



Work Package 2

D2.1

Market entry barriers report

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**Table of contents**

Summary ..... 4

1 Introduction ..... 5

    1.1 Introduction ..... 5

    1.2 The companies ..... 5

    1.3 General approach ..... 5

2 Identified Hurdle: End of Life ..... 6

    2.1 Introduction ..... 6

    2.2 A generically accepted end-of-life option for bio-based products is lacking ..... 6

    2.3 There is opposition from industry parties active in end-of-life technologies ..... 8

    2.4 There is no alignment in accepted end-of-life routes for products with the seedling logo, between different local governments *and* between local and national governments ..... 9

    2.5 A clear labelling as to how to dispose of a bio-based product (or other products) is lacking .. 10

        2.5.1 Existing labels often not clearly visible or not used ..... 11

        2.5.2 Different labels for the same message ..... 12

        2.5.3 Labels without compliance to certification scheme ..... 12

        2.5.4 Similar labels with different meaning ..... 13

        2.5.5 Green washing ..... 14

        2.5.6 Other labels ..... 14

    2.6 The waste removal fee system in different EU member states is not effective ..... 15

        2.6.1 Waste removal fee system in Italy ..... 15

        2.6.2 Waste removal fee system in Germany ..... 16

        2.6.3 Waste removal fee system in the Netherlands ..... 17

        2.6.4 Waste removal fee system in Belgium ..... 18

        2.6.5 Other countries ..... 20

    2.7 Summary and conclusions ..... 20

3 Identified hurdle: certification/standards ..... 21

    3.1 Introduction ..... 21

    3.2 Quantity of certification schemes in the current market ..... 22

    3.3 Complexity of (drafting) standards ..... 23

    3.4 Traditional standards for modern products ..... 23

    3.5 Standards that are in need of an update or missing altogether ..... 25

    3.6 Summary and conclusions ..... 25

4 Identified hurdle: Biofuel policy ..... 25

    4.1 Introduction and brief summary of interview results ..... 25

    4.2 The RED and the biofuel policy: Pressure on feedstock availability ..... 26

    4.3 Distorted competition for feedstock, fuel vs. materials ..... 26

    4.4 Negative image due to industrial use of food crops ..... 27

4.5	Summary and conclusions .....	28
5	Identified hurdle: Long term policy .....	28
5.1	Introduction .....	28
5.2	Level playing field not in place.....	29
5.3	Avoided CO <sub>2</sub> emissions do not bring any financial benefit .....	31
5.4	There are no clear policy and policy-instruments to promote bio-based products in place ....	31
5.4.1	Extended producer responsibility (EPR).....	32
5.4.2	Public Procurement.....	32
5.5	Clear sustainability criteria are missing .....	33
5.6	Absence of incentives to support integration between agriculture and industry .....	34
5.7	Summary and conclusions .....	34
6	Identified Hurdle: Communication and image .....	34
6.1	Introduction .....	34
6.2	Complexity of information .....	35
6.3	Certification and labelling .....	35
6.4	Standardisation: CEN/TC 411 .....	37
6.5	NGO campaigns and emotionality .....	38
6.6	Summary and conclusions .....	39
	List of abbreviations .....	40
	Literature .....	41
	Appendix A - Interview Format .....	42
	Appendix B - Advises for disposal of compostable packaging in different municipalities in the Netherlands	45
	Contact .....	47

## Summary

This report describes the market entry barriers due to regulation and standardisation that companies that are active in the bio-based economy experience. The analysis is based on extensive interviews with seven companies that were held mostly in 2017.

The companies that were interviewed were selected on the basis of a good spread of their respective positions in the value chain and over different feedstock. Next to the companies, in some cases other relevant stakeholders were approached for clarifying background or issues, especially when different views and standpoints were encountered during the interviews.

All hurdles that were mentioned during the interviews were grouped under five main themes and are described extensively in this report. The five themes are:

- End-of-Life, where a number of hurdles are present, including the fact that there is no general agreement as to which end-of-life option (recycling, digestion, composting, incineration, landfilling) for a given bio-based product is the most preferable. Furthermore there are conflicting interests between bioplastics/bioprodukt producers and waste processing companies/recyclers. Furthermore, there is a lot of confusion how to dispose of biodegradable or bio-based products: f.i. different municipalities in one country have different regulations. Also labelling of the products is often a hurdle: among others existing labels are often not clearly visible or not used, different labels exist for the same message, or there are similar labels with a completely different meaning.
- Certification and standards. There is a need for certification in the bio-based market to inform on characteristics of the products and materials. However, over the last years certification schemes have been developed that are similar or overlapping. The large quantity of certification schemes is perceived as a hurdle to further develop the bio-based industry. Additional identified hurdles related to standards are the challenges standardization offers in general, in particular for SMEs; time consuming, costly and the requested level of expertise. Another related identified hurdle within standardization are incorrect statements in standards or missing standards in general.
- Biofuel policy. The RED of 2009 and the RED II proposal are establishing conditions for biomass uses giving higher incentives of biomass use in biofuel and bioenergy sectors. Presently, there is no supportive legislative mechanism to support and regulate the use of the available biomass for producing materials. As the bio-based materials and bioenergy sectors compete for the same resources the competition remains unfair for the bio-based materials and products. Another result of biofuel policy is that the use of biomass in the bio economies other than food has received a negative image by the public.
- (Missing) long term policy. For bio-based products, a level playing field is not in place. Externalities by fossil products like damage to the environment are paid by the society as a whole and not by the producer or buyer of the product. This implies that wherever bio-based products may diminish these externalities they cannot benefit since the fossil products do not carry the price disadvantage.
- Communication and image. Bio-based materials are very diverse and differ in terms of structure, processes, feedstocks and applications. So, information regarding sustainability, handling of products, durability and end-of-life options may be complex to experts, and even more so to consumers. Moreover, there is a paradox between consumers wish for detailed information on the one hand and a desire to get simple messages on the other. There is a multitude of schemes available for different aspects of bio-based products, for instance for the biomass feedstock, this further confuses communication. Furthermore it is difficult to have a fact-based and rational discussion on food security in relation to the use of biomass for bio-based products.

The analysis laid down in this report will serve as the basis for proposing solutions to the market entry barriers related to regulation and standardisation that will be one of the main deliverables of the Star4BBI project.

## 1 Introduction

### 1.1 Introduction

This report describes the market entry barriers due to regulation and standardisation that companies operating in the bio-based economy experience. The analysis is based on extensive interviews that were held in 2017 mostly in the first half of the year.

The analysis will serve as the basis for proposing solutions to the market entry barriers related to regulation and standardisation that will be one of the main deliverables of the Star4BBI project.

### 1.2 The companies

The companies that were interviewed were selected on the basis of a good spread of their respective positions in the value chain and over different feedstock (see figure 1). This selection was done in an earlier phase of the project.

Approximately 15 companies were contacted, 6 companies were willing to actively participate in the project and are also available for analysis done in other work packages. One company was willing to have only an interview related to the market entry barriers analysis.

All companies do actually market products based on biomass feedstock and thus have experience in market entry barriers that may arise. Most companies that were interviewed are mainly active in the business to business market, three of the companies produce and sell also products for the consumer market, notably packaging material.

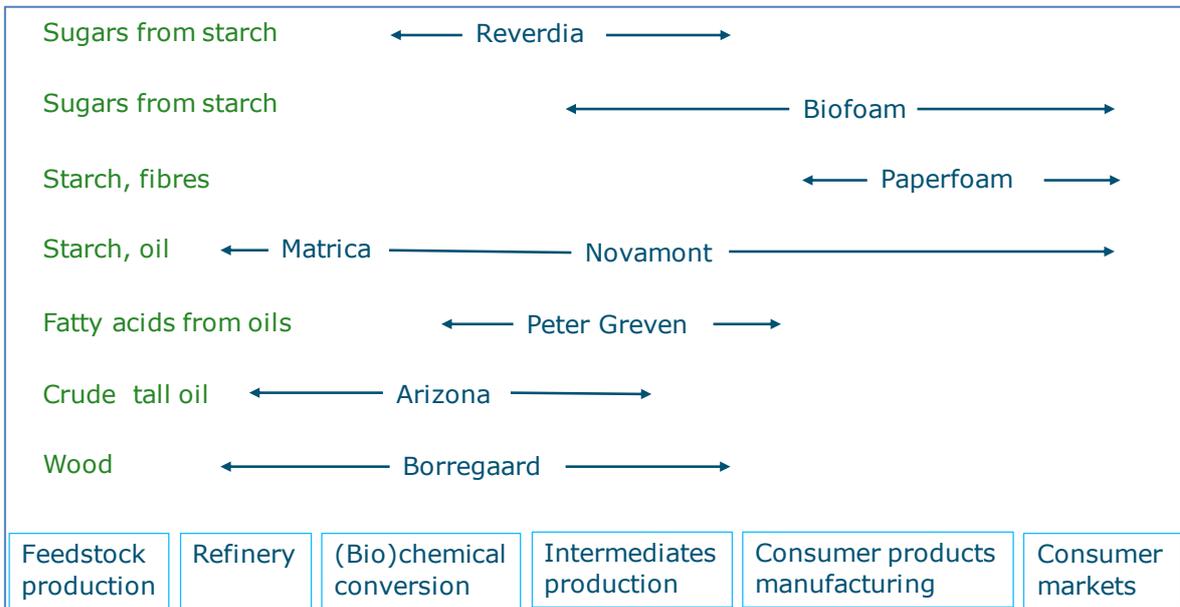


Figure 1: Position of interviewees in the production chain.

### 1.3 General approach

A first round of interviews was conducted with the representatives of the companies, loosely following the interview format presented in appendix A.

The outcome of these interviews was used as the basis for this report. Hurdles mentioned by the interviewees were bundled under overarching themes and examined further. The hurdles identified relate to:

- End-of-Life, a number of aspects related to different end-of life options for bio-based products.
- Certification and standards.
- Biofuel policy, issues related to biofuel policy affecting especially feedstock availability.
- (Missing) long term policy, issues relating to a lack of level playing field especially compared to petrochemical based products, clear and stable policy.
- Communication and image.

Each of the market entry barriers will be described in detail in the following chapters grouped under the themes mentioned above. Additionally, the stakeholders related to each of the hurdles described will be listed. In further STAR4BBI work a stakeholder analysis will be carried out to identify the necessary communication mechanisms for reaching out these essential stakeholders. The proposal for the regulatory and standardisation changes which will be developed within STAR4BBI will be proposed to these stakeholders.

## 2 Identified Hurdle: End of Life

### 2.1 Introduction

For a number of bio-based applications the end-of-life options are one of the important aspects that can help with or stand in the way of market introduction. This is especially apparent for applications in packaging, since these are products with a relatively short service life. Several of our interviewees commented on hurdles related to end-of-life options. These hurdles take different forms:

- *A generically accepted end-of-life option for bio-based products is lacking.* There is no shared vision on which end-of-life option is the most preferable for different bio-based products.
- *There is opposition from industry parties active in end-of-life technologies.* Especially recycling companies and industrial composters are sceptical towards bio-based products.
- *There is no harmonisation in accepted end-of-life routes for bio-based products, between local governments and between national governments.*<sup>1</sup> In various countries collecting household waste is a responsibility of the local governments. Different local governments have different rules as to what is accepted in which bin. Also the ambitions of the national government differ from the rules of local governments.
- *A clear labelling as to how to dispose of a bio-based product (or other products) is lacking.* Issues are: different icons to indicate the same end-of-life route (compostable), icons are very small (you cannot read them), icons are often missing on packaging for which it is not clear where to dispose.
- *The waste removal fee system for packaging materials active in some countries is not effective.* Companies that use a packaging material in the Netherlands pay a fee, this fee is lower for bio-based products. Nevertheless the system does not work well for bio-based products. Question is if there are similar schemes in other countries and if they are effective.

These issues will be discussed separately in the following subsections.

### 2.2 A generically accepted end-of-life option for bio-based products is lacking

There is no shared vision on which end-of-life option is the most preferable for different bio-based products. Bio-based products are a diverse group, that can be divided in a number of main categories, and for each category different end-of-life options are available, see Table 1:

*Table 1: Overview of technically available end-of-life options for products from various bio-based material categories.*

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<sup>1</sup> <https://www.vlaanderen.be/nl/natuur-en-milieu/afval/afvalinzameling> , visited 30 November 2017.

End-of-life route	Landfilling	Incineration, with or without E-recovery	(Industrial) Composting	Anaerobic digestion	Plastics recycling	Paper recycling	Textile recycling
Category of bio-based products							
Paper, cardboard and other products based on paper fibres	All	All	Most	Some	None	Most	None
Biodegradable bio-based plastics and bio-based resins (non-textile)	All	All	All	Some	Most	None	None
Non-biodegradable bio-based plastics and bio-based resins (non-textile)	All	All	None	None	Most	None	None
Combinations of fibres and bio-based plastics and resins (a.o. panels and boards)	All	All	Some	Some	Some	None	None
Bio-based textiles	All	All	Some	None	Some	None	some

In this table the key categories of bio-based products as examined in this project are presented.

Moreover, several bio-based materials can be processed by more than one end-of-life route, which makes it more complicated to come to a generally accepted end-of-life option. For example: all bio-based products can be landfilled or incinerated. Biodegradable bio-based products can mostly be composted in industrial composting facilities, a smaller fraction also in home compost, some can also be digested. Both biodegradable and non-biodegradable bio-based plastics can be recycled from a technical point of view; provided that the recycling facilities are in place. Bio-based thermoset resins can mostly not be composted or digested, nor recycled. Paper fibre based bio-based products (e.g. Paperfoam, drink cartons, coffee cups) can often be recycled in a paper recycling process, provided that a separate collection system and a dedicated recycling is performed.

Some of these options are technically possible, but due to various reasons are not currently being implemented, for instance:

- Landfilling is mostly not the preferred end-of-life option, and in some EU countries it is actively discouraged.
- Whereas in principle all thermoplastics can be recycled, only the large volume plastics actually are. Recycling of smaller fraction is generally not economic and therefore not implemented (even PS, yoghurt cups etcetera, is not recycled as a separate stream today).
- Compostable plastics are not always accepted by industrial composters, mostly due to the fact that composters fear the introduction of non-biodegradable plastics in the waste stream. Often, they therefore remove all plastics in the stream, including the biodegradable plastics.

Another underlying problem is that there is no consensus considering the most preferred option for any single product from an environmental point of view<sup>2</sup> (see also chapter 5.5). General policy, and thus regulations, addressing these issues is lacking. Furthermore, there is no consensus on how to weigh the different environmental impacts of the various end-of-life processes among each other (f.i. how to compare the impact of depletion of fossil fuels, land use, eutrophication and smog). The most preferred end-of-life route depends on the weighting of the different impact categories.

<sup>2</sup> [http://www.plastics.org.nz/images/documents/PDFs/EUBP\\_pp\\_home\\_composting.pdf](http://www.plastics.org.nz/images/documents/PDFs/EUBP_pp_home_composting.pdf) , visited 29 November 2017.

Furthermore, there are conflicts of interest between the various players in the entire chain, f.i. bioplastics producers, fossil plastics producers, plastics converters, and waste processors (see also chapter 2.3)

Key problems:

- No general agreement as to which end-of-life option (recycling, digestion, composting, incineration) for a given bio-based product is the most preferable
- Conflicting interests bioplastics/bioprodukt producers versus waste processing companies/recyclers

Stakeholders: government/policy makers, producers of bio-based products, waste processing companies/recyclers, plastic converters.

### 2.3 There is opposition from industry parties active in end-of-life technologies

Producers of compostable plastics would like their products meeting the EN 13432 standard to be accepted in the green bin. However, especially recycling companies and industrial composters are sceptical towards bio-based products. Composting of biodegradable plastic does not bring waste processors anything, biodegradable plastics decompose to CO<sub>2</sub> and H<sub>2</sub>O only and leave no compost. At the same time acceptance of (certified) compostable plastics brings the risk of ordinary non-biodegradable plastics ending up in the green bin, either accidentally or deliberately. This will require additional separation efforts in the facilities and there is a risk that non-biodegradable plastics end up in the compost, lowering its quality. Dutch and Italian waste processors do accept compostable plastic bags when they facilitate the collection of (wet) compostable material which is otherwise incinerated at higher cost. Producers of compostable plastics see a co-benefit in a range of products next to bags for collection of organic kitchen waste: tea bags, coffee capsules, packaging of vegetables and fruit.<sup>3</sup>

The German 'Bundesgütegemeinschaft Kompost' (BKG) rejects composting of all compostable plastics, even collecting bags.<sup>4</sup> No specific info on this subject has been found at the European Compost Network.<sup>5</sup>

Nowadays, bio-based plastics constitute only about 1% of total plastic volume (Van den Oever, 2017).<sup>6</sup> In the Netherlands, basically all plastic is collected together. This plastic is sent to waste processors to separate the different plastics as well as possible. Technically, most plastics except for black plastics and laminate plastics can be recycled. However, plastic waste processors only make money with the largest fractions, consequently virtually all being fossil plastics: HDPE, PP and PET. Bio-PE and Bio-PET can be recycled with the fossil PE and PET respectively, because they are chemically identical. Other fractions are plastic film and mixed plastics, including: PS, PET trays and laminated flexible packaging. Further separation adds more costs than the income from the respective recyclates (Van den Oever, 2017). Therefore, waste processors object to the introduction of additional types of (bio-based) plastics like PLA, PHA and PEF because they fear that the quality of the recyclates will decrease, or that the throughput of the sorting facilities will go down, although little research has been performed. New bio-based plastics such as PLA, at present conditions, will likely end up in various streams: films will end in the plastic film fraction (DKR-310), trays in the mixed plastics fraction (DKR-350), bottles in the mixed plastics (DKR-350) or the PET bottle stream (DKR-329-1). It is not clear what further developments in plastic separation will bring.

Paperfoam would like their biofibre-starch based product to be accepted in the waste paper stream because this enables the recycling of the fibres. However, paper recyclers are not happy to accept products like Paperfoam, because of the relatively low fibre content of 12-15%<sup>7</sup> and the high starch content which increases water treatment costs (WEPA, 2018; PRN, 2018). Also, there is concern about other non-paper

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<sup>3</sup> <http://www.hollandbioplastics.nl/inspiring/composteerbare-producten-en-verpakkingen-zijn-een-onvermijdbare-keuze-op-weg-naar-een-circulaire-economie/> , visited 10 April 2018.

<sup>4</sup> [https://www.kompost.de/fileadmin/user\\_upload/Dateien/Themen\\_Positionen/5.4.1\\_Position-BAW\\_2014\\_final.pdf](https://www.kompost.de/fileadmin/user_upload/Dateien/Themen_Positionen/5.4.1_Position-BAW_2014_final.pdf) , visited 17 January 2018.

<sup>5</sup> <https://www.compostnetwork.info/> , visited 8 February 2018.

<sup>6</sup> [https://www.wur.nl/upload\\_mm/e/6/8/113a1607-0925-4829-b864-f0e6a5fc79c5\\_170419%20Report%20Bio-based%20Plastic%20Facts.pdf](https://www.wur.nl/upload_mm/e/6/8/113a1607-0925-4829-b864-f0e6a5fc79c5_170419%20Report%20Bio-based%20Plastic%20Facts.pdf) .

<sup>7</sup> <https://www.paperfoam.com/sustainability#Biobased> , visited 12 March 2018.

products ending up in the waste paper stream. Such non-paper products need to be separated during the pulping-paper making process and disposed of as waste.

Separation by households is unreliable, consumers have a key role. This may relate to costs and relates in any case to lack of clarity.

Key problems:

- Producers of biodegradable plastics would like all of their products to be accepted in the green bin, while waste processors mainly see the risk of: 1) non-biodegradable plastic entering the composting line, 2) decreased quality of recyclates or 3) decreased throughput of the separation lines.
- Producers of paper-like products like their products to be accepted in the paper recycle stream because they see the valuable fibres, while paper recyclers mainly see the non-fibre constituents of the product which causes them costs and the risk of non-paper products entering their feedstock.
- Waste processors do not like biodegradable plastics in the plastics recycling stream, they claim the quality of the recyclate is influenced negatively.
- No research has been performed however on recycling of bio-based plastics and composting of biodegradable plastics with both the bio-based plastics suppliers and the waste processors being stakeholders in the project.

Stakeholders: Waste processing companies, recyclers, producers of bio-based materials and products

## **2.4 There is no alignment in accepted end-of-life routes for products with the seedling logo, between different local governments *and* between local and national governments**

In most cases, all over European Member States, local municipalities are responsible for the waste removal of households. Even though the national government may be inclined to promote putting compostable plastics in the green bin, local governments still make their own decisions, in some municipalities it is allowed, in some it is not.

Some examples of Dutch municipalities:

- Municipality of Arnhem: Compostable plastics are “rest-waste”. It is mentioned however that together with peels etc they are allowed in the green bin. They refer to advises for disposal routes by Milieu Centraal (Figure 14 in ).<sup>8</sup> This is since recently also the vision of the Dutch Ministry of Infrastructure & Water Management<sup>9</sup>.
- Municipality of Utrecht: Plastics with seedling logo are accepted in the green bin (Figure 15).<sup>10</sup> This is in accordance with the ‘weggooiwijzer’ (guide for desired disposal routes) published by KIDV (Dutch Knowledge Institute for Sustainable Packaging).<sup>11</sup>
- Municipality of Wageningen: All plastics packaging is directed to the PMD (Plastic, Metal, Drink cartons) stream. Special attention is given to eventual use of bags to collect organic waste: it is recommended to use compostable bags, and not standard plastic bags (Figure 16).<sup>12</sup> The same holds for the municipality of Renkum/Oosterbeek.<sup>13</sup>

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<sup>8</sup> <https://www.afvalscheidingswijzer.nl/?id=14683&u=verpakkingen+van+composteerbaar+plastic> visited 8 February 2018.

<sup>9</sup> <https://lap3.nl/sectorplannen/sectorplannen/gft/>

<sup>10</sup> <https://www.utrecht.nl/wonen-en-leven/afval/groente-fruit-en-tuinafval-heeft-waarde/#c337416> , visited 24 January 2018.

<sup>11</sup> <https://www.kidv.nl/6428/weggooiwijzer.pdf> , visited 8 February 2018.

<sup>12</sup> <https://www.acv-groep.nl/wageningen/afvalinzameling/afvalscheidingstips> , visited 8 February 2018.

<sup>13</sup> <https://www.renkum.nl/Inwoners/Afval/Afvalsoorten> , visited 8 February 2018.

The German Ministry of Environment clearly states that even biodegradable bags should not go into the biowaste bin, except for compostable waste bags for collecting biowaste.<sup>14</sup> Like in the Netherlands, German municipalities show different approaches. Some municipalities like Berlin<sup>15</sup> accept compostable bags to collect organic waste. Several others like Hamburg<sup>16</sup>, Frankfurt am Main<sup>17</sup> and Cologne<sup>18</sup> say that plastic does not go into the bio bin, without differentiating between biodegradable or non-biodegradable. Other municipalities like Munich<sup>19</sup>, Stuttgart<sup>20</sup>, Bremen<sup>21</sup> and Bonn<sup>22</sup> explicitly do not accept even compostable bags for collection of organic waste.

At present, very few EU Member States have nationwide industrial composting systems in place. Although some EU Member States have existing composting infrastructures (BE, SE, DK, FI), there is often a lack of clear policies and guidelines for the end-of life choices of bio-based products, and if for example compostable plastics can be sent to the composting facilities or not (nova, 2017). European Bioplastics is working on a map of the European composting landscape, but it is only accessible for members as of now.

Key problems:

- In the Netherlands, 3 different example municipalities advise 3 different disposal routes for (compostable) plastic packaging products: In the green bin (Utrecht); in the plastics bin; in the grey bin, unless carrying organic waste. Also, institutions providing guides for disposal of waste do not have identical recommendations (Milieu Centraal, KIDV).
- In Germany, the Ministry of Environment states that biodegradable packaging should not go into the biowaste bin, except for compostable bags for collecting biowaste. This is taken over by some municipalities. From the municipalities checked, however, the majority does not accept compostable bags to collect organic waste.

Stakeholders: EU commission, national governments, municipalities, waste operating companies, consumers

## 2.5 A clear labelling as to how to dispose of a bio-based product (or other products) is lacking

For consumers, even for professionals, it is often difficult to distinguish materials of products and consequently to know how to dispose a (bio-based) product after use. The majority of interviewees identified the lack of a clear labelling system on how to dispose bio-based products (or other products) as a major hurdle. More in particular:

- Existing labels are often not clearly visible or not used
- Different labels exist for the same message
- Similar labels have different meaning
- Labels without compliance to certification scheme are present
- Labels are used for green washing
- Many (packaging) products do not have a logo

These issues will be elaborated below. Labelling is also addressed in chapter 6 on communication and image.

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<sup>14</sup> <http://www.bmub.bund.de/themen/wasser-abfall-boden/abfallwirtschaft/abfallarten-abfallstroeme/bioabfaelle/das-gehoert-in-die-biotonne/> , visited 23 February 2018.

<sup>15</sup> <https://www.bsr.de/bioabfall-20009.php> , visited 1 March 2018.

<sup>16</sup> <http://www.hamburg.de/recycling/4801708/bioabfall/> , visited 1 March 2018.

<sup>17</sup> [http://www.frankfurt.de/sixcms/detail.php?id=2828&\\_ffmpar\[\\_id\\_inhalt\]=41619](http://www.frankfurt.de/sixcms/detail.php?id=2828&_ffmpar[_id_inhalt]=41619) , visited 1 March 2018.

<sup>18</sup> <https://www.awbkoeln.de/tonnen/biotonne/> , visited 1 March 2018.

<sup>19</sup> [https://www.awm-muenchen.de/fileadmin/PDF-Dokumente/privatkunde/Trennliste\\_deutsch.pdf](https://www.awm-muenchen.de/fileadmin/PDF-Dokumente/privatkunde/Trennliste_deutsch.pdf) , visited 1 March 2018.

<sup>20</sup> <https://www.stuttgart.de/bioabfall> , visited 1 March 2018.

<sup>21</sup> <https://www.die-bremer-stadtreinigung.de/detail.php?gsid=bremen206.c.2710.de> , visited 1 March 2018.

<sup>22</sup> <https://www.bonnorange.de/abfallwirtschaft/private-haushalte/infos-von-a-z/b/biotonnegruene-tonne.html> , visited 1 March 2018.

2.5.1 Existing labels often not clearly visible or not used

Many packaging products do carry a label nowadays. Ideally, by looking at the label, consumers should be able to know to which bin the product belongs to, and consequently, each product should have a proper label. For example, in the Netherlands there are some informative materials on how to dispose products with different labels prepared by the Netherland Institute on Sustainable Packaging (KIDV, 2017, Figure 2).<sup>23</sup> However, often the labels are very small (Figure 3). Also, many producers of packaging products do not use the labels. In the UK, a very different scheme of labels for products has been established, indicating whether a packaging product can be recycled (Figure 4).

## Weggooiwijzer

### Richtlijn voor bedrijven voor het toepassen van weggooi-instructies

Augustus 2017



Figure 2: Labels for different disposal routes prepared by Netherland Institute on Sustainable Packaging (KIDV, 2017).



Figure 3: Labels for disposal routes for plastic bag and clip on packaging of bread in AH supermarket: label text is very small, label colour is different from those presented by KIDV.

<sup>23</sup> <https://www.kidv.nl/6428/weggooiwijzer.pdf>, visited 8 February 2018.

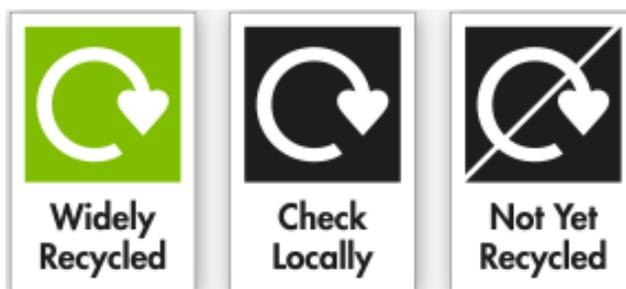


Figure 4: Labels to indicate whether a packaging product can be recycled (OPRL, UK).<sup>24</sup>

### 2.5.2 Different labels for the same message

To indicate that a product is compostable, many labels are available (Figure 5). The excess of labels dilutes the recognisability and the effect.



Figure 5: Different labels to indicate that a product is industrially compostable.<sup>25</sup>

### 2.5.3 Labels without compliance to certification scheme

Also some companies have introduced their own label for compostable products (Figure 6). And many more logos related to compostability are around (Figure 7). Possibly, many of these labels are just promotion without compliance to any testing scheme or framework, thus undermining the effect of registered labels.



Figure 6: Label for compostable products introduced by Kilby Packaging.<sup>26</sup>

<sup>24</sup> <http://www.oprl.org.uk/get-involved/what-is-the-scheme/> , visited 1 March 2018.

<sup>25</sup> TÜV AUSTRIA Group has acquired OK Compost label from Vinçotte as per 1 December 2017.

<sup>26</sup> <https://www.kilby.co.uk/company/environmental/compostable-logo.html> , visited 8 February 2018.



Figure 7: Small selection of many logos appealing to biodegradation and compostability.<sup>27</sup>

#### 2.5.4 Similar labels with different meaning

Biodegradation is a complex matter itself. For instance, PLA is compostable at industrial composting conditions, but it will not easily degrade in soil or in marine or surface water. Therefore, different labels have been established to address this issue. However, labels for different degradation routes look very much alike, thus potentially leading to missing the exact message (Figure 8). Moreover, it is the question whether it makes sense to communicate messages like ‘marine biodegradable’ to the general public.

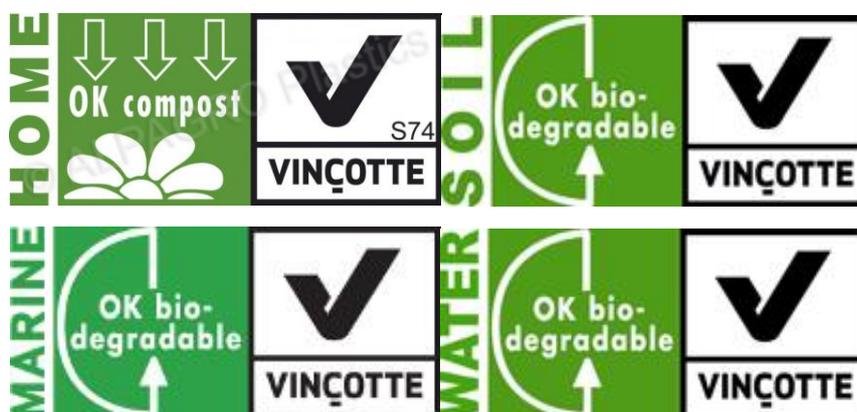


Figure 8: Different labels to indicate biodegradability in different environments.

Another issue is that some certification bodies use labels with basically the same (organisation specific) layout to indicate very different features of a product. E.g. Vinçotte and Dincertco use labels for the bio-based content of a product (Figure 9), which very much resembles the labels used for compostable products (Figure 5).

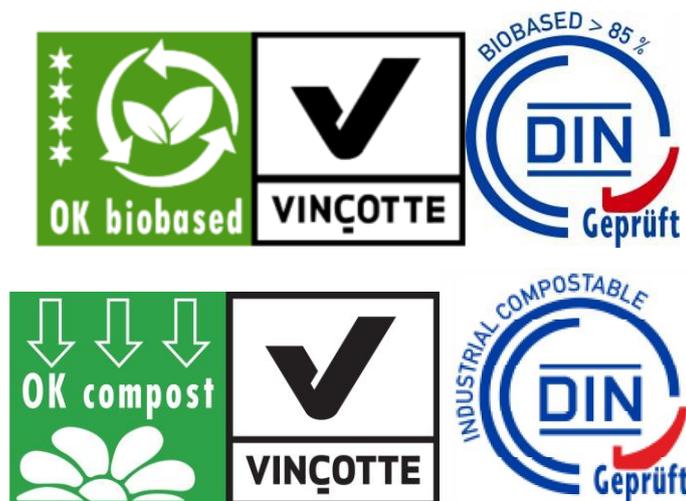


Figure 9: Labels from Vinçotte and Dincertco to indicate the bio-based content of a product (top), resembling very much the labels used to indicate industrial compostability (bottom).

<sup>27</sup><https://www.bing.com/images/search?q=compostable+logo&id=CC3CF9080A308AB099043243566F68BFA084F0B9&FORM=IQFRBA> , visited 8 February 2018.

### 2.5.5 Green washing

As biodegradability, though a very diffuse term as explained above, is attracting more and more attention, it is also getting increasing marketing value. Consequently, misuse and green washing may be expected to increase. An example of green washing is 'oxo-biodegradability'. In oxo-degradables mostly an additive has been added to a non-biodegradable plastic like PE which cause the plastic product to break up into small fragments in the presence of oxygen, heat and UV.<sup>28</sup> General concern is that these fragments do not biodegrade to CO<sub>2</sub> and H<sub>2</sub>O quickly and consequently contribute to similar effects as caused by the plastic soup, though basically invisible.<sup>29,30</sup> Also, plastic recyclers fear the oxo-plastics, as it corrupts the quality of recyclates while separation techniques cannot distinguish between oxo-degradable plastic and standard plastic.<sup>31</sup> In fact a huge amount of parties, organised in a special initiative led by the Ellen MacArthur Foundation, plea for a ban on oxo-degradable plastics.<sup>32</sup>

To indicate oxo-degradability also several labels are available<sup>33</sup>, including a label (Figure 10) which claims two positive aspects (biodegradable, recyclable) which are not valid for oxo plastics as indicated above.



Figure 10: Label claiming oxo-biodegradability and recyclability.<sup>34</sup>

### 2.5.6 Other labels

A range of labels are available to indicate that a product contains recycled material. Examples are presented in Figure 11.



Figure 11: Labels to indicate that a product contains recycled content: Generic symbol (left) and a label introduced by a company, SCS Global Services (right).<sup>35</sup>

Some labels seem to suggest that a product is based on recycled content, however, it indicates that the producer of a packaging product has paid the fee for its recycling (Figure 12).

<sup>28</sup> [https://en.wikipedia.org/wiki/Oxo\\_Biodegradable](https://en.wikipedia.org/wiki/Oxo_Biodegradable) , visited 8 February 2018.

<sup>29</sup> <https://newplasticseconomy.org/news/over-150-organisations-back-call-to-ban-oxo-degradable-plastic-packaging> , visited 22 February 2018.

<sup>30</sup> <https://publications.europa.eu/en/publication-detail/-/publication/bb3ec82e-9a9f-11e6-9bca-01aa75ed71a1/language-en> , visited 23 February 2018.

<sup>31</sup> <https://newplasticseconomy.org/assets/doc/oxo-statement-vF.pdf> , visited 1 March 2018.

<sup>32</sup> <https://newplasticseconomy.org/publications/oxo-statement> , visited 8 February 2018.

<sup>33</sup> [http://www.ows.be/wp-content/uploads/2013/10/Final-Report-DSL-1\\_Rev02.pdf](http://www.ows.be/wp-content/uploads/2013/10/Final-Report-DSL-1_Rev02.pdf) , visited 8 February 2018.

<sup>34</sup> <https://sustainability.stackexchange.com/questions/2507/how-can-i-tell-biodegradable-plastic-bags-apart-from-non-biodegradable> , visited 8 February 2018.

<sup>35</sup> <https://www.scsglobalservices.com/services/recycled-content-certification> , visited 1 March 2018.



**Figure 12: Green Dot label; ‘Der Grüner Punkt’ in Germany where it was invented.<sup>36</sup>**

Summarising, the key problems are:

- Existing labels often are not clearly visible, or not used at all.
- Different logos having the same meaning, e.g. for compostability. The excess of labels dilutes the recognisability and the effect.
- Not all logos, e.g. related to compostability, indicate compliance to any testing scheme, thus undermining the effect of registered labels.
- Labels with basically the same layout indicate very different features of a product, e.g. labels for the bio-based content of a product and labels for compostable products.
- Green washing, e.g. oxo-degradables.

Stakeholders: Certifying bodies, manufacturers and packaging producers, associations of waste processors

## 2.6 The waste removal fee system in different EU member states is not effective

Two of the interviewees mentioned that companies that use a packaging material in the Netherlands pay a fee, this fee is lower for bio-based products. Nevertheless, they indicated that the system does not work well for bio-based products. Systems in several countries have been investigated, including Netherlands, Belgium, Italy, Germany.

### 2.6.1 Waste removal fee system in Italy

Italy has in place an extended producer responsibility (EPR) scheme for collecting packaging waste, following the individual producer responsibility (IPR) approach, in which the industry has to support financially the recycling systems. Separately collected packaging waste benefits from the crediting scheme managed by CONAI (National Consortium for Packaging). It includes a fee modulation, which charges different fees to producers for each type of packaging materials (Table 2).

*Table 2: Removal fees for various packaging materials in Italy to be paid by the party bringing the packaging to the consumer market.*

Material	Fees 2016 EUR/ton	Fees 2018/ton <sup>37</sup>
Steel	13,00	13,00
Aluminium	45,00	45,00
Paper	4,00	10,00
Wood	7,00	7,00
Plastic	188,00	188,00 (recyclable packaging from industry and trade) 208,00 (recyclable packaging from domestic origin)

<sup>36</sup> [https://en.wikipedia.org/wiki/Green\\_Dot\\_\(symbol\)](https://en.wikipedia.org/wiki/Green_Dot_(symbol)) , visited 1 March 2018.

<sup>37</sup> <http://www.conai.org/notizie/variazioni-del-contributo-carta-e-plastica/> , visited 8 March 2018.

		228 (packaging which cannot be recycled with current state of technology)
Glass	17,30	17,30

Starting on January 2018, a modulated fee system for different type of plastic packaging has been introduced. This system, however, does not specifically address bio-based or compostable plastic packaging, and non-drop in bio-based plastics are charged with the highest fee for plastic not being recyclable to current state of technology. On the other hand, CONAI also organizes an award for sustainable packaging, with the aim of promoting the design and development of innovative packaging solutions. The current system aims at: i) encouraging the use of sustainable packaging; ii) encourage reuse; iii) enabling and simplifying recycling; iv) supplying of materials for markets. Nevertheless, also this action plan does not encourage the use of bio-based packaging.

A strong support to the bio-based economy in Italy has been provided with the introduction of a national regulatory instrument that banned the use of single-use, non-biodegradable plastic bags. Indeed, the new Law 28/2012 requires shopping bags to be biodegradable and compostable as laid down by the standard UNI EN 13432:2002 (and so reusable for organic waste collection). This law represents an important instrument for the promotion of the bioplastics development across the country. However, even if in 2014 the law was further strengthened by the introduction of penalties for infringements (legislative decree 91/2014), currently around 50% of bio-based shopping bags on the market are “fake”. The lack of control, is considered as an important regulatory hurdle that is hampering the market for important bio-based players, including Novamont.

Starting on the 1<sup>st</sup> of January 2018, Italy applied the European Plastic Bag Directive 2015/720 and according to a new law<sup>38</sup> all fruit and vegetable bags must be 100% biodegradable and the supermarket cannot give them out for free.

Key problems:

- Waste removal fee in Italy does not make a difference for bio-based and fossil based plastics. Actually, bio-based plastic packaging is in the category of the highest fee, similar to non-recyclable plastics.
- Lack of control by government for false declared compostable plastic bags for organic waste collection.
- Biodegradable is supported but not necessarily bio-based.

Stakeholders: CONAI, manufacturers of bags, (associations of) waste processors

## 2.6.2 Waste removal fee system in Germany

In Germany, the packaging waste is collected under the direct responsibility of the industry (EPR fully respected). Until December 2012, the use of bioplastics in certain applications was slightly favoured by the German legislation. For example, the German packaging law (VerpackV) promoted the use of biodegradable plastics, by exempting certified biodegradable packaging from the Green Dot licence fees required under the Dual System Germany (DSD) (packaging tax). Additionally, the law exempted all single-use beverage containers from the deposit fee (€0.25 per container) if they contain at least 75% of bio-based materials. Firms wishing to apply for certification had to have their materials tested according to DIN EN13432 or ASTM D 6400. Due to different concerns of relevant stakeholders (e.g. recycling industry and NGOs), among others, the difficulty of processing bio-based plastics in the recycling industry, these measures were stopped in 2012.

However, the recently approved new packaging act (Verpackungsgesetz<sup>39,40</sup>), which aims at boosting recycling of packaging waste and will enter into force on 1 January 2019, stipulates that the systems collecting the

<sup>38</sup> LEGGE 3 agosto 2017, n. 123 , <http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2017;123> , visited 8 March 2018.

<sup>39</sup> <https://verpackungsgesetz-info.de/en/> ,visited 23 February 2018.

<sup>40</sup> <https://www.gruener-punkt.de/de/leistungen/ruecknahmeloesungen/verpackungsgesetz.html>

waste fees are obliged to create incentives that encourage the use of recycled material or material from renewable sources for the production of packaging (§21 (1). Currently there are still many open questions (such as the amount of the incentives) regarding the exact implementation of this new fee concept. It remains unclear how the implementation for private sellers (e.g. via e-bay) will be. Everyone selling a packaged product should be registered in a central service point, however, private retailers are not registered as a business. And small businesses sometimes have a system that their loyal consumers recycle the packaging and give it back to the seller (e.g. jars for selling honey): How the honey seller should register the recycled packaging in the central service system remains unclear. However, as stated by European Bioplastics, this represents an important signal for the bioplastics industry as bio-based and recycled materials are recognised as equally viable solutions to make packaging more sustainable and reduce dependency on fossil resources.

Key problem: There are many open questions regarding the exact implementation of the new fee concept in Germany.

Stakeholders: Green Dot, packaging industry, waste processors

### 2.6.3 Waste removal fee system in the Netherlands

Dutch law obliges companies that use packaging materials in the Netherlands to bring products to the market to contribute to the recycling of these materials.<sup>41</sup> This is organised through the “Afvalfonds Verpakkingen”. Afvalfonds Verpakkingen ('Packaging Waste Fund') was established by producers and importers to collectively meet the extended producer responsibilities as stated in the Packaging Decree and Packaging Agreement.<sup>42</sup> It is a not-for-profit organisation governed by a board of directors, who are themselves appointed by producers and importers.

In practice there are four main responsibilities related to packaging for producers and importers, to:

- meet the Essential Requirements;
- meet the limits on heavy metal concentration levels;
- record and account for the amount of packaging released onto the Dutch market;
- register with the Packaging Waste Fund if the amount of packaging released onto the Dutch market is more than 50,000 kg in a year. And pay the Packaging Waste Management Contribution.

The Packaging Waste Management Contribution (PWMC) covers the costs of implementing the Packaging Agreement, and consists of two components:

- The main costs per material for collecting and processing, and for acquiring a guarantee from recycling companies that they will use the collected materials;
- The system costs: the prevention of litter, monitoring and organizational costs.

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<sup>41</sup> <https://www.nedvang.nl/regelgeving> , visited 24 January 2018.

<sup>42</sup> <https://afvalfondsverpakkingen.nl/en/> , visited 8 February 2018.

Table 3: Waste removal fees for various packaging materials in the Netherlands to be paid by the party bringing the packaging to the consumer market\*.

Material	Fee 2016/2017/2018 (€/kg) ex. VAT
Glass	0.056
Paper/Cardboard	0.022
Plastics	0.640
Biodegradable plastics	0.020
Aluminium	0.020
Other metals	0.020
Wood	0.020
Other materials	0.020
General fee (company can't or won't specify the material)	0.770
Beverage cartons	0.180
Bottles in a deposit system	0.020
Plastic bottle > 0.75 l without deposit	7.50

\* Biodegradable plastics concerns plastic packaging that meets the EN 13432 standard for industrial compostability and is certified accordingly: f.i. labelled with the Seedling logo.<sup>43</sup>

Key problem: Even though the fee for biodegradable plastics in the Netherlands is lower than the fee for plastics, two of our interviewees state that the fee system is not effective:

- The financial advantage for biodegradable plastics is in cases too small to overcome the price difference. Additional problem here is that biodegradable materials often have a higher density than the fossil plastics they replace, the same package will therefore be heavier and thus the fee will be relatively higher, as it is calculated per kilogram
- In large companies the fee is paid by another department than the one responsible for purchasing packaging materials, so they don't realize they can save money
- Non-biodegradable bio-based plastics are not promoted through this system

Stakeholders: Afvalfonds verpakkingen, buyers and financial departments of larger companies

#### 2.6.4 Waste removal fee system in Belgium

In Belgium each company which brings packaging materials to the market is responsible for processing of that packaging after use.<sup>44</sup> A collaboration agreement with the government includes 3 key obligations:

- A general prevention plan for companies bringing > 300 ton one way packaging to the market.
- Prove to meet prescribed percentages for recycling and useful applications of the packaging it has brought to the market.
- Provide and communicate volumes of packaging brought to the market and taken back.

The "Interregionale Verpakkingscommissie" (IVC, Interregional Packaging Commission) is responsible for the organisation of the collaboration agreement. Each party has to show to the IVC annually how much packaging has been brought to the market, and how much has been taken back and recycled, either directly by the party itself or via a third party/organisation. The IVC has recognised Fost-Plus to collect household waste, and Val-I-Pac to collect industrial waste. Municipalities are responsible for collection of household waste and may determine the collection fees within limits.<sup>45</sup>

<sup>43</sup> <http://www.european-bioplastics.org/bioplastics/standards/labels/>, visited 8 February 2018.

<sup>44</sup> <http://www.ivcie.be/admin/upload/page/file/393.pdf>, visited 23 January 2018.

<sup>45</sup> <https://www.vlaanderen.be/nl/natuur-en-milieu/afval/afvalinzameling>, visited 23 January 2018.

The fees for several material categories of packaging to be collected as household waste by Fost-Plus are presented in Table 4 and Table 5. The fee in €/kg for HDPE and PET bottles is lower than for other plastics, including bio-based plastics. This means that bio-based plastic bottles have a price disadvantage compared to traditional fossil based bottles. For packaging to be collected as industrial waste by Val-I-Pac, fees are presented in Table 6. Here, no differentiation for bio-based materials is made.

Table 4: Waste removal fee for the various packaging materials in Belgium.<sup>46</sup>

## De Groene Punt-tarieven per materiaal

Hieronder vindt u een overzicht van de tarieven voor een aantal veel voorkomende materialen.

Materialen	2016 (EUR/kg)	2017 (EUR/kg)
Glas	0,0239	0,0214
Papier-karton	0,0185	0,0169
Staal	0,0848	0,1244
Aluminium	0,0353	0,0326
PET (flessen en flacons)	0,1471	0,2107
HDPE (flessen en flacons)	0,1471	0,2107
Drankkartons	0,2498	0,2455
Andere, valoriseerbaar	0,2873	0,2823
Andere, niet valoriseerbaar	0,3161	0,3106

Table 5: Waste removal fee for the various packaging materials in Belgium in 2018.<sup>47</sup>

Materialen	Tarief in EUR/kg excl. BTW
Glas	0,0273
Papier - karton (> 85%)	0,0253
Staal (> 50%)	0,1514
Aluminium (> 50% en > 50µ)	0,0447
Flessen en flacons in PET (en doppen in PET) *	0,3275
Flessen en flacons in HDPE (en doppen in HDPE)	0,3275
Drankkartons	0,3164

<sup>46</sup> <https://www.fostplus.be/nl/bedrijven/lid-worden-van-fost-plus/wat-kost-het> , visited 8 February 2018.

<sup>47</sup> [https://www.fostplus.be/sites/default/files/Files/Bedrijven/GPtarieven/groenepunttarieven\\_nl\\_2018\\_final.pdf](https://www.fostplus.be/sites/default/files/Files/Bedrijven/GPtarieven/groenepunttarieven_nl_2018_final.pdf) , visited 8 February 2018.

Andere valoriseerbaar		
011	Plastic	0,3766
012	Samengestelde verpakkingen, voor het merendeel bestaande uit papier-karton	0,3766
013	Samengestelde verpakkingen • Aluminium < 50µ • Staal < 50% maar grootste gewicht, < 50µ	0,3766
014	Samengestelde verpakkingen, voor het merendeel bestaande uit plastic	0,3766
016	Andere materialen (hout, textiel, enz.)	0,3766

Table 6: Waste removal fee for the various industrial packaging materials in Belgium<sup>48</sup>

### Financieringsbijdrage

Tarieven (excl. BTW) per ton aangegeven bedrijfsmatige verpakkingen	2018
<b>Enmalige verpakkingen</b>	<b>€ per ton</b>
Papier/karton, metaal, glas, natuurvezels, hout en andere recycleerbare materialen	14,50
Recycleerbare kunststof	39,50
Recycleerbare kunststof voor bouwsector <sup>(1)</sup>	49,50
Niet-recycleerbare materialen (niet-recycleerbare kunststof inbegrepen)	53,00
<b>Herbruikbare verpakkingen</b>	0

Key problem: In Belgium, the fee for bio-based materials is the same as for fossil based materials, or even higher.

Stakeholders: Government, Interregional Packaging Commission (IVC)

### 2.6.5 Other countries

Austria charges a lower fee for domestic 'bio-plastic' / biodegradable plastic packaging compared to fossil plastics, 0.45 vs. 0.61 €/kg, respectively (Watkins et al, 2017)<sup>49</sup>. For commercial and industrial plastic packaging waste, however, the fee for bio-plastic/biodegradable plastic is higher (0.1 vs 0.0 €/kg). Exactly the opposite is the case for expanded polystyrene (EPS) for which the waste fee for domestic products is lower than for bio-plastic (0.19 vs 0.45 €/kg), and for commercial and industrial products it is higher than for bio-plastic (0.19 vs 0.1 €/kg).

In Latvia, the fee for 'bio-plastic' packaging is lower than for other plastics not being PET or HDPE: 0.033 €/kg vs. 0.149 and 0.00 €/kg, respectively (Watkins et al, 2017).

## 2.7 Summary and conclusions

The end-of-life options are important for market success or failure for a number of bio-based applications, in particular for packaging applications, because of their relatively short service life. A large number of the hurdles mentioned by the stakeholders are related to end-of-life issues.

A first hurdle is that there is no general agreement as to which end-of-life option (recycling, digestion, composting, incineration) for a given bio-based product is the most preferable. Also, sometimes conflicting interests exist between bioplastics/bioproduct producers and waste processing companies/recyclers. F.i.,

<sup>48</sup> <http://valipac.be/pdf/2018/2018%20-%20Barema%20financieringsbijdragen.pdf> , visited 8 February 2018.

<sup>49</sup> <https://ieep.eu/uploads/articles/attachments/95369718-a733-473b-aa6b-153c1341f581/EPR%20and%20plastics%20report%20IEEP%209%20Nov%202017%20final.pdf?v=63677462324> , visited 6 March 2018.

producers of biodegradable plastics would like all of their products to be accepted in the green bin, while waste processors mainly see the risk of: 1) non-biodegradable plastic entering the composting line, 2) decreased quality of recyclates or 3) decreased throughput of the separation lines. No consolidated public research has been performed, however, on recycling of bio-based plastics and composting of biodegradable plastics with both the bio-based plastics suppliers and the waste processors involved in the project. A similar thing happens for paper-like products: producers mainly see the valuable paper fibres in their products and wish these to be accepted in the paper recycle stream, while paper recyclers mainly see the non-fibre constituents of the product which cause them costs and the risk of non-paper products entering their feedstock.

Further, different local governments have different rules as to what is accepted in which bin. F.i. in the Netherlands, 3 different example municipalities advise 3 different disposal routes for (compostable) plastic packaging products: In the green bin (Utrecht); in the plastics bin (Wageningen); in the grey bin, unless carrying organic waste (Arnhem). Also the ambitions of the national government may differ from the rules of local governments. In Germany, the Ministry of Environment states that biodegradable packaging should not go into the biowaste bin, except for compostable bags for collecting biowaste. This is taken over by some municipalities. From the municipalities checked, however, the majority does not accept compostable bags to collect organic waste.

Next, a clear labelling as to how to dispose of a bio-based product (or other products) is lacking. Often, existing labels are not clearly visible, or not used at all. But also different labels for the same message are used (e.g. compostability) and - just the other way around -, very similar labels having different meaning (e.g. labels for the bio-based content of a product and labels for compostable products). The excess of labels dilutes the recognisability and the effect. Not all logos indicate compliance to any testing scheme, e.g. related to compostability, thus undermining the effect of registered labels. Finally, labels are used for green washing (e.g. oxo-degradables).

The removal fee system for various bio-based plastics is basically not effective, and different in different EU countries. In the Netherlands, the fee for biodegradable plastics is lower than the fee for plastics, however, the financial advantage for biodegradable plastics is in cases too small to overcome the price difference. Additional problem here is that biodegradable materials often have a higher density than the fossil plastics they replace; the same package will therefore be heavier and thus the fee will be relatively higher, as it is calculated per kilogram. Moreover, in large companies the fee is paid by another department than the one responsible for purchasing packaging materials, so they do not realize they can save money.

In Latvia, the fee for 'bio-plastic' packaging is lower than for other plastics, but higher than for PET or HDPE (0.033, 0.149 and 0.00 €/kg, respectively. Austria charges a lower fees for domestic 'bio-plastic' packaging compared to fossil plastics (0.45 vs. 0.61 €/kg), however, for commercial and industrial plastic packaging waste the fee for 'bio-plastic' is higher (0.1 vs 0.0 €/kg). Exactly the opposite is the case for expanded polystyrene (EPS) for which the waste fee for domestic products is lower than for bio-plastic (0.19 vs 0.45 €/kg), and for commercial and industrial products it is higher than for bio-plastic (0.19 vs 0.1 €/kg). In Belgium, the fee for bio-based materials is the same as for fossil based materials, or even higher. And in Italy the waste removal fee does not make a difference for bio-based and fossil based plastics. Actually, bio-based plastic packaging is in the category of the highest fee, similar to non-recyclable plastics. Italy does support the biodegradable plastic bags, not necessarily bio-based, however, lack of control by government for compostable plastic bags for organic waste collection causes a 50% 'fake' compostable bags on the market.

### **3 Identified hurdle: certification/standards**

#### **3.1 Introduction**

Standards and certification serve useful purposes for bio-based products. They lend credibility to originators, manufacturers, traders and retailers of bio-based products. The standards and certificates establish benchmarks of performance to which manufacturers must adhere, and they provide valuable objective verification to intermediates and final consumers that performance claims are true. There is a distinctive difference between standards and certification. Standards have been developed to represent requirements for components, materials and/or product performance. Compliance to standards is not monitored unless the product is certified. Certification provides for conformity assessment and is the only way to be sure that standards have been met.

Even though standards and certifications add to the credibility of bio-based products there are also several hurdles identified that halt the development of the bio-based products market. The hurdles identified through the interviews relate to:

- The quantity of certificates in the market
- The challenges of standardization in general
- The fact that bio-based products have to comply with traditional standards
- The fact that some standards are in need of an update or are missing altogether

### 3.2 Quantity of certification schemes in the current market

Certification schemes for bio-based products have been developed to help consumers, manufacturers, distributors, traders to choose the right products for their purpose and to provide for a conformance testing. Over the last years many certificates have been developed for this reason by NGOs, authorities or certification bodies. Among others, certificates to demonstrate the sustainability of biomass, certificates to prove the bio-based content of a product, certificates for the end-of-life have been developed over the last years. As a result many different certification schemes are available in the market and sometimes they overlap. Several of these certification schemes are only requested in particular regions. DIN Certo is f.e. asked by customers in Germany. Where Vinçotte is demanded in other regions from Europe. Performing business in these regions means that the products need to be certified by these specific schemes. When a company is active in different regions this results in the need of multiple certificates that could be more or less similar.

Multiple standards related to one type of application can cause for a related challenge for producers where they need to take into account these standards when developing bio-based products. There is the example of insulation materials. A harmonized European Standard has been defined (EN 13171) for factory made wood fibre insulation materials. No such harmonized EN has been established for insulation products based on vegetable (flax, hemp, etc.) and animal fibres (sheep wool). The members of the European Organisation for Technical Approvals (EOTA) have thereafter jointly developed a European Assessment Document (EAD) with title 'Factory-made thermal and/or acoustic insulation products made of vegetable or animal fibres' (EAD nr 040005-00-1201) to regulate standardisation of product testing and classification ([www.eota.eu](http://www.eota.eu)).

Another issue around multiple standards/certificates arises when a product developer develops multiple products that have slightly different applications but are made from the same materials. For each application/product line a similar material test needs to be performed. F.i. for only slightly different packaging products slightly different drop impact resistance needs to be certified to satisfy customers (Paperfoam, 2017). This is a time consuming and expensive process.

To receive all the requested and required certificates takes time, paper work and funds. These extra costs that come with the requested certificates are usually not paid by the final consumer as in practice the consumer is unwilling to pay extra costs for certified goods. The request for certified products can even lead to sub-optimal situations. There are 2 main regulations for sustainable forestry. Some countries use one system, others use the other system. This means that companies supplying or exporting forestry products to 2 countries with different certification system need to certify their products according to both systems. In Norway there are for example the following certification schemes FSC and PEFC. All forest in Norway is certified with PEFC, and not FSC. Other parts of Europe also use FSC as the main certification scheme. Thus Norwegian companies like Kebony who are exporting their wood products (sophisticated environmentally friendly impregnated wood), do have their wood production in Norway, but cannot use Norwegian wood, since some customers are requesting FSC certified wood and do not accept PEFC certified wood.

According to an interviewee there are however cases where an increased demand for certified goods will increase efficient production and thereby reduce costs. Segregated production is costly, because the equipment needs to be cleaned beforehand. When increasing demand for certified material would allow a dedicated production line which can run on its own, there would then be no need for cleaning of the production line, thus reducing costs.

Key problems:

- Different organisations have issued certificates during the past years: NGO's authorities and certification bodies. As a result, certificates are overlapping. That certificates overlap does however not always mean that the different certification schemes accept other certificates within the value chain. For example Better Biomass (NTA 8080) does not accept other certificates within the value chain. If an end-user wants to become certified with the Better Biomass certificate the entire chain needs to become certified with Better Biomass.
- Some regions demand particular certification. When a company is active in different regions this results to the need of multiple certificates that are more or less similar.
- Different standards apply for basically very similar products with exactly the same application purpose.
- The demand for a specific certificate might cause disturbances in the market as this could result in increased transportation even though there is enough certified materials locally.

Stakeholders: raw-materials originators, bio-based materials companies, traders, consumers

### 3.3 Complexity of (drafting) standards

Standardization is the process of developing a norm-setting document based on the consensus of all parties concerned. Experts from different stakeholder groups take part in this process. The process of drafting the standard and reaching consensus can take time. It is perceived by some of the interviewed parties that it is difficult to take part in standardization committees due to the required expertise, the amount of money and time invested in taking part in the discussions.

Overall, standardization is perceived as a long theoretical road with in the end presenting standards that are difficult to use in practise. The created standards are perceived as difficult to read as drafted in a complicated way. This is confirmed by stakeholders in the bio-based industry for the existing bio-based standards created by the CEN/TC 411.

Examples of a complex standards are EN 13171 and EAD 040005-00-12.01 which specify a wide range of testing methods for wood fibre and annual biofibre based insulation materials. In particular the procedure to determine the so called declared thermal conductivity,  $\lambda_D$ , of materials. These standards address the effect of moisture content on  $\lambda_D$  in an indirect way. The  $\lambda_D$  of an insulation material (the lower the better) is derived from  $\lambda$  at 10°C and 'dry' conditions,  $\lambda_{10,dry}$ . Subsequently, this  $\lambda_{10,dry}$  value is multiplied by conversion factors based on  $\lambda$  of insulation material determined at 10°C, however, having moisture contents which are at equilibrium with 50% RH at 23°C. The conversion factors are calculated using equations comprising alternately logarithms and exponents. Though in a rather non-transparent way, these methods account for the effect of moisture on thermal conductivity. The effect of temperature, however, is not included in EAD 040005-00-12.01 and EN 13171. And it may be assumed that the thermal conductivity of an insulation material is most relevant at low temperature (freezing conditions) and at high temperature (summer).<sup>50</sup>

Key problems:

- Taking part in a committee developing standards requires expertise and investment of time/money which is difficult to afford for SMEs.
- Some standards are drafted in a complicated way and difficult to use in practice.

Stakeholders: bio-based materials companies, consumers, standardization experts

### 3.4 Traditional standards for modern products

There are globally over 25.000 standards developed since 1800. Most of these standards have been developed based upon the characteristics of traditional products. With regards to these traditional, fossil based variants, bio-based products are relatively new to the market. The characteristics of both these

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<sup>50</sup> OpenBio Deliverable 4.5 (Restricted report, p.103-104)

products are usually different, resulting in a challenge for companies developing bio-based products to comply with these standards to receive a specific certificate. Certification agencies and test houses do not have the long term experience with bio-based products as they have with fossil based products. Some bio-based materials do not have the performance track record that fossil based materials have.

As a result, bio-based materials are evaluated differently by the certifying bodies and producers are in some cases unable to get certification for their products. An example is the bio-based insulation material that could not get certified as it is a relatively new material not mentioned in the standard and without a long track record meant that the certifying body evaluated it differently compared to traditional materials. In the end the material was proven to be equivalent to other materials as insulation material and is now included in the NEN standard. This took however a long time and much effort.

A related hurdle is the recyclability of any product. Most of the current standards have not included or have deliberately excluded the acceptance of recycled materials and products. Values are derived from the business-as-usual materials and not necessarily from the requirements of the application in these standards (Dammer et al, 2015)<sup>51</sup>. The same challenge is faced by bio-based products where the materials are tested and not necessarily the applications and performance. Standards should in general be checked on performance based requirements first and next on whether these requirements are actually based on actual needs or historical experience with traditional products (and thus hinder bio-based alternatives).

Biodegradability is identified as another aspect in standards that is perceived as a challenge for bio-based products. As mentioned before wood and lignin are not biodegradable according to standards like EN 13432 since they are only degraded down to smaller natural organic molecules, not all the way to CO<sub>2</sub> and water. Products that contain lignin are therefore not biodegradable by these standards. This is however in contrast to the practical situation as these products are definitely biodegradable in the sense that they are degraded to humic acid, which is the natural and needed organic matter in soil.

Bio-based product producers have to regularly perform tests to show the durability of their products. These so-called climate tests are usually based on standards developed for fossil fuel products. These standards are:

- ASTM D4332- Standard Practice for Conditioning Containers, Packages, or Packaging Components for Testing
- ASTM E171- Standard Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials
- ASTM F2825- Standard Practice for Climate Stressing of Packaging Systems for Single Parcel Delivery

It is sometimes difficult to comply to these standards for new bio-based materials. Amendment of the tests towards testing the application of the products instead of the material could help bio-based producers severely.

Also, sometime a list of allowed materials in a particular product blocks the use of new (bio-based) ingredients. E.g. the OPWA specifies which materials may be used in (Dutch) road asphalt (OPWA, 2018). Lignin is currently being successfully tested in road asphalt in the Netherlands, however, as long as it is not on the OPWA list, it cannot be used beyond pilot scale.

Key problems:

- Some standards are based on the performance of traditional (fossil based) products, and not on the application requirements.
- Some standards exclude the use of recycled materials.
- Standards are based on wrong assumptions (all organic materials ultimately break down to CO<sub>2</sub> and H<sub>2</sub>O).
- Lists of allowed materials in a particular product block the use of new (bio-based) ingredients.

Stakeholders: bio-based materials companies, certification bodies, standardization bodies

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<sup>51</sup> <http://www.biobasedeconomy.eu/app/uploads/sites/2/2017/03/Market-entry-barriers.pdf> , visited 8 March 2018.

### 3.5 Standards that are in need of an update or missing altogether

As mentioned before there are situations where standards are used for products or processes for which they have not primarily been developed. A related challenge for participants of the bio-based economy are standards that are not in line with the reality in everyday practice/industry. There is an example given of the EN 13432 standard - define the technical specification for the compostability of bioplastics products. The composting cycle described in the standard is not equivalent to the way the composters run their processes. Conforming to this standard is therefore not always practical.

There are some identified gaps and needs in the market where standards are missing in the bio-based industry. According to an interviewee there is a lack of standardization of recycling methods and symbols (Composting in EU/Paper Recycling in US). Also see section 2.5. Details of lack of standardisation will be addressed in a deliverable report D4.3 to be published at a later stage.

Key problems:

- Standards are not in line with the reality in everyday practice/industry. E.g. the composting cycle described in the EN 13432 standard is not equivalent to the variety of composting processes run by composters.
- Standardization gaps in regards to recycling methods

Stakeholders: bio-based materials companies, consumers, standardization bodies

### 3.6 Summary and conclusions

The bio-based economy faces several hurdles related to certification and standardisation.

It is clear that there is a need for certification in the bio-based market to inform on characteristics of the products and materials. However, over the last years certification schemes have been developed that are similar or overlapping. The quantity of certification schemes is perceived as a hurdle to develop the bio-based industry further. Companies are required to have several certificates in most value chains as this is required by their customers. This is especially the case when working in different geographical areas. Holding multiple certificates implies more time, costs and multiple tests.

Additional identified hurdles related to standards are the challenges standardization offers in general; time consuming, costly and the requested level of expertise. Some standards that are developed for traditional products are not applicable for bio-based products. The standards are however requested by customers to be used or are used through a required certification scheme. Another related identified hurdle within standardization are incorrect statements in standards or missing standards in general.

## 4 Identified hurdle: Biofuel policy

### 4.1 Introduction and brief summary of interview results

The legislation and policy on bioenergy and biofuels is determined at both EU and Member State level, with the instruments being closely interlinked. The Renewable Energy Directive (RED) of 2009 and the new proposal of the European Commission for the Renewable Energy Directive (RED II) that should come into force for the timeframe of 2021 to 2030 include provisions that have detrimental effects on several branches of bio-based industries in the EU.

On the one hand the bio-based industry is left deprived of raw materials as the RED creates high incentives for the use of raw materials in bioenergy and biofuels. On the other hand, the use of renewable raw materials in bio-based products creates a negative image for companies due to the continued controversy around the use of food crops for any other uses than food and feed by NGOs, consumers and policy makers. This debate has been caused by the strong incentives for biofuels and their perceived negative impacts on food security and biodiversity, but the bio-based material industry gets hit by it as well – even though the scales are much smaller and there are no public subsidies or mandatory use.

As both biomaterial sector and the biofuels rely on the same raw materials, appropriate political will and policies are required to create fair conditions for both sectors – a situation which is often called the “level playing field”. Also missing is relevant certification and good communication mechanisms (see chapter 6) to communicate the necessary information to the customers in order to overcome a potentially negative image created by the usage of certain renewable raw materials in the industries.

#### 4.2 The RED and the biofuel policy: Pressure on feedstock availability

The RED of 2009 set up a mandatory target of a 20% share of renewable energies in the EU energy mix by 2020, and by the same date each Member State must ensure that 10% of total terrestrial transport such as road transport and train fuel comes from “renewable energy”, defined to include biofuels and biogas, as well as hydrogen and electricity. The overall 20% renewable energy target to be achieved by 2020 has required a rapid deployment of solid biomass applications for heat and electricity, increasing biomass demand from the energy sector.

On 30 November 2016, the European Commission published a proposal for the recast of the Renewable Energy Directive (RED), providing a potential outline of the Union’s renewable energy framework for the timeframe 2021 to 2030. This proposal is also known as the “RED II proposal”. The new proposal sets the overall target of a renewables share in the EU’s energy consumption at 27% by 2030 and includes the sectors electricity, heating and cooling as well as transport. So this will increase pressure on biomass availability for bio-based products. Most importantly for the bio economy the provision of a cap of fuels produced from food or feed crops is set to max. 3.8%; and the minimum share of advanced biofuels, using non-food biomass feedstocks, is set to 3.6 % to be achieved by 2030 (EC, 2016)<sup>52</sup>.

Key problems:

- An increasing amount of biomass is needed to meet bioenergy and biofuel targets, putting pressure on biomass availability for bio-based products.
- Incentives by the RED in fact subsidise the use of biomass feedstock in bioenergy and biofuels (in the form of fines) at the expense of use in bio-based materials and products.

Stakeholders: EU commission, national governments

#### 4.3 Distorted competition for feedstock, fuel vs. materials

As reported by several interviewees, the allocation of biomass is distorted due to the massive support policy for bioenergy and biofuels. The non-level playing field between energy and material use of biomass creates negative impacts on the industry of the latter. High biomass prices and uncertain biomass supplies deter investors from putting money into bio-based chemistry and materials and distort market conditions for existing processes – even though these create higher value at greater resource efficiency. It should be made clear that not all branches confirm that supply is insecure; it strongly depends on the type of biomass needed for one product. Sugar and starch for example do not seem to be scarce in Europe, even though it may still be true that supply is more economical and less prone to fluctuations elsewhere. However, several ‘more special’ feedstocks are impacted much more strongly by competition by the RED; which is mentioned below.

The double counting mechanism<sup>53</sup> for fuels from certain feedstocks (Annex IX of the RED) exacerbates hurdles for some bio-based industries who rely on the same feedstock. In the context of the RED, a feedstock used to produce a biofuel for transportation can either be classified as a product, a co-product, a residue or a waste. For a feedstock classified as a residue or a waste, it is easier for the fuel producer to fulfil the sustainability criteria of the RED. There is a list of valuable co-products of various production lines that are used as high value materials for the chemical industry which are included in the list of feedstocks in Annex IX, which leads to the increased allocation of these raw materials to biofuel production. Examples of such co-products which were mentioned in the interviews are crude tall oil (CTO) and tallow.

<sup>52</sup> [https://ec.europa.eu/energy/sites/ener/files/documents/1\\_en\\_act\\_part1\\_v7\\_1.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf) , visited 8 March 2018.

<sup>53</sup> “Double counting” means that a fuel can be accounted for with double its energy content in the quota, which makes it easier to fulfil the quota, since only half the amount of a given fuel is needed in total.

- CTO is a co-product produced during the wood pulping process necessary for paper manufacturing. It is a versatile chemical and renewable raw material used by Arizona Chemical for over 80 years for a big variety of high value-added products.
- Tallow is an animal fat produced during the rendering process of animal carcasses after meat collection. Animal fats are the main feedstock for the European oleochemistry. From tallow, fatty acids and glycerol are produced, which are then used as raw materials by other chemical industries.

During our interview, Kraton Arizona noted that the RED classification of CTO as a residue instead of a co-product gives higher motives for CTO being used in biofuels. As mentioned above in RED II proposal the share of the advanced biofuels is set to 3.6 % to be achieved by 2030. In other words, the RED II creates a market distortion for other sectors of the economy that use tall oil as a raw material.

Tallow, similar to CTO, is classified by the RED as a residue instead of a co-product. Similar to the case of CTO, the double counting mechanism leads to distorted competition that originates in one-sided incentives (quotas, CO<sub>2</sub> certificates, subsidies etc.) for animal fats that go to the biodiesel industry. In our interview with Peter Greven, they raised the issue of unfair competition for tallow feedstock within EU, based on the current and planned RED classification system. Additionally, Borregaard has affirmed that biofuels and bioenergy are subsidized and that the created feedstock competition and shortages for bio-based economy is not natural.

Key problems:

- Increasing demand for biomass as feedstock for bioenergy/biofuels and related fines leads to increased prices, also when the feedstock is sourced for bio-based products.
- Increasing feedstock prices deter investors to put money in bio-based chemistry and materials.
- Biofuels produced from a number of feedstocks listed by the RED may be double counted, while the same feedstocks are being used for bio-based chemistry/materials for some time already. This creates a market distortion for these 'traditional' sectors.

Stakeholders: EU government, national governments, bioenergy and bio-based production companies

#### 4.4 Negative image due to industrial use of food crops

As mentioned above, another problem faced by many companies relying on bio-based feedstocks is a negative image created by the fact that they use "food crops" for industrial purposes. There is a recent debate about whether food crops should be used for other applications than food and feed, namely for energy or materials. The public debate mostly focuses on the obvious direct competition for food crops between different uses: food, feed, industrial materials and energy.

During our interviews the companies raised number of hurdles they face that are consequences of biofuel policy, more specific misinterpreted information, which leads to a false image about bio-based products in the public (also see chapter 6). For example, Borregaard has mentioned that bio-based products have to prove that they are environmental friendly whereas fossil based do not. Baseline products do not need a LCA while bio-based products do. These are extra efforts and costs that competing products do not have, leading to additional barriers of these products in the market.

Peter Greven also noted that for their products companies are asking many sustainability questions via questionnaires about the products (labour conditions, children work, plantation etc.), especially for palm oil, whereas for other markets there is no such need. They said they get more questions about palm-oil based products than companies producing petrochemical based products do. Long questionnaires pose an administrative and bureaucratic burden. Companies seem to protect themselves from criticism (by NGOs) by trying to ensure that their suppliers take care about all the topics mentioned Peter Greven.

Additionally, Reverdia has indicated in our interview that the communication is difficult and that the discussions tends to get emotional and not based on facts and numbers. Reverdia does not see a role for the government to tackle this, but sees this more as a task for brand-owners. However, they think that an important task for the governments would be to provide clear policy and rules, stable over the years, in order to set a clear playing field for businesses.

Key problems:

- As a result of the biofuel policy and the resulting food-for-fuel discussion, bio-based products have to prove they are environmentally friendly, whereas fossil based do not. This leads to extra costs.
- The same holds for labour conditions, children work, etc.
- Companies seem to feel the need to protect themselves by forcing their suppliers (of bio-based feedstock) to ensure that literally all aspects of their products is sound.
- A clear policy and rules, stable over the years, are missing.

Stakeholders: EU commission, national governments, bio-based materials companies, consumers

## 4.5 Summary and conclusions

The bio-based economy faces a number of hurdles due to the current/proposed legislative system as well as misinterpretation of information as a result of biofuel policy on the usage of available biomass.

Presently, there is no supportive legislative mechanism to support and regulate the uses of the available biomass for producing materials. The RED of 2009 and the RED II proposal are establishing conditions for biomass uses with giving higher incentives of biomass use in biofuel and bioenergy sectors. As the bio-materials and bioenergy sectors compete for the same resources the competition remains unfair for the bio-based economies: supportive legislation increases biomass prices and deters investors from putting money in bio-based chemistry and materials. Also, some markets distortion occurs for a number of bio-based feedstocks which may be double counted due to listing by the RED, thus increasing their price, while the same feedstocks are being used for bio-based chemistry/materials for some time already.

Another result of biofuel policy is that the use of biomass in the bio economies other than food has received a negative image by the public. Companies have to make extra efforts to prove the sustainability of their products while in competing economies they are often aren't even asked about these issues.

## 5 Identified hurdle: Long term policy

### 5.1 Introduction

Consistent long term policy is relevant for (m)any kind of transitions. However, considering bio-based products, there are no general long term policy goals in place. This is further reflected in the fact that there are also few policy instruments dedicated to the support of bio-based products. Several interviewees have mentioned various missing elements of long term policy and policy instruments, which we will combine under 5 subsections:

- Level playing field not in place
  - o Environmental advantages of the bio-based material are not monetarized, thus no level playing field with fossil materials
  - o Sustainable energy is supported with (tax) incentives from governments, bio-based materials are not supported
  - o Bio-based products are not even supported through communication by many governments
  - o Bio-based products should be supported the same as biofuels
- Avoided CO<sub>2</sub> emission does not bring financial benefit
  - o Missing CO<sub>2</sub> tax
  - o Far away from the principle "the polluter pays"
  - o Carbon tax could be (part of) the solution
  - o Externalities of fossil based plastics are presently not included in the plastics price. Carbon pricing would increase the speed of the uptake of green products
- Clear policy and instruments to promote bio-based products is missing
  - o Packaging tax/fee misses effect due to the way it is organized
  - o Public procurement could help the market development of bio-based products
  - o Sustainable procurement often fails because the bio-based product is more expensive (price overrules sustainability advantages)
  - o Government could much more actively support

- In case there is only one supplier, public buyers are not allowed to buy because more than one offer is needed
- Clear sustainability criteria are missing, conflicting information. Comparison with other products (e.g. paper) is needed
- Absence of incentives to support integration between agriculture and industry
  - Sometimes setting land aside brings the farmer more income than cultivating a crop

## 5.2 Level playing field not in place

As stated there is no overall clear policy for the promotion of bio-based products in place. A number of the bio-based products are newly developed, which implies that their price is still relatively high. Therefore they have difficulty competing with for instance fossil alternatives. A number of bio-based products that have been in the market for much longer times (fi Peter Greven's portfolio) are based on much more mature technology and are able to compete, for instance on the basis of additional functionality. The non-level playing field has two dimensions:

- bio-based products vs products from fossil feedstock like conventional plastics
- bio-based products versus biofuels

Figure 13 illustrates the non-level playing field of the two dimensions mentioned above:

- Bioenergy and biofuels are competitive vs fossil energy and fuels only because of the subsidies created for bioenergy and the incentives for biofuels (defined by RED), thus creating artificial competitiveness between fossil based and bio-based fuels. As bio-based materials are not promoted and do not receive subsidies, these have low competitiveness to fossil-based products.
- On the other hand, subsidies and incentives created for biofuels make it easier for biofuel industry to access biomass. As a consequence, pressure on biomass availability for the bio-based product producers increases, thus decreasing competitiveness to fossil-based products.
- Additionally, limited local biomass availability may lead to importing of biomass by the industries using it for material production. The import taxes generate additional costs, which in turn leads to decline of the competitiveness of bio-based materials.

Thus, bio-based products appear in two-sided disadvantaged situation from both biofuels and petrochemical industry.

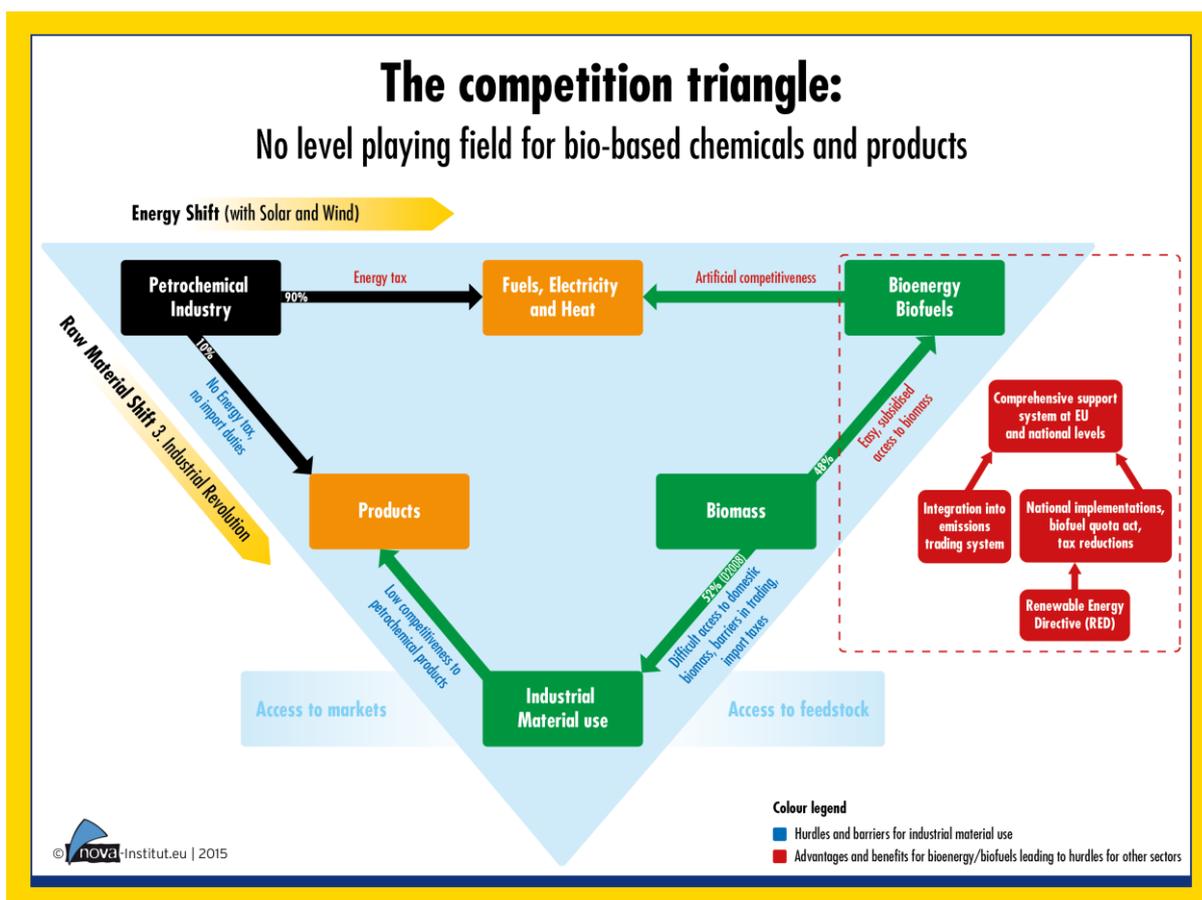


Figure 13: Overview of issues related to non-level playing field for biomass for bio-based chemicals/materials (Carus et al, 2014).<sup>54</sup>

Bio-based products can help in the mitigation of climate change and a number of other environmental problems. However, externalities like damage to the environment by for instance fossil products are paid by the society as a whole and not by the producer or buyer of the product. This implies that the environmental advantages of bio-based products do not bring financial advantages to producers or buyers of bio-based products.

On the other hand biofuels are promoted through policy and instruments such as mandatory blending. This leads in some cases to competition for feedstock (see chapter 4), and to higher prices for bio-based products, even though the production of bio-based products generally leads to more avoided GHG, more added value and more employment. An overview of the several non-level playing field for bio-based chemicals and materials is presented in Figure 13.

Added to this for instance in the Netherlands, the government is internally divided in their position towards bio-based-products: The Ministry of Economic Affairs values the positive environmental aspects of bio-based products (CO<sub>2</sub> mitigation, avoidance of non-renewable resources) and their potential value to economic activities, whereas the Ministry of Infrastructure and Environment stresses mainly the negative aspects related to agriculture and land use change. The consequence is that there is also very little support in communication from the government, and minor interest to install policy to favour bio-based-products over conventional products.

Key problems:

- Non-level playing field bio-based versus fossil: Externalities like damage to the environment by e.g. fossil products are paid by the society as a whole and not by the producer or buyer of the product.

<sup>54</sup> <http://era-ib.net/sites/default/files/14-09-09-nova-paper-4-remd.pdf>, visited 6 March 2018.

- Non-level playing field bio-based products versus biofuels: Biofuels are promoted through policy and instruments such as mandatory blending, sometimes leading to higher prices for bio-based products, even though the production of bio-based products generally leads to more avoided GHG and higher employment.
- Government (e.g. Netherlands) is internally divided regarding positive environmental aspects of bio-based products (CO<sub>2</sub> mitigation, avoidance of non-renewable resources) and negative aspects related to agriculture and land use change. Consequence: Little support in communication from the government.

Stakeholders: EU government, national governments

### 5.3 Avoided CO<sub>2</sub> emissions do not bring any financial benefit

For material industries, avoided CO<sub>2</sub> emissions do not result in financial benefits. While in the energy sector, the emissions “cap & trade” system as well as efficiency initiatives provide competitive advantages for companies reducing their CO<sub>2</sub> footprint, this is not the case for material industries. So far, there is no mechanism to offset material use of fossil carbon which eventually leads to CO<sub>2</sub> emissions at the end of a lifetime of a given product.

A general carbon tax has been discussed for decades, since it would offer the simplest and most elegant solution and would adhere to the “polluter pays” principle. Of course, internalising the externalities of fossil based plastics (ecosystem, environmental and health impacts resulting from emissions during petroleum extraction, pollution during production processes, oil spills etc.) would constitute strong incentives and increase the speed of the uptake of green product.

The reason that such a carbon tax is not yet in place is that it needs to be implemented worldwide.<sup>55</sup> If, for example, only the EU were to introduce such a tax, this would result in a huge loss of industrial activities which would be relocated to production sites with a less heavy tax burden. Existing carbon taxes only refer to the carbon content of fuels – targeting the energy sector, as mentioned. It should be noted that as a learning from the European Emissions Trading System (EU ETS), any future carbon tax would also need to be set significantly higher than the current (2015) price<sup>56</sup> of about 7 €/ton of CO<sub>2</sub> to be effective – which makes it even less probable to be implemented at current conditions.

Key problems:

- While in the energy sector companies benefit from reducing their CO<sub>2</sub> footprint, this is not the case for material industry.
- A carbon tax seems a simple solution to account for CO<sub>2</sub> footprint, however, its needs to be implemented worldwide in order to be effective.
- The price for CO<sub>2</sub> emissions needs to be significantly higher than the current (2015) 7 €/ton in order to be effective.

Stakeholders: EU government, national governments

### 5.4 There are no clear policy and policy-instruments to promote bio-based products in place

As acknowledged in the European Bioeconomy Strategy, the promotion of a bioeconomy is dependent on policy efforts across a wide spectrum of policy spheres (EC, 2012). At the same time, multiple and diverse policy instruments from different policy domains have the potential to promote bio-based products. Important instruments in this regards include: i) the use of extended producer responsibility (EPR) schemes for packaging waste, with reduced fees for bio-based materials; ii) the use of public procurement for

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<sup>55</sup> <https://www.carbontax.org/where-carbon-is-taxed/>, visited 6 March 2018.

<sup>56</sup> <http://documents.worldbank.org/curated/en/636161467995665933/pdf/99533-REVISED-PUB-P153405-Box393205B.pdf> (page 21), visited 6 March 2018.

stimulating markets for bio-based products, iii) the use of labels. Some of these policy instruments, have been already used in the EU with the aim of promoting the establishment of a bio-based economy. However, many challenges still remain, that are explained in the following lines.

#### 5.4.1 Extended producer responsibility (EPR)

The extended producer responsibility (EPR) is an environmental policy approach whereby producers take over the financial and/or organizational responsibility for collecting or taking back used goods, as well as sorting and treatment for their recycling (Watkins et al. (IEEP), 2017). Some existing packaging EPR schemes in Europe do apply lower fees for bioplastics: e.g. Austria and Latvia and soon Germany (Watkins et al, 2017), or for biodegradability or compostability (e.g. Netherlands) (also see section 2.6). Therefore, modulation of fees for bio-based plastics could be considered as an important policy instrument for encouraging a transition away from a fossil-based society. However, the current implementation and organization of EPR at a national level prevents from achieving expected desirable results. As indicated in the IEEP report, the implementation of an ERP involves several challenges, in particular for compostable products, linked to: lack of clarity on material properties, intended after-use pathways, and to the potential cross-contamination with recycling streams (Watkins et al., 2017).

#### 5.4.2 Public Procurement

Public procurement has been indicated by the experts as an important market development instrument for bio-based products. However, it was highlighted that public procurement often fails because sustainability criteria are not taken into account (price overrules sustainability advantages). For a short period of time, 'sustainable' may be attractive even for a higher price, however, soon enough price becomes leading again when there are no 'hard' sustainability criteria. In addition, different potential general sustainability benefits of bio-based products (such as reduced dependency on crude oil, driver of innovation) are characteristics that can often not be addressed in tender's specifications. The EU InnProBlo project defined these characteristics as "secondary incentives". Also, not all bio-based products have an LCA which is relevant for governments to verify sustainability claims. Another issue is that usually organisations sign multi years procurement contracts because of cost aspects, which limits possibilities to anticipate new developments. However, whereas companies simply pay a fine when new opportunities arise, governments tend to stick to their contracts in order to avoid potential issues with other parties who subscribed to the tender and who may claim that the tender was not set up well.

As a reference, the BioPreferred program of the USDA aims to increase the purchase and use of bio-based products.<sup>57</sup> The reason that such a program has not been introduced in Europe so far is that sustainability effects of the biofuels policy (chapter 4) are not unambiguously positive and have made policy makers hesitant.

Another limitation may be linked to the fact that for really innovative products, a conventional counterpart is not available. In this case, it is not possible to conduct a comparison of offers of different products before acquiring the product, which is required by European tender rules. For example, bio-based molecules or chemicals without a "significant fossil based counterpart".<sup>58</sup>

Additionally, in some cases, although bio-based products are more expensive, their specific capabilities may result in more favourable life-cycle costs, especially those related to the end of life costs (e.g. biodegradability capability of some bio-based products). Therefore, tender specification should focus on the entire life cycle considering all life cycle costs.

Key problems:

- The current implementation and organization of the Extended producer responsibility faces challenges linked to: lack of clarity on material properties, intended after-use pathways, and to the potential cross-contamination with recycling streams.

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<sup>57</sup> <https://www.biopreferred.gov/BioPreferred/> , visited 19 March 2018.

<sup>58</sup> <http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/bbi.2017.r7.html> , visited 11 April 2018.

- Public procurement often fails because sustainability criteria are not taken into account. At the same time, sustainability effects of the biofuels policy (chapter 4) are not unambiguously positive and have made policy makers hesitant.
- General sustainability benefits of bio-based products (such as reduced dependency on crude oil, driver of innovation, reduced GHG and life cycle costs) are often not addressed in tender's specifications.
- Not all bio-based products have a LCA which is necessary for governments to verify the sustainability of a product.
- The multi years procurement contracts limit governments' possibilities to anticipate new developments because governments tend to stick to their contracts in order to avoid potential issues with other parties who subscribed to the tender and who may claim that the tender was not set up well.

Stakeholders: Municipal waste management operators, waste collectors, companies producing bio-based products, public procurers.

## 5.5 Clear sustainability criteria are missing

The development of comprehensive sustainability schemes is crucial to encourage the market growth of bio-based products. Clear sustainability schemes, will boost the market by providing security to the main stakeholders. As identified by the European Commission's Lead Market Initiative (LMI) and the expert group for bio-based products for the development of the current European Bioeconomy Strategy, as well as, in earlier research projects (i.e. Open-Bio, Biohorizons, and BIOTIC), regulatory uncertainty and a lack of sustainability schemes for bio-based products represent key market barriers.

Various sustainability criteria and indicators are already included in existing sustainability certifications of the EU bio-based economy. These available criteria cover different sustainability aspects, including: sustainable feedstock and bio-based content. However, the lack of clear criteria for bio-based products still represents a major gap that is hampering the future development of the industry. For example, criteria on indirect and direct land use change, and end of life (such as recyclability/biodegradation) are not significantly reflected by current assessment schemes. Experts highlighted that there is conflicting information around sustainability assessment schemes. For example, LCAs are conducted following different methodologies (e.g. including or excluding the after-use phase) and using different data sources, thus obtaining results that are not comparable.

In addition, with currently available sustainability schemes it is not easy to demonstrate that a bio-based product is superior to a conventional petrochemical product. Although, tools for allowing the comparison of bio-based products with other bio-based products do exist, there are not a lot of studies that conducted comparisons. BioFoam recalled that comparison with other products (for instance land use for paper/cardboard versus land use for bioplastics) is needed and often not addressed in schemes, to be able to make the comparison on a fair basis.

Key problems:

- LCAs are conducted following different methodologies and using different data sources. E.g. criteria on indirect and direct land use change, and end of life are not significantly reflected by current assessment schemes.
- Land use is often not included in sustainability schemes, although it is needed to make comparisons on a fair basis.

Stakeholders: Certification bodies, governments, standardization organizations, industry and academia.

## 5.6 Absence of incentives to support integration between agriculture and industry

One of the case studies, Novamont, promotes an approach to the bioeconomy that is based on the efficient use of renewable resources and on the concept of territorial regeneration (conversion of abandoned factories), starting with the local areas, to generate new production chains, new products and new jobs (Novamont Sustainability report, 2016).<sup>59</sup> By promoting a system that involves the whole production chain at a regional scale, the potential effects on employment do not only concern Novamont plants, but also rural areas, especially new opportunities for employment and earning for farmers. However, sometimes setting land aside brings the farmer more income than cultivating a crop, and this demotivates them from cooperating with Bioeconomy companies.

## 5.7 Summary and conclusions

For bio-based products, a level playing field is not in place. Externalities by fossil products like damage to the environment are paid by the society as a whole and not by the producer or buyer of the product. This implies that wherever bio-based products may diminish these externalities they cannot benefit since the fossil products do not carry the price disadvantage.

On the other hand, biofuels are promoted through policy and instruments such as mandatory blending, sometimes leading to higher prices for feedstock for bio-based products. This hampers the use of this feedstock for products other than fuels, even though the production of bio-based products generally leads to more avoided GHG and higher employment. Also, the energy sector companies benefit from reducing their CO<sub>2</sub> footprint, while this is not the case for material industry. This is because biofuel industry as a part of the Emission Trading Scheme gain financial benefits due to the avoided CO<sub>2</sub> emissions, whereas there is no mechanism where bio-based products can have financial benefit due to CO<sub>2</sub> savings in comparison to fossil based products.

An overall carbon tax seems a simple solution to account for CO<sub>2</sub> footprint, however, it would need to be implemented worldwide in order to be effective. At the same time, the price for CO<sub>2</sub> emissions needs to be significantly higher than the current (2015) 7 €/ton in order to be effective.

Public procurement often fails because sustainability criteria are not taken into account (price overrules sustainability). At the same time, sustainability effects of the biofuels policy are not unambiguously positive and have made policy makers hesitant.

The current implementation and organization of the Extended producer responsibility (EPR) faces challenges linked to: lack of clarity on material properties, intended after-use pathways, and to the potential cross-contamination with recycling streams.

General sustainability benefits of bio-based products (such as reduced dependency on crude oil, driver of innovation, reduced GHG) are often not addressed in tender specifications.

Finally, clear sustainability criteria are missing. LCAs are conducted following different methodologies and using different data sources. E.g. criteria on indirect and direct land use change, and end-of-life are not significantly reflected by current assessment schemes. As a consequence, it may not be surprising that sometimes governments (e.g. Netherlands) are internally divided regarding the positive environmental aspects of bio-based products (CO<sub>2</sub> mitigation, avoidance of non-renewable resources) and negative aspects related to agriculture and land use change.

## 6 Identified Hurdle: Communication and image

### 6.1 Introduction

Five out of seven companies mentioned hurdles in the market related to communication and image. The analysis shows that the core issues are complexity of information, emotionality, NGO campaigns, certification

<sup>59</sup> <http://www.novamont.com/eng/biorefineries-integrated>, visited 11 April 2018.

and labelling as well as greenwashing – all of which are solvable through legislation and standardisation only to a very limited extent.

## 6.2 Complexity of information

Bio-based materials are – in some cases, such as a number of bio-based plastics – quite new and unknown, whereas other bio-based materials have been on the market for centuries, such as oleochemicals, and paper and board. There is not one homogeneous class of bio-based materials – they are very different in terms of structure, processes, feedstocks and applications. So, the implications related to sustainability, handling of products, durability and end-of-life options differ strongly as well – which might confuse consumers. For example, up until today, the misunderstanding is very common that any bio-based product is also biodegradable. Recent research (see Dammer et al. 2017, Pfau et al. 2017) has shown that awareness and understanding among consumers seems to be increasing, but is still not very high. The complexity issue can be addressed to some extent by standardisation, which has been tackled by CEN/TC 411 (see chapter 6.4). However, it can be observed in the market that communication by different companies on their diverse bio-based products is far from being consistent and homogeneous. Terms such as “renewable sourced”, “plant based”, “renewable based”, “biomass based” and others compete with “bio-based” for the same meaning, which is just one example.

There is a lot of misunderstanding surrounding biodegradability. The InnProBio project has addressed them in a factsheet which is available at the project website.<sup>60</sup>

Key problem:

- Bio-based materials are very diverse and differ in terms of structure, processes, feedstocks and applications. So, the implications related to sustainability, handling of products, durability and end-of-life options differ strongly as well – which may confuse consumers.

Stakeholders: Companies producing bio-based products, governments

## 6.3 Certification and labelling

### Paradox detailed information versus simple message

One tool often mentioned which could be appropriate to address concerns about bio-based products is certification and labelling. One crucial problem identified both by Dammer et al. (2017) and Pfau et al. (2017) is a paradox between the need for detailed information on the one hand and a desire to get simple messages on the other, which are both often cited by consumers in studies. An important stakeholder in this dilemma are trustworthy institutions, such as independent NGOs or governmental institutions, who can provide legitimacy to simple-information labels.

### Multitude of certifiers and certification schemes

#### *Sustainable feedstocks*

The cultivation of renewable resources (usually from forestry and agriculture, sometimes from marine aquaculture) has a huge impact on the sustainability of the final bio-based products. Due to the EU’s renewable energy policy, a multitude of certifiers have developed certification schemes for agricultural biomass that adhere to the conditions laid down in the EU’s Renewable Energy Directive (RED). Most of them have by now adapted their schemes in a way that they can be applicable also to materials, not only to energy. For wood, sustainability certification schemes were developed already before the renewable energy policy was in place due to concerns about unsustainable forestry practices in many parts of the world.

Examples of available schemes are:

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<sup>60</sup> <http://innprobio.innovation-procurement.org/bio-based-products-services/factsheets/>, visited 9 February 2018.

- **Wood**
  - [Forest Stewardship Council \(FSC\)](#)
  - [Programme for the Endorsement of Forest Certification \(PEFC\)](#)
- **Agricultural Biomass**
  - [International System for Carbon Certification \(ISCC\)](#) – all agricultural biomass
  - [Roundtable on Sustainable Biomaterials \(RSB\)](#) – all agricultural biomass
  - [REDcert](#) – all agricultural biomass
  - [Better Biomass](#) – all agricultural biomass
  - [Roundtable on Sustainable Palm Oil \(RSPO\)](#) – only palm oil
  - [Bonsucro](#) – only sugar
  - [Roundtable Responsible Soy \(RTRS\)](#) – only soy

#### *Bio-based (carbon) content*

A bio-based product is a product wholly or partly derived from biomass. Different standards are available for determination of bio-based (carbon) content. There is a difference between [bio-based carbon content](#) and [bio-based content](#). In some cases the bio-based weight fraction of a product can differ substantially from the bio-based carbon weight fraction. For example, products in which part of the raw materials has been replaced by bio-based alternatives containing other elements like O, N and H (such as carbohydrate-based products) will indicate a lower bio-based fraction when this is only derived from the bio-based carbon content (Van den Oever et al., 2017).

The bio-based [carbon](#) content in a material can be measured according to e.g. EN 16640 or ASTM D6866. However, the basis for these 2 methods is different again. EN 16640 (“Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method”) relates to the total carbon content of the product whereas ASTM D6866 (“Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis”) refers to the organic carbon content (so excluding C of e.g. chalk which is sometimes used as fillers in plastics). The bio-based content of a material can be determined with EN 16785-1 (“Determination of the bio-based content using the radiocarbon analysis and elemental analysis”). So different standards can be used to determine different parameters which are difficult to distinguish by the general public and even industry. Also, different European certification bodies issue different certificates:

- [OK biobased](#) (owned and awarded by Vinçotte)
- [DIN-Geprüft Biobased](#) (owned and awarded by DIN CERTCO)
- [Biobased content](#) (owned and awarded by NEN)

The complexity of these several methods and certificates poses a hurdle for clear and unambiguous communication.

#### *End-of-life options*

There are some certifications and labels that highlight the special end-of-life options of bio-based products such as compostability, biodegradability in soil, biodegradability in sea water, etc. The following are the three most popular certifications used in Europe to prove compliance with the compostability norm EN 13432. (See also section 2.5.)

- **Industrial compostability**
  - [“The Seedling”](#) (owned by European Bioplastics, awarded by DIN CERTCO and Vinçotte)
  - [“DIN-Geprüft Industrial Compostable”](#) (owned and awarded by DIN CERTCO)
  - [“OK compostable”](#) (owned and awarded by Vinçotte)

For an overview of all globally available logos demonstrating compostability, see a summary report of the KBBPPS (Knowledge Based Bio-based Products’ Pre-standardization) project on compostability standards (KBBPPS, 2013).

- **Home compostability**
  - [“OK home compostable”](#) (owned and awarded by Vinçotte)

- **Biodegradability in soil**
  - [“OK biodegradable soil”](#) (owned and awarded by Vinçotte)
  - [“DIN-Geprüft biodegradable soil”](#) (owned and awarded by DIN CERTCO)
- **Biodegradability in sea water**
  - [“OK biodegradable marine”](#) (owned and awarded by Vinçotte)<sup>61</sup>

#### Well established procedures block using labels by new comers

Labels and certificates are based on agreements between industry and different competent bodies. In the case of the EU Ecolabel, for example, both the European Commission as well as the national authorities are involved in the labelling scheme. These processes are quite well-established. However, by applying phrasing in standards (for example referring to “wooden flooring” excludes bamboo flooring, because bamboo is a grass) or additional requirements for new materials (as experienced by Synbra with the “new” material PLA for insulation applications), some procedures block new comers from using such labels.

#### Awareness and trust

The barriers also comprise many companies not being aware of the existing labels cited above or that consumers either do not trust labels in general or are overwhelmed by the multitude of labels in the market. It needs to be kept in mind that the influence of regulation and standardisation is limited in this area, since a lot of the success of labels depends on perception by consumers. As the OpenBio project concluded after an extensive analysis of the connection between the EU Ecolabel and bio-based products, another key factor is the commitment of companies, since without their initiative, there will be no new labels on bio-based products.

#### Key problems:

- There is a paradox between the need for detailed information on the one hand and a desire to get simple messages on the other.
- A multitude of certifiers have developed certification schemes for agricultural biomass.
- Different standards are available for determination of differently defined bio-based (carbon) contents, e.g. based on total carbon content of the product (EN 16640), based on the organic carbon content (ASTM D6866) and based on the bio-based content, so including O, N and H elements next to C (EN 16785-1). Different definitions of bio-based (carbon) content, different standards and different certification bodies using different labels make communication complex and misunderstanding likely.
- Well established procedures for certificates and labels sometimes contain phrasing or additional requirements for new materials, thus blocking new comers from using such labels.

Stakeholders: Companies, national competent bodies, European Commission, NGOs

## **6.4 Standardisation: CEN/TC 411**

The European Commission has identified that standards for bio-based products are needed in order to promote the uptake of these products by consumers, develop the market and enable public authorities to implement 'green procurement' policies. In 2011, the European Commission addressed two mandates to CEN in relation to bio-based products: Mandate M/491 for the development of European standards and technical specifications and/or technical reports for bio-surfactants and bio-solvents in relation to bio-based product aspects; and Mandate M/492 for the development of horizontal European standards and other standardization deliverables for bio-based products. The horizontal aspects covered in M/492 include a consistent terminology for bio-based products, sampling, bio-based content, application of and correlation

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<sup>61</sup> The information on certification and labels has been taken from the InnProBio factsheet on sustainability of bio-based products, available at <http://innprobio.innovation-procurement.org/bio-based-products-services/factsheets/>

towards LCA and sustainability of biomass used, and guidance on the use of existing standards for the end-of-life options.

The CEN/TC 411 "Bio-based products" created five Working Groups to prepare the work items as requested in the mandates. The CEN/TC 411 published seven European Standards, two Technical Specifications and one Technical Report. Additionally, two standards are under development. The developed standards are:

- EN 16575: 'Bio-based products – Vocabulary'
- EN 16785-1: 'Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis'
- EN 16785-2: 'Bio-based products - Bio-based content - Part 2: Determination of the bio-based content using the material balance'
- CEN/TS 16640: 'Bio-based products - Determination of the bio based carbon content of products using the radiocarbon method'
- CEN/TR 16721: 'Bio-based products - Overview of methods to determine the bio-based content'
- EN 16760: 'Bio-based products - Life Cycle Assessment'
- EN 16751: 'Bio-based products – Sustainability' criteria
- EN 16848: 'Bio-based products - Template for B2B reporting and communication of characteristics - Data sheet'
- EN 16935: 'Bio-based products - B2C reporting and communication - Requirements for claims'
- CEN/TS 16766: 'Bio-based products - Bio-based solvents - Requirements, application classes and test methods'

As mentioned above, these standards are horizontal standards. This means that they contain only fundamental principles, concepts, definitions, terminology, and similar general information applicable over a broad subject area. These standards therefore do not for example contain any thresholds for specific products. This is sometimes perceived as a hurdle by players in the bio-based economy. However the intention of the CEN/TC 411 was to cover horizontal aspects for the entire bio-based economy.

The Mandate ended in 2017. The focus for CEN/TC 411 for the future will be on:

- a) bio-based products in relation to the circular economy
- b) generating interest for the developed standards through communication and dissemination

Most of the developed standards are relatively unknown to actors in the bio-based industry. With the further promotion of the standards the CEN/TC 411 wants to support further growth of the bio-based products market. In particular, to increase market transparency by providing common reference methods and requirements that enable the verification of claims regarding the bio-based content, bio-degradability or environmental sustainability of different products.

Key problem:

- European Standards and Technical Specifications recently developed by CEN/TC 411 on 'Bio-based products' do not contain thresholds for specific products.

Stakeholders: European Commission, standardisation institutions, industry

## 6.5 NGO campaigns and emotionality

The bio-based products industry is – in some cases – also concerned by the debate around the sustainability of renewable feedstocks, especially considering the use of first generation feedstocks. The main claim by NGOs is that crops which can be eaten should not be used for any other purpose, either energy or materials.

This debate spiked after the food crisis in 2008/2009, which many stakeholders connected to the extreme incentives that Europe provided (and still provides) to biofuels made from agricultural crops. In this regard, bio-based products and materials are negatively impacted by something they can only influence to a limited extent. As food security is a rather emotional issue which impacts humans at a very basic level, it is difficult to lead fact-based and rational discussions on it, even though there is increasing evidence that the use of food crops for materials or fuels might even have positive effects on the livelihood of farmers and food security in general (Kline et al., 2016).

Key problem:

- It is difficult to have a fact-based and rational discussion on food security. NGOs tend to claim that crops which can be eaten should not be used for other purposes, while there is increasing evidence that livelihood of farmers, but even food security in general, benefits from the use of food crops for materials or fuels.

Stakeholders: Companies, NGOs

## 6.6 Summary and conclusions

Bio-based materials are very diverse and differ in terms of structure, processes, feedstocks and applications. So, information regarding sustainability, handling of products, durability and end-of-life options may be even complex to experts, and even more so to consumers. Also, different standards are available for the determination of differently defined bio-based (carbon) contents. Moreover, there is a paradox between the wish for detailed information on the one hand and a desire to get simple messages on the other. To make communication worse, a multitude of certifiers have developed certification schemes for agricultural biomass.

Furthermore, well established procedures for certificates and labels sometimes contain phrasing or additional requirements for new materials, thus blocking new comers from using such labels. To make communication about 'bio-based' more uniform, CEN/TS 411 has recently developed European Standards and Technical Specifications. However, these standards and specifications do not contain thresholds for specific products.

Another issue is that although there is increasing evidence that livelihood of farmers and food security in general benefit from the use of food crops for materials or fuels, it is sometimes difficult to have a fact-based and rational discussion on food security because NGOs tend to claim that crops which can be eaten shouldn't be used for other purposes.

### List of abbreviations

ASTM	American Standard for Testing and Materials
Bio-PE	Polyethylene containing bio-based materials
Bio-PET	Polyethylene terephthalate containing bio-based materials
C	Carbon
CEN/TC	European Committee for Standardization / Technical Committee
CO <sub>2</sub>	Carbon dioxide
DIN	German institute for standardisation
DKR	Deutsche Gesellschaft für Kreislaufwirtschaft und Rohstoffe mbH
EAD	European Assessment Document
EC	European Commission
EN	European standard
EPR	Extended producer responsibility
EPS	Expanded polystyrene
EuPC	European Plastic Converters
FSC	Forest Stewardship Council
H	Hydrogen
H <sub>2</sub> O	Water
HDPE	High-density polyethylene
ISO	International Organization for Standardization
LCA	Life cycle assessment
LMI	Lead Market Initiative
N	Nitrogen
NEN	Dutch Standard (Nederlandse Norm)
NGO	Non-governmental organisation
O	Oxygen
PE	Polyethylene
PEF	Polyethylene furanoate
PEFC	Programme for Endorsement of Forest Certification Schemes
PET	Polyethylene terephthalate
PHA	Polyhydroxyalkanoate
PLA	Polylactic acid
PMD	Plastic, metal, drinking cartons
PS	Polystyrene
RED	Renewable Energy Directive

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## Appendix A - Interview Format

### The structure of the interview

#### *General*

Ask if you are permitted to record the interview for future reference. The recording will only be used in the framework of the project and not be made public. If the interviewee objects you will have to make extensive notes during the interview.

Focus of the interview is on a product that has reached the market in at least small quantities. During the interview also products/developments that did not reach the market due to hurdles encountered can be discussed.

It is important when you touch upon a hurdle to keep on asking what exactly is the nature of the hurdle until you fully understand, it can be difficult to get a clear and complete picture. If you do not fully understand it, the other project members probably will not understand either.

*1. Ask the interviewee to tell the history of the development of the product from the moment he/she became involved (if he/she is only involved recently try to find someone to fill in the earlier history.*

- What is the product (or family of products) you produce
- What is it made from
- What is its function in the market (intermediate B2B product or consumer product, new product functionality or 1 on 1 replacement)
- Who do you cooperate with to produce it
- Where do you produce it (country and region) and why
- Who did you cooperate with to develop it
- When did the development start
- What hurdles, related to law, regulation and standards did you encounter during the development and commercialisation stages
- Which part of your value chain was affected by these hurdles?
- How did you deal with these hurdles
- What is the present status, are they overcome or do they still hinder the product
- What hurdles do you encounter at this moment that are not overcome
- Have you recently worked on a development that did not reach the market due to regulatory hurdles
- What hurdles are these
- Would you foresee a way to overcome them

*2. During the interview try to structure it in periods that are logical for the development of the product under study (f.i (a) during the initial R&D stage, (b) during building and exploiting the pilot plant etc.). Feel free to set up a structure that fits. This will help us to organise the hurdles.*

*3. Focus in the interview on the hurdles that were encountered and possibly overcome during the development and commercialisation stages. Most hurdles have different aspects, try to split this up in regulatory aspects (e.g. laws or regulations, policy) and instrumental aspects (standards, labelling, subsidies, taxes etc.) Be aware that both regulatory and instrumental aspects can play a role in a hurdle. If possible, fill in the report form for each hurdle with the interviewee. Categories:*

#### **Regulatory aspects**

##### ***Law or regulations***

- Existing conflicting laws
  - o Concerning the feedstock used
  - o Concerning the processes used
  - o Concerning the product
  - o Concerning the market uptake (commercialization)

- The level at which the law/regulation is defined: in European or national law, at a lower governmental level, regions or municipalities, in the market between stakeholders/companies or, other
- Conflicting requirements in national and/or European regulations
- Lack of law or regulation

***Policy, the lack of policy or conflicting policy on national or European level***

- Conflicting policy or protectionism of established parties influencing policy lobby
- Relevant policy fields: Environmental, Agricultural, Biofuel, Energy, Waste, Chemicals, Packaging, Regional development, Other

**Instrumental aspects**

***Standards and certifications or the lack of standards***

- o Concerning the feedstock
- o Concerning the (intermediate) product(s)
- o Concerning the process specifics
- o Specification descriptions that are irrelevant towards the product functionality
- At which level the standard is defined: International (ISO), European (EN) or national, at a lower governmental level, internal or in the market between stakeholders/companies
- The applicability of the standards for the product, bottlenecks for new bio-based products due to existing standards
- Cost of certification, no certificates, too many different standards/certificates
- Problems in the chain of custody, conflicting/non-fitting certification in the production chain
- Protectionism of established parties in standardisation committees

***Subsidies or the lack of subsidies***

- Lack of subsidies
- Subsidies that favour competing products or promote other feedstock uses (eg bioenergy)

***Taxes***

- Lack of tax advantages
- Taxes that favour competing products or promote other feedstock uses

***Other instrumental aspects***

- Public procurement
- Obligations such as mandatory use
- Restrictions
- Lack of control of the application of regulations and laws (including false declarations of products characteristics);
- Etc.

*4. In the second half of the interview after the history is told and the hurdles discussed, switch the approach and ask specifically for all hurdles mentioned in the report form if they were encountered at one point during development and marketing of the product. You may touch upon additional hurdles in this way that were overlooked in the first part of the interview*

**Reporting**

*Write down the history of the product development in a concise story.*

*Fill in the report form for each hurdle that you touched upon during the interview.*

*Have both checked by the interviewee*

*After the interview, in a following step we will try to categorize the hurdles*

- Perceived hurdles: hurdles that are perceived by the interviewee, but are caused by a misunderstanding or misinterpretation of a regulation or instrument
- Operational hurdles: hurdles for which the regulatory aspects do not pose the barrier and which may for instance be solved by adapting the instrument
- Structural hurdles: hurdles for which regulation needs to be changed in order to solve them
- Fundamental hurdles: hurdles that have several aspects and cannot be solved by changing one instrument or regulation
- Conflicting hurdles: hurdles that conflict with societal goals and may not be solved

**Appendix B - Advises for disposal of compostable packaging in different municipalities in the Netherlands**

Additional information to section 2.4: Examples of advises for disposal of compostable packaging in different municipalities in the Netherlands: Arnhem, Utrecht and Wageningen.

**Je zoekt op**  
**verpakkingen van composteerbaar plastic**

**Afdanken via:**  
**Vuilnisbak (restafval)**

**⚠ Let op:**

Gebruik een verpakking met kiemplantlogo of OK-compostkeur om je schillen in weg te gooien in de GFT-bak. Verpakkingen van composteerbaar kunststof (met Kiemplantlogo of OK-compostlogo) mogen bij het restafval, maar kunnen met schillen en al ook bij het gft-afval. Composteerbare plastic verpakkingen zijn alleen goed composteerbaar in een industriële composterringsinstallatie. Thuis op de composthoop verstoort het het composteringsproces. Plastic van natuurlijke grondstoffen heet biobased, maar dat hoeft niet te betekenen dat ze ook composteerbaar zijn. De termen biobased, bioplastic en composteerbaar plastic worden vaak verward.

**Het is:**  
**Overig afval**

Deze producten vallen niet onder een van de andere afvalsoorten. Per product wordt een specifiek advies gegeven onder "Let op".

**Figure 14: Advise for disposal of compostable packaging, provided by the Dutch MilieuCentraal, and referred to by the municipality of Arnhem.**

**GROENTE, FRUIT EN TUIN (GFT)**

<b>😊 WEL</b>	<b>☹ NIET</b>
<p>Wat mag wel bij GFT</p> <ul style="list-style-type: none"> <li>• Aardappelschillen</li> <li>• Bladeren</li> <li>• Bloemen</li> <li>• Broodresten</li> <li>• Dunne takken</li> <li>• Eierschalen</li> <li>• Etenresten</li> <li>• Fruitschillen</li> <li>• Grasmaaisel</li> <li>• Groenteresten</li> <li>• Kaas en kaaskorsten</li> <li>• Kamerplanten</li> <li>• Kattenbakkorrels met milieukeur</li> <li>• Koffiedik</li> <li>• Pinda- en notendoppen</li> <li>• Plastic met het kiemplantlogo</li> <li>• Schelpen</li> <li>• Schors</li> <li>• Stro</li> <li>• Theebladeren of -zakjes (alleen van organisch materiaal)</li> <li>• Tuinaarde en potgrond in kleine hoeveelheden</li> <li>• Turfmolm</li> <li>• Uitwerpselen van huisdieren</li> <li>• Visgraten</li> <li>• Vlees- en visresten</li> <li>• Vleesbotjes</li> <li>• Zaagsel</li> </ul>	<p>Wat mag niet bij GFT</p> <ul style="list-style-type: none"> <li>• As uit asbak en open haard</li> <li>• Frituurvet</li> <li>• Honden- en kattenharen</li> <li>• Hout en dikke takken</li> <li>• Kattenbakkorrels, zonder milieukeurmerk</li> <li>• Kauwgom</li> <li>• Kerstbomen</li> <li>• Lucifers</li> <li>• Luiers</li> <li>• Melk- en sappakken</li> <li>• Oasis (steekschuim)</li> <li>• Sigarettenpeuken</li> <li>• Stofzuigerzakken en inhoud</li> <li>• Vogelkooizand, zonder milieukeurmerk</li> <li>• Zand</li> </ul>

**Figure 15: Advise for disposal of compostable packaging communicated by the municipality of Utrecht.**



Plastic verpakkingen, metalen verpakkingen / blik en drinkpakken (PMD) doet u in de grijze PMD-kliko of levert u in bij de PMD-brengcontainers die oa bij supermarkten staan.



Doe groente-, fruit- en afval in de groene kliko. Let op: verpak het GFT-afval niet in plastic zakken, maar gebruik hiervoor speciale biozakjes die te koop zijn bij onder andere de Action en Blokker. Doordat deze zakjes gemaakt zijn van zetmeel of mais zijn ze 100% afbreekbaar en composteerbaar.

**Figure 16: Advise for disposal of (any) plastic packaging, communicated by waste processor ACV, and referred to by the municipality of Wageningen.**

Contact

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