European Biomass Industry Association

An overview on the biopolymers market potential in Europe

European Bio-polymers Summit 2016, London, UK

Who is speaking

EUBIA

The European Biomass Industry Association

Supporting Biomass Sector at all Levels

EUBREN

The European Biomass Research Network

Researching for Bioeconomy

A MULTI-FACETED SUPPORT

A business facilitator

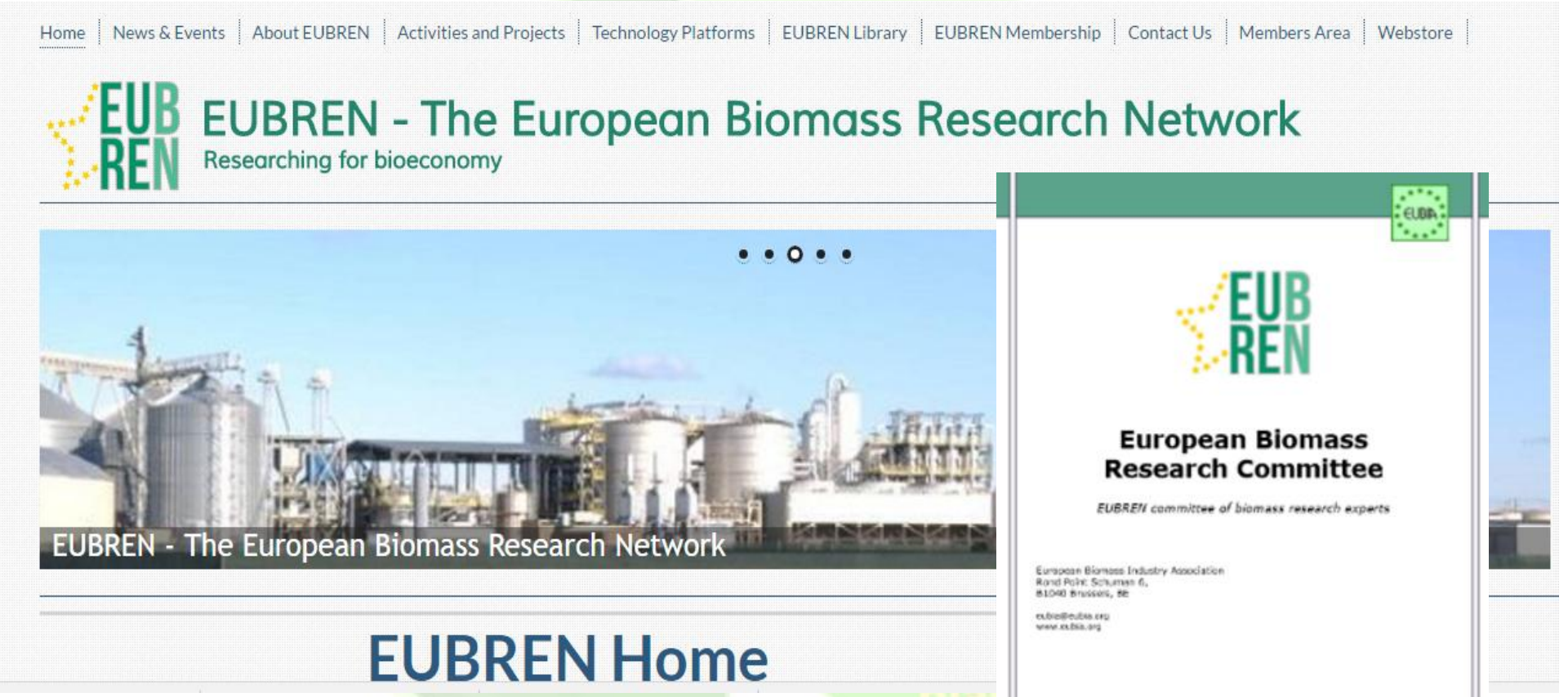
- Identification of competitive projects
- Markets potentials evaluation
- Creator of Business opportunities
- Technical consultancy

International Projects developer

- More than 50 EC projects experience
- Coordinator/Partner in technical tasks, policy and market assessment,
- Supporting Dissemination

Information provider & diffuser

- Organizer of workshops, training events
- International conferences supporter
- Policy Measures Position papers
- Dissemination opportunities
- Legal framework barriers identification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European Biomass Research Committee
EUBREN committee of biomass research experts

Introduction

Polymers (Greek: poly-many, meros-particle)

compounds with high molecular mass, constructed of interlinking, perennial basic building blocks, called monomers.

Polymers are the main components of plastics, with additives as fillers (inorganic or organic), pigments, lubricants, inhibitors of oxidation, etc.

About 75 % of all produced plastics are:

- PET (polyethylene terephthalate),
- Polypropylene (PP)
- Polystyrene (PS)
- Polyethylene (PE)

Biopolymers from Nature

Most of the living world is based on polymers.

Natural polymers are produced in the growth cycles of cells of living organisms

Their synthesis includes enzyme-catalysed polymerisation reactions of activated monomers, which occur within cells as products of complex metabolic processes

Polymers can be found in animals (hydrocarbons, proteins, fats, nucleic acids, etc.), plants (e.g. cellulose, oils, starches, even polyesters) as well as in lower organisms.

Making artificial Biopolymers

With biosynthesis, polymers can be produced in a manner identical to the natural.

There are primarily two types of Biopolymer, one that is obtained from living organisms and another that is produced from renewable resources but require polymerization.

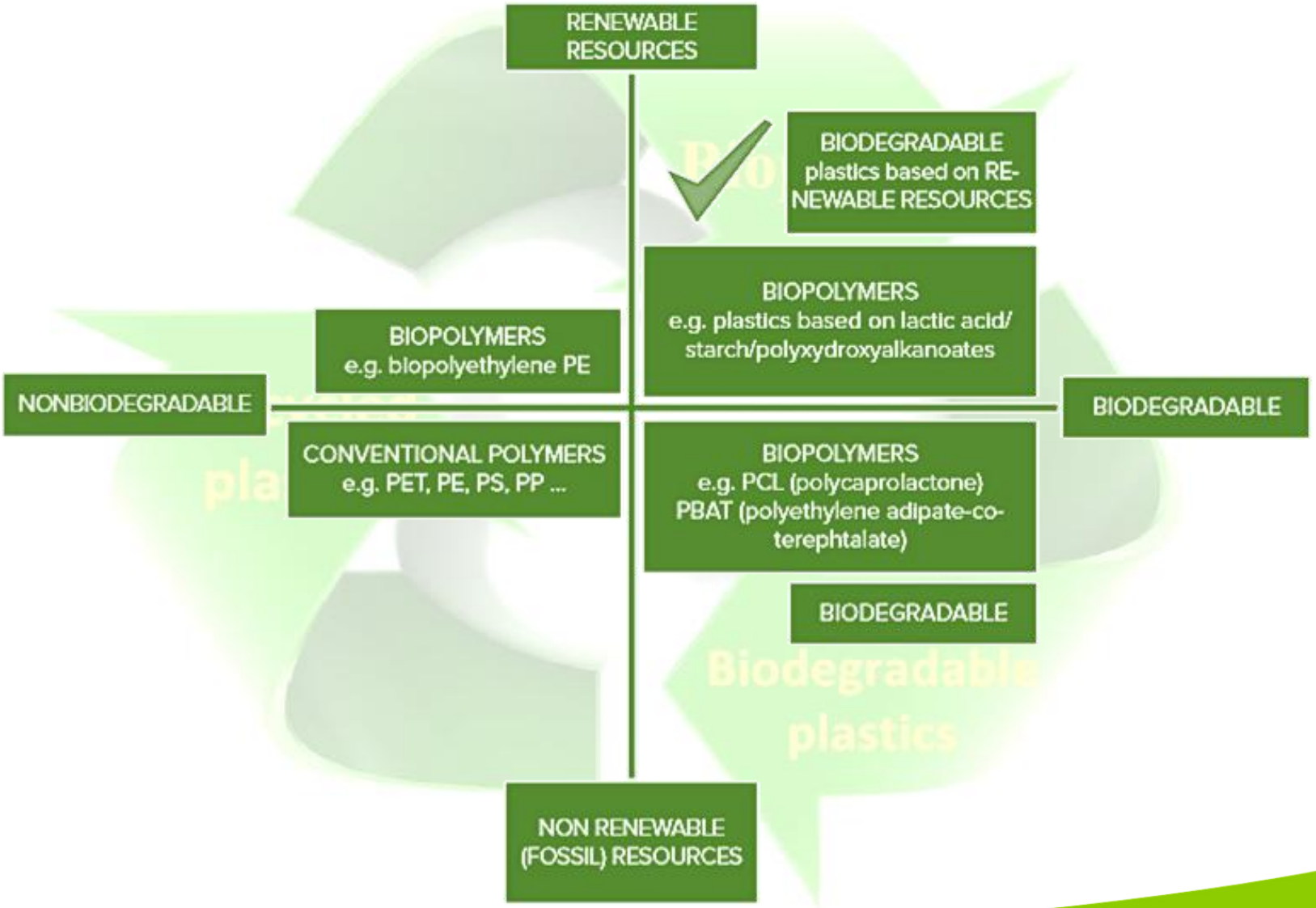
Those created by living beings include proteins and carbohydrates.

Difference between Polymer and Biopolym

Biopolymers and Bioplastics are often confused for one another. However, these are different materials.

Biopolymers are polymers that can be found in or manufactured from, living organisms. These also involve polymers that are obtained from renewable resources that can be used to manufacture Biobased plastics by polymerization.

Bioplastics are the plastics that are created by using biodegradable polymers. The great automobile manufacturer Henry Ford devised a way of manufacturing bioplastic car sections from soybeans back in the middle of the 20th century.


RENEWABLE RESOURCES
BIODEGRADABLE plastics based on RE-NEWABLE RESOURCES
BIOPOLYMERS e.g. plastics based on lactic acid/ starch/polyxydroxyalkanoates
BIOPOLYMERS e.g. biopolyethylene PE
NONBIODEGRADABLE
BIODEGRADABLE
CONVENTIONAL POLYMERS e.g. PET, PE, PS, PP ...
BIOPOLYMERS e.g. PCL (polycaprolactone) PBAT (polyethylene adipate-co-terephtalate)
BIODEGRADABLE
NON RENEWABLE (FOSSIL) RESOURCES

Biobased polymers production routes

Polymers directly extracted/removed from biomass:

- polysaccharides, for example starch and cellulose;
- proteins, for example casein and gluten.

Polymers made by classical chemical synthesis using renewable monomers:

- polylactide,
- bio-polyester formed by polymerisation of monomers, i.e. lactic acid (PLA).

Bio-Based Chemical	Reference petrolchemicals
Ehyl lactate	Ethyl acetate
Ethylene	Ethylene
Adipic Acid	Adipic Acid
Acetic Acid	Acetic Acid
n-Butanol	n-Butanol
PTT	PTT & Nylon 6
PHA	HDPE
PLA	PET and PS
FDCA	Terephtalic acid
Succinc Acid	Maleic Anhydride

Polymers obtained with the help of microorganisms or genetically modified bacteria.

- polyhydroxyalkanoates (PHA)
- bacterially synthesised cellulose

Biochemicals in Europe and worldwide

EU GHG emission reduction targets 2030

- ✓ a 40% cut in greenhouse gas emissions compared to 1990 levels
- ✓ at least a 27% share of renewable energy consumption
- ✓ at least 27% energy savings compared with the business-as-usual scenario
- ✓ A reformed EU emissions trading scheme (ETS)
- ✓ New indicators for the competitiveness and security of the energy system, such as price differences with major trading partners and interconnection capacity between EU countries

Material production specific energy consumption

Semiconductors - 3,000 MJ per kg

Silicon - 230 to 235 MJ per kg

Plastics from crude oil requires 62 to 108 MJ per kg (35% eff.)

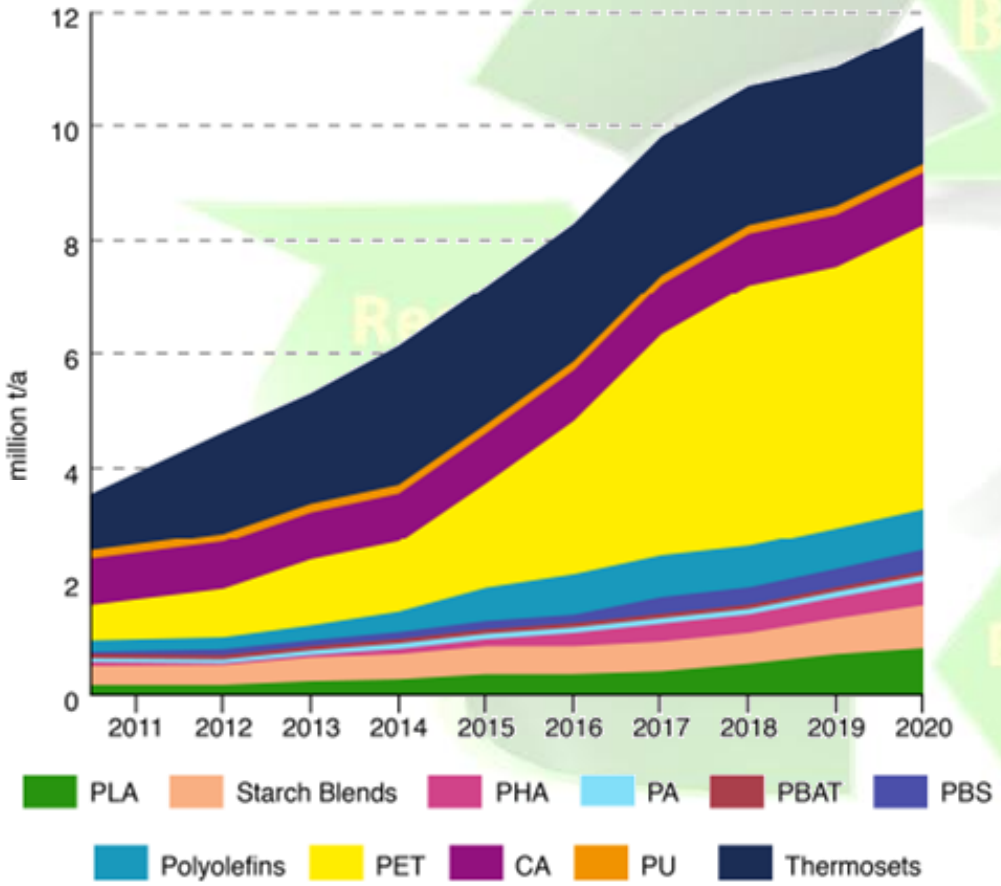
Steel (from iron) - 20-50 MJ,

paper (from timber) - 25-50 MJ per kilogram.

iron from iron ore requires 20-25 MJ of energy,

glass (from sand, etc.) - 18-35 MJ

Bio-based polymers market trend from 2011 to 2020



Polymers market in 2011:

Total production: 265 million tons

Bio-based polymers : 3.5 million tons

Bio-based polymers share 1.5%

Polymers market expected in 2020:

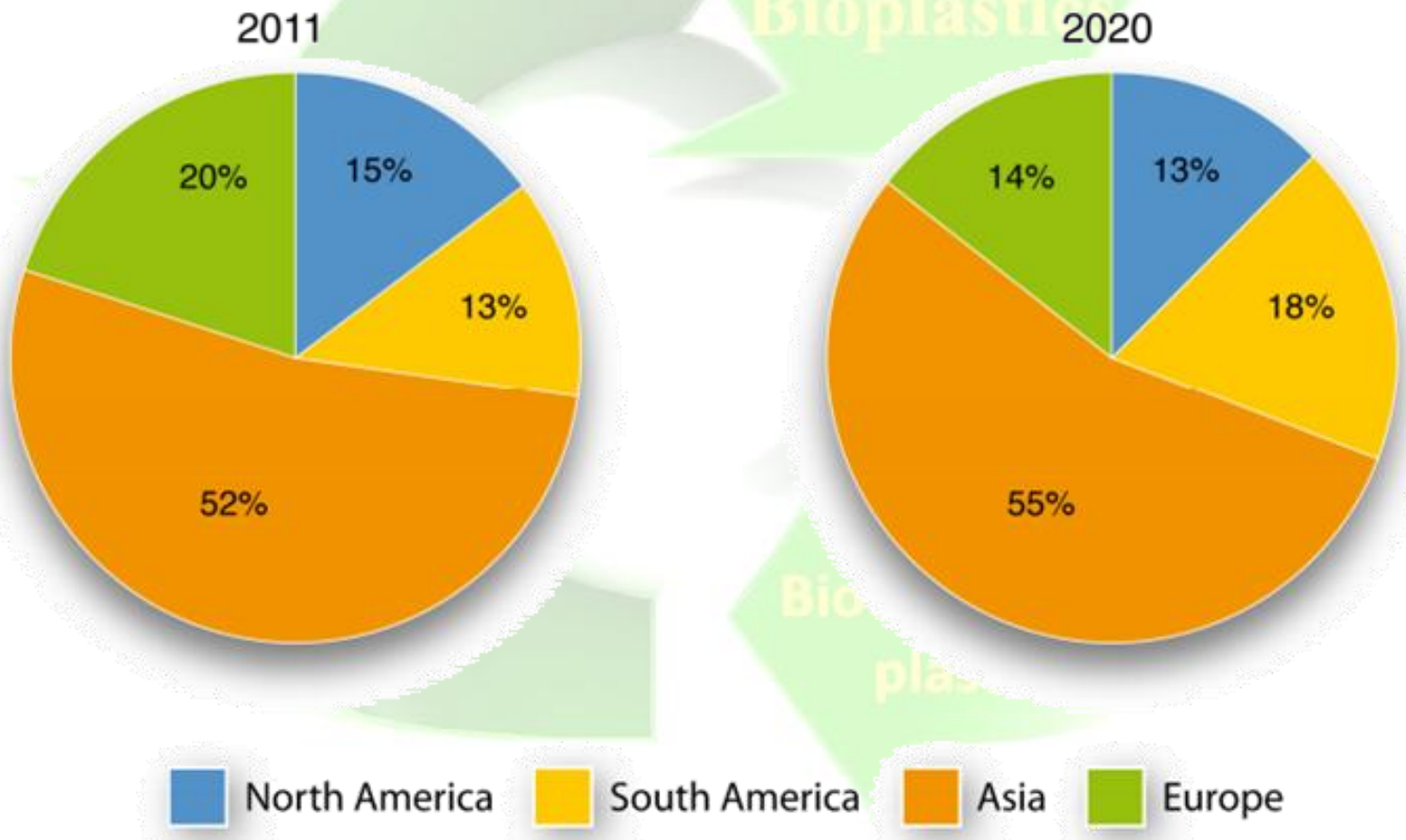
Total production: 400 million tons

Bio-based polymers: 12 million tons

Bio-based polymers share: 3%

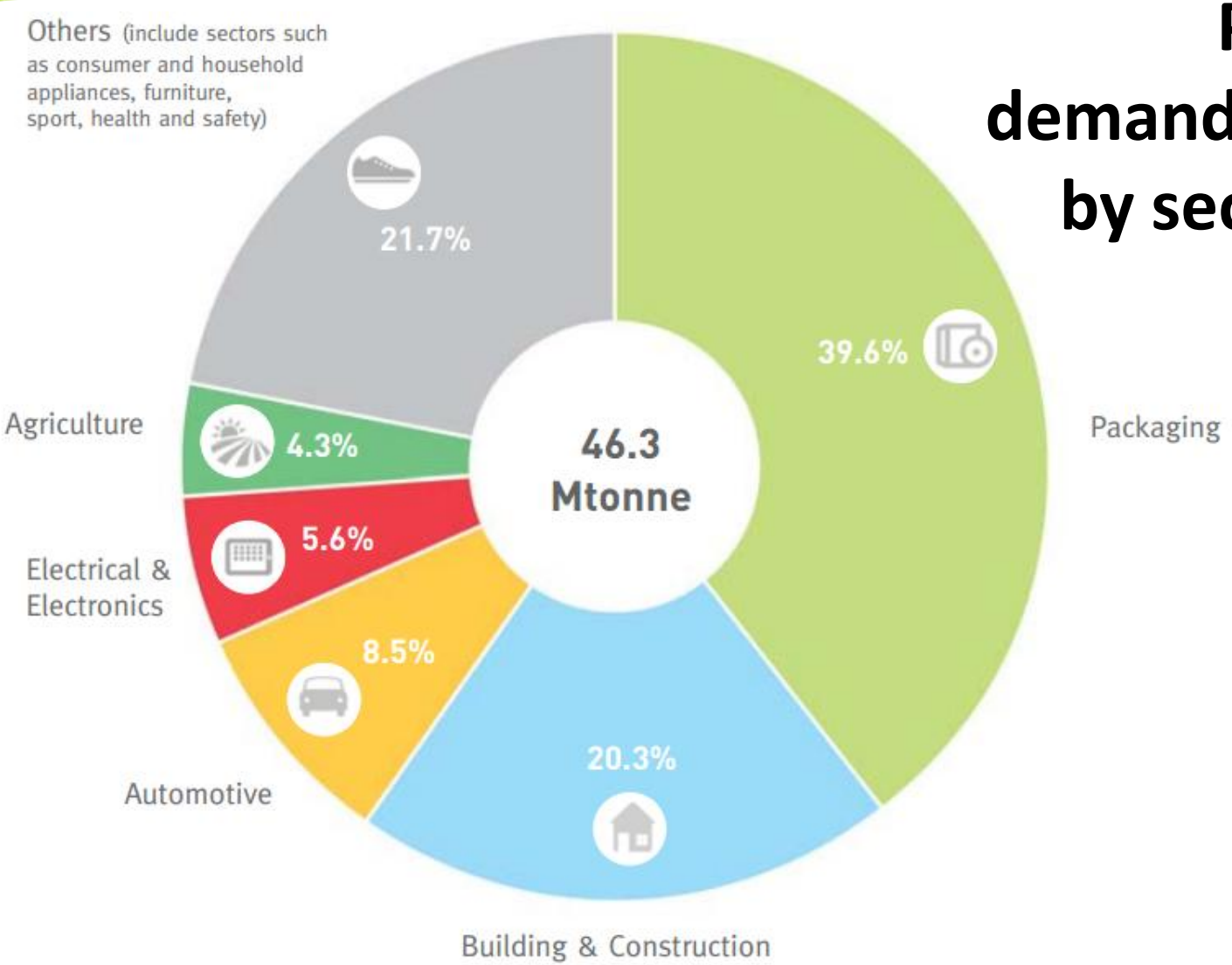
Source: NOVA Institute

Shares of biobased polymers production expected capacity in different world regions



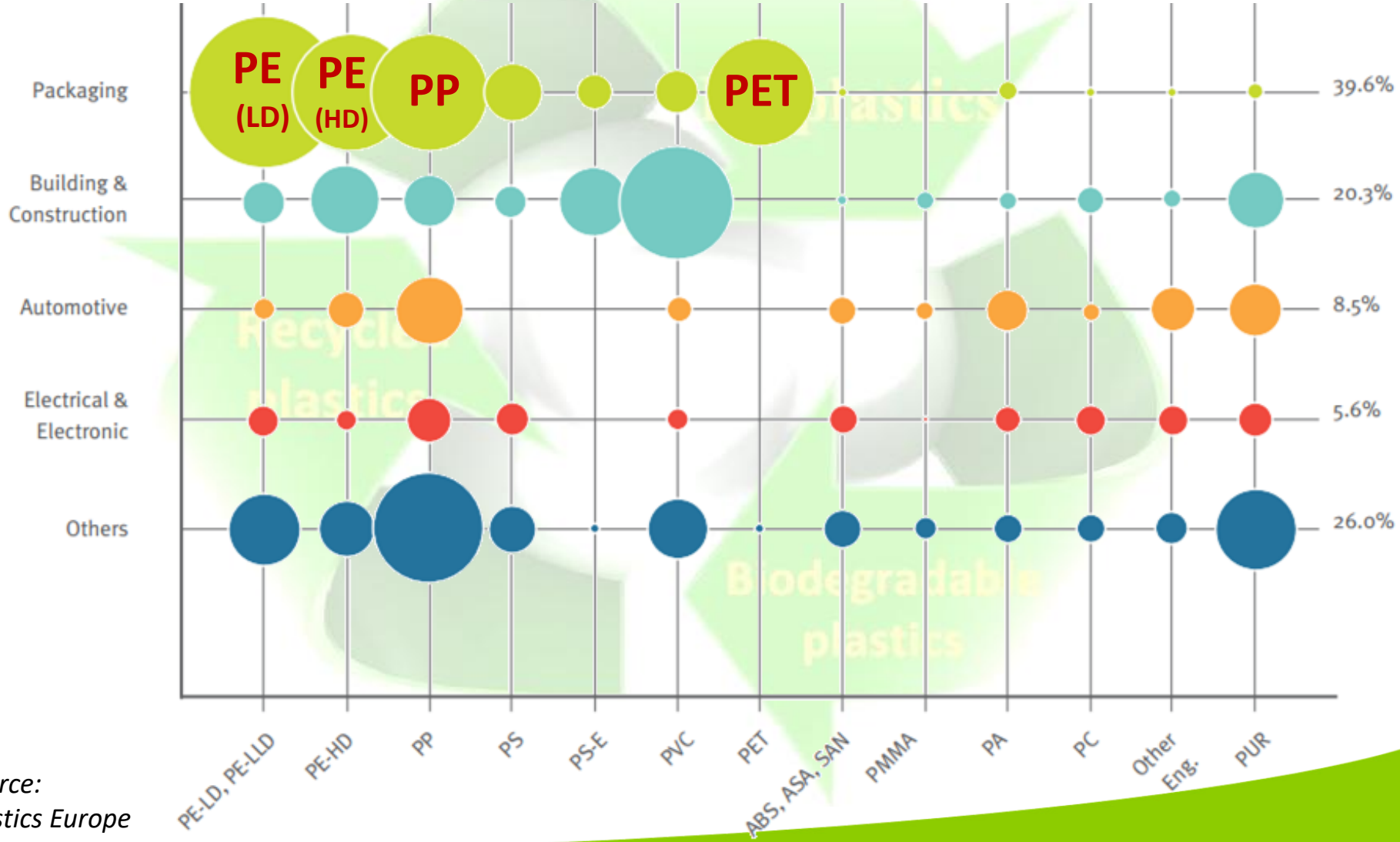
Source: NOVA Institute

Plastic demand in EU by sector in 2014



Source: Plastics Europe

European type of polymer demand by sector



Source: Plastics Europe

Market sector development foreseen for Biobased polyethyene (PE)

Biobased polyethylene production is stable at around 250,000 t/year, without a strong increase expected for 2020

Bio-Polyethylene (PE) is a 100% bio-based drop-in polymer. The bio-based building block needed is bio-based ethylene.
Polyethylene is produced as HD polyethylene (PE HD) and light Polyethylene (PE)

Bioethylene production systems:

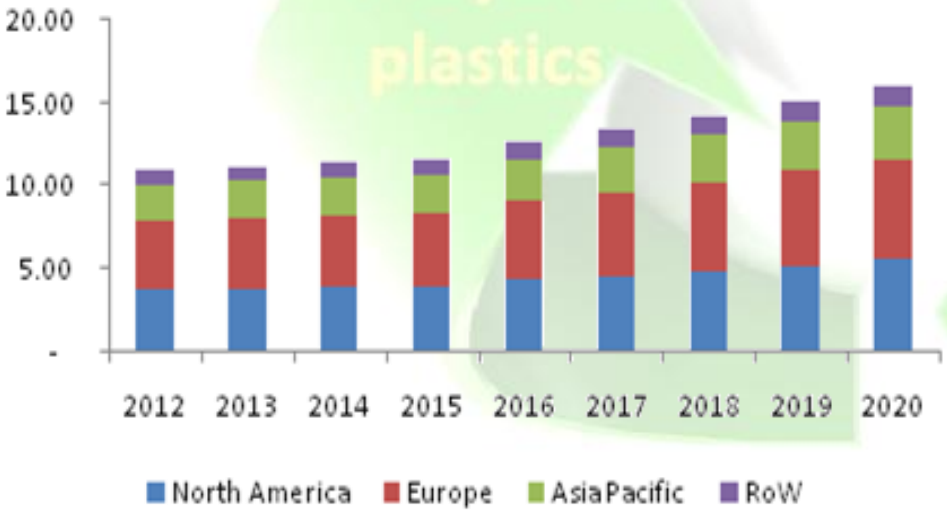
- Dehydratation of bioethanol using alumina catalyst (most used in Brazil and USA)
- Cracking of bionaptha from Fischer Tropsch process

Emergence of substitutes such as bio-based PET, PLA and PEF in packaging is expected to hamper bio-based PE market growth over the forecast period

Market sector development foreseen for Biobased polypropylene (PP)

Biobased polypropylene (PP) market is at a nascent stage. Most of the companies are pursuing activities on manufacturing naturally derived isopropanol and n-butanol.

Corn, biomass, and vegetable oil are typically used for the manufacturing of aforementioned biobased products



Global PP market trend from 2012 to 2020 (ktons)

Europe was the largest biobased PP market in 2013, with more than 35% of the global volume share.

The European Biobased polypropylene production in 2020 should be around 8,000 t/year

The promising market growth of PLA

PLA is expected to quadruple the capacity between 2011 and 2020.

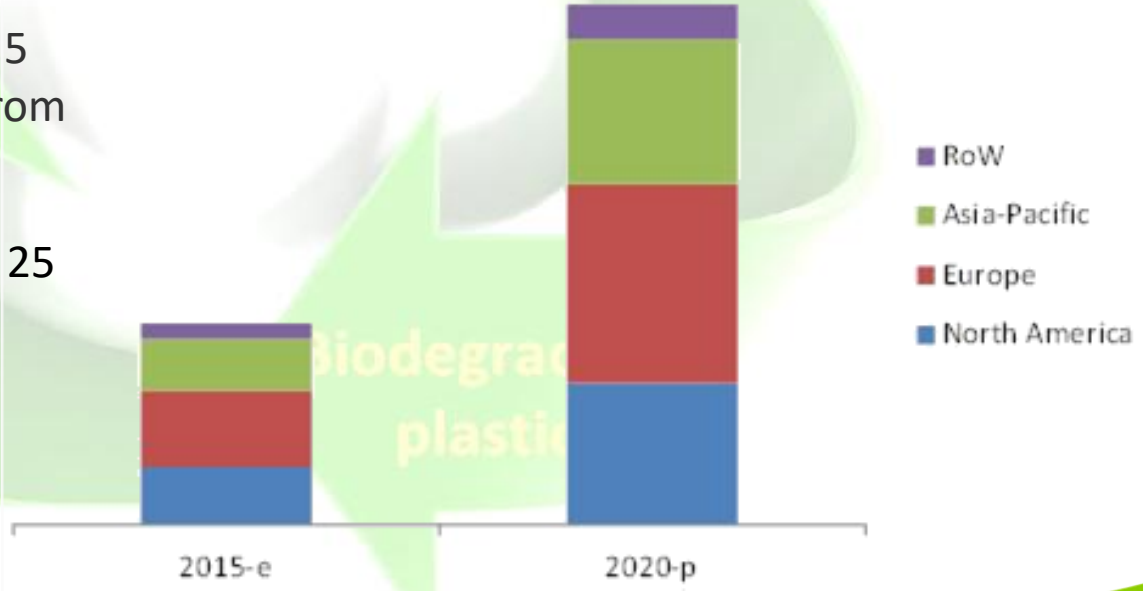
Polylactic acid (PLA) is a 100% bio-based and biodegradable (only under certain conditions) polymer, produced from lactic acid. Lactic acid (LA) is easily produced from starch bacterial fermentations and extracted.

In 2014, packaging application garners the highest share of 65.2% in the global PLA market.

PLA Market is expected to reach € 5 billion, at a growth rate of 19,5% from 2013 to 2020.

According to NOVA institute study, 25 companies produce more than 180,000 tons/year of PLA.

The capacity is planned to reach around 800,000 t/a by 2020.



Polylactic acid market perspectives. 2013

Source: Future Market Insights

Market sector development foreseen for Bio-based PET

Bio-based PET: 7 million production capacity by 2020

Bio-PET market in Europe, with food & beverage industry growth in Germany, France & UK, expects to reach over 2.8 billion € by 2023.

Bio Based Polyethylene Terephthalate (PET) Market size was 500.0 kilo tons in 2015.

Currently the material is 20% bio-based and produced out of glucose hydrolysis, fermented in two different tanks to gain ethanol and isobutanol, further processed into bio-based monoethylene glycol (MEG) and terephthalic acid (TPA) as a drop-in bio-based polymer

Polyethylene furanoate (PEF) is 100% bio-based and is produced out of bio-based 2,5-furandicarboxylic acid (2,5-FDCA) and MEG.

PEF is similar to PET. Both PEF and PET are used in bottle production, however PEF is said to have better properties, such as better barrier properties, than PET.

Europe driving the development: the pathway towards Biopolymers market growth

European supports the application of biobased building blocks

2008

Lead Market Initiative between 2008 and 2011: Taking Bio-based from Promise to Market

2012

- Communication on Industrial Policy also identifies bio-based products as an area where further investment should be encouraged
- Innovation for sustainable growth: A bio-economy for Europe

2013

- The Commission issued the standardization mandate M/430 on bio-polymers and bio-lubricants

- A Commission Expert Group for Bio-based Products was set up from 2013 to 2017. Expert Group's objective is to advise the Commission on the development of the bio-based products sector

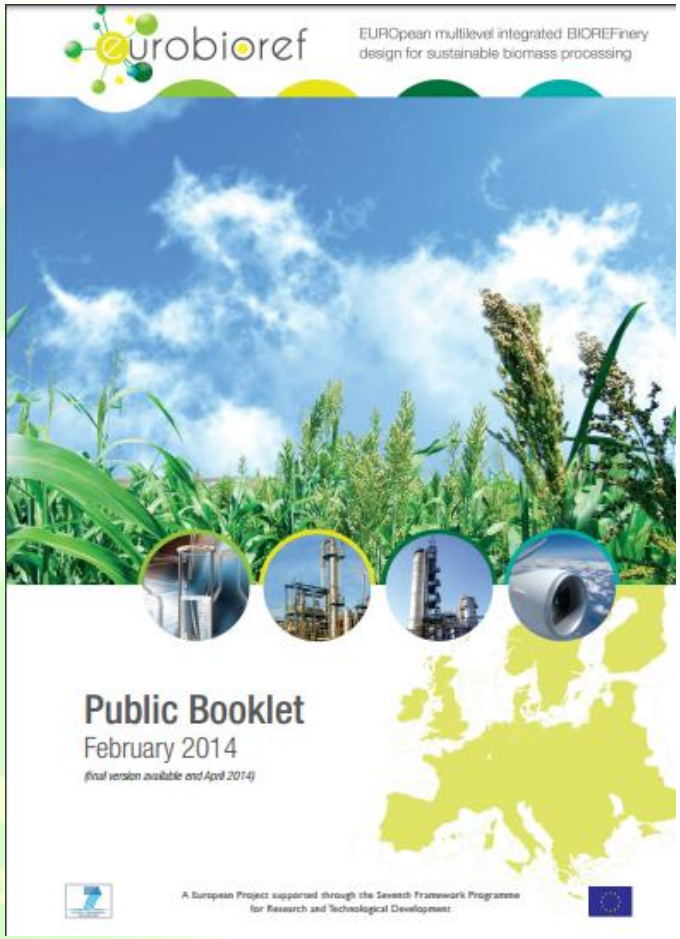
EuroBioRef

European Multilevel Integrated Biorefinery Design for Sustainable Biomass Processing

29 partners project from 15 countries

Demonstrating the technical and economic viability of the synergy of the biomass agro-industry with chemical, biochemical and thermochemical conversion processes.

Combination of technologies to optimise production routes of high added value bio aviation fuels, chemicals and polymers.



AGROCYCLE
for a circular economy

Sustainable techno-economic solutions for the agricultural value chain

WP 5: Biowaste valorisation into high value products

Task 5.2. Bioadditives for polymers or biopolymers

Extraction, purification and modification of valuable fractions from potato waste

Potato extracted proteins aqueous solution, partially denatured and processed

valorised as gas barrier biopolymers for packaging of oxidation sensitive food

Rice Bran processing and RB Oil extraction

Novel self nano-emulsifying drug delivery systems

polymer processing on compostable polymers (PLA, PHAs, and CDA)

bio-polymeric blends produced in lab scale

Thank you for your attention!

Andrea Salimbeni

EUBIA Project Manager

andrea.salimbeni@eubia.org

Skype: a_salimbeni