RoadToBio
Roadmap for the chemical industry towards a bioeconomy

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Consortium:

DECHEMA Gesellschaft für Chemische Technik und Biotechnologie e.V.

btg biomass technology group

E4tech Strategy | Energy | Sustainability

nova Institute for Ecology and Innovation

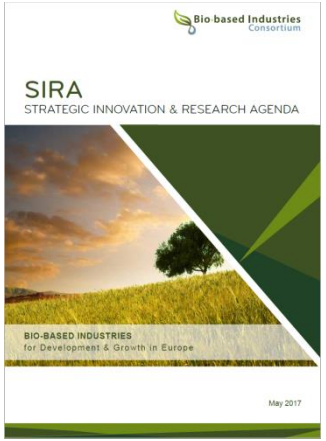
Horizon 2020
European Union Funding
for Research & Innovation

BIO-BASED INDUSTRIES Public-Private Partnership

Bio-based Industries Consortium

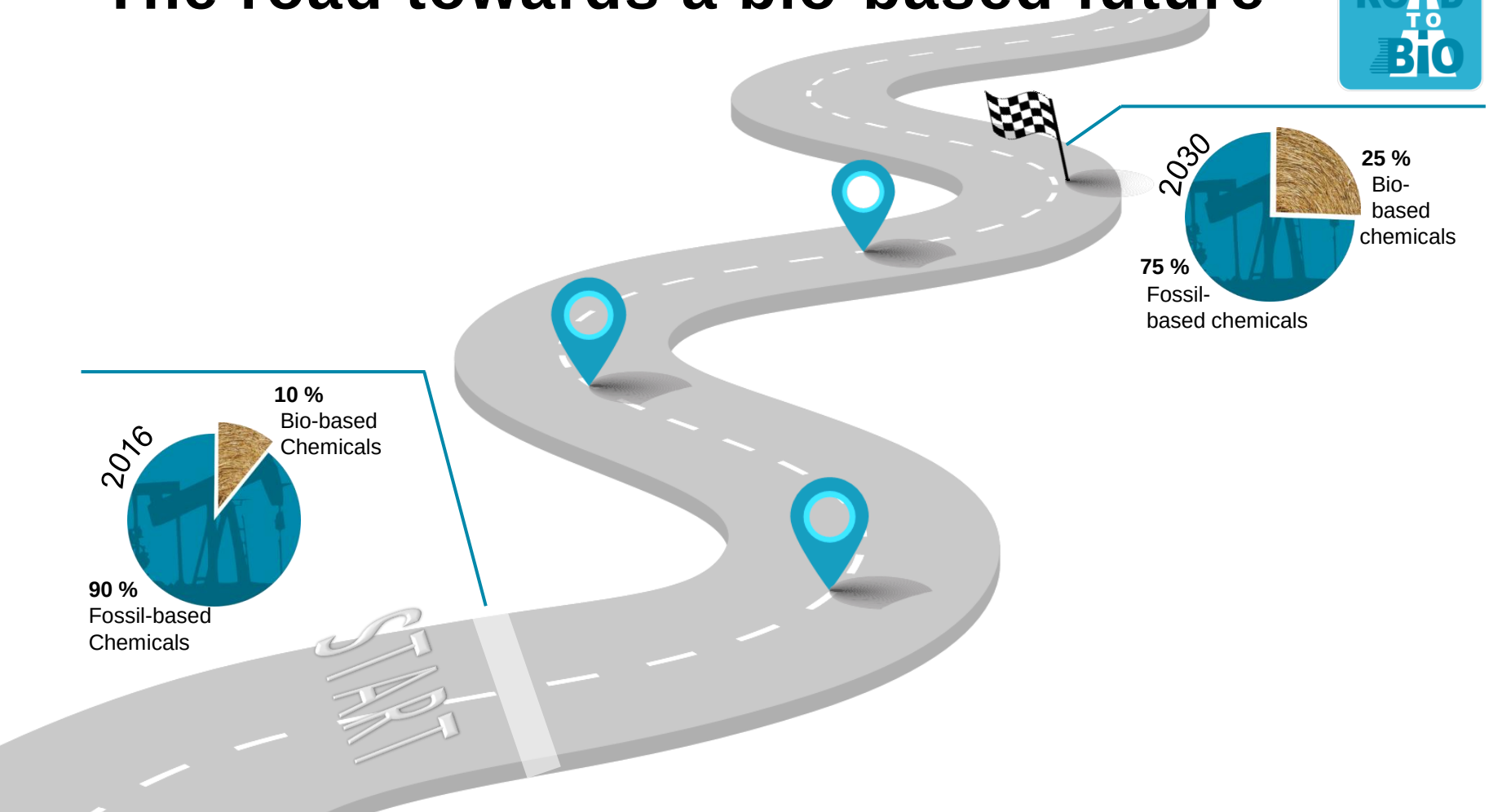
Project RoadToBio

- Duration: 24 Months (May 2017 – April 2019)
- Budget: 996.000 €
- Consortium:

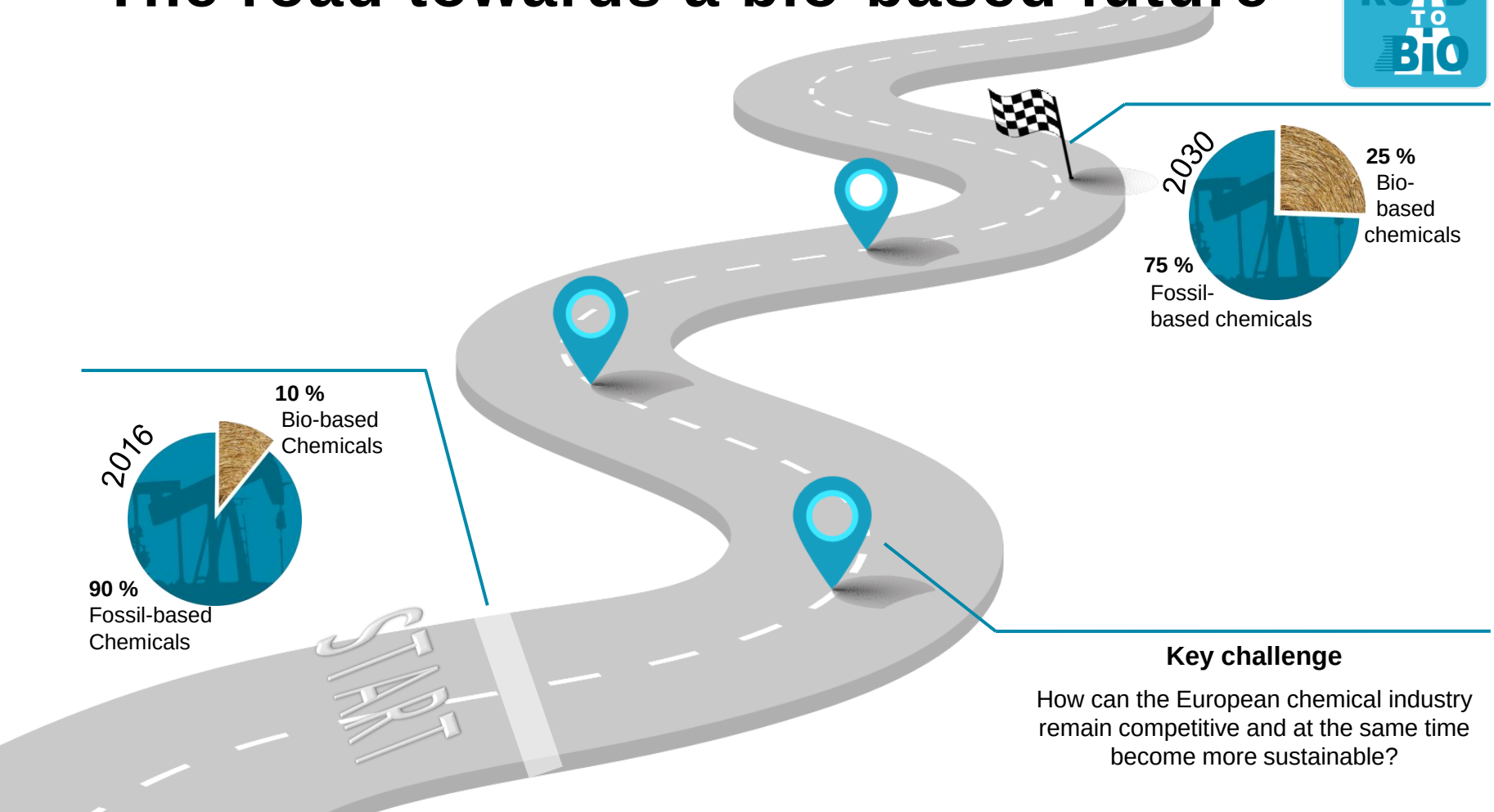


- Funded by: BBI JU (Bio-Based Industries Joint Undertaking)
  - Public-Private Partnership established in 2014
  - Developing sustainable and competitive bio-based industries in Europe
  - Partners: European Union (via EC) and Bio-based Industries Consortium (BIC)
  - www.bbi-europe.eu

The road towards a bio-based future



The road towards a bio-based future

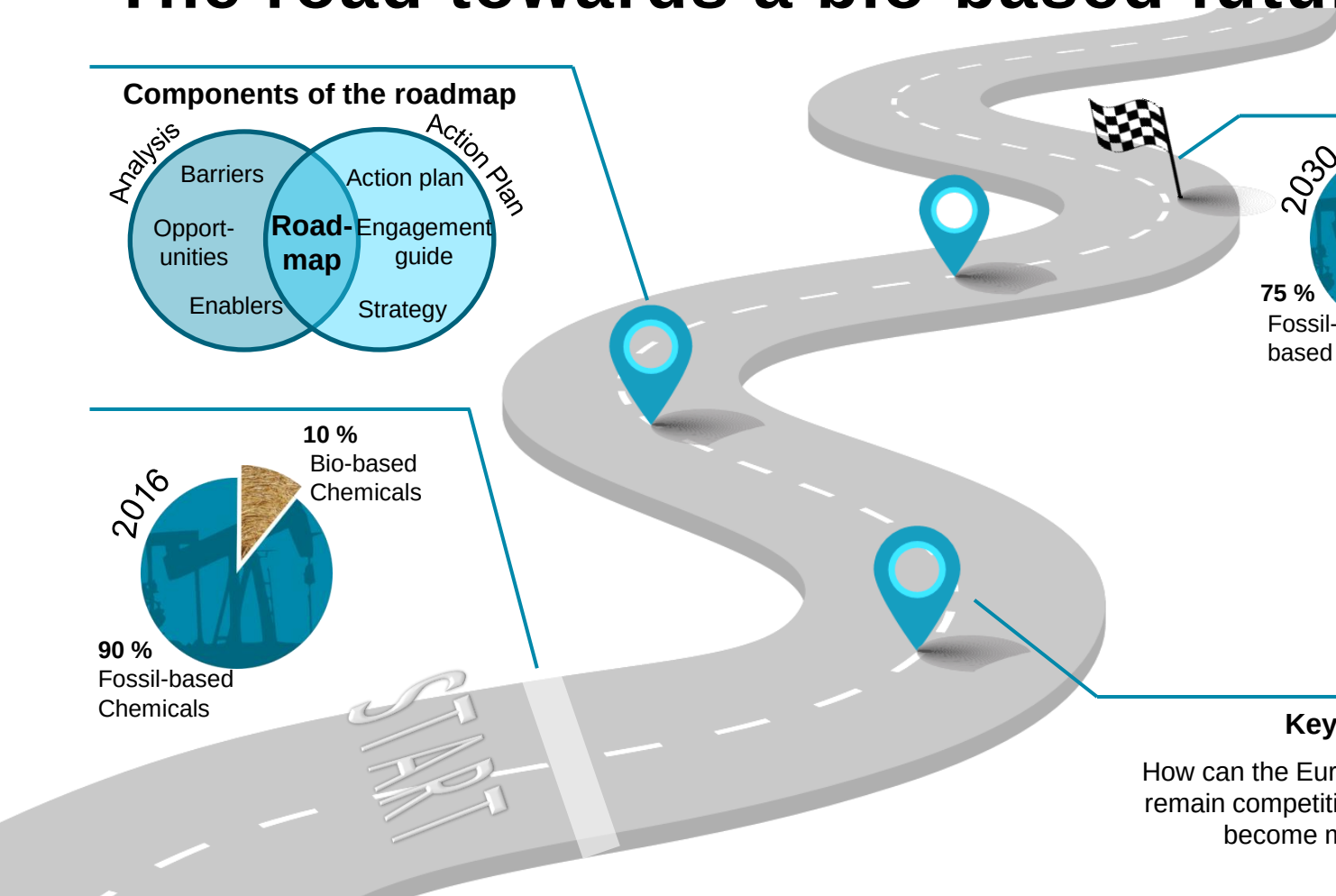


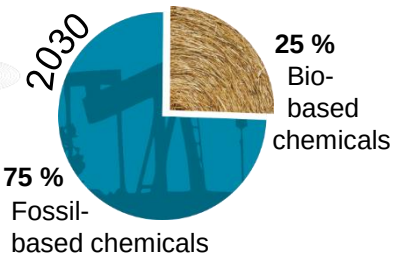
Key challenge

How can the European chemical industry remain competitive and at the same time become more sustainable?

The road towards a bio-based future

Components of the roadmap





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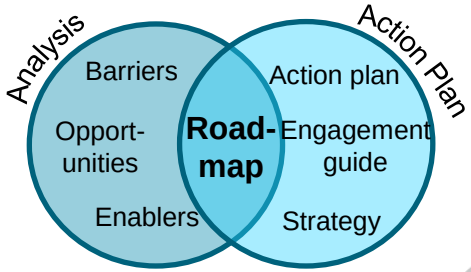
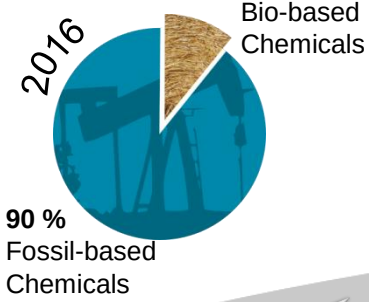
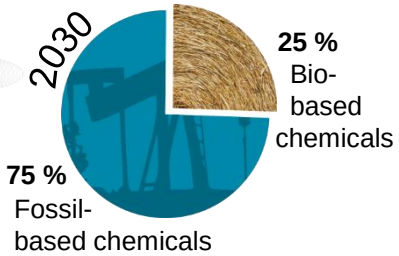






Stakeholder participation in creating the roadmap:

Chemical Industry
NGOs
Administrative Bodies
Governments

Key challenge

How can the European chemical industry remain competitive and at the same time become more sustainable?

What did we do?

Analysis

- Bio-based opportunities
- Public perception
- Regulatory barriers
- Case studies on potentially attractive opportunities

Stakeholder engagement

- Workshops
- Webinar
- Event participation
- Surveys
- Interviews

Roadmap

Strategy document

„Background report“

- EU bio-based background
- Nine product groups
- General barriers

Engagement guide

Set of three factsheets

1. Readers guide to roadmap
2. Key messages for communication on bio-based
3. Communication guide

Action plan

Brochure

- Actions that need to be performed to overcome
  - General barriers
  - Product group related barriers

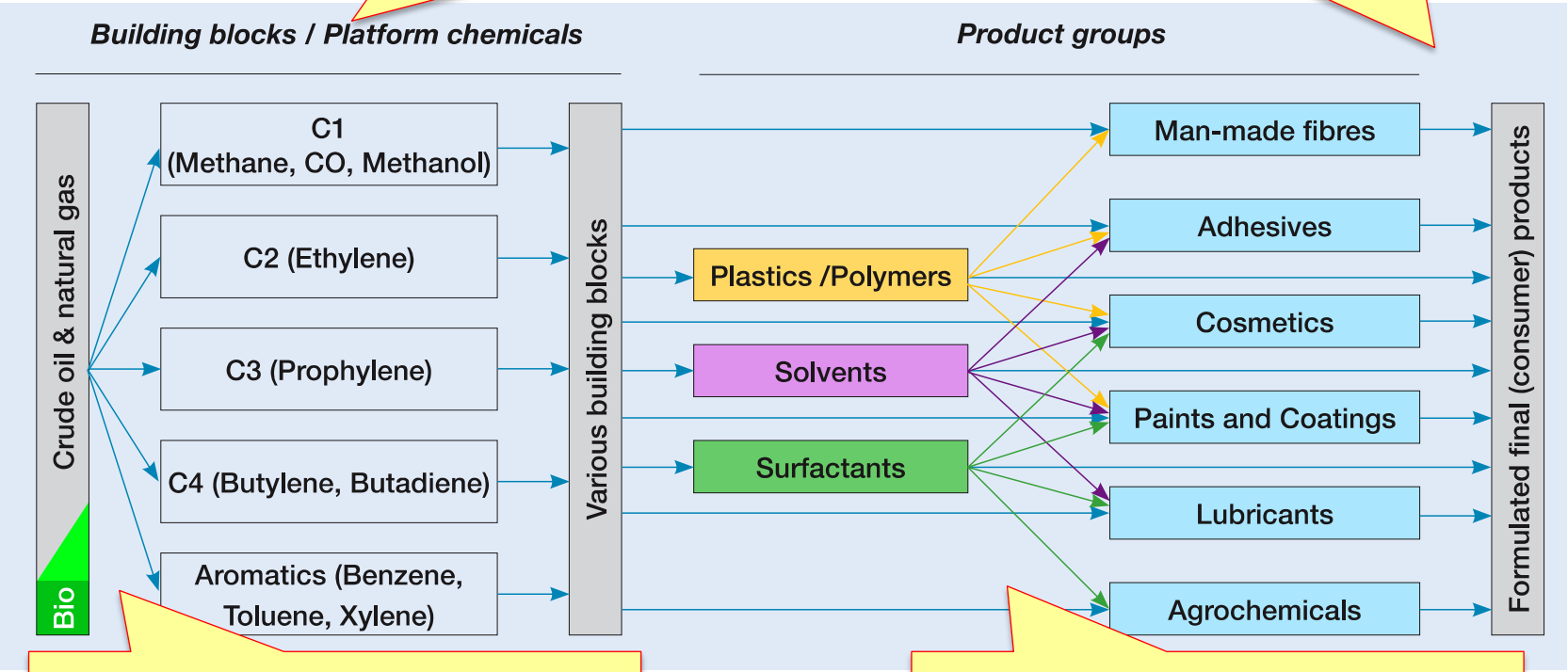
Strategy Document

- provides in-depth background information integrating all RoadToBio research activities
  - Introduction
    - EU bio-based background
    - Rationale for bio-based chemicals
    - RoadToBio project
  - Roadmap scope and objectives
  - Approach and methodology
  - Nine product groups
    - Current status and drive for bio-based chemicals/products
  - Barriers and recommended actions

RoadToBio project target, product groups and outcome

Opportunities and barriers identified

Potential actions recommended

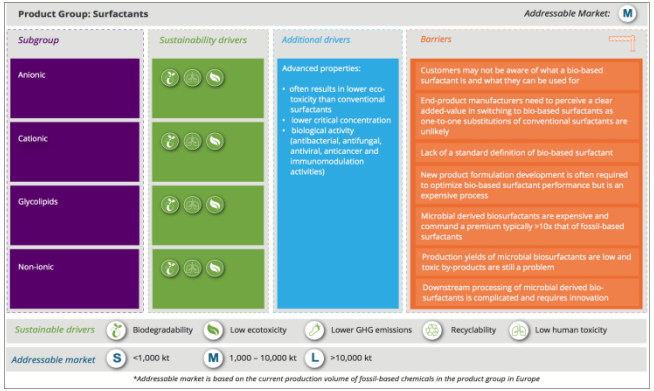


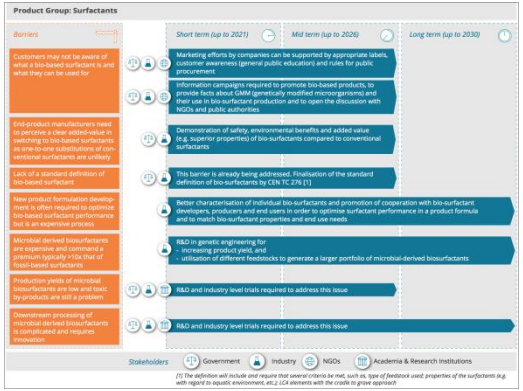
25% bio-based in 2030 (from 10%)

Focussed on nine product groups

Action Plan

- First entry point to the Roadmap
- The most important facts and figures at a glance!
  - Overview of product groups
  - Overview of all actions
- Linking to background information, to be consulted as needed

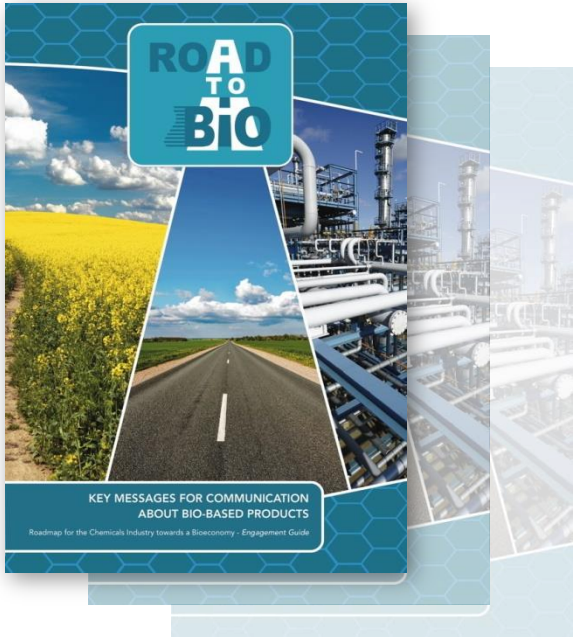




Engagement Guide

- ✓ Tips and tools to communicate about bio-based products
- ✓ Supplementary to the Action Plan
- ✓ Collection of factsheets in brochure style
- ✓ Tailored for the chemical industry

1. Readers Guide
2. Key Messages
3. Communication Guide



Engagement guide

Readers Guide

Content:

- How to read the Action Plan and Strategy document
- Recommendations for collaboration of stakeholders

What's in it for you?

- ✓ Helps you make the most of the Roadmap!
- ✓ Useful internal and external references

Communication Guide

Content:

- Recommendations for communication to three target groups: businesses, customers, societal stakeholders
- Including take home messages and info on communication channels
- Based on results and experiences of recent EU projects focused on communication

What's in it for you?

- ✓ Customizable messages to communicate to broader public
- ✓ Tips to tailor messages to your communication needs

Readers Guide

Content:

- Key Messages about the value of bio-based products
- Key Messages about sustainability efforts of the chemical industry

What's in it for you?

- ✓ Customizable messages to communicate to broader public
- ✓ Tips to tailor messages to your communication needs

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Public-Private Partnership

Bio-based Industries Consortium

Any chemical or material made from fossil oil or gas can be made from biomass

Background

Many chemicals, materials and consumer goods are made from fossil resources (e.g. plastics, synthetic fibres, washing detergents or solvents). The fossil resources (oil and natural gas) were originally biomass that was converted in a process spanning millions of years. Any fossil-based ingredient can be replaced by renewable biomass resources or biomass residues so that we can speed up or by-pass this process. In the current bioeconomy, chemicals and materials produced from biomass already replace fossil-based ones.

Chemicals or materials produced from biomass can help to reduce CO_2 emissions

Background

The carbon in fossil resources was captured millions of years ago and is released at the fossil-based products' end of life. This release of carbon dioxide (CO_2) contributes to an increase of greenhouse gas concentration in the atmosphere. Greenhouse gases are one of the major drivers of climate change. To stay below the 1.5-2°C target of global warming, 70% of all coal reserves and at least one third of oil and natural gas reserves need to stay in the ground or their CO_2 emissions have to be kept from entering the atmosphere.

In comparison, CO_2 released by renewable resources was recently captured and will be captured again when biomass is regrown to produce new products. This way, the carbon is kept in a shorter cycle (under sustainable cultivation practices).

When biomass is used instead of fossil resources, fossil carbon can remain in the ground. This way, renewable biomass resources contribute to limiting climate change and global warming.

Status quo of the bio-based chemical industry as starting point for the roadmap

Results of three product groups

Cosmetics

Agrochemicals

Paints & Coatings

Presented by:

Yamini Panchaksharam – E4tech

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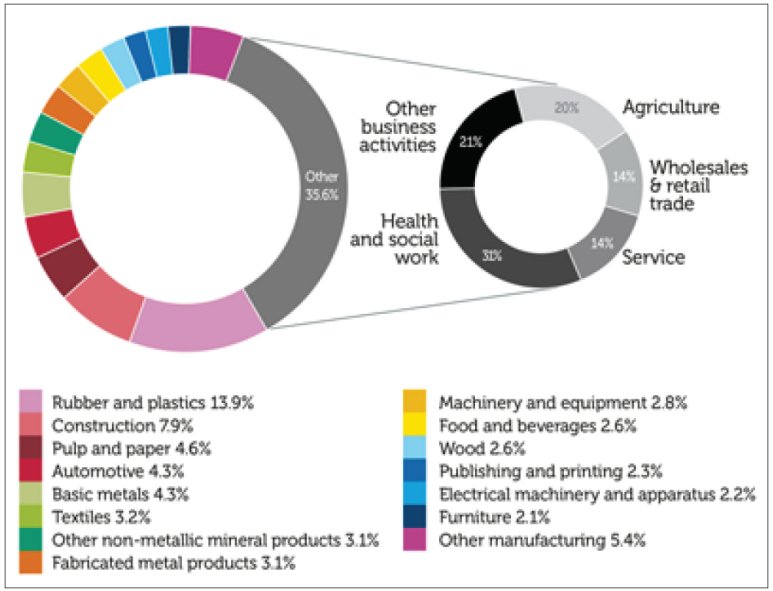
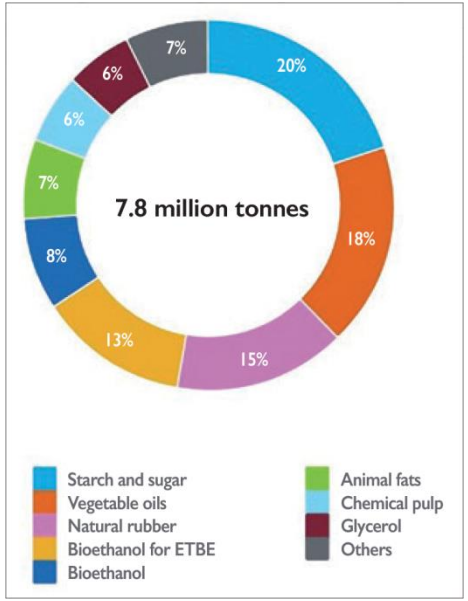
Status quo of the bio-based chemical industry as starting point for the roadmap

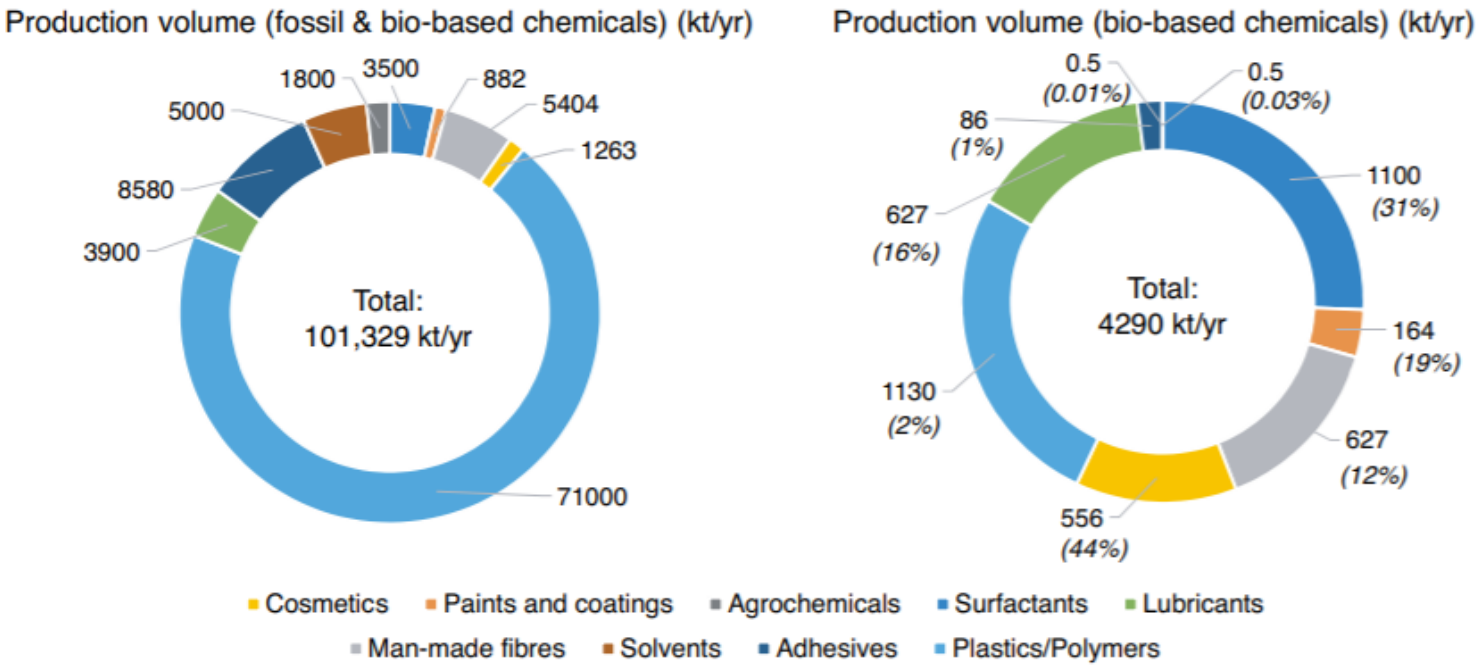
Contribution of the chemical industry to the EU economy (Source: Eurostat and Cefic)



Bio-based raw materials use in the EU chemical industry (Source: Cefic)



Volumes of bio-based chemicals vs total volume of chemicals in nine product groups in the EU



(reference year: 2015)

RoadToBio covered nine product groups

Image source: pixabay

Sustainability characteristics of bio-based chemicals and their fossil equivalents in the solvents product group

Sub-product group	Bio-based chemicals identified	% of bio-based content in the chemical identified	Category Drop-in/ smart drop-in/ dedicated	Sustainability characteristics					Comments	TRL
				B	LHT	Low GHG	LE	R		
Hydro-carbons	Bio-based xylene *(bio-based alternative for xylene)*	100	Drop-in	X				X		6-7
Hydro-carbons	D-Limonene *(identified as bio-based alternative for xylene)*	100	Dedicated	X	X	X	X	X	In terms of performance, D-limonene is the next best substitute for xylene. But these solvents still retain some level of toxicity, their odours may become over-powering during prolonged exposure and they can be incompatible with some of the mounting media. D-Limonene solvents also dry very slowly compared to xylene and they often leave an oily residue.	9
Hydro-carbons	Bio-based toluene *(bio-based alternative for toluene)*	100	Drop-in	X				X	**LHT and LE are desired sustainability characteris-tics**, however toluene does not fulfil this requirement.	6-7

Key:
B=Biodegradable, LHT=Low human toxicity, Low GHG, LE=Low ecotoxicity, R=Recyclability

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Cosmetics

Product Group: Cosmetics

Addressable Market: S

Subgroup	*Sustainability drivers*	*Additional drivers*	*Barriers*
Botanical extracts		EU-based production of bio-based cosmetics ingredients can reduce regulatory burdens to commercialization, which are high when importing ingredients from outside the EU	Producers are concerned about the functionality, cost competitiveness and availability of bio-based ingredients
Other building blocks / functional ingredients	Case dependent, can include:		Long and expensive approval process for switching from one chemical to another especially if they are derived from residues or GMO
Solvents			Different cosmetics companies have different definitions of 'natural' or 'bio'. For e.g. some companies reject bio-butanol as feedstock if it is derived from GM corn
Vegetable oils			The information on difference between organic and natural is not clear

Sustainable drivers: Biodegradability; Low ecotoxicity; Lower GHG emissions; Recyclability; Low human toxicity

Addressable market: S <1,000 kt; M 1,000 – 10,000 kt; L >10,000 kt

**Addressable market is based on the current production volume of fossil-based chemicals in the product group in Europe*

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Cosmetics

Product Group: Cosmetics

Barriers	Short term (up to 2021)	Mid term (up to 2026)	Long term (up to 2030)
Producers are concerned about the functionality, cost competitiveness and availability of bio-based ingredients	R&D to improve functionality R&D to Improve biomass supply by enabling Europe to produce highly productive crops rather than import Develop cost effective methods for extracting bio-active ingredients from feedstock Develop products using novel feedstocks like algae R&D to focus on the development of bio-based cosmetics that outperform fossil equivalents		
Long and expensive approval process for switching from one chemical to another especially if they are derived from residues or GMO	Shorter and more affordable approval procedures for chemicals that are not toxic + if they have the identical chemical structure as one that has already been approved Financing options to cover approval procedures, partly from the government and industry		
Different cosmetics companies have different definitions of 'natural' or 'bio'. For e.g. some companies reject biobutanol as feedstock if it is derived from GM corn	Consultative process between industry, policy and consumers to align understanding and increase standardisation		
The information on difference between organic and natural is not clear	Improve labeling in cosmetics (Interest is high, labels are not as well-known as in food)		

Stakeholders Government Industry Academia & Research Institutions Consumers

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Agrochemicals

Product Group: Agrochemicals

Addressable Market: M

Subgroup	*Sustainability drivers*	*Additional drivers*	*Barriers*
Coatings for fertilizers		Potential for new bio-based formulations that overcome the problem of pesticide resistance	Bio-based agrochemicals face tough competition from established fossil-based equivalents
Fungicide			Bio-based alternatives need to be compatible with the plants (low/no phytotoxicity)
Insecticide			Few bio-based solvents available for agrochemicals that fulfil functionality like solvency and compatibility with wide range of active ingredients
Solvents for insecticides and pesticides			European agrochemical industry is strictly regulated. Use of new ingredients in products is subject to long and often expensive approval procedures

Sustainable drivers: Biodegradability; Low ecotoxicity; Lower GHG emissions; Recyclability; Low human toxicity

Addressable market: S <1,000 kt; M 1,000 – 10,000 kt; L >10,000 kt

**Addressable market is based on the current production volume of fossil-based chemicals in the product group in Europe*

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Agrochemicals

Product Group: Agrochemicals

Barriers	Short term (up to 2021)	Mid term (up to 2026)	Long term (up to 2030)
Bio-based agrochemicals face tough competition from established fossil-based equivalents	Gradually increase the bio-based content of commercially-available agrochemicals by replacing some of their fossil-based intermediates or building blocks with bio-based drop-ins in the agrochemicals' manufacturing process		
Bio-based alternatives need to be compatible with the plants (low/no phytotoxicity)	Focus efforts on developing bio-based chemicals that have low/no phytotoxicity effect and are reliable when applied in open field		
Few bio-based solvents available for agrochemicals that fulfil functionality like solvency and compatibility with wide range of active ingredients	Invest in R&D and innovation to create solvents for agrochemicals with superior functionality		
European agrochemical industry is strictly regulated. Use of new ingredients in products is subject to long and often expensive approval procedures	Explore option of shorter and more affordable approval procedures. There is a low risk category within the legislation 1107/2009 that places plant protection products on the market. This could be readily adapted for speedier approval of bio-based pesticides and is already ratified by the European Parliament, but has not been actioned by European Commission		
	Financial support to SME for approval procedures		

Stakeholders Government Industry NGOs Academia & Research Institutions

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Paints & Coatings

Product Group: Paints and coatings

Addressable Market: S

Subgroup	*Sustainability drivers*	*Additional drivers*	*Barriers*
Additives		Improved reduced drying time Performance enhancer for waterborne paints, high viscosity and stability	Bio-based solvents and coating materials are not yet cost competitive with fossil equivalents
Binder		Advanced properties like better drying properties	High costs involved in the development of new formulations
Polymer/Hardener		Improved hydrophobicity, flexibility and chemical resistance	Performance issues such as the yellowing of some bio-based substances
Solvents			Changes in product properties require new paint application techniques

Sustainable drivers: Biodegradability; Low ecotoxicity; Lower GHG emissions; Recyclability; Low human toxicity

Addressable market: S <1,000 kt; M 1,000 – 10,000 kt; L >10,000 kt

**Addressable market is based on the current production volume of fossil-based chemicals in the product group in Europe*

Image source: pixabay; RoadtoBio consortium in cooperation with Drohm Design

Paints & Coatings

Product Group: Paints and coatings

Barriers

- Bio-based solvents and coating materials are not yet cost competitive with fossil equivalents
- High costs involved in the development of new formulations
- Performance issues such as the yellowing of some bio-based substances
- Changes in product properties require new paint application techniques

Short term (up to 2021)	Mid term (up to 2026)	Long term (up to 2030)
Regulations required to drive bio-based share in paints and coatings		
Carbon tax, subsidizing bio-based products while taxing fossil equivalents		
Development of new formulation systems / databases		
Funding schemes/establishment of technology platforms for the development of new formulations		
Identification/matching of ingredient properties and applications		
Educate users on application techniques with appropriate labelling and instructions, whilst also raising public awareness about the benefits of bio-based paints		

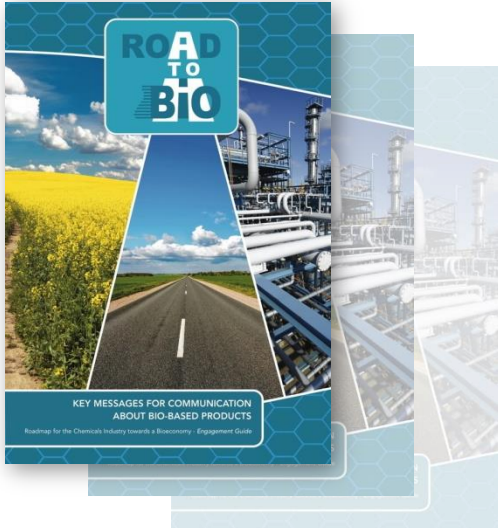
Stakeholders

Government | Industry | NGOs | Academia & Research Institutions

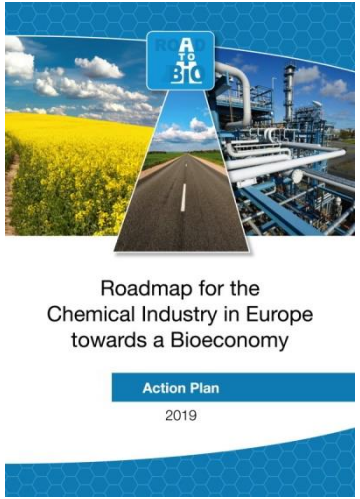
Thank you for your attention

Roadmap Downloads: https://roadtobio.eu

Strategy document



Engagement guide



Action plan

This project has received funding from the Bio Based Industries Joint undertaking und the European Union´s Horizon 2020 research and innovation programme under the grant agreement No 745623.

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