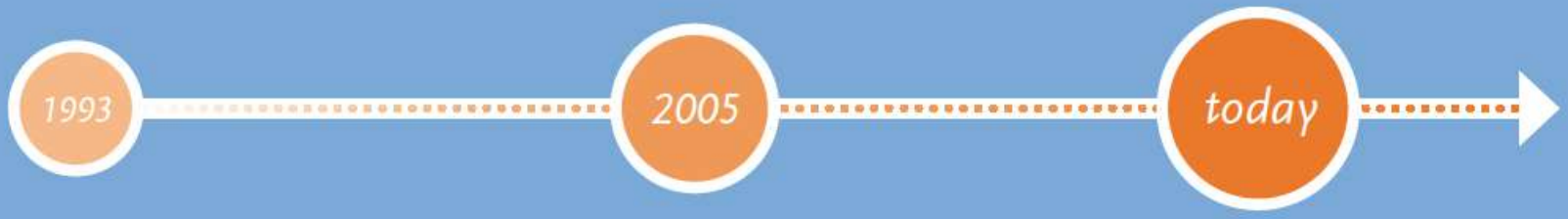
Bioplastics – A key pillar of the Circular Economy in Europe

Constance Ißbrücker, Head of Environmental Affairs, European Bioplastics (EUBP)

Symposium –Workshop on Central Region Bioeconomy | November 9, 2017 | Santa Fe, Argentina

European Bioplastics: 20 years of bioplastics experience

- European Bioplastics represents the interest of the bioplastics industry along the entire value chain in Europe.
- Our foremost goal and commitment is to build and strengthen a supporting policy framework in the EU for bioplastics to thrive in through a strong network and engagement in dialogue with all relevant stakeholder.



12 Members

- **Foundation of IBAW**
- Biodegradable polymers
- Germany

50 Members

- Name change to **European Bioplastics**
- Bioplastics incl. biobased & biodegradable
- Europe

70 Members

- Networking on **EU & Member State** level

*Members of European Bioplastics – The value chain**

Renewable raw materials / Green chemistry

Cargill · TOTAL · Corbion · ROQUETTE · Tereos · reverdia sustainable solutions powered by DSM + Roquette

Bioplastics manufacturers and auxiliaries

BASF We create chemistry · Braskem · BIOTEC BIOPLASTICS FOR A BETTER LIFE · DUPONT · FKuR plastics - made by nature! · NatureWorks LLC · NOVAMONT · Perstorp WINNING FORMULAS

Converters

GOGLIO COFIBOX S.p.A. · Huhtamaki · SIG · SPHERE · COVERIS HIGH PERFORMANCE PACKAGING · rethink storaenso · wentus Film · Packaging · Flexibility

Brand owners

DANONE · FERRERO · ORIGINAL FOOD

Recycling

BPM GmbH BÖSELPLASTIC MANAGEMENT

Research

AIMPLAS INSTITUTO TECNOLÓGICO DEL PLÁSTICO · Fraunhofer ISC

*selection of EUBP members in 2017

European Bioplastics – activities and services

- EUBP is a knowledge partner and business network for companies, experts, and all relevant stakeholder groups of the bioplastics industry
- **Our activities and services at a glance:**
  - > Gathering insights and knowledge about the industry
  - > Formulating and communicating our industry's key positions
  - > Representing our members' policy interests in Europe
  - > Connecting our members with potential business partners
  - > Facilitating a dynamic stakeholder dialogue

European Bioplastics – activities and services

- European Bioplastics puts high value on the expert knowledge within the association and all its members, which is gathered and shared with in standing and ad-hoc Working Groups:

  > **Product Group Biobased**

  > **Product Group Biodegradables**

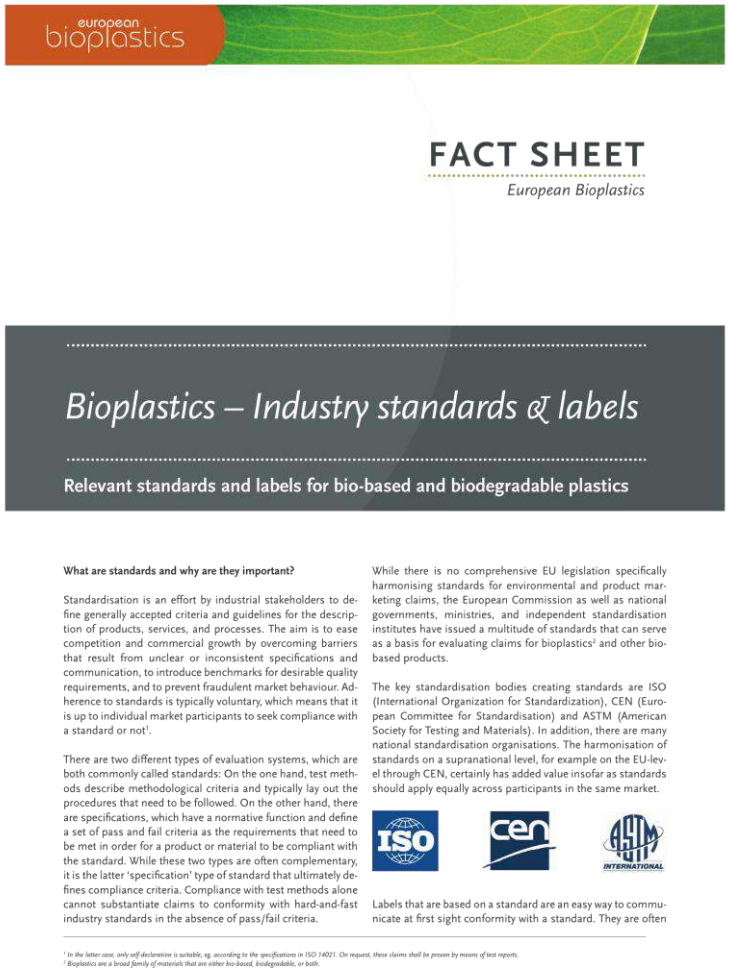
  > **Working Group Communications**

  > **Working Group Regulatory Affairs**

  > **Working Group Standardisation**

Supporting standardisation, certification & labelling

- EUBP is a member of the relevant standardisation committees at DIN and CEN level, e.g. CEN/TC 411 on bio-based products
- We support independent third party certification according to acknowledged standards
- EUBP owns the Seedling mark for (industrial) compostability awarded by certifiers DIN CERTCO and Vinçotte
- We provide comprehensive information on standardisation, e.g. in our fact sheet on relevant industry standards and labels (download on our website)



european bioplastics

FACT SHEET

European Bioplastics

Bioplastics – Industry standards & labels

Relevant standards and labels for bio-based and biodegradable plastics

What are standards and why are they important?

Standardisation is an effort by industrial stakeholders to define generally accepted criteria and guidelines for the description of products, services, and processes. The aim is to ease competition and commercial growth by overcoming barriers that result from unclear or inconsistent specifications and communication, to introduce benchmarks for desirable quality requirements, and to prevent fraudulent market behaviour. Adherence to standards is typically voluntary, which means that it is up to individual market participants to seek compliance with a standard or not[1].

There are two different types of evaluation systems, which are both commonly called standards: On the one hand, test methods describe methodological criteria and typically lay out the procedures that need to be followed. On the other hand, there are specifications, which have a normative function and define a set of pass and fail criteria as the requirements that need to be met in order for a product or material to be compliant with the standard. While these two types are often complementary, it is the latter 'specification' type of standard that ultimately defines compliance criteria. Compliance with test methods alone cannot substantiate claims to conformity with hard-and-fast industry standards in the absence of pass/fail criteria.

While there is no comprehensive EU legislation specifically harmonising standards for environmental and product marketing claims, the European Commission as well as national governments, ministries, and independent standardisation institutes have issued a multitude of standards that can serve as a basis for evaluating claims for bioplastics[2] and other bio-based products.

The key standardisation bodies creating standards are ISO (International Organization for Standardization), CEN (European Committee for Standardisation) and ASTM (American Society for Testing and Materials). In addition, there are many national standardisation organisations. The harmonisation of standards on a supranational level, for example on the EU-level through CEN, certainly has added value insofar as standards should apply equally across participants in the same market.

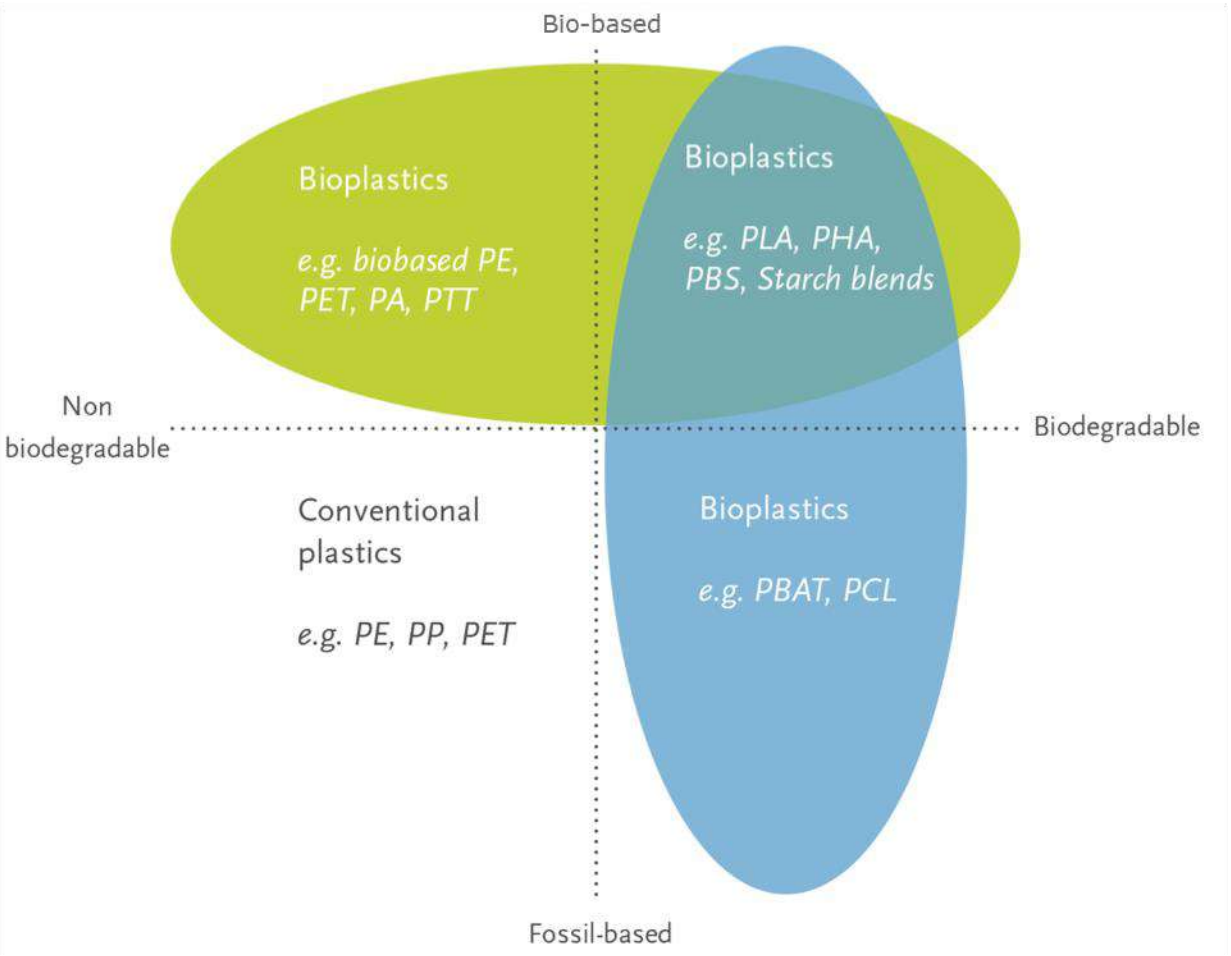
ISO cen ASTM INTERNATIONAL

Labels that are based on a standard are an easy way to communicate at first sight conformity with a standard. They are often

[1] *In the latter case, only self-declaration is suitable, eg. according to the specifications in ISO 14021. On request, these claims shall be proven by means of test reports.*
[2] *Bioplastics are a broad family of materials that are either bio-based, biodegradable, or both.*

What are bio-based plastics?

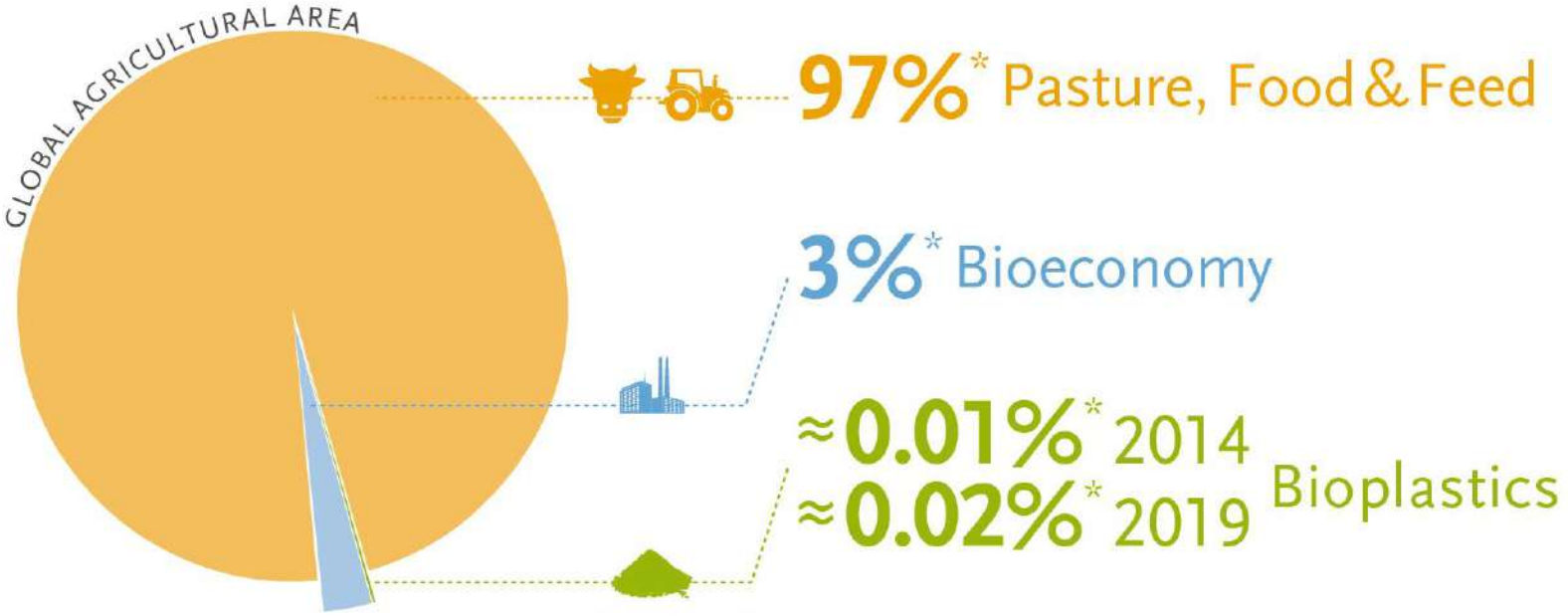
What are bioplastics?



Feedstock options for bioplastics

Growing demand for biomass but no competition to food and feed!

Land use for bioplastics 2014 and 2019



Source: European Bioplastics, Institute for Bioplastics and Biocomposites, nova-Institute (2015).
More information: ***www.bio-based.eu/markets*** *and* ***www.downloads.ifbb-hannover.de***

** In relation to global agricultural area*

Bioplastics - multiple benefits on different levels

Environment

- Climate protection
- Resource efficiency

Functionality

- New applications
- Enhanced performance

Renewable resources

- Use of annual re-growing crops
- Supply security
- Reduced use of fossil resources
- Reduced dependency on oil imports
- Cascade use: First industrial use, then energy production
- Increased use of platform chemicals (e.g. bio-based succinic acid)

End-of-life

- Mechanical recycling
- Organic recycling
- Thermal recovery
- Feedstock recovery

Social dimension

- Consumer acceptance
- Job creation and security
- Potential to develop rural areas

Bioplastics – great benefits, but complex to explain

- Bioplastics are complex and therefore not easy to communicate
- A lot of misconceptions still prevail, for example:
  - > All bioplastics are biodegradable
  - > Biodegradability = compostability
  - > Compostable plastics = solution to littering and landfilling
- Standards, certifications, and labels to proof environmental claims
- Avoid vague, general claims (“green”, “sustainable”, etc.) but substantiate claims with data and according certificates
- Specify “biodegradabilty” with testing standard and information on environment and timeframe

BIOBASED > 85 %
DIN Geprüft
OK compost
S187
VINÇOTTE
Certified Sustainability
ISCC
Certified GHG Savings
RSB

End-of-life options for bioplastics

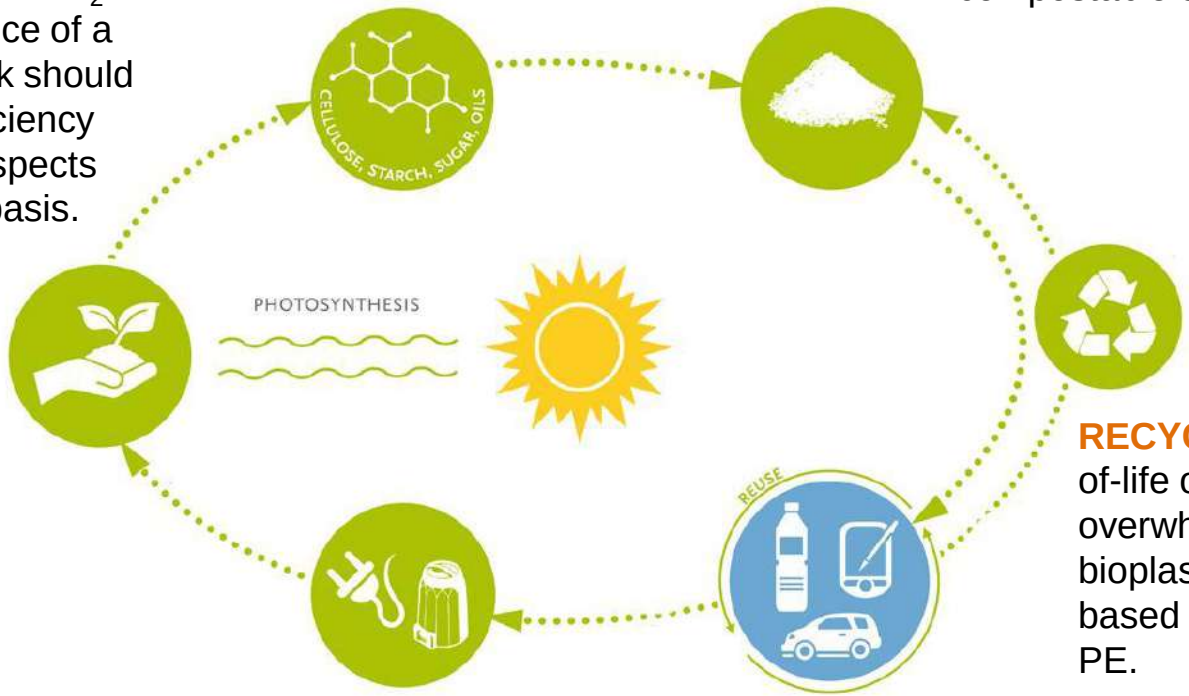
Bioplastics are suitable for a broad range of waste treatment options:

- **Prevention** through innovative materials
- **Mechanical recycling** in existing recycling streams (bio-PE or bio-PET) or separate streams for PLA (when economically feasible)
- **Organic recycling** of certified compostable (EN 13432) products in industrial composting plants
- **Chemical recycling / feedstock recovery** possible for some polymers, e.g. PLA, to hydrolyse back into constituting monomers
- **Energy recovery** produces renewable energy
- Regional infrastructure determines most effective and applicable recovery route

Bioplastics life cycle model – closing the carbon loop

RENEWABLE RESOURCES increase efficiency and reduce CO_2 emissions. The choice of a renewable feedstock should be governed by efficiency and sustainability aspects on a case by case basis.

BIOPLASTICS are a large family of materials that are bio-based, compostable or both.

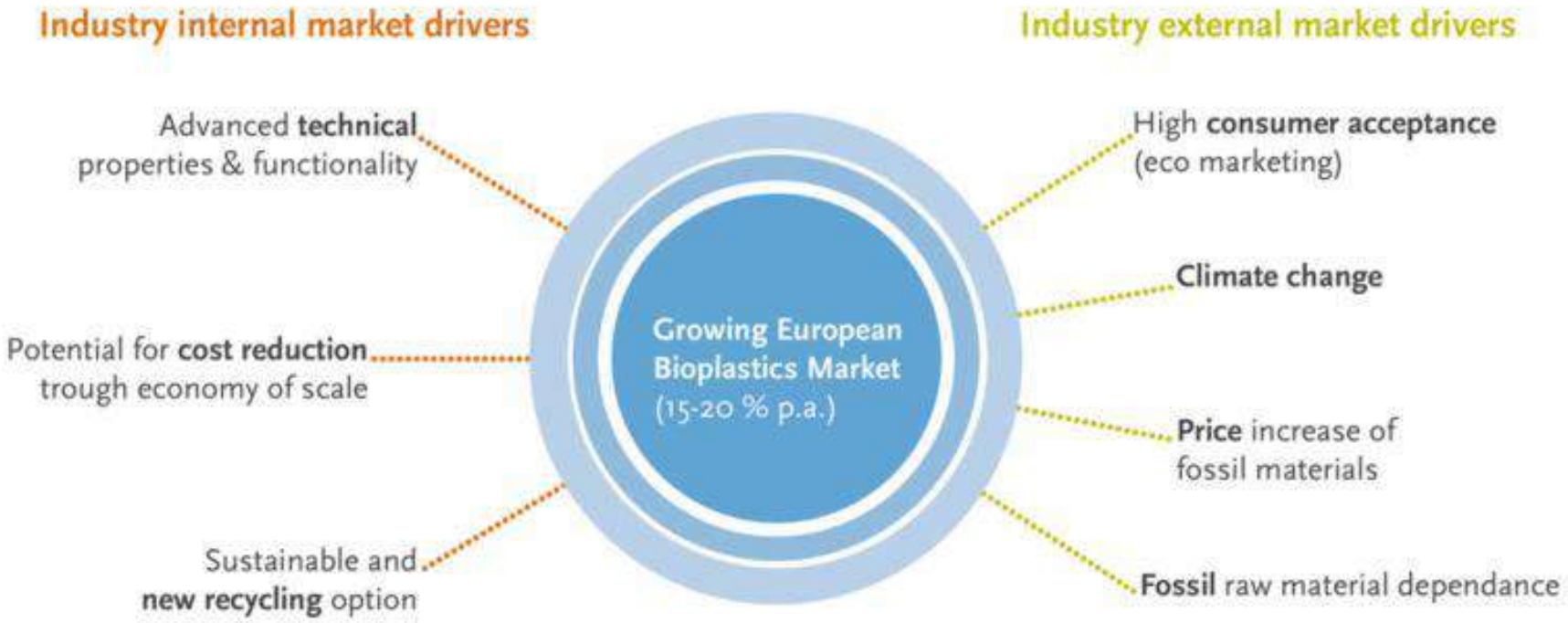


RECYCLING is the end-of-life option for the overwhelming part of bioplastics, e.g. bio-based PET or bio-based PE.

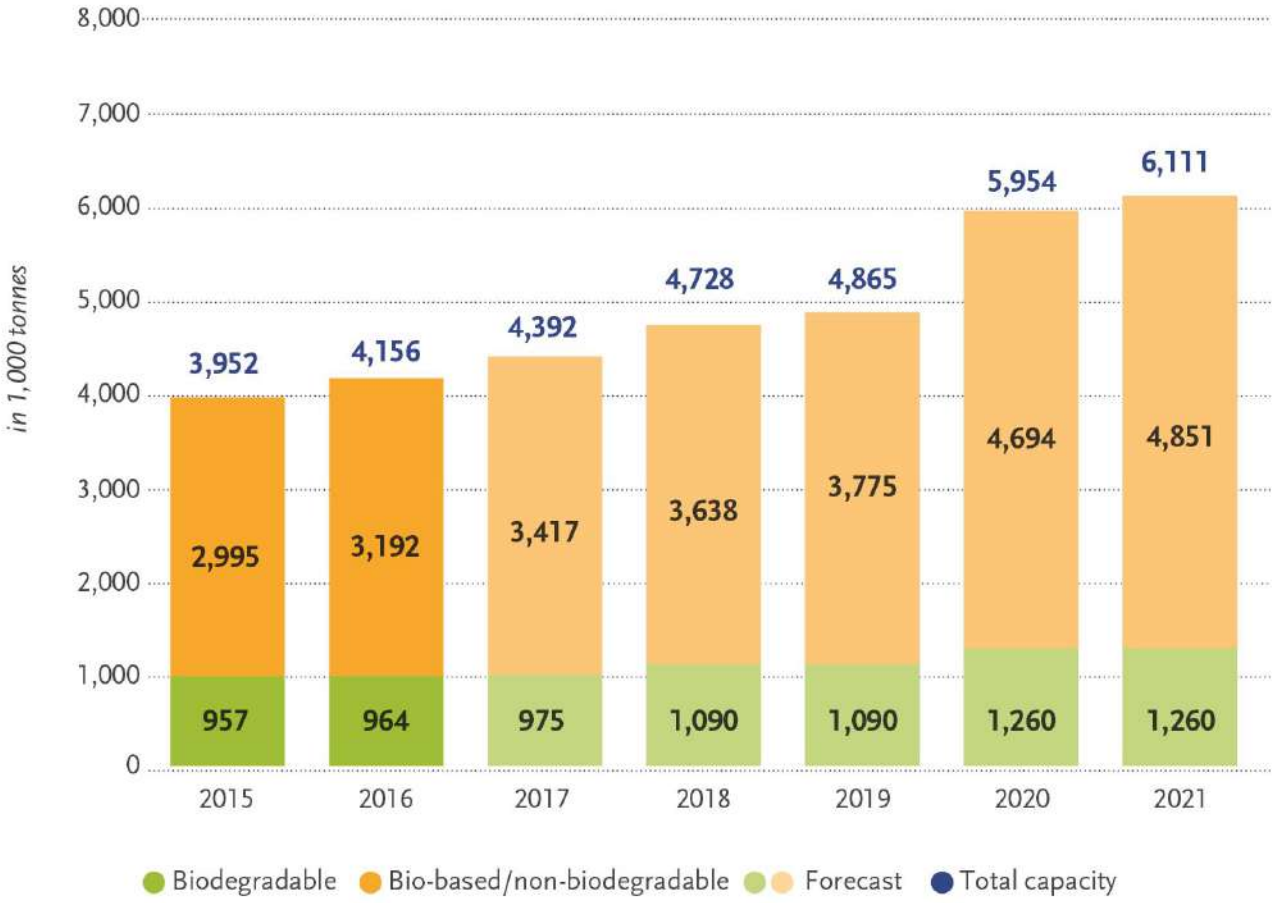
ENERGY RECOVERY / ORGANIC RECYCLING are additional options for bioplastic materials where fitting the product and the existing waste management infrastructure.

PRODUCTS: bioplastics can be used in all applications where fossil-based plastics are used.

Market driver for the bioplastics industry



Production capacities worldwide between 2015-2021



Source: European Bioplastics, nova-Institute (2016).
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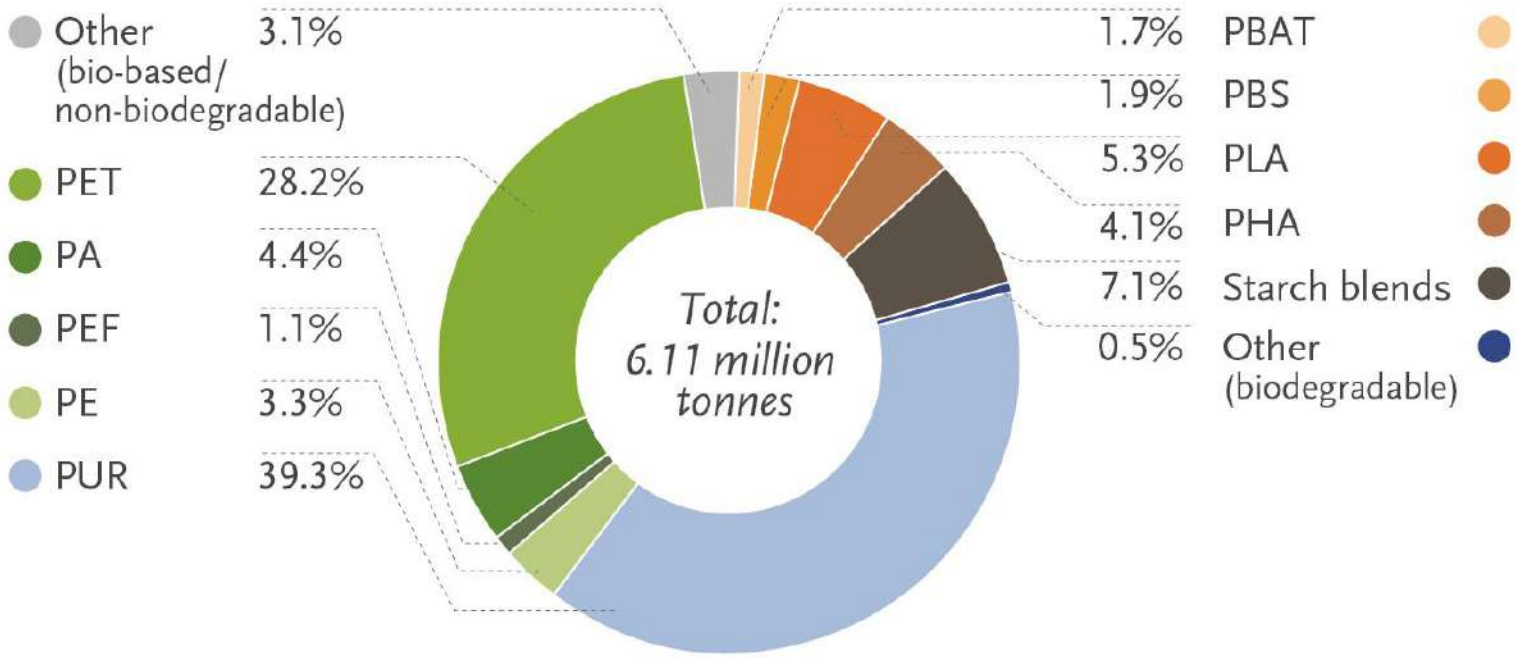
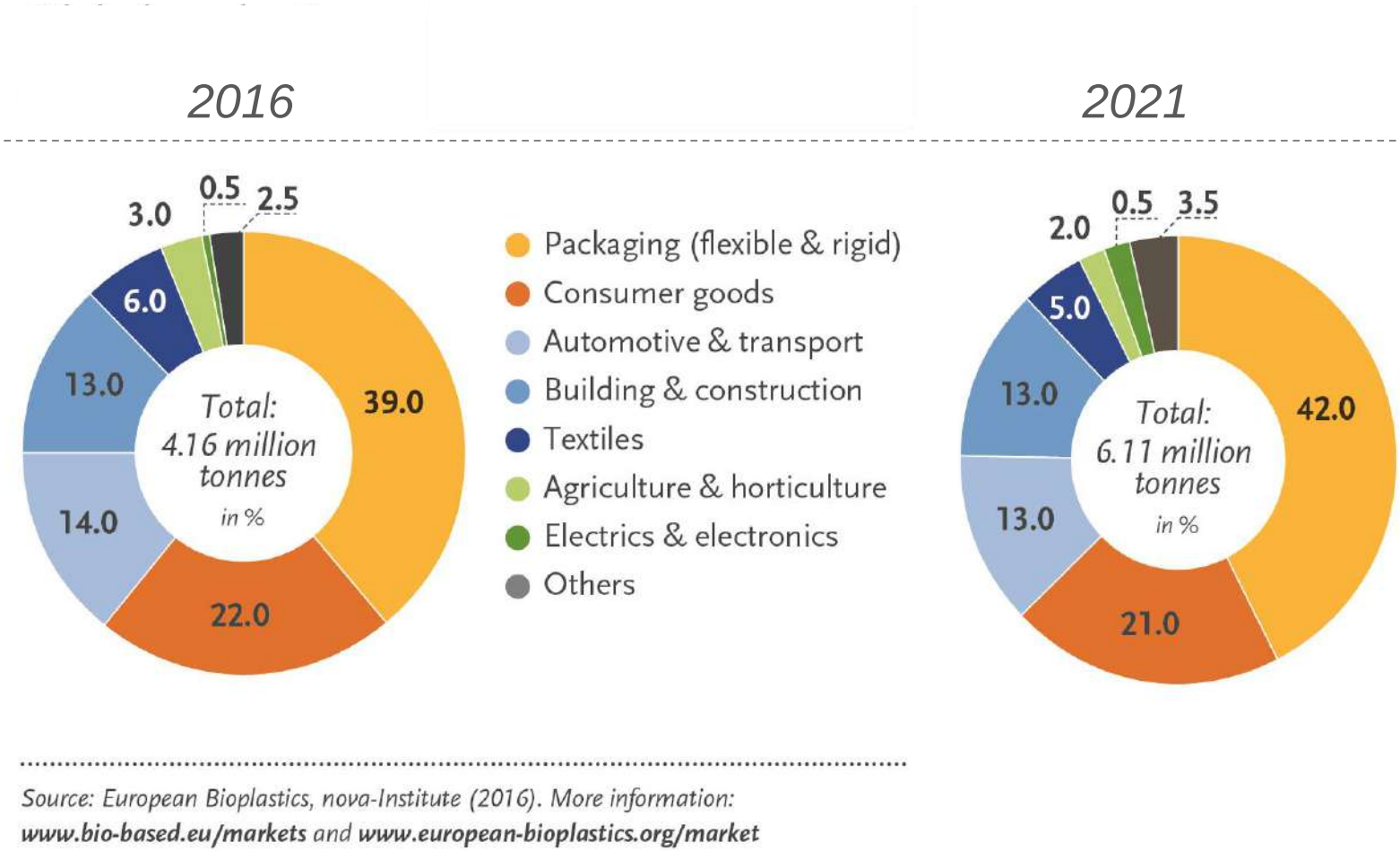
Production capacities – breakdown by material type 2021



Source: European Bioplastics, nova-Institute (2016).
More information: ***www.bio-based.eu/markets*** *and* ***www.european-bioplastics.org/market***

Bioplastics are already part of our **EVERYDAY LIFE.**

Production capacities – breakdown by market segment



Source: European Bioplastics, nova-Institute (2016). More information: ***www.bio-based.eu/markets*** *and* ***www.european-bioplastics.org/market***

Regional development of production capacities 2016

Source: European Bioplastics, nova-Institute (2016).

More information: ***www.bio-based.eu/markets*** *and* ***www.european-bioplastics.org/market***

BASF SE

Headquartered in Ludwigshafen, Germany

BASF
We create chemistry

ecoflex®

- Fossil-based, certified compostable polymer (PBAT), fossil-based, but can already–at least partially–be bio-based
- Ideal blend component to improve properties

ecovio®

- Certified compostable (EN13432) polymer with bio-based content (ecoflex + PLA)
- Main use:
  - Biowaste bags
  - Mulch films (ecoflex)
  - Compostable packaging
  - Foam packaging

Novamont

Headquartered in Novara, Italy

Mater-bi®

- Innovative family of biodegradable plastics
- High bio-based content based on starches, cellulose, vegetable oils
- Certified compostable (EN 13432)
- Main uses:
  - Agriculture
  - Packaging
  - Carrier bags
  - Biowaste bags
  - Food service

NatureWorks

Headquartered in Minnetonka, MN, USA

Ingeo® PLA

- Bio-based and biodegradable polymer
- Derived from first and second (developing) generation feedstocks
- Research plant for turning CO_2 or CH_4 into lactic acid
- Main uses:
  - 3D printing
  - Toys
  - Packaging
  - Medical and hygiene

NatureWorks LLC

Total Corbion

Headquartered in Gorinchem, The Netherlands

Luminy® PLA

- Bio-based and compostable polymer
- Derived from sugarcane (Thailand, Bonsucro certified)
- Standard PLA grades and high-heat PLA grades (100-140˚C)
- Replacement for polystyrene (PS), polypropylene (PP) and acrylonitrile butadiene styrene (ABS) in more demanding applications
- Main uses:
  - Packaging & serviceware
  - Electronics
  - Agriculture

Futamura

Headquartered in Japan

FUTAMURA

Naturflex™

- Cellulose-based (regenerated cellulose)
- Superior biodegradability properties
- Wood-pulp feedstock (FSC certified)
- Final product: Thin transparent film with great barrier properties to air/oxygen, mineral oils, bacteria; aroma protection
- Certified compostable in different environments (industrial/home composting)
- Main uses:
  - Food packaging

BIO-FED

Headquartered in Cologne, Germany

BIO-FED
Think Sustainable

M.VERA®

- Bio-based and biodegradable compound based on PHA and PLA
- Certified compostable (EN 13432)
- Biodegradable in various environments, depending on application and requirements
- Main uses:
  - Bags
  - Agricultural applications
  - Coffee capsules
  - Disposable tableware

BIOTEC

Headquartered in Emmerich, Germany

BIOPLAST®

- Starch-based polymers with high bio-based contents
- Certified compostable in different environments (industrial and home compostable)
- Partly or fully derived from plant-based resources such as potato starch
- Main uses:
  - Film applications, such as bags
  - Food packaging
  - Office supplies

BIOTEC®

BIOPLASTICS FOR A BETTER LIFE

DuPont Tate & Lyle BioProducts

Headquartered in Loudon, TN, USA

DuPont Tate & Lyle BioProducts™

Susterra®

- Largest global producer of bio-based 1,3-propanediol (1,3-PDO)
- Susterra® propanediol is the bio-based building block that delivers high performance in a variety of polyurethane (PUR) applications:
  - Footwear
  - waterproof films
  - artificial leather
- Sustainable manufacturing process: 56% less GHG emissions and 42% less non-renewable energy consumption than equivalent petroleum-based diols

Braskem

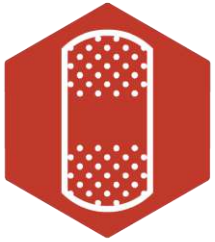
Headquartered in São Paulo, Brasil

I'm Green™ PE

- Ethylene building block is made from ethanol produced by fermentation of agricultural feedstock (e.g. sugarcane)
- Bio-based PE identical to fossil-based PE
- Mechanically recyclable
- Main use:
  - Packaging (food, beverages)
  - Personal and home care
  - Cosmetics
  - Toys & office supplies
  - Bags

Horizon 2020 Project: POLYBIOSKIN

POLYBIOSKIN



This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No. **745839.**

Bio-based Industries Consortium

BIO-BASED INDUSTRIES Public-Private Partnership

Horizon 2020 European Union Funding for Research & Innovation

Relevant standards for bio-based plastics

- Determination of bio-based carbon content:
  - > Method: ^{14}C / radiocarbon method
  - > CEN/TS 16137 and EN 16640
  - > ASTM D6866 (test method for the USDA BioPreferred Label)
  - > ISO 16620-2

- Determination of bio-based (mass) content:
  - > EN 16785-1 (^{14}C + elemental analysis), EN 16785-2 (material balance method)
  - > New biobased label developed by NEN based on EN 16785-1
  - > ISO 16620-4

biobased %

USDA CERTIFIED BIOBASED PRODUCT
PRODUCT 57%
PACKAGE 32%

BIOBASED > 85 %
DIN
Geprüft

Bio-based label

DIN CERTCO

OK biobased
VINÇOTTE
more than 80 %
Biobased

Bio-based label

Vinçotte

Relevant standards for biodegradable plastics (I/II)

- Industrial composting:
  - > EN 13432 /EN 14995 (90% disintegration after 12 weeks and 90% biodegradation after 6 months)
  - > ASTM D6400 /D6868 (the US BPI compostable in industrial facilities logo is based on these standards)
  - > ISO 18606 /ISO 17088
  - > Certifier network EUBP, DIN CERTCO, Vinçotte since April 2012

compostable

HOME OK compost VINÇOTTE

- Home composting:
  - > Currently no international standard, only national ones
  - > French standard NF T51-800 (based on Vinçotte's OK compost home certification scheme: 90% biodegradation in 12 months, ambient temperatures
  - > EU draft mandate for a standard for home compostable carrier bags

HOME COMPOSTABLE DIN Geprüft

BPI® COMPOSTABLE IN INDUSTRIAL FACILITIES
Check locally, as these do not exist in many communities. **Not suitable for backyard composting.** CERT # SAMPLE

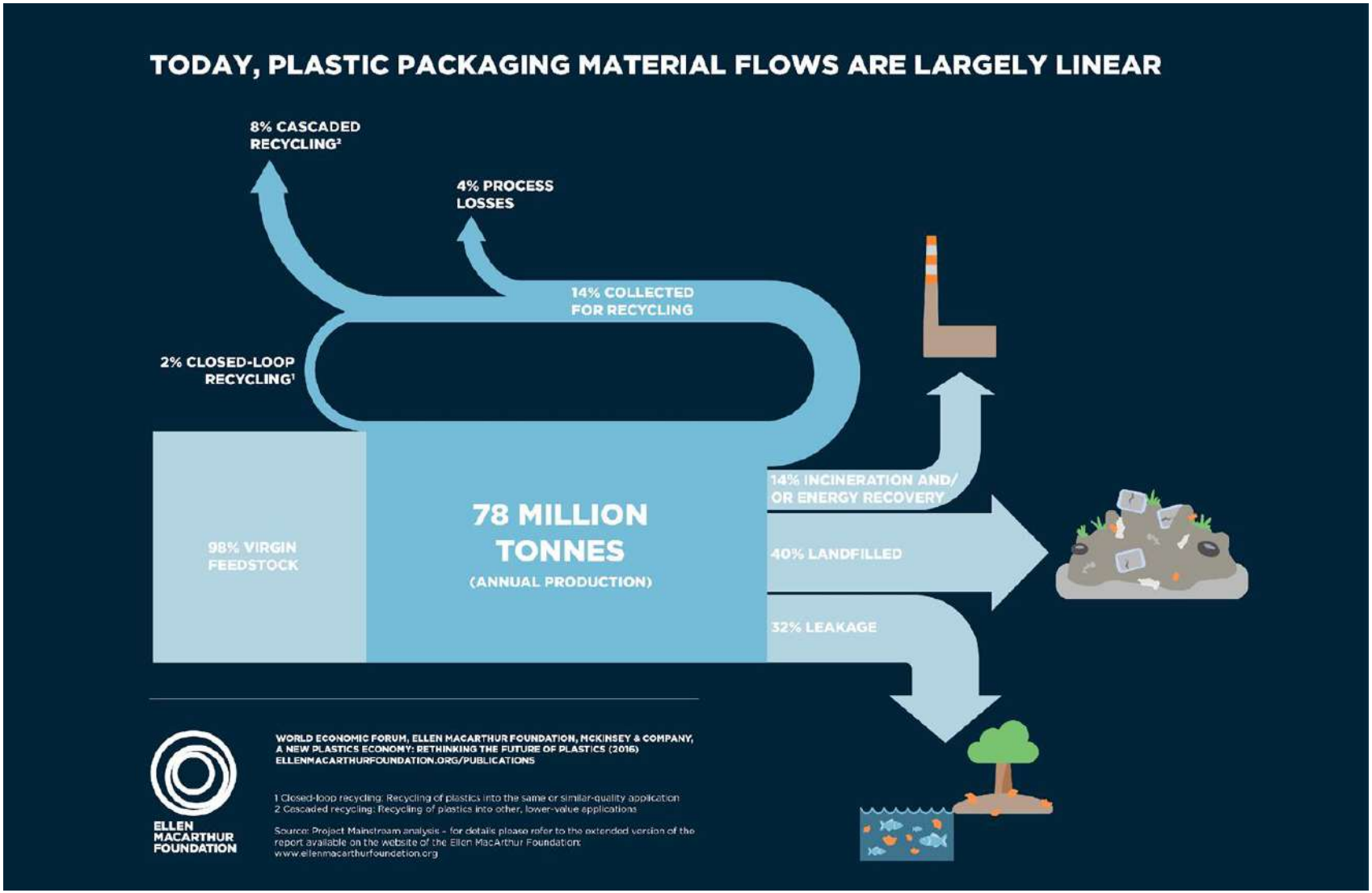
Relevant standards for biodegradable plastics (II/II)

- Compostability in soil:
  - > Vinçotte's OK biodegradable soil certificate is based on EN 13432 / EN 14995 but has been adapted to require at least 90% biodegradation in two years at ambient temperatures
  - > DIN CERTCO awards the DIN-geprüft biodegradable in soil label in accordance with CEN/TR 15822
  - > New standard EN 17033 - *Biodegradable mulch films for use in agriculture and horticulture – Requirements and test methods* is expected in 2017, requiring biodegradation of at least 90% in two years at preferably 25° C
- Marine biodegradation:
  - > US standard ASTM D7081 was withdrawn without replacement, new developments on ISO level
  - > Research on-going (e.g. the recently finalised Open-Bio project)
  - > Reliable standard (pass/fail criteria) needed before meaningful communication possible,

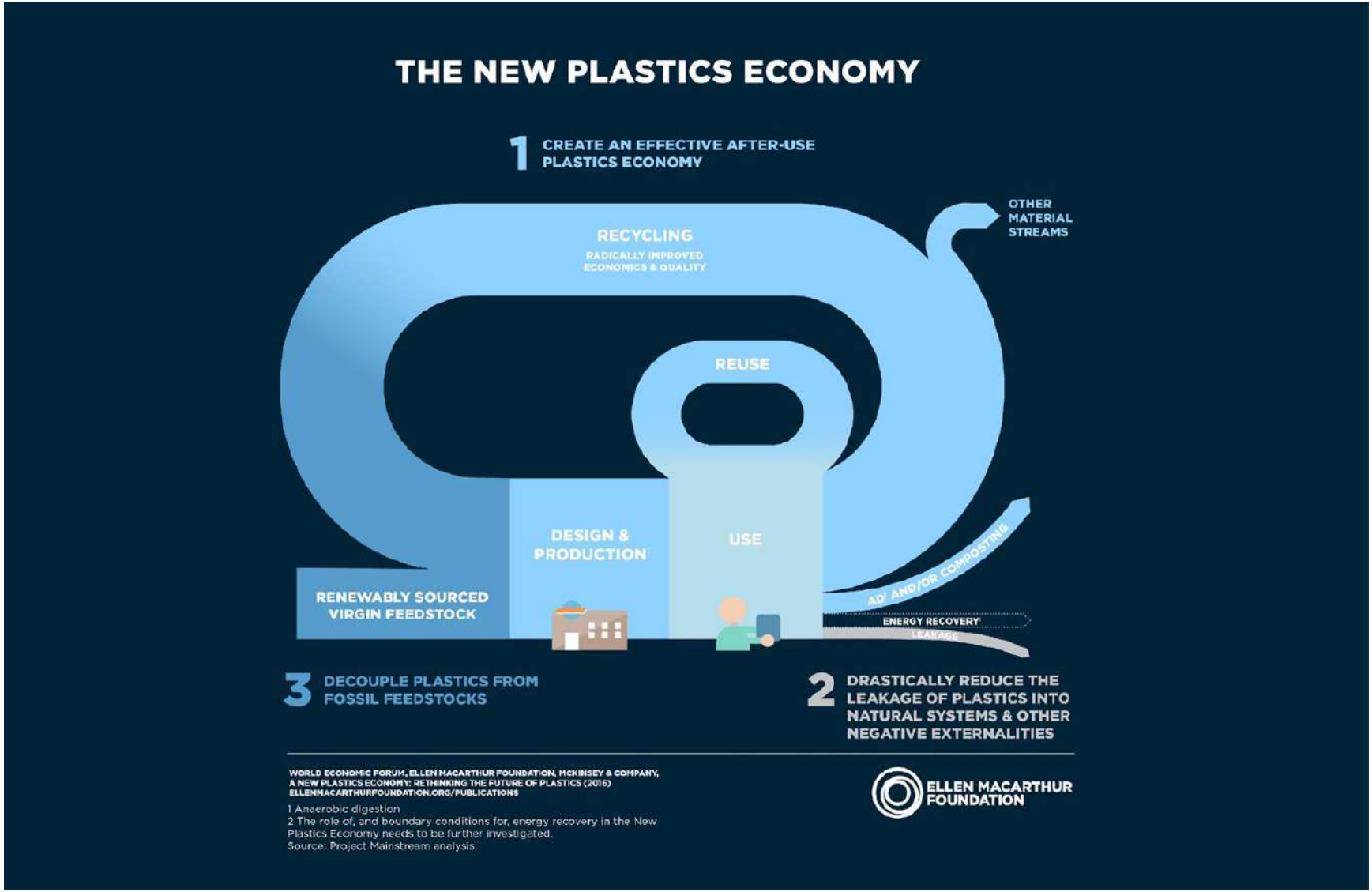
Relevant standards - Sustainability of bio-based plastics

- Sustainability aspects:
  - > ISO 14040 / 14044 Life cycle assessment
  - > ISO/TS 14067 Carbon footprinting (method and communication)
  - > EN 16760 – Life cycle assessment (formulates specific requirements; based on ISO 14040 series of standards)
  - > EN 16751 – Sustainability criteria (no thresholds or limits → cannot be used to make sustainability claims)
  - > ISCC PLUS, RSB, REDcert: certification systems for biomass sustainability based not on standards but on the EU Renewable Energy Directive (RED, 2009/28/EC), FSC for wood-based materials

Today's plastics economy



The ‚New Plastics Economy'



Framework: legislation and initiatives at EU level

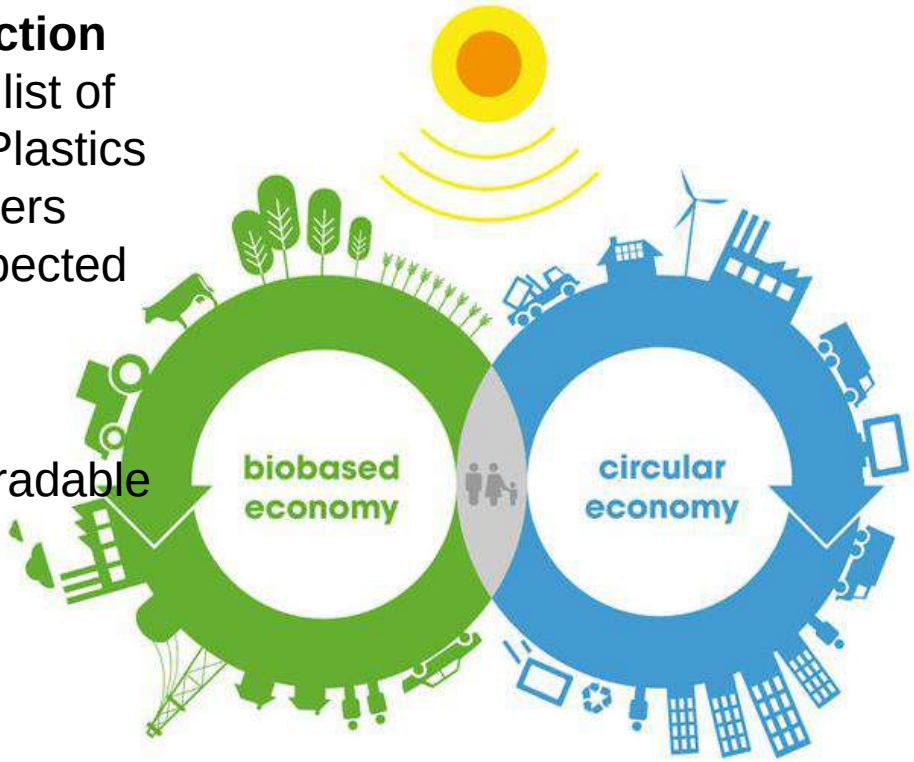
- **Europe 2020**
  - Innovation Union „Bioeconomy“ (since 2010)
  - Resource Efficiency Strategy (2011)
  - Bioeconomy Strategy (2012)
- **Lead Market Initiative (LMI) for bio-based products**
  - LMI (since 2007)
  - Report with policy recommendations (2009, 2011)
  - Standardisation for bio-based products on-going
- **Legal Framework Waste & Packaging**
  - Green paper on waste strategy 2013
  - Revision of Packaging & Packaging Waste Directive (‘bagislation’) 2014
  - **Circular Economy Package & Action plan 2015 - today**

Circular economy proposal

- Part 1**: Waste legislation revision** -Waste Framework Directive (WFD), Packaging & Packaging Waste Directive (PPWD), Landfill Directive

- Part 2: **'Closing the loop - An EU action plan for the Circular Economy'** - a list of numerous initiatives from drafting a Plastics Strategy to the revision of the Fertilisers Regulation (Roadmap published, expected end of 2017)

- Fertilizers Directive – include biodegradable mulch films as soil iprovers



EU Member States - Measures to boost supply and demand of bioplastics

- **Italy:** bio-based and compostable single-use carrier bags (according to EN 13432, minimum bio-based content from 2018), well-established industrial composting landscape; centre of excellence for integrated biorefineries,
- **The Netherlands:** mandatory separate biowaste collection, compostable (EN 13432) plastic packaging allowed in biowaste bin; reduced material fees for compostable plastic packaging
- **France:** prohibiting single-use carrier bags except for bio-based and home-compostable ones; disposable plastic tableware has to be bio-based and home-compostable from 2020 onwards
- **Germany:** mandatory separate biowaste collection since 2015, compostable biowaste bags (EN 13432) allowed in the biowaste bin

Bioplastics essential in the future plastics economy

- Links the bioeconomy and the circular economy
- Treat waste as a valuable resource
- Cut resource use, reduce waste, enable true circularity by setting clear methodologies and standards
- Addresses all stages of the product life cycle, including product design (efficient use of feedstock) and waste treatment
- Feedstock from renewable sources helps to decouple plastics production from fossil feedstock and reduce greenhouse gas emissions
- Compostable plastics can help return nutrients to the soil
- Increase use of secondary raw materials; enable separate waste collection and improved waste treatment options; reduce and eventually phase-out landfilling for recyclable materials

12th EUBP Conference – Berlin, 28/29 November 2017

More information on www.european-bioplastics.org/events/eubp-conference/

Thank you!

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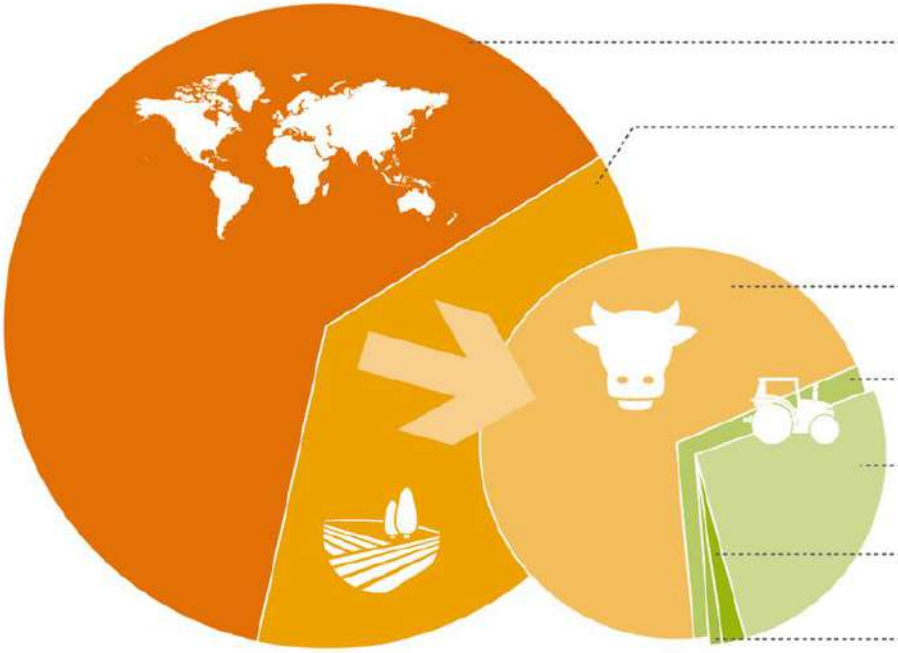
http://twitter.com/EUBioplastics

Growing demand for biomass but no competition to food and feed!

Land use for bioplastics 2014 and 2019



Global land area
13.4 billion ha = 100%

Global agricultural area
5 billion ha = 37%

GLOBAL AGRICULTURAL AREA

Pasture
3.5 billion ha = 70%*

Arable land**
1.4 billion ha = 30%*

Food & Feed
1.24 billion ha = 26%*

Material use *including*
106 million ha = 2%*

Biofuels
53 million ha = 1%*

Bioplastics
2014
0.68 million ha≈0.01%*
2019
1.4 million ha≈0.02%*

Source: European Bioplastics, Institute for Bioplastics and Biocomposites, nova-Institute (2015).
More information: ***www.bio-based.eu/markets*** *and* ***www.downloads.ifbb-hannover.de***

* *In relation to global agricultural area*
** *Also includes approx. 1% fallow land*