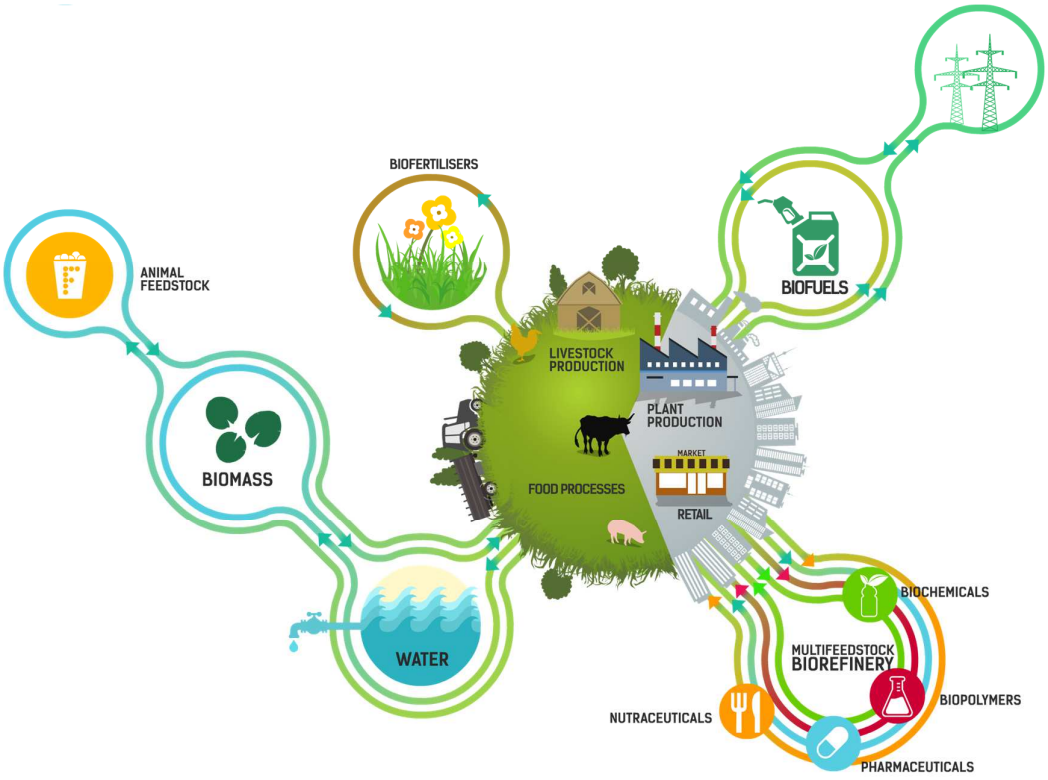
D1.4 Report on EU regulatory frameworks for AWCB management, environmental, and potential health risks



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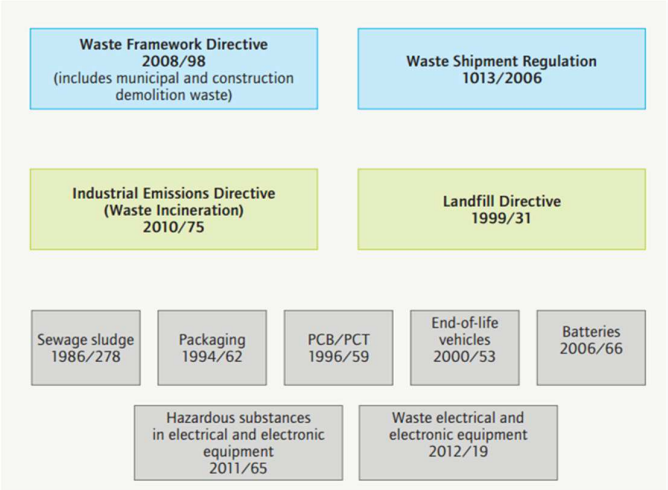
1. Introduction

Environmental policy, as well as waste policy is a shared competence in the EU. Thus, both the EU and the Member States legislate on waste. At the EU level, the Waste Framework Directive is the umbrella which sets out the main legal framework for waste. It was transposed by Member States into national legislation with flexibility in terms of objectives to be achieved and means to achieve objectives.[1]

The Waste Framework Directive covers the collection, transport, recovery and disposal of most types of waste, including bio-waste. It sets the principle by which Member States must adopt measures to encourage sorting and valorisation of bio-waste. The revised Waste Framework Directive contains specific bio-waste related elements (new recycling targets for household waste, which can include bio-waste) and a mechanism allowing setting quality criteria for compost (end-of-waste criteria). The End-of-waste criteria contribute to create legal certainty and a level playing field as well as to remove unnecessary administrative burden.



The Landfill Directive (1999/31/EC) obliges Member States to reduce the amount of biodegradable municipal waste that they landfill to 35% of 1995 levels by 2016 (for some countries by 2020). The Member States were thus required to set up a national strategy for the implementation of the reduction of biodegradable waste going to landfills. The IPPC Directive (now Industrial Emissions Directive) lays down the main principles for the permitting and control of bio-waste treatment installations of a capacity exceeding 50 tonnes/day. The incineration of bio-waste is regulated in the Waste Incineration Directive, while the health rules for composting and biogas plants which treat animal by-products are laid down in the Animal By-products Regulation.

An overview table of the European waste legislation framework is provided in chapter 5.

Prevention and recycling of waste

The European waste hierarchy includes five options for waste management in descending order of priority: prevention, re-use, recycling (including composting), recovery (including

[1] This chapter is based on previous analysis and work conducted by EUBIA in the framework of the NEWAPP project, co-funded by the 7th Framework Programme under grant agreement n° [605178]

energy recovery) and disposal (landfilling or incineration without energy recovery). As part of the Waste Framework Directive in accordance with Article 4 of Directive 2008/98/EC1, the waste hierarchy is legally binding. In line with this the 7th Environment Action Programme sets out 5 priority objectives for waste policy in the EU: to reduce the amount of waste generated, to maximise recycling and re-use, to limit incineration to nonrecyclable materials, to phase out landfilling to nonrecyclable and non-recoverable waste, to ensure full implementation of the waste policy targets in all Member States.

While the waste management hierarchy also applies to the management of bio-waste, optimal bio-waste treatment depends on a number of local factors, inter alia collection systems, waste composition and quality, climatic conditions, the potential of use of various waste-derived products. Therefore, national strategies for the management of this waste should be determined in a transparent manner and be based on a structured and comprehensive approach such as Life Cycle Thinking (LCT). In order to assist decision makers in making the best use of biodegradable waste in line with the waste hierarchy, the Commission has prepared a set of guidelines on how to apply Life Cycle Assessment (LCA) and Life Cycle Thinking to planning the management of bio-waste. In December 2005 the Commission published a Communication on the Thematic Strategy on the prevention and recycling of waste. This document aimed to point out the key actions to modernize the existing legal framework and to promote waste prevention, reuse and recycling in compliance with the EU waste acquis at national level. Progress towards the objectives set out in the strategy has been reviewed in the "Report on the Thematic Strategy on waste prevention and recycling" published in 2011. The Europe 2020 strategy includes the long-term goal of the EU waste management policy: to turn Europe into a recycling society, avoiding waste and using unavoidable waste as a resource wherever possible in order to ensure a sustainable growth of its economy.

The End of Waste classification

The Waste Framework Directive lays down a vocabulary along with definitions. It notably distinguishes between waste and by-products and determines at which stage the waste has been sufficiently valorised to be no longer considered as a waste ("end of waste" status). The particularity of this definition is that how the waste will be considered is largely dependent on the intention at the outset: if further use of the waste is certain, it will be considered as a by-product at that stage, and when market demand exists for the by-product, it will have reached the end of waste status and no longer be considered waste.

The regulation sets out at which stage the waste will have been sufficiently valorised to no longer be considered as waste. However, waste which has undergone valorisation may still be considered as waste and may thus re-enter the waste circuit, depending on the intention. End-of-waste criteria specify when certain waste ceases to be waste and obtains the status of a product (or a secondary raw material). Article 6 (1) and (2) of the Waste Framework Directive 2008/98/EC states that certain specified waste ceases to be waste when it has undergone a recovery (including recycling) operation and complies with specific criteria to be developed in line with certain legal conditions, in particular:

- the substance or object is commonly used for specific purposes;
- there is an existing market or demand for the substance or object;
- the use is lawful (substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products);
- the use will not lead to overall adverse environmental or human health impacts.

A methodology to develop the criteria has been elaborated by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS) as part of the so-called 'End-of-Waste Criteria report'. The Commission uses the procedure described in Article 39(2) of the Waste Framework Directive (so called "comitology") with Council and Parliament scrutiny. The output of this process takes the form of a Regulation. After having agreed this methodology with the Member States, the Commission prepared a set of end-of-waste criteria for priority waste streams. Besides describing the criteria, these studies include all the background information necessary for ensuring conformity with the conditions of Article 6 of the Directive. For each waste stream, the background studies will be developed based on the contributions of experts from Member States and from interested stakeholders, by means of a technical working group. The working groups are composed of experts from Member States administration, industry, NGOs and academia.

The communication procedure is as follows: for each waste stream IPTS took initiative and submitted background documents with questions to the technical working group. Open questions were discussed with the experts at the workshops and, if needed to clarify individual elements, by personal communication. IPTS collected the necessary information from the experts, as appropriate before and/or after the workshops, and synthesized this information in draft documents. At the end of the process for each waste stream, these documents resulted in technical proposals on end-of-waste, and were submitted to DG Environment for further use in the preparation of proposals of Commission Regulations. In the political decision process, Member States (Comitology in the Technical Adaptation Committee under the Waste Framework Directive, followed by scrutiny from both Parliament and Council) will discuss each of the Regulation proposals and, if approved, these will enter into force.

End of Waste programme on Biodegradable Waste

End of waste programme approaches the organic waste aspect starting from the identification of the most relevant bio-waste categories. The distribution is based on municipal and non-municipal biodegradable waste, which can be subjected to fermentation, digestion and composting. Below the two macro-categories:

1. Biodegradable fractions of municipal solid waste (MSW): MSW comprises wastes from private households and similar wastes from other establishments that municipalities collect together with household waste.
2. Other biodegradable wastes: other biodegradable wastes may be composted on their own or together with the biodegradable fraction of MSW.
    - commercial food waste, not collected as part of the MSW:
        - waste from markets
        - catering waste;
    - forestry residues:
        - bark
        - wood residues;
    - waste from agriculture,
        - animal husbandry excrements (solid and liquid manure)
        - straw residues
        - sugar beet and potato haulm
        - residues of growing of beans, peas, flax and vegetables
        - spent mushroom compost
    - wastes from the food and beverage industry

    - breweries and malt houses
    - wineries
    - fruit and vegetable production industry
    - potato industry including starch
    - sugar beet residues and soils
    - slaughterhouse residues
    - meat production or whey;
- sewage sludge (derived from biological treatment of wastewater)

When considering the life cycle end of bio-waste, mainly three EU Directives influence the quantities and qualities available for further uses, such as the production of compost or biochar. By regulating the disposal of inert, hazardous and non-hazardous waste, the Landfill Directive (1999/31/EC) aims at preventing and reducing the negative effects of landfilled waste on the environment in the short as well as in the long-term perspective. The Landfill Directive requires that the biodegradable waste going to landfills is reduced by

- 25 % by 16 July 2006
- 50 % by 16 July 2009
- 65 % by 16 July 2016

compared to the total amount of biodegradable municipal waste produced in 1995.

2. Overview on European Waste Legislation

The table below outlines the legislation at European in the subject of waste management.[2]

Title	Overview
Directive 2008/98/EC Bio-waste from Waste Framework	The Directive describes basic waste management principles. It prescribes that waste be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest.
Regulation 1907/2006/EC Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)	This Regulation amends Directive 1999/45/EC and cancels Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.
Directive 86/278/EEC Sewage Sludge	This Directive seeks to regulate and encourage correct use and management of sewage sludge in agriculture to prevent harmful effects on soil, vegetation, animals and human health.
Directive 99/31/EC Landfill of Waste	The objective of the Directive is to prevent or reduce as far as possible negative effects on the environment from the landfilling of waste, by introducing stringent technical requirements for waste and landfills. The Directive is intended to prevent or reduce the adverse effects of the landfill of waste on the environment, in particular on surface water, groundwater, soil, air and human health. However, the Landfill Directive does not prescribe specific treatment options for the diverted waste. In practice, Member States are often inclined to choose the seemingly easiest and cheapest option disregarding actual environmental benefits and costs. This has triggered a long standing discussion on the possible need for supplementary regulation. In December 2010 the EC published a Stakeholder Consultation proposing a 36.5% target for recycling bio-waste, corresponding to the average bio-waste recycling rate in the EU. The UK has opposed setting such targets for bio-waste.
The IPCC Directive	The objective of the Directive is to prescribe the main principles for the permitting and control of bio-waste treatment installations of a capacity exceeding 50 tonnes/day. The IPPC Directive will be annulled with effect from 7 January 2014 by Directive 2010/75/EU on industrial emissions.
Regulation 142/2011 (EU) **European Parliament and the Council laying down health rules as regards to animal by-products and derived products not intended for human consumption.**	This regulation is implementing Regulation (EC) No 1069/2009, entered into force on 4 March 2011. The so-called ABPR restricts the types of animal by-products that may be transformed into a biogas or composting plant. Materials that are allowed under certain conditions include: ▪ manure and digestive tract content ▪ animal parts fit for human consumption (not intended for human consumption because of commercial reasons) ▪ animal parts rejected as unfit for human consumption (without any signs of transmissible diseases) and derived from carcasses fit for human consumption ▪ blood, hides and skins, hooves, feathers, wool, horns, hair and fur (without any signs of diseases communicable through them) ▪ former foodstuffs and waste from the food industry containing animal products; ▪ raw milk ▪ shells, hatchery by-products and cracked egg by-products

[2] Source: Tom Oldfield - School of Biosystems and Food Engineering, University of Dublin

Title	Overview
	▪ fish or other sea animals (except sea mammals) ▪ fresh fish by-products derived from the food industry
Directive 2010/75/EU – The European Parliament and of the Council of 24 November 2010 on industrial emissions (Integrated Pollution Prevention and Control)	This Directive sets up the classification of industrial activities by groups regarding their contaminant potential, establishing the obligation of the application of the BATs (Best Available Technologies), and the procedures of permitting, reporting, following the previously mentioned classification. It sets up operational and process conditions for Composting (and other non-hazardous "valorisation" waste treatment plants) over 75 t/day, as well as the only dedicated anaerobic digestion plants with a capacity over 100 t/day.
Regulation 1069/2009 (EC) Laying down health rules as regards animal by-products and derived products not intended for human consumption and revoking Regulation 1774/2002 (EC) (Animal by-products Regulation)	This Regulation prescribes the health rules for animal by-products and derived products not intended for human consumption. Providing detailed hygienisation rules for composting and anaerobic digestion (biogas) plants which treat animal by-products for technical products (compost, fertilsers, others). There are also controls on the use of animal by-products when used as feed (including pet food), and on disposal by rendering and incineration.
Directive 91/676/ (EEC) This concerns the protection of waters against pollution caused by nitrates from agricultural sources.	The Directive regulates and limits the Nitrogen dosage (total amount per hectare by any type of fertilizing or amendment organic or mineral) in agricultural lands classified as sensitive or in risk of being polluted by the lixiviation of this element to the underground and surface waters. The action programmes should include measures to limit the land-application of all nitrogen-containing fertilizers and in particular to set specific limits for the application of livestock manure.
Regulation 850/2004 (EC) Persistent organic pollutants and amending Directive 79/117/EEC.	This Regulation deals with persistent organic pollutants. Its purpose is to protect human health and the environment against the effects of POPs. To do this: ▪ It prohibits and limits the production, marketing and use of certain substances. ▪ It imposes an obligation on Member States to develop action plans for the reduction, minimization and elimination of emissions into the atmosphere, water and soil.
Regulation 1195/2006 (EC) – Amending Annex IV to Regulation 850/2004 (Persistent organic pollutants)	This Regulation prescribes general maximum concentration limit values in waste for PCBs (50 mg/kg) and PCDD/F (15µg/kg). If these limits are exceeded, the waste must be treated in such a way as to ensure that the POP content is destroyed or irreversibly transformed.

3. Overview on legislation for the use of AWBC for biofuels

The Renewable Energy Directive 2009/28/EC has established an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020 – to be achieved through individual national targets. All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020.

Although emissions from other sectors are generally falling, road transport is one of the few sectors where emissions have risen rapidly in recent years. The transport sector is on track to become the EU's biggest source of CO2 by 2030 according to the European Commission. In this framework the production of advanced biofuels from wastes and residues, if mobilized in a sustainable manner, can make a sizeable contribution to reducing European dependence on imported oil, reducing CO2 emission at the same time.

The Fuel Quality Directive (2009/30/EC) requires a reduction of the greenhouse gas intensity of the fuels used in vehicles by 6 % by 2020. It has previously led to drastic reductions in the sulphur content of fuels, enabling the deployment of vehicle technologies to reduce greenhouse gas and air pollutant emissions, and delivering substantial health and environmental benefits. This legislation also regulates the sustainability of biofuels and in particular:

- Greenhouse gas emissions must be at least 35% lower than from the fossil fuel they replace. From 2017, this will increase to 50% and, from 2018, the saving must be at least 60% for new installations;
- Biofuels cannot be grown in areas converted from land with previously high carbon stock such as wetlands or forests;
- Biofuels cannot be produced from raw materials obtained from land with high biodiversity such as primary forests or highly bio-diverse grasslands.

The growing production of biofuels has opened a discussion about ILUC (Indirect Land Use Change) and consequential GHGs emissions associated. This has been taken in consideration in the 2015/1513 Directive, that now limits the way Member States can meet the target of 10% for renewables in transport fuels by 2020. There will be a cap of 7% on the contribution of biofuels produced from food crops, and a greater emphasis on the production of advanced biofuels from waste feedstocks. Member States must then include the law in national legislation by 2017, and show how they are going to meet sub-targets for advanced biofuels. In particular, the remaining 3% can be achieved by many alternatives, among which it is listed the production of advanced biofuels (and they are double counted in the GHGs savings calculation). In Annex II this Directive integrates the list of double counting feedstock with many wastes and agricultural residues such as cobs cleaned of kernels of corn, nut shells, grape marcs and wine lees, husks, etc.

In 2016 the EU Commission released a proposal for a revised Renewable Energies Directive (COM 2016/767/EC) which continues the "post 2020" approach. The new framework sets out the European Union target of at least 27% for the share of renewable energy consumed in the EU in 2030.

It mainly focuses on six topics:

1. Creating an enabling framework for further deployment of renewables in the Electricity Sector;
2. Mainstreaming renewables in the Heating and Cooling Sector;
3. Decarbonising and diversifying the Transport Sector;

4. Empowering and informing consumers;
5. Strengthening the EU sustainability criteria for bioenergy;
6. Making sure the EU level binding target is achieved on time and in a cost effective way.

On topic 3 it is stressed out the need of a reduction of carbon emissions in the transport sector: a minimum share of 1.5% of fuel (in energy terms) by 2021 must come from renewable and low-carbon sources, including advanced biofuels and waste-based fuels. The level of the obligation increases to 6.8% by 2030, with at least 3.6% of advanced biofuels. At the same time the new Directive Introduces national databases to ensure traceability of the fuels and mitigate the risk of fraud.

In Annex V values are provided for the calculation of greenhouse gas impact of biofuels (and fossil fuels comparators) also for some residual feedstock. In particular it states that "no emissions shall be allocated to wastes and residues" and "co-products that have a negative energy content shall be considered to have an energy content of zero for the purpose of the calculation". Besides, referring to wastes and residues "shall be considered to have zero life-cycle greenhouse gas emissions up to the process of collection of those materials irrespectively of whether they are processed to interim products before being transformed into the final product".

A list of wastes and residues allowed for production of advanced biofuels is listed in Annex IX, part A:

Feedstocks:

a) Algae if cultivated on land in ponds or photobioreactors.
b) Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under point (a) of Article 11(2) of Directive 2008/98/EC.
c) Bio-waste as defined in Article 3(4) of Directive 2008/98/EC from private households subject to separate collection as defined in Article 3(11) of that Directive.
d) Biomass fraction of industrial waste not fit for use in the food or feed chain, including material from retail and wholesale and the agro-food and fish and aquaculture industry, and excluding feedstocks listed in part B of this Annex.
e) Straw.
f) Animal manure and sewage sludge.
g) Palm oil mill effluent and empty palm fruit bunches.
h) Tall oil and tall oil pitch.
i) Crude glycerine.
j) Bagasse.
k) Grape marcs and wine lees.
l) Nut shells.
m) Husks.
n) Cobs cleaned of kernels of corn.
o) Biomass fraction of wastes and residues from forestry and forest-based industries, i.e. bark, branches, pre-commercial thinnings, leaves, needles, tree tops, saw dust, cutter shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil.
p) Other non-food cellulosic material as defined in point (s) of the second paragraph of Article 2.

q) Other ligno-cellulosic material as defined in point (r) of the second paragraph of Article 2 except saw logs and veneer logs.

The table below outlines the European legislation and standards in the subject of agricultural residues and wastes for biofuels production:

Title	Overview
Directive 2009/28/EC **Renewable Energy Directive**	▪ By 2020, 20 % share of RES in final energy consumption, 20 % increase in energy efficiency. ▪ 10 % target for RES in transport in each Member State, Harmonised approach with Fuel Quality Directive. ▪ Minimum GHG reduction for biofuels 35% and 50% from 2017 on; 60% for new installations from 2017 on; for plants operating in Jan 2008 GHG requirement will start in Apr 2013 (amended in Directive (EU) 2015/1513). ▪ Bonus of 29 g CO2/MJ for biofuels from degraded/contaminated land. ▪ Biofuels from waste, residues, non-food cellulosic material, and lignocellulosic material will count twice for RES transport target. ▪ Mass balance approach for certification of sustainability. ▪ Establishment of a committee for sustainability of biofuels.
30/2009/EC **Fuel quality**	This Directive revises the fuel quality directive (Directive 98/70/EC). It introduces a mechanism aimed to monitor and reduce greenhouse gas emissions and ensure the sustainability of biofuels, for example it requires that biofuels aren't produced in in land with high biodiversity. It also facilitates the blending of bio components in fuel (for example up to 10% of ethanol in petrol).
Decision 2010/335/EU **On guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC**	Sets out the guidelines for the calculation of land carbon stock, for the purpose of Annex V to the RED 2009/28/EC.
COM 13/2011/EC On certain types of information about biofuels and bioliquids to be submitted by economic operators to Member States	In this communication indications are provided regarding some information requested for each consignment of biofuel (or bioliquid) and some procedures are eased for who adopts a voluntary scheme recognised by the EU Commission.
COM/2013/017 **Clean Power for Transport: A European alternative fuels strategy**	It presents a comprehensive strategy for alternative fuels, explaining how these can be applied to all forms of transport. The strategy covers technological developments, investment in using the new fuels and ways to explain the benefits to the public. It states that biofuels are currently the most important alternative fuels. It points the fact that advanced biofuels (for example from residues and wastes) should be the only one to receive public support in the future.
Regulation 1307/2014/EC **On defining the criteria and geographic ranges of highly biodiverse grassland**	This regulation provides definitions not included in the RED or in the Fuel Quality Directive, such as 'grassland' and 'natural high-biodiverse grassland'. It further defines criteria for a certain habitat to achieve the status of highly-biodiverse grassland: in Article 2 it states "Highly biodiverse grassland in the European Union is not limited to the geographic ranges referred to under (1), (2) and (3) of this Article. Other grassland might fulfil the criteria for highly biodiverse grassland set out in Article 1", in order to be able to protect certain areas that might show some future criticism.
Directive 2015/1513/EU **Directive to reduce indirect land use change for biofuels and bioliquids**	The contribution of biofuels produced from 'food' crops (to the 10 % renewables in transport target) is capped at 7%. The other 3% will come from a variety of multiple counted alternatives, among which Advanced biofuels are double counted. Besides it defines a bench mark for the share of advanced biofuels in the transport sector of 0.5%. Member States have to

Title	Overview
	transpose the directive into national legislation by mid-2017, and establish the level of their national indicative sub-targets for advanced biofuels.
Proposal for a directive **COM 2016/767/EC** **Use of energy from renewable resources**	The intent of the proposal is to adapt the framework for renewable energy development to the 2030 perspective, providing certainty and predictability to investors and addressing the potential of renewable energy. The proposal introduces an obligation on European transport fuel suppliers to provide an increasing share of renewable and low-carbon fuels, including advanced biofuels, renewable transport fuels of non-biological origin (e.g. hydrogen), waste-based fuels and renewable electricity. The level of this obligation is progressively increasing from 1.5% in 2021 (in energy terms) to 6.8 % in 2030, including at least 3.6% of advanced biofuels. To minimize the Indirect Land-Use Change (ILUC) impacts, the proposal introduces a cap on the contribution of food-based biofuels towards the EU renewable energy target, starting at 7% in 2021 and going down progressively to 3.8% in 2030.

4. Overview of legislation for the use of AWCB for biofertilizers

The current legislation in EU (2003/2003/EC, Fertilizer Regulation, and further amendments) sets the standards of composition, safety, and utilization for fertilizer production and use in Europe. Annex 1 defines the types of fertilizers that are recognized in the European Union. Only products included in this list can be labelled as "EC-fertilizer" and can be sold and used throughout the EU. For a new type designation to be listed in the Annex I, the manufacturer of a fertiliser corresponding to that type designation must file a request to the national competent authority. This request is forwarded to the European Commission, which consults the other EU countries and decides to accept or reject the application based on the advice of a committee set up by the regulation.

At present, more than 50% of the fertilizers available on the market are subject to this procedure, as they are not listed in the regulation. These include a few inorganic compounds and almost every fertilizer produced from organic materials, such as animal or other agricultural products, and recycled bio-waste.

In the context of a biobased and circular economy there is a strong interest in developing bio-fertilizers in order to generate values from secondary resources, avoiding their direct use on land, or their disposal in landfill causing unnecessary eutrophication and greenhouse gas emissions.

Furthermore, the trend is to use more customised products, based on soil analysis where the fertilizer will be used, also according to the EU soil strategy.

As shown in COM 046/2012/EC (The implementation of the Soil Thematic Strategy and ongoing activities), in the framework of EU Biodiversity strategy 2020, the policy is the sustainable use of agricultural soils and the efficient use of resources, in order to preserve the function, to prevent from further degradation and eventually to restore degraded soils.

In 2016 the Commission has released a proposal that is going towards the update of the Fertilizer Regulation. (COM 2016/157/EC laying down rules on the making available on the market of CE marked fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009)

The objective is a better definition of the products, in order to harmonise the quality, safety and environmental criteria to produce and trade fertilizers throughout the EU. -The proposal also aims to include the fertilizers obtained from organic and secondary raw materials, which are not included in the current Regulation.

The aim of this legislative effort is to facilitate nutrient recovery and reduce dependency from critical raw materials, together with the need to better protect health and environment.

In Annex I to the proposal several product function categories are defined (fertilizers, soil improvers, agronomic additives, plant biostimulants, fertilizing product blends etc…) and for each one of these, the composition and limit values of contaminants are defined.

Annex IV defined the conformity assessment procedures that depend on component material and product function.

The legal framework is flexible: it doesn't descript industrial process but it limits to define composition, in order to include several products from various sources.

In support to the definition of this legislative framework, currently some research project that are developing technical proposals for setting up possible nutrient recovery rules for struvite (from waste waters), biochar and ash-recovery materials working in the same direction of the

2016 EC commission proposal: carrying out a circular-economy approach and studying solutions that lead to a high quality product, not only in terms of bio-chemical performance but also from environmental, agronomic and human health point of views.

The table below outlines the European legislation and standards in the subject of bio-fertilizers:

title	overview
Regulation (EC) no 2003/2003 of the European parliament and of the council of 13 October 2003 relating to fertilisers **(and further amendings)**	The regulation combines and harmonizes all the European rules applied to those chemical compounds that provides nutrient to plants. It also sets technical requirements for their use and trade. Annex I lists the fertilizer types that can be labelled as EC-fertilizers according to their characteristics.
COM 2016/157/EC **Proposal for a regulation of the European parliament and of the council laying down rules on the making available on the market of CE marked fertilising products and amending regulations (EC) no 1069/2009 and (EC) no 1107/2009**	The proposal focuses on the necessity of establishing harmonised criteria to produce high-quality, safe and environmental sustainable fertilizers from organic and secondary raw materials. It defines product function categories and requirements of composition.
Proposal for a Directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC /* COM/2006/0232 final - COD 2006/0086 */	The proposal sets a common framework to protect soil on the basis of the principles of preservation of soil functions, prevention of soil degradation, mitigation of its effects, restoration of degraded soils and integration in other sectoral policies. It also defines requirement to identify, describe and assess the impact of some sectoral policies on soil degradation processes with a view to protect soil functions.
Regulation 834/2007/EC **On organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91**	This regulation sets standards for organic products. It also defines some categories of fertilizers and plant protection products that can or cannot be used in organic agriculture and farming.
889/2008/EC **Laying down detailed rules for the implementation of council regulation (EC) no 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control**	Referring to the previous regulation in Annex I various types of fertilizers and soil conditioners that can be used in organic agriculture and farming are listed.
Com 2013/517/EC **Consultative communication on the sustainable use of phosphorus**	The purpose of this Consultative Communication is to draw attention to the sustainability of phosphorus use and to initiate a debate on the state of play and the actions that should be considered. It suggests re-use from phosphorous-content wastes.
Regulation 1107/2009/EC **The placing of plant protection products on the EU market**	It lays down rules for authorising the sale, use and control of plant protection products in the EU. It recognises the precautionary principle which EU countries may apply if there is scientific uncertainty about the risks a plant protection product might pose to human or animal health or the environment.

title	overview
Directive 2008/98/EC bio-waste from waste framework	The directive describes basic waste management principles. It prescribes that waste be managed without endangering human health and harming the environment. In Annex II it defines R10 “Land treatment resulting in benefit to agriculture or ecological improvement” as a viable waste recovery operation.
ISO Standard 7851: 1983 **Fertilizers and soil conditioners**	Establishes a classification system. It includes an explanation of the meaning of each heading and clearly assigns each material to an appropriate group.

5. Overview on water & wastewater legislation[3]

The European Commission is highly interested concerning protection and preservation of water resources. This interest is highlighted in the significant number of legislation, policies and directives that have been put forward in the last 30 years, covering almost any aspect concerning protection and preservation of water resources. The main overall objective of EU water policy is to ensure access to good quality water in sufficient quantity for all Europeans, and to ensure the good status of all water bodies across Europe. Therefore, policies and actions are set up in order to prevent and to mitigate water scarcity and drought situations, with the priority to move towards a water-efficient and water-saving economy.

Conventional wastewater treatment process comprises of three distinct phases, each one yielding different effluent quality.

- Primary wastewater removes just settable solids from wastewater, and thus the quality of treated wastewater produced makes it inappropriate for reuse.
- Secondary treatment refers to the removal of postulate and dissolved organic matter and to the oxidation of ammoniac nitrogen, by microorganisms. Some pathogens and hurtful substances are also removed during secondary treatment. Secondary treatment is the most common treatment practice in most Mediterranean countries.
- Water effluent from tertiary treatment can also be used for ground water recharging.

In the followings, the legislation framework of the EU for water and wastewater effluents is critically summarized.

TITLE	OVERVIEW
2000/60/EC **Water framework directive**	It establishes a framework for the Community action in the field of water policy. It comprises a series of prescribed steps that should be undertaken by all EU members so as to achieve the main objective which is the "good status" for all water bodies, i.e. ground and surface waters (rivers, lakes, transitional waters, and coastal waters) in the EU. The ecological and chemical status of surface waters are assessed in terms of: biological quality, hydromorphological quality, and physicochemical quality.
2006/118/EC Groundwater directive	This Directive establishes a regime, which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that takes account local characteristics and allows further improvements to be made based on monitoring data and new scientific knowledge. Member States should establish standards at the most appropriate level and take into account local or regional conditions.
96/676/EC **Nitrates directive**	This Directive aims to reduce and prevent water pollution caused by nitrates from agricultural sources. It obliges Member States to designate vulnerable zones of all known areas in Member States whose waters – including groundwater – are or are likely to be affected by nitrate pollution. Vulnerable zones are defined as those waters, which contain a nitrates concentration of more than 50 mg/l or are susceptible to contain such nitrates concentration if measures are not taken. The link with groundwater policy is clear in this respect, i.e. nitrate contamination levels should not be over the trigger value set at 50 mg/l. The measures for action of the nitrates directive are also listed in the Water Framework Directive (Annex VI) and the Groundwater Directive (Annex IV, part B).

[3] Source: Sotiris I. Patsios - Center for Research & Technology - Hellas (CERTH)

TITLE	OVERVIEW
91/271/EC **Urban wastewater treatment directive**	This Directive aims to protect the environment from the adverse effects of discharges of urban wastewater and wastewater from certain industrial sectors (e.g. food sector), and concerns the collection, treatment and discharge of: domestic wastewater, mixture of wastewater, and wastewater from certain industrial sectors. The Directive requires: Collection and treatment of wastewater in all agglomerations of > 2000 p.e., pre-authorization of all discharges of the aforementioned wastewater streams, monitoring of the performance, controls of sewage sludge disposal and re-use, and wastewater reuse. In this context, the identification of "sensitive areas" relates essentially to freshwater, estuaries or coastal waters, which are found to be eutrophic; lakes and streams reaching lakes/reservoirs with poor water exchange; and surface freshwater intended for drinking water, which contains more than 50 mg/l nitrates.
2010/75/EU Industrial emissions directive	This Directive is the main EU instrument regulating pollutant emissions from industrial installations including wastewater. Specific food processing industries are included in this Directive. It is based on a Commission proposal recasting 7 previously existing directives (including in particular the IPPC Directive 96/61/EC). The IED aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT). Around 50,000 installations undertaking the industrial activities listed in Annex I of the IED are required to operate in accordance with a permit (granted by the authorities in the Member States). This permit should contain conditions set in accordance with the principles and provisions of the IED.
98/83/EC Drinking water directive	The Drinking Water Directive concerns the quality of water intended for human consumption. Its objective is to protect human health from adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean. The Drinking Water Directive applies: to all distribution systems serving more than 50 people or supplying more than 10 cubic meter per day, but also distribution systems serving less than 50 people/supplying less than 10 cubic meter per day if the water is supplied as part of an economic activity; to drinking water from tankers; to drinking water in bottles or containers; and to water used in the food-processing industry.
99/31/EC **Landfill directive**	The Landfill Directive seeks to prevent or reduce the negative effects of landfill waste on the environment, including groundwater. For each site the groundwater, geological, and hydrogeological conditions in the area must be identified. The sites must be designed, so as to prevent groundwater from entering landfill waste, collect and treat contaminated water and leachate, and prevent the pollution of soils, groundwater or surface water by using the appropriate technical precautions such as geological barriers and bottom liners. The directive establishes criteria for waste testing and acceptance taking into consideration the protection of the surrounding environment, including groundwater.
2006/7/EC **Bathing water directive**	It requires Members States to monitor and assess the bathing water for at least two parameters of (faecal) bacteria. In addition, they must inform the public about bathing water quality and beach management, through the so-called bathing water profiles. These profiles contain for instance information on the kind of pollution and sources that affect the quality of the bathing water and are a risk to bathers' health, such as waste water discharges.

Although, at present there is no EU legislative framework (i.e. Directive) concerning water reuse, this issue is a top priority area in the Strategic Implementation Plan of the European

Innovation Partnership on Water, and maximization of water reuse is a specific objective in the Communication "Blueprint to safeguard Europe's water resources". Water reuse encounters numerous barriers in the EU, although this practice is commonly and successfully used in, for example, Israel, California, Australia, and Singapore. Limited awareness of potential benefits among stakeholders and the general public, and lack of a supportive and coherent framework for water reuse are two major barriers currently preventing a wider spreading of this practice in the EU. For these reasons, the Commission is working on legislative or other instruments to boost water reuse when it is cost-efficient and safe for health and the environment. To support this policy development, an impact assessment study was prepared and published in 2015. In line with Commission guidelines for the development of impact assessment studies, the report includes a description of the problem definition and of the baseline situation regarding water reuse in the EU, and elaborates on policy options to be developed in an initiative by the Commission.

Recently, guidelines on Integrating Water Reuse into Water Planning and Management in the context of the WFD were developed by the Commission, Member States and stakeholders, within the Common Implementation Strategy of the WFD.

6. Overview of legislation for the use of AWCB for bioplastics

Worldwide, the consumption of plastic products continues to rise: from 50 million tonnes in 1976 to about 330 million tonnes in 2015. Europe produces about one quarter of the overall 235 million tonnes per year.

Plastic or polymer products differ in whether they are structural polymers (the commonly called plastic, used in industrial applications) or functional polymers (used for non-material applications such as additives, adhesive, flocculants etc.). Bioplastic are thermoplastics made in a large part, or completely from renewable resources (biodegradable but petroleum based plastics are not considered bioplastics).

The conflict involving the possible use of food or animal feed resources for the production of bioenergy, applies also (on a smaller scale) to the industrial use of materials from renewable resources for bioplastic production. There is nowadays a strong interest to find ways to use manly agricultural residues and waste material in this field. The type bioplastic so produced can be:

- Modified natural polymers: polysaccharide-based like thermoplastic starch or cellulose-based plastic, protein- or lignin-based plastics etc.
- Synthesized bio-based polymers from synthesized bio-based monomers: bio-based polyesters, polyamides, polyurethane, polyacrylates etc.

Their application covers a wide range of fields: packaging, medicine and personal care, consumer electronics, textile, housing and construction. The potential use of bioplastics is virtually unlimited.

According to the circular economy definition as “prevention and recovery of waste”: depending on the type of product and plastic in question, as well as the amount and the recycling system, there are different sustainable end-of-life scenarios:

- Material and chemical recycling;
- Energy recovery (thermal recycling);
- Biological treatments.

The standard and certification aim to either identify the bio-based ratio of bioplastics (DIN CERTCO, USDA, OK-biobased) which aim to identify the percentage of the composition of renewable raw material, or their compostability (DIN CERTCO, OK-compost, Compostable). The last ones are based on EN 13432 which sets standards for the characteristics of a product to be biodegradable or compostable.

On the subject of producing and managing bioplastics from residues and waste standards and norms besides the previous quoted:

- EN 13432: Requirements for packaging recoverable through composition and biodegradation – Test scheme and criteria for the final acceptance of packaging.
- EN 14995 Plastics: Evaluation and compostability - test scheme and specifications.
- EN 15932: 2010 Plastics – Recommendation for terminology and characterization of biopolymers and bioplastics
- EN 16137:2011 Plastics: Determination of bio-based carbon content
- EN 16295:2012 Plastics: Declaration of the bio-based carbon content
- 16398:2012 Plastics: Template for reporting and communication of bio-based carbon content and recovery options of biopolymers and bioplastics – Data sheet.

- COM 2005/666/EC: taking sustainable use of resources forward: A Thematic Strategy on the prevention and recycling of waste
- COM 2010/235/EC: future steps in bio-waste management in the European Union.

7. Conclusions

The use of AWCB is subject to several different legislations in Europe. These are also usually complemented by National legislations. At the EU level, the Waste Framework Directive covers the collection, transport, recovery and disposal of most types of waste, including bio-waste. This introduces fundamental principles that guide the use and re-use of wastes and therefore also affect the management of AWCB. Concerning liquid AWCB waste streams (wastewater), there are different legislation mainly related to protection and preservation of freshwater resources in Europe. The European Water Framework Directive provides the main set of steps that should be undertaken by all EU members so as to achieve good status for all water bodies. Regarding, reuse of treated wastewater, there is no current EU legislative framework. Nonetheless, it is a top priority area in the Strategic Implementation Plan Of EIP Water, whereas in some countries there are legislation concerning treated wastewater reuse. In addition to these Directives, different legislations and norms can regulate the use of AWCB depending on the market segment they are used. In this report, we have considered three main market segments for AWCB, namely biofuels, bio-fertilizers and bio-products.

Regarding biofuels, the role of AWCB is set to grow in the current policy scenario. First generation biofuels based on food crops will be gradually phased-out between 2020 and 2030, while advanced biofuels made from no-food crops and wastes will be promoted. Ligno-cellulosic energy crops such as *Miscanthus, Arundo donax* or short rotation plantations represent an important resource to meet the biomass demand of large scale advanced biorefineries, however at present there are still significant techno-economic constraints to address for a large-scale cultivation of these crops. Furthermore, there is still an open debate on the actual availability of sufficient agricultural land for growing these crops without creating competition with food crops. While there is no doubt that energy crops are necessary to develop a stable bio-based economy, in the next years it is likely that industrial initiatives will have to rely on a mix of resources which will include AWCB, in particular straw, forest residues and agro-industrial residues.

Regarding bio-fertilizers, in the context of a biobased and circular economy there is a strong interest in developing bio-fertilizers in order to generate values from secondary resources, The current Fertilizer directive does not regulate the production and use of bio-fertilizers, but in 2016 the Commission has released a proposal for the update the regulation, which includes fertilizers obtained from organic and secondary raw materials. The aim of this legislative effort is to facilitate nutrient recovery from residues and wastes, to reduce dependency from critical raw materials, while protecting the environment. In this context, the use of AWCB is particularly promising for biochar, hydro-char, compost and bio-stimulants.

Concerning bio-plastics, the market currently represents less than 1% of the total plastics market (330 million tons in 2015). However, technological development and a growing demand are driving the current expansion of this sector. In 2012 1.7 million tons of biomass were processed into bio-based plastics, in 2016 this figure was assessed in around 3.5 million tons, and double-digit growth rates are expected for the coming years. In this domain, the normative framework is mostly constituted by EN norms and standards for the determination of quality parameters of bio-plastics, while no specific regulation at European level yet. From the technical point of view almost 90% of all plastics could be switched from fossil fuels to renewable sources, although at present economic barriers and relatively insufficient availability of biomass still represent major barriers. Even though the demand of bio-plastics is unlikely to generate high pressure on land availability to produce biomass, research organizations and industries are increasingly targeting agricultural residue and waste materials for the future production of bio-plastics.

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