC, 2021)

Certification

Formal procedure by which an accredited or authorised person or agency assesses and verifies (and attests in writing by issuing a certificate) the attributes, characteristics, quality, qualification, or status of individuals or organizations, goods or services, procedures or processes, or events or situations, in accordance with established requirements or standards. (EC, 2021)

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Chemicals building blocks (also known as "platform chemicals')

Chemicals that form the base form more complex products. For instance, they constitute the monomers that react together to build a chain, called polymer. (EC, 2021)

Circular Bio-based Europe (CBE) Joint Undertaking.

The public-private partnership succeeding BBI JU that aims to accelerate Europe's transformation into a circular bio-based economy and would continue biorefinery deployment in Europe, while involving all stakeholders along the value chain, strengthening collaboration with regional actors and systematically measuring the environmental and socio-economic impacts of funded projects. (Vos et al 2021)

Circular economy

A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature.

It is underpinned by a transition to renewable energy and materials. Transitioning to a circular economy entails decoupling economic activity from the consumption of finite resources. This represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. (EMF, 2021)

Circularity

Achieving circularity in the value chain involves retaining the value of different kinds of resources (not only biological resources) in the economic cycle as long as possible before these resources reach the end-of-life stage. Applying the principles of circularity is a key aspect of making the bioeconomy sustainable. Circularity, which is focused on 'designing out' waste by adding value to biological waste and by-products flows, increases resource use efficiency in the biomass value chain; less inputs are used and less waste is produced. (based on Gomez San Juan, 2019)

Claim

Claim refers to assertions made by companies about beneficial qualities or characteristics of their goods and services. (UNEP and CI, 2021).

Composite

A composite material (also called a composition material or shortened to composite) is a material which is produced from two or more constituent materials. These constituent materials have notably dissimilar chemical or physical properties and are merged to create a material with properties unlike the individual elements. Within the finished structure, the individual elements remain separate and distinct, distinguishing composites from mixtures and solid solutions.

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Compost

Decayed organic material used as a fertiliser for growing plants. (Oxford dictionaries)

Compound

A substance consisting of atoms or ions of two or more different elements in definite proportions joined by chemical bonds into a molecule. (Dictionary, 2021)

Compostability

The term compostable is used to describe a product that can disintegrate into non-toxic, natural elements. It also does so at a rate consistent with similar organic materials. Compostable products require microorganisms, humidity, and heat to yield a finished compost product (CO_2, water, inorganic compounds, and biomass).

> *Note to entry: The main difference between compostable and biodegradable is that biodegradable material can take an undetermined time to break down whereas, in contrast, compostable materials will decompose into natural elements within a specific time frame. However, it will require certain conditions like those found in industrial composting facilities to do so.*

Compostable materials

Materials that can be disposed with biological materials and decay into nutrient-rich material. (WBCSD, 2021)

> *Note to entry: To meet the EU standard of compostability (EN 13432:20006 for packaging and EN 14995:20067 for not packaging) materials must meet four criteria:*

- *Chemical composition: volatile matter and heavy metals as well as fluorine should be limited.*
- *Biodegradability: the conversion of >90% of the original material into CO2, water and minerals by biological processes within 6 months.*
- *Disintegrability: at least 90% of the original mass should be decomposed into particles that are able to pass through a 2×2 mm sieve.*
- *Quality: absence of toxic substances and other substances that impede composting.*

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Composting

Treatment process that decomposes organic matter in an oxygenated environment. The result is nutrient-rich fertilizer or soil amendment. (WBCSD, 2021). Common types of composting include industrial composting (also known as 'commercial composting') and home composting.

Consumer

An individual member of the general public purchasing or using goods, property or services for private purposes.

Consumer acceptance

Willingness of consumers to buy (e.g. bio-based products). (Meeusen et al, 2015)

Co-product

A product produced together with another product. (US EPA, 2021)

Corporate Social Responsibility – CSR (also known as 'corporate citizenship')

A self-regulating business model that helps a company be socially accountable — to itself, its stakeholders, and the public. By practicing corporate social responsibility companies can be conscious of the kind of impact they are having on all aspects of society including economic, social, and environmental. To engage in CSR means that, in the normal course of business, a company is operating in ways that enhance society and the environment, instead of contributing negatively to it. (CIO Wiki, 2021).

Code of practice

A set of written rules which explains how people working in a particular profession should behave. (Collins Dictionary)

Cradle to cradle

A common type of boundary for life cycle assessments, and a specific kind of cradle-to-grave, where the end-of-life disposal step for the product is a recycling process." (EC, 2013). This follows the model of the circular economy, where products are designed in a way so that at the end of their initial life they can be readily reused or recycled.

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Cradle to gate

A common type of boundary for life cycle assessments, where a partial product supply chain is considered, from the extraction of raw materials ('cradle') up to the manufacturer's 'gate'. The distribution, storage, use stage and end-of life stage of the supply chain are omitted." (EC, 2013).

Cradle to grave

A common type of boundary for life cycle assessments, where a full product's life cycle is considered including raw material extraction, processing, distribution, storage, use, and disposal or recycling stages. All relevant inputs and outputs are considered for all of the stages of the life cycle." (EC, 2013). Conventionally, life cycle assessments address "the environmental aspects and potential impacts throughout a product's life, i.e. from cradle to grave" (ISO, 2006).

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D

Degradation

Irreversible process leading to a significant change in the structure of a product, typically characterized by a change of properties (e.g. integrity, molecular mass or structure, mechanical strength) and/or by fragmentation, affected by environmental conditions, proceeding over a period of time and comprising one or more steps. (CEN/TC 411 2014)

Dedicated bio-based chemicals

Dedicated bio-based chemicals are chemicals which are produced via a dedicated pathway and do not have an identical fossil-based counterpart. As such, they can be used to produce products that cannot be obtained through traditional chemical reactions and products that may offer unique and superior properties that are unattainable with fossil-based alternatives. (BIO-TIC 2014). Compared to drop-in commodity chemicals, bio-based dedicated pathways are more efficient, utilising not only the carbon in the biomass, but the whole biomass – carbon, oxygen, hydrogen and nitrogen. This is reflected in a high biomass utilisation efficiency – BUE. (Carus et al. 2016) BUE is defined as the percentage of initial biomass ending up in the end product based on the molar mass of the reactant (= biomass) and target bio-based product. (Iffland et al, 2015).

Note to entry: Examples of dedicated bio-based chemicals:

- *Dihydrolevoglucosenone.*
- *Glycerol and derivates, 3-hydroxypropionic acid and 3-hydroxypropanal, itaconic acid, farnesene, furans (HMF, furfural, FDCA), lactic acid, levulinic acid, methylenesuccinic acid, sorbitol, xylitol*
- *PEF, PHA, PLA, PA (10,10, 10,12 and 12,12)*
- *Bio-based lubricants and surfactants, e.g. sophoro- and rhamnolipids, alkylpolyglycosides*
- *Cellulose fibres, nano- and microcellulose (Carus et al, 2017)*

Depolymerisation

The process of converting polymers back into monomer(s). (WBCSD , 2021)

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Downcycling

Use of secondary materials that results in a lower economic value of that material that cannot be recovered. (WBCSD, 2021)

Downstream

Occurring along a product supply chain after the point of referral.

Drop-in

Short for "drop-in chemical". See also "bio-based drop-in chemicals".

Durability

The ability of a product, component or material to remain functional and relevant when used as intended. (EMF, 2021)

E

Ecolabel / Ecolabelling (see discussion)

Ecolabelling is a voluntary method of environmental performance certification and labelling that is practised around the world. An ecolabel identifies products or services proven to be environmentally preferable within a specific category. (Vos et al 2021)

> *Note to entry: with regard to different aspects of bio-based products, relevant ecolabels and certification schemes include for example: multi-issue ecolabels specifying bio-based products – e.g. the EU Ecolabel, the Nordic Ecolabel or "Swan", and the Blue Angel ecolabel; schemes certifying the sustainability of biomass used as raw material, such as wood (Forest Stewardship Council. Programme for the Endorsement of Forest Certification or agricultural biomass (e.g. International Sustainability & Carbon Certification, Roundtable on Sustainable Biomaterials, REDcert or Better Biomass) schemes certifying the bio-based (carbon) content e.g. TÜV Rheinland / DIN CERTCO), TÜV Austria and Biobased Content and schemes certifying end-of-life options of bio-based products, such as industrial compostability, home compostability, biodegradability in soil, biodegradability in sea water, etc.*

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Ecosystem

A biological community of interacting organisms and their physical environment. (Oxford dictionaries)

> *Note 1 to entry: A business ecosystem is the network of organisations—including suppliers, distributors, customers, competitors, government agencies, and so on—involved in the delivery of a specific product or service through both competition and cooperation. (Investopedia, 2021)*

> *Note 2 to entry: Innovation ecosystem is the term used to describe the large number and diverse nature of participants and resources that are necessary for innovation. These include "entrepreneurs, investors, researchers, university faculty, venture capitalists as well as business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development" (KNOW-HUB, 2021)*

Ecosystem services

The benefits people derive from ecosystems. Ecosystem services include provisioning services of essential goods (e.g. food, water, timber and fibre); regulating services that affect climate, flooding, the spread and control of pests and diseases, waste management, and water quality; cultural services that provide recreational, aesthetic and spiritual benefits; and supporting services, such as soil formation, photosynthesis, and nutrient cycling (UNDP, 2021).

Ecotoxicity

The ability of a chemical or physical agent to have an adverse effect on the health of an ecosystem, by damaging individual species and/ or changing the structure and function of the ecosystem. (AllThings.Bio, 2021)

End-of-life

The life cycle stage during which a product no longer has value to its original owner and is then disposed of. (WBCSD, 2021)

Environmental impact

Any change to the environment, whether adverse or beneficial, that wholly or partially results from an organisation's activities, products or services. (AllThings.Bio, 2021)

European Bioeconomy Network (EuBioNet)

Alliance of EU-funded projects dealing with bioeconomy promotion and communication.

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European Circular Bioeconomy Fund

The European Circular Bioeconomy Fund (ECBF) is a financial instrument that seeks to help achieving the European Green Deal goals of making Europe climate neutral by 2050. The ECBF partners with ambitious and visionary entrepreneurs to accelerate late-stage circular bioeconomy companies and will invest in innovative projects in the areas of agriculture, aquaculture and fisheries, the forest-based sectors, biochemicals and biomaterials, focusing on scaling up innovative bio-based companies in a late-stage (demonstration or commercial phases). The investment size ranges from € 2.5- 10 million. (Vos et al 2021)

European Green Deal

A set of policy initiatives by the European Commission with the overarching aim of making Europe climate neutral in 2050.

F

Feedstock

A material or substance that is used as an input to a product or process. (WBCSD, 2021)

Fertiliser

A chemical or natural substance added to soil or land to increase its fertility. (Oxford dictionaries)

Fibre products

Products derived from the fibres of herbaceous and woody plant materials. Examples include pulp, composition board products and wood chip. (AllThings.Bio, 2021)

Finite materials

Materials that are non-renewable on timescales relevant to the economy, i.e. not geological timescales. Examples include: metals and minerals; fossil forms of carbon such as oil, coal, and natural gas; and sand, rocks, and stones. (EMF, 2021)

Forest residues

By-products of logging operations (primary forest residues), such as branches, stumps, tree tops and sawdust, and industrial wood processing (secondary forest residues), for example bark, sawmill slabs, sawdust and wood chip. (AllThings.Bio, 2021)

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Footprint

The impact of a product or service across its life cycle. One can calculate a product's carbon, water, energy and material footprints, for example. This is similar to a life cycle assessment except that footprints typically only evaluate one environmental issue. (WBCSD, 2021)

Fossil fuel

A carbon or hydrocarbon fuel formed in the ground from the remains of dead plants and animals. It takes millions of years to form fossil fuels. Oil, natural gas, and coal are fossil fuels. (AllThings.Bio, 2021)

Fuel

An energy carrier intended for energy conversion, which can be liquid, solid or gaseous. (FAO 2004 & CEN/TC 411 2012)

In the context of the bioeconomy fuel is mainly used as a term for liquid fuels (petrol and diesel fuels) while gaseous and solid fuels normally are not included.

Functional performance

Functional performance refers to the capacity of the material to fulfil its requirements in the specific device application.

Functionality

The quality of being useful, practical, and right for the purpose for which something was made (Cambridge Dictionary, 2021)

G

Green chemistry (also known as 'sustainable chemistry')

Green chemistry is the design of chemical products and processes that minimise or eliminate the use or generation of substances hazardous to humans, animals, plants, and the environment. Green chemistry applies across the life cycle of a chemical product, including its design, manufacture, and use. (based on US EPA, 2021)

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Green claim

Practice of suggesting or otherwise creating the impression (in a commercial communication, marketing or advertising) that a good or a service has a positive or no impact on the environment or is less damaging to the environment than competing goods or services. (EC, 2005) This may be due to its composition, how it has been manufactured or produced, how it can be disposed of and the reduction in energy or pollution expected from its use. When such claims are not true or cannot be verified, this practice is often called 'greenwashing'. (ECOS, 2021).

Green engineering

Designing products and processes to minimise environmental impacts and protect human health without compromising economic value. (WBCSD, 2021)

Greenhouse effect

The Earth's atmosphere contains gases that largely allow short-wave solar radiation to pass through, but absorb (long-wave) thermal radiation and thus heat the system. In analogy to a greenhouse – which lets solar radiation pass through and "holds" heat radiation – the greenhouse effect refers to this process. The gases that cause this effect are called greenhouse gases. Water vapour and carbon dioxide, in particular, absorb part of the thermal radiation emitted from the Earth's surface and therefore reduce the proportion of thermal radiation emitted into space. (RCI, 2021)

Greenhouse gases

Greenhouse gases constitute a group of atmospheric gases that add to the greenhouse effect, contributing to global warming and climate change. The Kyoto Protocol covers six greenhouse gases: (i) the non-fluorinated gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O); (ii) the fluorinated gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6). Converting them to carbon dioxide (or CO_2) equivalents makes it possible to compare them and to determine their individual and total contributions to global warming. (shortened from RCI, 2021)

Greenhouse gas emissions

Greenhouse gas emissions describe the release of greenhouse gases (GHG) into the earth's atmosphere. As these emissions are the major driver of climate change, global GHG emissions are increasingly monitored. Scenarios for climate change are derived from current and projected GHG emissions and most targets toward mitigating climate change are based on quantifying the reduction of these emissions. (RCI, 2021)

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Green hydrogen

Green hydrogen is a form of hydrogen (H_2) produced with the use of renewable energy such as solar, wind and bioenergy without using fossil carbon feedstocks. The hydrogen in this case is produced via electrolysis of water with electricity produced from solar, wind or hydro energy. In carbon capture and utilisation (CCU) the green hydrogen is then used to react with the carbon monoxide (CO) or carbon dioxide (CO_2) as an energy carrier to form syngas, hydrocarbons such as methane or ethylene, alcohols such as methanol and ethanol or other chemicals such as formic acid. (RCI, 2021)

Green marketing (also known as 'environmental marketing' or 'sustainable marketing')

Green marketing refers to the practice of developing, advertising and selling products based on their real or perceived environmental sustainability. (Investopedia, 2021). Green marketing is also known as environmental marketing or sustainable marketing.

Green premium

The additional price a market actor is willing to pay for the additional emotional performance and/or the strategic performance of the intermediate or end product the buyer expects to get when choosing the bio-based alternative compared to the price of the conventional counter-part with the same technical performance. (Carus et al, 2014)

Green washing (also known as 'green sheen')

Greenwashing is the process of conveying a false impression or providing misleading information about how a company's products are more environmentally sound. ... Greenwashing is a play on the term "whitewashing," which means using misleading information to gloss over bad behaviour. (Investopedia, 2021). Greenwashing is an attempt to capitalize on the growing demand for environmentally sound products. It can convey a false impression that a company or its products are environmentally sound. Genuinely green products back up their claims with facts and details.

H

Home composting

The controlled decomposition of organic material such as yard trimmings, kitchen scraps, wood shavings, cardboard and paper. It is a means of recovery of organic matter into compost, which can be used for soil improvement or as a fertiliser. At home, organic material can be composted outdoors (e.g. backyard composting) or even indoors (using a special type of bin).

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Home compostable

When a product or a package is labelled home compostable, then it can be placed in a home compost bin or in the green bins where it will decompose and become organic rich soil, within a measured period of time.

Home compostable plastics

Home compostable plastics are designed to biodegrade in the conditions of a well-managed home composter at lower temperatures than in industrial composting plants. Most of them also biodegrade in industrial composting plants. (EEA, 2020)

I

Industrial composting (also known as 'commercial composting')

Industrial composting is an established process for transforming biodegradable waste of biological origin into stable, sanitised products to be used in agriculture. It occurs under certain, managed conditions (in the presence of heat, humidity and oxygen) in industrial (commercial) composting plants. Common technologies include windrow composting, aerated static piles, tunnel composting and in vessel composting. (Source: European Bioplastics, 2009)

Industrial compostable (also 'commercial compostable' or 'municipal compostable')

Compostable only under a controlled environment with industrial conditions, which include high temperatures and allow for a faster composting than home composting. Industrial compostable is also called 'commercial compostable' or 'municipal compostable'.

Industrially compostable plastics

Industrially compostable plastics are designed to biodegrade in the conditions of an industrial composting plant or an industrial anaerobic digestion plant with a subsequent composting step. (EEA, 2020)

Intermediate product

Output from a unit process that is input to other unit processes that require further transformation within the system.

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L

Label

Label describes a logo or stamp highlighting a product or service's specific characteristic(s), which may also be used as a form of trademark. A label may or may not represent a certification. (UNEP and CI, 2021).

Label requirements

Requirements to be met by the works, products, services, processes or procedures in question in order to obtain the label concerned. (EU Directive 2014/24/EU)

Life cycle

All of the stages that a product goes through in its lifetime: raw material extraction, processing, manufacturing, use, end-of-life and transportation. (CEPD, 2021)

Life cycle approach

Takes into consideration the spectrum of resource flows and environmental interventions associated with a product from a supply-chain perspective, including all stages from raw material acquisition through processing, distribution, use, and end-of-life processes, and all relevant related environmental impacts (instead of focusing on a single issue). (EC, 2021)

Life cycle assessment

Life cycle assessment (previously also known as life cycle analysis) is defined as a systematic analysis of environmental impacts of a product or service throughout its entire life cycle. For this analysis, the material and energy inputs and outputs along all steps of the life cycle (this includes raw material extraction, production, distribution, use and disposal at end-of-life) are collected and then assessed in terms of potential environmental impacts of a product system. LCA is accepted as one of the main methods to identify environmental impacts and is standardised on the widely accepted standards ISO 14040 and ISO 14044. (RCI, 2021) Life cycle inventory and life cycle impact assessment are consecutive parts of a life cycle assessment. (EC, 2021) Comparative life cycle assessment refers to a life cycle assessment. in which two or more products or systems are compared. Streamlined life cycle assessment refers to a simplified version of a life cycle assessment. that focuses on the most significant environmental impacts of a product or system. (WBCSD, 2021)

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Life cycle costing

A method to evaluate the financial impacts of a product or system over its life cycle. (CEPD, 2021)

> *Note to entry: (Hunkeler et al. 2008) differentiate LCC into three types—conventional LCC, environmental LCC, and societal LCC. Conventional LCC focuses on internal costs directly associated with a product's life cycle. Environmental LCC goes beyond that scope and includes external costs likely to be internalised in the decision-relevant future, such as environmental taxes and subsidies. Societal LCC even includes costs emerging from the side-effects of production which manifest in people's lives and society, whether today or in the long-term. Within the realm of LCSA, it is normally referred to as environmental LCC.*

Life cycle impact analysis

The second phase of a life cycle assessment in which environmental impacts are determined. (WBCSD, 2021)

Life cycle impact assessment

Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product. (EC, 2021)

Life cycle improvement analysis

The third stage of a life cycle assessment in which solutions are evaluated for mitigating environmental impacts. (WBCSD, 2021)

Life cycle interpretation

Phase of life cycle assessment in which the findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations. (EC, 2021)

Life cycle inventory analysis

The first stage of a life cycle assessment in which the inputs and outputs (materials, energy, water, economic value, etc.) of the system are identified. (WBCSD, 2021)

Life cycle management

The integration of life cycle thinking into decision-making. (WBCSD, 2021)

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Life cycle perspective

The compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle. (ISO, 2006). A life cycle perspective includes consideration of the environmental aspects of an organisation's activities, products, and services that it can control or influence. Stages in a life cycle include acquisition of raw materials, design, production, transportation/delivery, use, end of life treatment, and final disposal. (ISO, 2021)

Life cycle thinking

Approach of accounting for economic, environmental and social impacts across all stages of a product or services life cycle. (WBCSD, 2021)

Lifespan/lifetime

The period of time from when a product is released for use after manufacture to the moment it becomes obsolete beyond recovery at product level. (EMF, 2021)

Linear economy

An economy in which finite resources are extracted to make products that are used - generally not to their full potential - and then thrown away ('take-make-waste'). (EMF, 2021)

Local materials

Materials that are extracted and processed within the same region they are being purchased. Specific distances depend on the material, process and objectives. (WBCSD, 2021)

M

Man-made fibre

Fibre whose chemical composition, structure, and properties are significantly modified during the manufacturing process. Man-made fibres are spun and woven into a huge number of consumer and industrial products. (Encyclopædia Britannica, 2021)

Marginal lands

Areas not suitable for agriculture, such as land that is subject to drought or extreme flooding, or that suffers from salt stress. It is a broad definition that covers many different types of land. It's considered land of poor quality with regard to agricultural use, and unsuitable for housing and other uses.

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Market acceptance

Relates to the willingness of market actors to adopt, purchase and financially support a new technology. Market actors refer to actors with a direct influence on market development. This generally includes consumers or firms, which may act as adopters and buyers of a particular product, as well as investors. Government agencies and other public bodies also represent an important source of potential demand for environmentally-friendly and innovative technologies. (Meeusen et al, 2015)

Mass balance

Relationship between input and output of a specific substance within a system in which the output from the system cannot exceed the input into the system. (CEN/TC 411, 2014)

The mass balance approach is used as a tool in order to increase the share of renewable content used as a feedstock, Multiple players in the chemicals and polymer industry finding supply chains that incorporate renewable materials. (e.g. BASF) are utilising the mass balance approach to increase the amount of renewable content in their feedstocks

Material

Substance that is exploited by humans in their practical activities. (Vert et al. 2012)

Material use

In "material use" the biomass serves as raw material for the (industrial) production of all kinds of goods as well as their direct use in products. This clearly distinguishes it from energy use, in which the biomass serves purely as an energy source. (Carus et al., 2010)

Methane (CH_4)

A colourless gas, odourless at low concentrations, but with a sweetish chloroform-like odour at high concentration. It is highly combustible, and mixtures of about 5 to 15 percent in air are explosive. Upon release into the atmosphere methane is destroyed by reactions with other chemicals in the atmosphere, giving a lifetime of about 10 years. (EEA, 2021). Methane is one of the six greenhouse gases o be mitigated under the Kyoto Protocol. Significant emissions occur as a result of animal husbandry and agriculture.

Monoculture

Growing genetically identically/very similar plants over a large area, with no other types of plants present. (AllThings.Bio, 2021)

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Monomer

A molecule of low molecular weight capable of chemically reacting to another molecule of the same type to form a larger molecule, such as dimer, trimer, tetramer, polymer, etc. (EC, 2021)

Municipal solid waste (MSW)

Waste that is generated by households, schools, hospitals and businesses in a given city or region. (WBCSD, 2021) It includes mixed commercial and residential garbage, such as yard trimmings, paper and paperboard, plastics, rubber, leather, textiles, and food wastes. MSW for bioenergy also represents an opportunity to reduce residential and commercial waste by diverting significant volumes from landfills to the refinery. (USDOE, 2021)

N

Natural capital

The stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people. (WBCSD, 2021)

Natural fibre

Any hairlike raw material directly obtainable from an animal, plant, or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth. (based on Encyclopædia Britannica, 2021)

Natural resources

Natural resources are derived from the environment. Many natural resources are essential for human survival, while others are used for satisfying human desire. Conservation is management of natural resources with the goal of sustainability.

Nitrous oxide (N_2O)

One of the six greenhouse gases to be mitigated under the Kyoto Protocol. The main anthropogenic source of N_2O is agriculture (soil and animal manure management), but important contributions also come from sewage treatment, fossil fuel combustion, and chemical industrial processes. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. (IPCC, 2018)

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Non-biodegradable plastics

Non-biodegradable plastics last for long periods of time. They can disintegrate into smaller pieces, forming microplastics, and accumulate in the environment. (EEA, 2020)

O

Organic waste

Waste containing carbon compounds; derived from animal and plant materials. (EC, 2021)

P

Personal benefit

A profit or gain pertaining to, directed toward, or affecting a person. (Law Insider, 2021)

Plastic

Generic term used in the case of polymeric material that may contain other substances to improve performance and/or reduce costs. (Vert et al. 2012)

Platform chemicals (also known as "chemical building blocks')

Chemicals that form the base form more complex products. For instance, they constitute the monomers (see definition of monomer) that react together to build a chain, called polymer. Examples include lactic acid and succinic acid.. (based on EC, 2021)

Polymer

A chemical compound consisting of repeating monomers, a class of molecule that can bond in long chains. (Gomez San Juan et al. 2019)

Product

Substance, material or object resulting from a production process. (CEN/TC 411 2014)

Public acceptance

See social acceptance.

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R

Raw material

Crude or virgin material that is used in product manufacturing or processing. (WBCSD, 2021).

Recyclate

A raw material sent to and processed in a waste recycling plant or materials-recovery facility so it can be used in the production of new materials and products. For example, plastic bottles can be made into plastic pellets and synthetic fabrics.

Recycle

Transform a product or component into its basic materials or substances and reprocessing them into new materials. (EMF, 2021)

Recyclability

The ease with which a material can be recycled in practice and at scale.(EMF, 2021)

Recycled content

The portion of a product that is made from recovered and recycled materials. (WBCSD, 2021)

Recycling

The collection, sorting and processing of disposed materials for use in another manufacturing process. (WBCSD, 2021)**Recycling, Chemical**

Chemical recycling represents a set of various recycling technologies for a range of different plastics and polymers. The main technologies can be separated into solvent-based (alcoholysis, hydrolysis, ammonolysis and aminolysis, combined methods), thermochemical (pyrolysis, gasification) and enzymolysis. In general, two characteristic traits are mainly associated with the term chemical recycling which are the change of the polymers molecular structure and the change of the plastics formulation. The underlying definitions may therefore vary depending on the design which can either be based more on natural sciences or on politics. Chemical recycling is often associated with more generic terms such as "advanced recycling". (RCI, 2021)

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Recycling, Mechanical

The term mechanical recycling refers to operations which neither change the formulation of a plastic (or material) nor substantially change the molecular structure of the polymer. The involved steps of mechanical plastic or textile recycling deviate from each other and may cover collection/segregation, cleaning and drying, mechanical disintegration (e.g. chipping/sizing), colouring/agglomeration, extrusion and granulation, re-spinning into yarns, and manufacturing of the end product. (RCI, 2021)

Recycling, Other

Recycling processes may not fit into the mechanical or chemical recycling category or may refer to other materials such as paper via mechanical or chemical pulping. Such recycling concepts for cellulose are somewhere between these two concepts. Breaking down to monomers and re-polymerisation does not work for cellulose recycling. The molecular structure may be kept intact or be modified throughout the process, a separation of the cellulose molecules takes place to some extent as well as the formulation may change. Another recycling process that cannot be clearly categorised into mechanical or chemical recycling is the solvent-based purification of plastics in which the molecular structure of the polymer is kept intact but the formulation of the plastic is changed throughout the process which is often referred to as physical recycling. (RCI, 2021)

Refinery

A refinery is a technical plant for the purification and refinement of raw materials (e.g. fractionation of crude oils via distillation which is based on the different boiling points of the respective fractions). Often, it refers to a petroleum oil refinery, which consists of a group of chemical engineering processing and refining units to convert crude oil into basic chemicals for further utilisation. This is usually done via cracking (steam cracking or catalytic cracking), a process in which large hydrocarbon molecules are broken down into smaller and more useful ones. A key product of a refinery is fossil-based petroleum naphtha, an intermediate liquid hydrocarbon stream, which serves as a raw material for the production of many other chemicals. Petroleum naphtha can be replaced with naphtha derived from renewable carbon alternatives (either bio-based, CO_2-based or chemical recycling). Different refineries also exist for other raw materials, e.g. sugar, salt, natural gas, edible oils, metals etc. (RCI, 2021)

Refurbish

Return a product to good working order. This can include repairing or replacing components, updating specifications, and improving cosmetic appearance. (EMF, 2021)

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Remanufacture

Re-engineer products and components to as-new condition with the same, or improved, level of performance as a newly manufactured one. Remanufactured products or components are typically provided with a warranty that is equivalent to or better than that of the newly manufactured product. (EMF, 2021)

Renewable carbon

Renewable carbon entails all carbon sources that avoid or substitute the use of any additional fossil carbon from the geosphere. Renewable carbon can come from the biosphere, atmosphere or technosphere – but not from the geosphere. (RCI, 2021)

Renewable material

Material that is composed of biomass and that can be continually replenished. (CEN/TC 411, 2014)

Renewable resources

Materials, energy and water sources that replenish themselves after human extraction within a finite amount of time. (WBCSD, 2021)

Repair

Operation by which a faulty or broken product or component is returned back to a usable state to fulfil its intended use. (EMF, 2021)

Residue

A small amount of something that remains after the main part has gone or been taken or used. (Oxford dictionaries). In the context of bioeconomy, residues are divided into four main sub-categories: agricultural, forestry, aquaculture and fisheries, and processing residues. A processing residue is a substance that is not the end product(s) that a production process directly seeks to produce. It is not a primary aim of the production process and the process has not been deliberately modified to produce it. (EC, 2021)

Resource

Resource refers to all the materials available in our environment which help us to satisfy our needs and wants. Resources can broadly be classified upon their availability — they are classified into renewable and non-renewable resources. They can also be classified as actual and potential on the basis of the level of development and use, on the basis of origin they can be classified as biotic and abiotic, and on the basis of their distribution, as ubiquitous and localised (private, community-owned, national and international resources).

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Resource depletion

The exhaustion of raw materials within a region. Resources are commonly divided between renewable resources and non-renewable resources. Use of either of these forms of resources beyond their rate of replacement is considered to be resource depletion. Resource depletion is most commonly used in reference to farming, fishing, mining, water, and fossil fuels. (Definitions.net, 2021)

Resource efficiency

A percentage of the total resources consumed that make up the final product or service. (Circular Economy Practioner Guide, 2021)

Resource productivity

The economic value created per unit of resource. (Circular Economy Practioner Guide, 2021)

Resource value optimisation

Maximizing the economic value that is created per unit of resource, over multiple lifetimes. (Circular Economy Practioner Guide, 2021)

Reuse (also written as re-use)

The repeated use of a product or component for its intended purpose without significant modification. Small adjustments and cleaning of the component or product may be necessary to prepare for the next use. (EMF, 2021)

S

Secondary raw materials

Waste materials that are recovered, recycled and reprocessed for use as raw materials. (WBCSD, 2021)

Smart drop-in chemicals

Smart drop-in chemicals are a special sub-group of drop-in chemicals. They are also chemically identical to existing chemicals based on fossil hydrocarbons, but their bio-based pathways provide advantages compared to the conventional pathways. Drop-in chemicals are considered to be 'smart drop-ins' if at least two of the following criteria apply:

- The Biomass Utilisation Efficiency – BUE (see Iffland et al. 2015) from feedstock to product is significantly higher compared to other drop-ins.

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- Their production requires significantly less energy compared to other production alternatives.
- Time-to-product is shorter due to shorter and less complex production pathways compared to the fossil-based counterpart or other drop-ins.
- Less toxic or harsh chemicals are used or occur as by-products during their production process compared to the fossil-based counterpart or other drop-ins. (Carus et al., 2017)

Social acceptance

A positive attitude towards a technology or measure, which leads to supporting behaviour if needed or requested, and the counteracting of resistance by others. Social acceptance is also referred to as public acceptance Acceptance that only covers an attitude without supportive behaviour may be described as 'tolerance'.(Climate Policy, 2014)

> *Note to entry: Wüstenhagen et al. (2007) offer the most comprehensive concept of social acceptance, distinguishing between three basic dimensions: community acceptance, socio-political acceptance and market acceptance. Socio-political acceptance is social acceptance on the broadest, most general level. Community acceptance refers to the behavioural responses within communities, which are affected by the placement of a technological object close to their home. Socio-political acceptance refers to the response to new technologies or areas of technological innovation by the public, by political parties and other key societal stakeholders, which help shape both policy and public opinion in the related field.*

Social life cycle assessment (S-LCA)

A method that can be used to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. This looks at the extraction and processing of raw materials, manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. S-LCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative, and complements the environmental LCA and LCC. It can either be applied on its own or in combination with the other techniques. (Life Cycle Initiative, 2021)

Solvent

A liquid that dissolves a solid, liquid, or gaseous solute, resulting in a solution. (AllThings.Bio, 2021)

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Standards

Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes, and services are fit for their purpose. Standards provide a basis for mutual understanding among individuals, businesses, public authorities, and other stakeholders, facilitating communication, commerce, measurement/testing and manufacturing. Most of the standards, including those of highest relevance to the uptake of bio-based products, are voluntary market agreements. (Vos et al 2021)

Sufficiency

Sufficiency is about ensuring that all humans can live a good life without overshooting the ecological limits of the Earth (for now and generations to come), and defining what that good life may be made of.

The concept of sufficiency has been primarily developed in the area of energy consumption. Energy sufficiency is about questioning and drastically reducing energy demand through 'changes in quantity or quality' of the energy-based services consumed, notably by 'favouring behaviours and activities that are intrinsically low on energy use'. Sufficiency is also applicable to material consumption. Material sufficiency consists in reducing demand for services and activities requiring high level of material resources, and favouring intrinsically lean ones. It is for instance associated with the ideas of avoiding wasteful consumption, owning fewer products, and prolonging their lifetimes.

Surfactants

Substances that tends to reduce the surface tension of a liquid in which it is dissolved. (Oxford dictionaries). Molecules that consist of one hydrophilic (water-loving) part and one hydrophobic (water-hating or oil-loving) part. (Kjellin & Johansson 2010)

Sustainability

In its most well-known definition, sustainability or sustainable development means meeting our own needs without compromising the ability of future generations to meet their own needs (UNWCED, 1987). In a simpler form, sustainability refers to the avoidance of natural resource depletion and greenhouse gas emissions in order to maintain an ecological balance and stability of earth systems. Modern sustainability definitions refer to it as a holistic approach that considers ecological, social and economic dimensions with the goal to consider all three of these so-called pillars of sustainability to find lasting prosperity for everyone.

Sustainable consumption

The use of goods and services that address the requirements of today's population. (WBCSD, 2021)

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Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (UNWCED, 1987) and balances social, economic and environmental concerns. (IPCC, 2018).

Sustainable development goals

The 17 global goals for development for all countries established by the United Nations through a participatory process and elaborated in the 2030 Agenda for Sustainable Development, including ending poverty and hunger; ensuring health and well-being, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change. (IPCC, 2018)

T

Total organic carbon

Quantity of carbon present in a product in the form of organic, inorganic and elemental carbon. (CEN/TC 411 2014)

Transition

The process of changing from one state or condition to another in a given period of time. Transition can be in individuals, firms, cities, regions and nations, and can be based on incremental or transformative change (IPCC, 2018)

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U

Upcycle

Use of secondary products, components or materials that results a higher economic value of that material. (WBCSD, 2021)

Upstream

Occurring along a product supply chain before the point of referral.

V

Value chains

A value chain describes the flow of value between different actors in a supply chain and may include a broader set of actors than in supply chains. Value can be reflected by a range of terms:

- Economic – where value chains describe the flow of profit or income between actors in the supply chain. For example, the flow of income to different actors based on the input and output costs.
- Environmental/climatic – where value chains describe the flow of benefits to given environmental or climate objectives. For example, the greenhouse gas emissions avoided as a result of a bioeconomy value chain.
- Social – where value chains describe the flow of benefits to people and communities. For example, the jobs created in rural areas as a result of new value chains.

These are distinct from supply chains, which describe the flow of goods and services between different actors, such as the production of wheat, its collection, processing, the manufacturing of pasta and eventual sale. (ENRD, 2019)

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W

Waste

Residue left when a compound or a product reaches the end of its initial usefulness. (Vert et al. 2012)

Waste hierarchy

The priority order available for managing wastes, ranked in descending order of preference, based on the best environmental outcome across the lifecycle of the material. (1) Prevention, (2) Reduce, (3) Reuse, (4) Recycle, (5) Incineration, (6) Landfill. (WBCSD, 2021)

Waste streams

Waste streams are flows of specific waste, from its source through to recovery, recycling or disposal. Waste streams can be divided into two main categories: material-related streams (including metals; glass; paper and cardboard; plastics; wood; rubber; textiles; bio-waste) and product-related streams (including packaging; electronic waste; batteries and accumulators; end-of-life vehicles; mining, construction and demolition waste). Each waste stream has its specific characteristics and applicable legislation, including in terms of treatment method, hazardousness, practical recovery and recycling possibilities. (Source: European Parliament, 2015).

Waste water

Spent or used water that contains dissolved or suspended solids. (WBCSD, 2021)

Wet waste

Wet waste feedstocks include commercial, institutional, and residential food wastes (particularly those currently disposed of in landfills); organic-rich biosolids; manure slurries from concentrated livestock operations; and organic wastes from industrial operations. Transforming these "waste streams" into energy can help create additional revenue for rural economies and solve waste-disposal problems. (USDOE, 2021)

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References

AllThings.Bio, 2021, Glossary, https://www.allthings.bio/keywords/. Last accessed 8 September 2021

Cambridge Dictionary, 2021, https://dictionary.cambridge.org/dictionary/english. Last accessed: 9 August 2021.

Carus, M., Piotrowski, S., Raschka, A. et al. 2010: The development of instruments to support the material use of renewable raw materials in Germany (Summary). Hürth, Germany, October 2010. (http://www.bio-based.eu/policy/en/)

Carus, M., Eder, A., Beckmann, J. 2014: nova paper #3: Green Premium prices along the value chain of bio- based products. (also available at http://bio-based.eu/nova-papers/#GreenPremium).

Carus M, Raschka, A., Iffland, K., Dammer, L., Essel, R., Piotrowski, S. 2016: How to shape the next level of the European Bio-based Economy? (also available at https://renewable-carbon.eu/publications/product/howe-to-shape-the-next-level-of-the-european-bio-based-economy-%E2%88%92-full-version/).

Carus, M., Dammer, L., Puente, A., Raschka, A., Arendt, O., 2017, Bio-based drop-in, smart drop-in and dedicated chemicals. (also available at https://roadtobio.eu/uploads/news/2017_October/RoadToBio_Drop-in_paper.pdf).

CEN/TC 411 – European Committee for Standardisation, Technical Committee 411. 2012: EN/14588. Solid biofuels – Terminology, definitions and descriptions.

CEN/TC 411 – European Committee for Standardisation, Technical Committee 411 2014: EN 16575 Bio-based products – Vocabulary.

Ceresana Research 2009: Market Study: Bioplastics. Konstanz 2009.

CIO Wiki, 2021, https://cio-wiki.org/wiki. Last accessed 6 September 2021.

Circular Economy Practioner Guide, 2021, Glossary, https://www.ceguide.org/Glossary. Last accessed: 3 December 2021Climate Policy, 2014, Social acceptance in technology deployment. https://climatepolicyinfohub.eu/node/34/pdf. Last accessed 9 August 2021.

Collins Dictionary, 2021, https://www.collinsdictionary.com/dictionary/english/code-of-practice. Last accessed: 9 August 2021.

CO_2 Value Europe, 2021, About Carbon Capture & Utilisation (CCU). https://www.co2value.eu/ccu/. Last accessed 9 August 2021.

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De Jong, E., Stichnothe, H., Bell, G., Jørgensen, H., 2020 Bio-Based Chemicals: A 2020 Update. International Energy Agency (IEA) Bioenergy. 79 pp. (also available at https://www.ieabioenergy.com/wp-content/uploads/2020/02/Bio-based-chemicals-a-2020-update-final-200213.pdf).

Definitions.net, 2021, multilingual dictionary, https://www.definitions.net/. Last accessed: 3 December 2021

Dictionary, 2021, https://www.dictionary.com. Last accessed: 3 December 2021.

Dubois, O. & Gomez San Juan, M. 2016. How sustainability is addressed in official bioeconomy strategies at international, national and regional levels. An overview. FAO. Rome. 48 pp. (also available at www.fao.org/3/a-i5998e.pdf).

EEA – European Environmental Agency, 2020, Biodegradable and compostable plastics — challenges and opportunities. (also available at https://www.eea.europa.eu/publications/biodegradable-and-compostable-plastics).

EEA – European Environmental Agency, 2021, Glossary - List of environmental terms used by EEA. https://www.eea.europa.eu/help/glossary Last accessed 9 August 2021.

ECOS, 2021, Too good to be too true? A study on green claims of plastic producers (also available at https://ecostandard.org/wp-content/uploads/2021/07/ECOS-RPa-REPORT-Too-Good-To-Be-True.pdf).

ENRD - European Network for Rural Development. 2019, European rural bioeconomy: policy and tools. Conclusions from the ENRD Thematic Group on 'Mainstreaming the bioeconomy'– Part 1. (also available at, https://enrd.ec.europa.eu/sites/default/files/enrd_publications/bioeconomy-briefing_1_policy-and-tools.pdf).

EN ISO 14040:2006: Environmental management – Life cycle assessment – Principles and frameworks. July 2006.

EN ISO 14044:2006: Environmental management – Life cycle assessment – Requirements and guidelines. July 2006.

EC - European Commission. 2005. Misleading green claims - Extract of the Guidance for the implementation/application of Directive 2005/29/EC on unfair commercial practices. Available at: https://ec.europa.eu/environment/eussd/pdf/green_claims/en.pdf

EC - European Commission. 2012: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Innovating for Sustainable Growth: A Bioeconomy for Europe. COM(2012) 60.

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EC - European Commission. 2012b: Proposal for a directive of the European Parliament and of the council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

EC - European Commission. 2013. Commission recommendation on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations. Brussels. 210 pp. (also available at https:// eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013H0179&from=EN).

EC - European Commission. 2018: A sustainable bioeconomy for Europe - strengthening the connection between economy, society and the environment: updated bioeconomy strategy

EC - European Commission 2021: Bioeconomy Glossary. https://knowledge4policy.ec.europa.eu/bioeconomy/glossary_en. Last accessed 9 August 2021

EC (European Commission). 2021a: Biodegradable waste, https://ec.europa.eu/environment/topics/waste-and-recycling/biodegradable-waste_en. Last accessed 9 August 2021

EC – European Commission. 2021b. Impact assessment report accompanying the document Proposal for a Council Regulation establishing the Joint Undertakings under Horizon Europe. European Partnership for a Circular Bio-based Europe. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_6446_2021_ADD_19&from=EN

Encyclopædia Britannica, 2021, https://www.britannica.com/. Last accessed 9 August 2021.

EMF – the Ellen MacArthur Foundation, 2021, Circular economy introduction, https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview, Last accessed 3 December 2021.

EMBL-EBI, 2021, online tutorial Biomacromolecular structures. DOI: 10.6019/TOL.BMS.2011.00001.1. Last accessed: 3 December 2021.

European Bioplastics, 2009, Fact Sheet Industrial Composting, (also available at https://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_industrial_composting.pdf).

European Parliament and the Council of the European Union 2014: Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC Text with EEA relevance

European Parliament, 2015. Briefing - Understanding waste streams, https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/564398/EPRS_BRI(2015)564398_EN.pdf

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FAO - Food and Agriculture Organization of the United Nations, 2004: Unified Bioenergy Terminology, http://www.fao.org/docrep/007/j4504E/j4504e00.htm. Last accessed 9 August 2021

GLOPACK – Granting society with low environmental impact innovative packaging. 2020. Position paper: on the benefits of home compostable biodegradable materials for a sustainable food chain, https://glopack2020.eu/wp-content/uploads/2020/05/GLOPACK-position-paper_CE.pdf.

Gomez San Juan, M., Bogdanski, A. & Dubois, O. 2019. Towards sustainable bioeconomy - Lessons learned from case studies. Rome, FAO. 132 pp. (also available at: http://www.fao.org/publications/card/en/c/CA4352EN/).

Hunkeler, D, Lichtenvort, K and Rebitzer G., 2008. Environmental Life Cycle Costing. First Edition. Boca Raton, USA: CRC Press.

IEA – International Energy Agency. 2021. Carbon Capture Utilisation and Storage, https://www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage. Last accessed: 9 August 2021

Iffland, K., Sherwood, J., Carus M., Raschka, A., Farmer, T., Clark, J. (2015): Definition, Calculation and Comparison of the "Biomass Utilization Efficiencies (BUE)" of Various Bio-based Chemicals, Polymers and Fuels. (also available at: https://renewable-carbon.eu/publications/product/nova-paper-8-on-bio-based-economy-definition-calculation-and-comparison-of-the-biomass-utilization-efficiency-bue-of-various-bio-based-chemicals-polymers-and-fuels-%e2%88%92-full-version/)

Investopedia, 2021, https://www.investopedia.com. Last accessed 3 December 2021.

IPCC, 2018: Annex I: Glossary [Matthews, J.B.R. (ed.)]. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press

ISO, 2021, https://committee.iso.org/sites/tc207sc1/home/projects/published/iso-14001---environmental-manage/life-cycle.html

ISO, 2006. EN ISO 14040:2006: Environmental management – Life cycle assessment – Principles and frameworks. July 2006. ISO, 2006b. EN ISO 14044:2006: Environmental management – Life cycle assessment – Requirements and guidelines. July 2006.

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Kjellin, M. and Johansson, I., 2010 Surfactants from Renewable Resources. DOI:10.1002/9780470686607. John Wiley & Sons, Ltd.

KNOW-HUB, 2021, Knowledge Base, http://www.know-hub.eu/ Last accessed 3 December 2021

Law Insider, 2021, https://www.lawinsider.com/. Last accessed 9 August 2021.

Life Cycle Initiative, 2021, Social Life Cycle Assessment (S-LCA), https://www.lifecycleinitiative.org/starting-life-cycle-thinking/life-cycle-approaches/social-lca/. Last accessed: 3 December 2021

Lokesh K, Ladu, L., Summerton, L., 2018, Bridging the Gaps for a 'Circular' Bioeconomy: Selection Criteria, Bio-Based Value Chain and Stakeholder Mapping. In: Sustainability 10(6), DOI: 10.3390/su10061695

Luzuriaga, S. and Marioni, M. 2018. The key market drivers of bio-lubricants. In: Lube Magazine 0. 143, February 2018, https://www.panolin.com/pdf/Lube-magazin-143.pdf

Matmatch, 2021, Biopolymers: Properties, Processing, and Applications. https://matmatch.com/learn/material/biopolymers. Last accessed 3 December 2021.

Merriam Webster. Free online dictionary. http://www.merriam-webster.com/.

Meeusen, M., Peuckert, J., Quitzow, R. 2015. Acceptance factors for bio-based products and related information systems. Open-BIO Deliverable 9.2. https://www.biobasedeconomy.eu/app/uploads/sites/2/2017/07/Acceptance-factors-for-bio-based-products-and-related-information-systems.pdf

Müller, A., Weigelt, J., Götz, A., Schmidt, O., Lobos Alva, I., Matuschke, I., Ehling, U. & Beringer, T. 2015. The Role of Biomass in the Sustainable Development Goals: A Reality Check and Governance Implications. Institute for Advanced Sustainability Studies (IASS) Working Paper (corrected 2nd Edition, August 2015). Potsdam, Germany, IASS ((also available at DOI 10.2312/iass.2015.010).

Oxford Dictionaries: Online dictionary. http://oxforddictionaries.com/

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Porc, O., Hark, N., Carus, M., Carrez, D., 2021, European Bioeconomy in Figures 2008–2018, https://biconsortium.eu/sites/biconsortium.eu/files/documents/European%20Bioeconomy%20in%20Figures%202008%20-%202018.pdf

RCI - Renewable Carbon Initiative, 2021, Glossary, https://renewable-carbon-initiative.com/renewable-carbon/glossary/. Last accessed 9 August 2021

Ronzon, I., Piotrowski, S., Tamosiunas, S., Dammer, L., Carus. M., M'barek, R, 2020. Developments of Economic Growth and Employment in Bioeconomy Sectors across the EU. In: Sustainability 12 (11), https://doi.org/10.3390/su12114507

Thrän, D., Pfeiffer, D. (Eds.), Method Handbook - Material Flow-oriented Assessment of Greenhouse Gas Effects (2015, https://www.energetische-biomassenutzung.de/fileadmin/user_upload/Downloads/Ver%C3%B6ffentlichungen/04_MHB_en_web.pdf (last accessed 9 August, 2021).

UNDP - United Nations Development Programme) (2021). Financing Solutions for Sustainable Development: Glossary. www.undp.org/content/sdfinance/en/home/glossary.html (last accessed 6 September 2021).

UNEP – United Nations Environment Programme: Convention on Biological Diversity. United Nations 1992 (http://www.cbd.int/convention/text/default.shtml)

UNEP - United Nations Environment Programme & CI - Consumers International (2021) Can I Recycle This? A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging. www.oneplanetnetwork.org/sites/default/files/unep_ci_2020_can_i_recycle_this.pdf. Last accessed 9 August 2021

UNFCCC – United Nations Framework Convention on Climate Change (2021) Glossary of climate change acronyms and terms. https://unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms (last accessed 6 September 2021).

UNWCED – United Nations World Commission on Environment and Development 1987: Our Common Future. New York. http://www.un-documents.net/our-common-future.pdf (last accessed 6 September 2021).

USDOE – United States Department of Energy 2021: Biomass Resources https://www.energy.gov/eere/bioenergy/biomass-resources (last accessed 21 July 2021)

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US EPA – Environmental Protection Agency 2021: Terminology Services. Search term "Biodegradation". http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do (last accessed 9 August 2021)

Vert, M., Doi Y, et al. (IUPAC Polymer Division) 2012: Terminology for biorelated polymers and applications (IUPAC Recommendations 2012) Pure Applied Chemistry 84 (2), pp. 377-410.

Vos, J. and Vikla, K., 2021, Report on brand owners' motivations and incentives. BIOSWITCH Deliverable D1.3 Part 1.

WBCSD – World Business Council for Sustainable Development, 2021, Circular Economy Practitioner Guide, https://www.ceguide.org/Glossary. Last accessed 9 August 2021.

Wüstenhagen, R., Wolsink, M., & Bürer, M. J., 2007, Social acceptance of renewable energy innovation: An introduction to the concept. Energy Policy, 35(5), 2683–2691.

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