4 REGIONS FOR BIOECONOMY

ECRN
European Chemical Regions Network

VANGUARD INITIATIVE
New growth through smart specialisation

Bioeconomy Pilot

Interregional cooperation on innovative use of non-food Biomass

Ilaria Re
Consorzio Italbiotec and Lombardy Green Chemistry Association
Technical coordinator of the Bioeconomy Pilot of the Vanguard Initiative

30 JUNE 2020 | Training Webinar 1: Biochemicals: status-quo at EU level and roadmap

The Lombardy Green Chemistry Association

Shaping the bio-based bioeconomy as one of the most powerful tools for sustainable development

Consorzio Italbiotec

Regione Lombardia
Cluster Tecnologici Lombardi

VANGUARD INITIATIVE
New growth through smart specialisation

- Founded in 2013 by Consorzio Italbiotec, the Italian lending no-profit organization on biotechnology sector together with other public and private R&D institutions
- Recognised in 2015 by the Lombardy Region as the regional Cluster of Bioeconomy and Green Chemistry
- Since 2016 technical coordinator of the Bioeconomy Pilot of the Vanguard Initiative

Our contribution to green acceleration

Shaping the bio-based bioeconomy as one of the most powerful tools for sustainable development

POLICIES DEVELOPMENT AND GOVERNANCE ACTION PLAN DESIGN

To promote the establishment of a regional bioeconomy supporting the Smart Specialization Strategy implementation .

KNOWLEDGE TRANSFER AND NEW BUSINESS OPPORTUNITIES CREATION

To combine the expertise of more than 65 actors covering the local network of the bioeconomy and the entire innovation chain.

BUSINESS DEVELOPMENT AND MARKET UPTAKE

To encourage the cross-regional cooperation to bioeconomy and circular economy sectors and supporting business cases creation.

NETWORKING & CONSORTIA BUILDING

To increase the internationazation of the industrial companies, universities and research institutes

52 members	4 value chains	+50

- 27 SMEs
- 7 Big industries
- 6 NGOs
- 6 Universities
- 6 Research Institutes

- AGROFOOD
- GREEN CHEMISTRY
- FOOD/PHARMA
- WOOD

European, national and regional funded projects on bioeconomy, circular economy fields.

- 65% beyond TRL 6 with validation of pilot plan at industrial level

New growth through the Smart Specialization

The Vanguard Initiative mission and benefits for EU regions

www.s3vanguardinitiative.eu

SUPPORTING THE SETTING UP OF INTERREGIONAL NETWORKS

FACILITATING ACCESS TO COMBINED FUNDING FOR CO-INVESTMENT PROJECTS

EXPLORING SOLUTIONS TO LEVERAGE PUBLIC-PRIVATE INVESTMENTS FOR DEMONSTRATION AND PILOTING NEW VALUE CHAINS

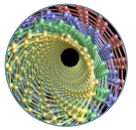
IMPLEMENTATION OF SMART SPECIALIZATION STRATEGIES TO FOSTER BETTER ALIGNMENT BETWEEN THE REGIONS

Bioeconomy

Efficient and Sustainable Manufacturing (ESM)

High Performance Production through 3D-Printing

Advanced Manufacturing for Energy Related Applications in Harsh Environments (ADMA Energy)



New Nano-Enabled Products Pilot

VANGUARD INITIATIVE

The Bioeconomy Pilot

Pilot's objectives and Vanguard Initiative regions engagement

Exploit the potential of the bio-based sector

Creation of new integrated bio-based value chains and connections between chemistry, agro-food, bioenergy, biofuels sectors

Trigger new interregional business opportunities

Promote new business opportunities through interregional cooperation, exchange of ideas and capitalisation the regional projects results

Support high innovation potential demo projects

Encourage projects at the demonstration stage towards their upgrading and business exploitation (beyond TRL 5).

Attract public-private investments

Support the establishment of investment pipelines based on industry-driven business cases coherent with the Smart Specialization strategies of the participating regions.

2 Co-leading regions - Lombardy and Randstad

18 Vanguard regions committed

3 Demo-cases operational at TRL 8

8 Use-cases engaging 50+ public-private entities

Basque Country	Małopolska	Randstad/Zuid Holland	Värmland
Emilia-Romagna	Navarra	Scotland	Wales
Flanders	North Netherlands	Slovenia	Wallonia
Lombardy	North Rhein-Westphalia	South Netherlands	
Lower Austria	Piedmont	Upper Austria	

The Bioeconomy Pilot demo-cases

New bio-based chemicals and biofuels pilot plants

4	12	18	50+ M€	50+ industries
Demo-case	Use-cases	regions involved	mobilized	& RTOs involved

Bioaromatics demo-case	Lignocellulosic biorefinery demo-case	Liquified Bio-methane demo-case	Biopolymers demo-case
			
Creating interregional value chains to produce lignin-based aromatic molecules and innovative sustainable materials	Set-up of European value chains from lignocellulose biomass to intermediate and end-products of bulk and fine chemicals.	Enhance wide diffusion of bio liquified natural gas for sustainable transport across Europe, by advancing the state of the art of biogas upgrading	Creating interregional value chains by matching polymer market applications and new biobased technologies

ESTIMATES OF EU BIO-BASED PRODUCTION

• Platform chemicals	181 kt/a	0.3% EU bio-based production share
• Polymers for plastics	268 kt/a	0.4% EU bio-based production share
• Paints, coatings, inks and dyes	1,002 kt/a	12.5% EU bio-based production share
• Surfactants	1,500 kt/a	50.0% EU bio-based production share

PREDICTED EU BIO-BASED PRODUCTION AND PRIVATE INVESTMENTS IN 2025

Platform **Chemicals** and **adhesives** are expected to growth the most relative terms, at **10% per year**.

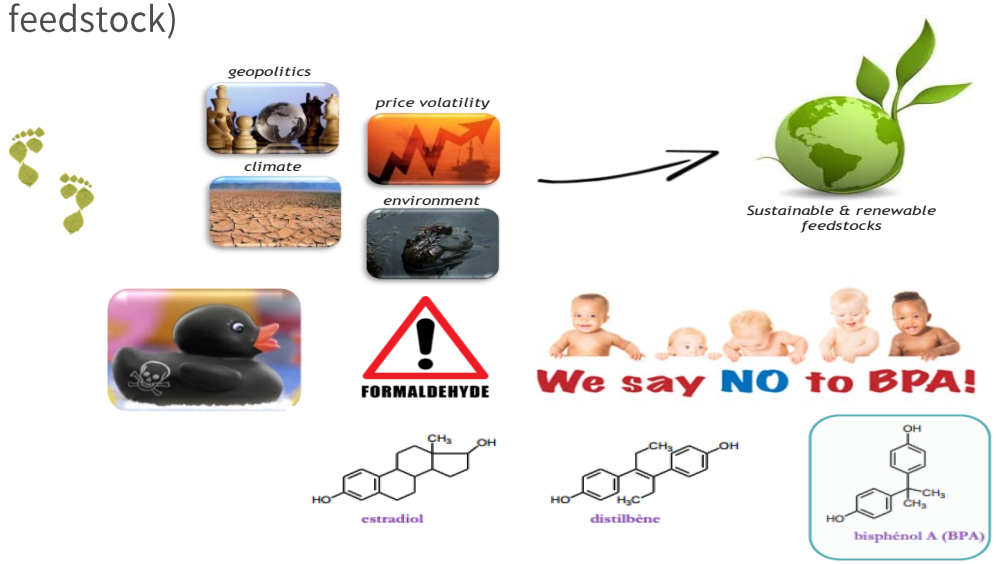
Sources: JRC, Insight into the European market for bio-based chemicals. Analysis based on 10 key product categories, 2019

The bioaromatics demo-case

Leader: Flanders, BE (Ludo Diels)
Co-leaders: South Netherlands, NRW

Drivers and opportunities for development of 'lignocellulosic feedstock to aromatics'

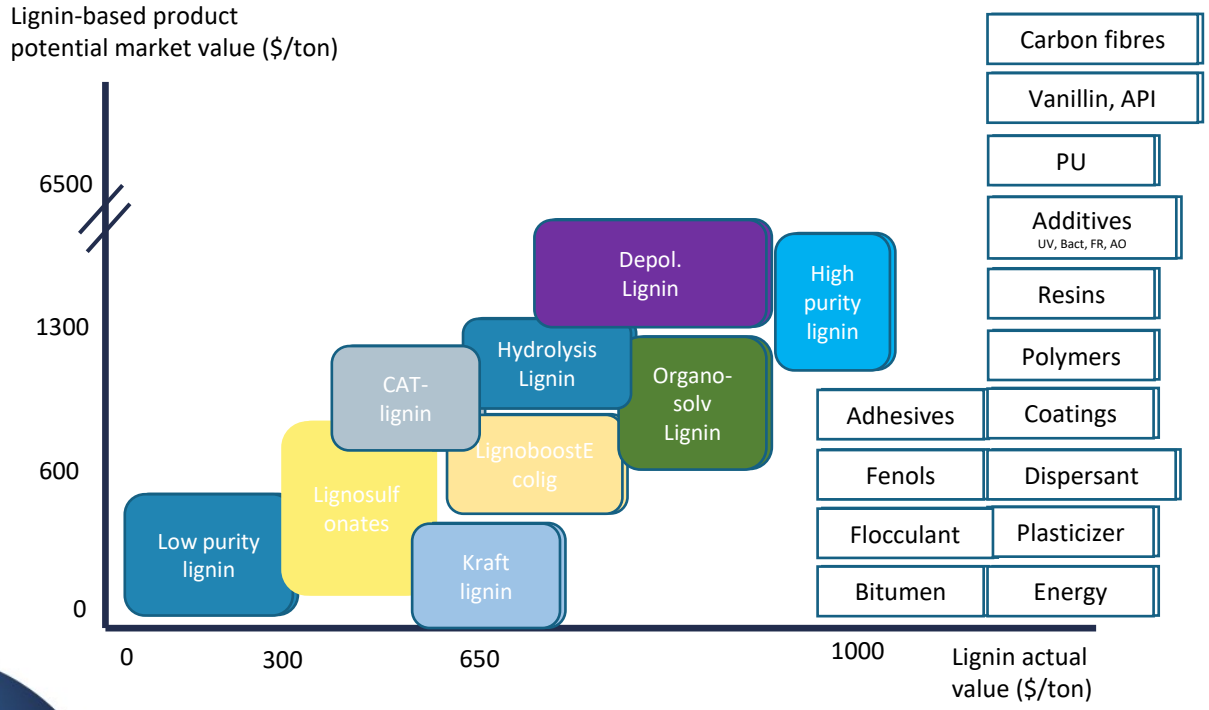
- Societal driver for transition to bio-economy (i.e. renewable feedstock)
- Reducing footprint of industrial processes
  - Use of biomass
  - Use of functionality (less steps)
- Innovation in chemicals & materials
  - Safer, performance-based products
  - Through disruptive enabling process technologies
- Economic drivers
  - 40% of chemicals are aromatic (>23 mln tons BTX-fenol)
  - Inability to valorize lignin is a lost opportunity in biorefining
  - Recovery boiler (P&P) is limited in solids content, removal of lignin solves this problem
  - Shale gas does not deliver higher than C3
  - 25% of world production in Europe (large amount of jobs)

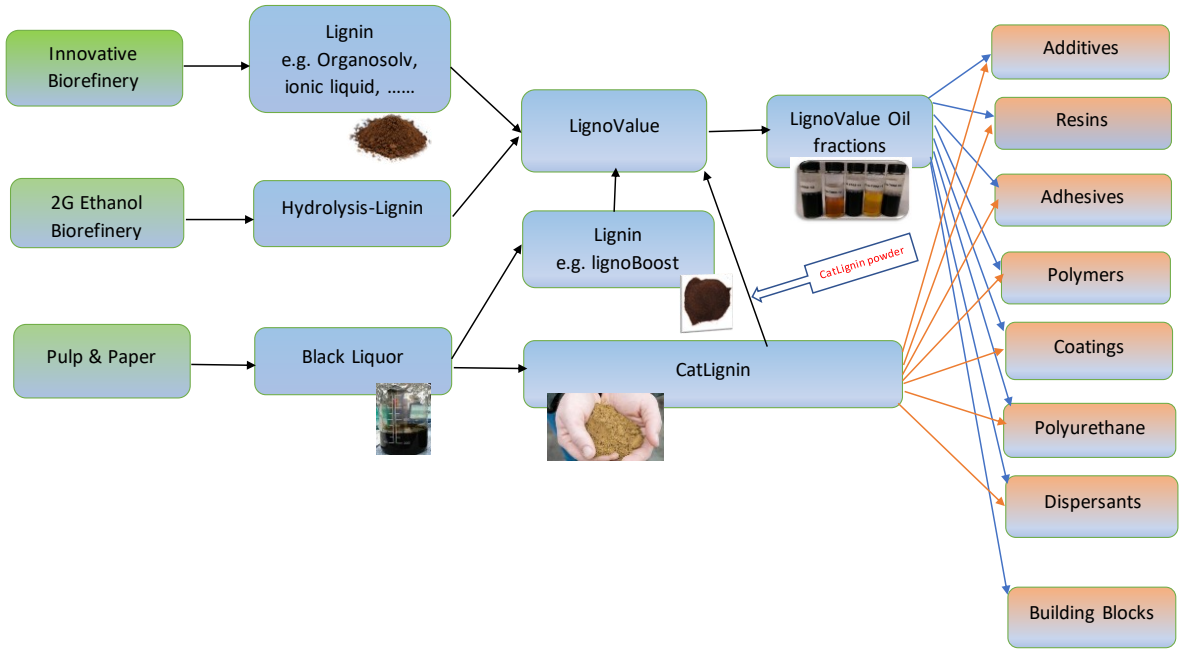


Source: Bioaromatics demo-case presentation by Ludo Diels

Lignin value vs lignin-based product value

The bioaromatics demo-case

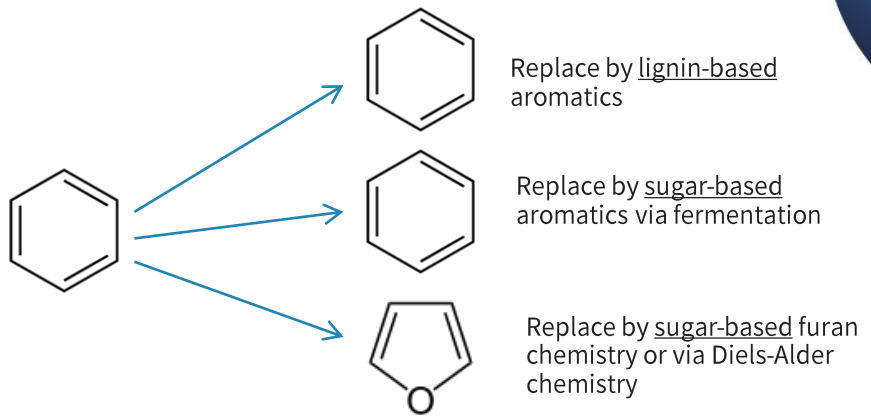




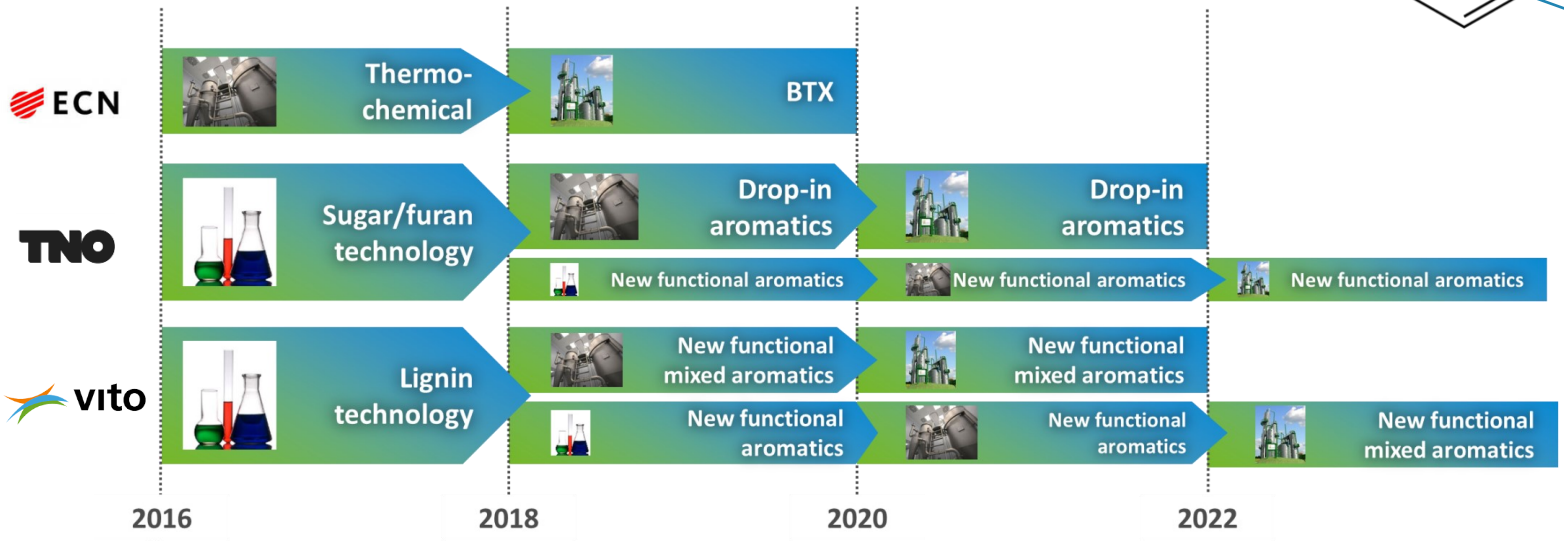
Source: Bioaromatics demo-case presentation by Ludo Diels

How can biomass replace aromatic characteristics?

The bioaromatics demo-case



Based on the lignocellulose biorefinery



Use-cases:

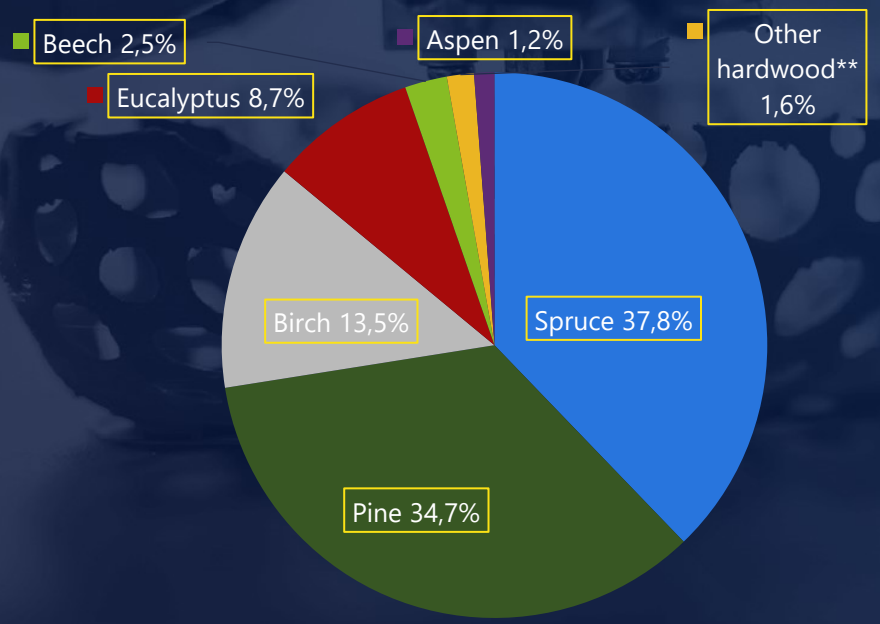
1. **Sugar to bio-aromatics**. Sugar-line based on furan and Diels-Alder chemistry: leading to functionalized furans and aromatics
2. **Lignin to bio-aromatics (lignoValue plant).** Lignin line based on depolymerisation, fractionation, conversion: leading to innovative functionalized molecules
3. **Thermochemical conversion of biomass to bio-aromatics**: leading mostly to bio-based BTX molecules

The Lignocellulosic biorefinery

Lignocellulose is typically considered one of the most promising feedstocks to produce a variety of renewable fuels and value-added chemicals.

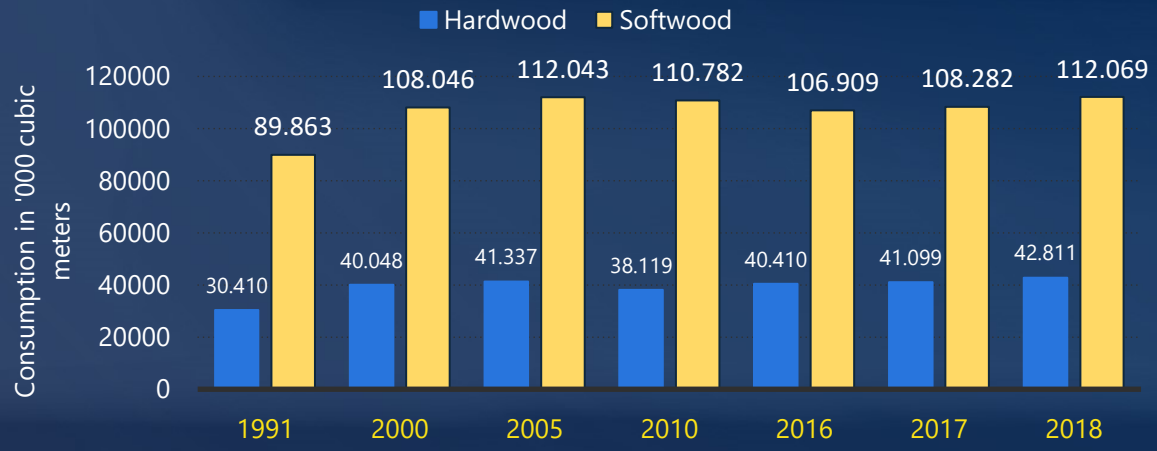
In 2015, the total EU-28 forest area amounted to **161 Mha** (Forest Europe, 2015), covering 38% of the land. Of this area, **134 Mha** (84%) are considered as forests available for **wood supply** (FAWS). In 2015, EU-28 forest reached 26 billion m^3, meaning that forest increased 34% over the last quarter of a century (aebiom, 2017).

Source: European Biomass Industry Association



Distribution of Confederation of European Paper Industries' (CEPI) wood consumption in 2017, by species

Source: Key Statistics European Pulp and Paper Industry 2018, page 19



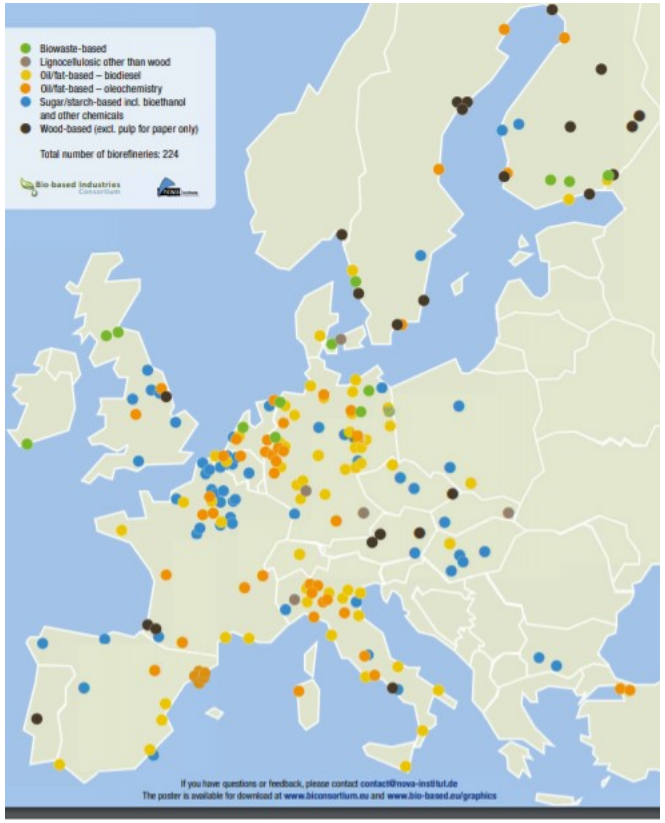
Wood consumption of the Confederation of European Paper Industries' (CEPI) in Europe from 1991 to 2018, by type

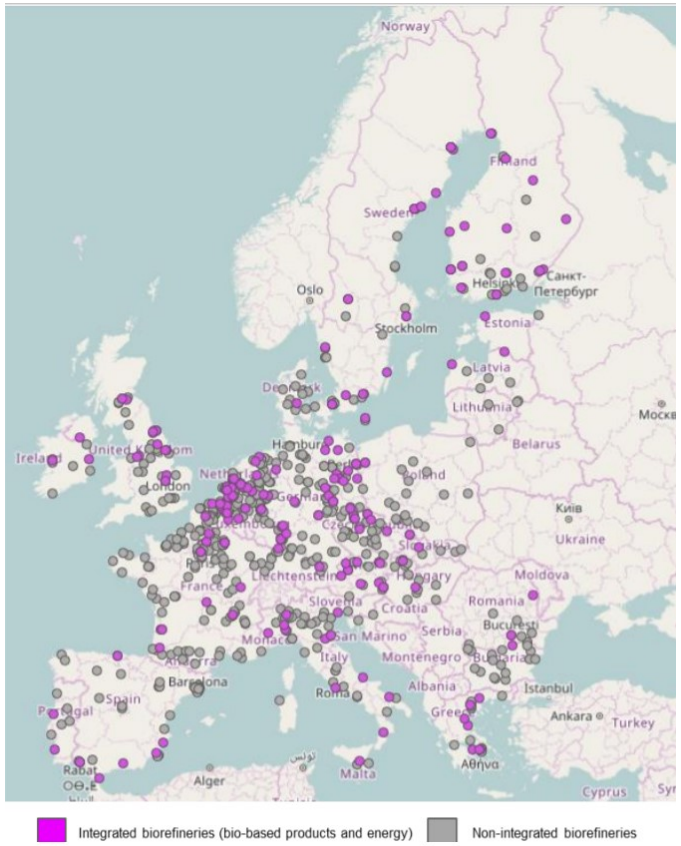
Source: Key Statistics European Pulp and Paper Industry 2018, page 5

The lignocellulosic biorefinery demo-case

Leader: South Netherlands, NL (Willem Sederel)

Biorefineries in Europe: pathway toward more sustainable materials





Use-cases:

1. **Large-scale biorefinery, the "Redefinery project"** focused on the production of sugar from cellulose and hemicellulose plus sustainable bio-asphalt from lignin (stemming from hardwood chip/pellets as feedstock).
2. **Softwood-based biorefinery** focused on the production of mixed sugars and panel form lignin (softwood as feedstock)
3. **Local4Local biorefinery**, based on small-medium biorefinery of wood, with cellulose to fiber and syngas production from the hemicellulose/lignin fraction.

Source: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC113216/online_biorefineries_research_brief.pdf

Source: https://biconsortium.eu/sites/biconsortium.eu/files/downloads/MappingBiorefineriesAppendix_171219.pdf

The Chaplin program

The Lignocellulosic biorefinery

CHAPLIN

In the CHAPLIN program we replace a large part of the bitumen in the asphalt formulation by lignin in a special biobased formulation. Lignin is one of the most abundant substances in nature. About 1/3 of trees and plants consists of lignin. It has excellent adhesive and protective properties. In the CHAPLIN program we focus on biobased asphalt with premium properties.

The Chaplin program

Interested in making asphalt roads more sustainable?

PARTICIPANTS		
COMPANIES	GOVERNMENT	KNOWLEDGE CENTERS
Dura Vermeer	Rijkswaterstaat (department of Waterways and Public Works)	Utrecht University
H4A	Province of Gelderland	Wageningen Food & Biobased Research
NTP	Province of North Brabant	TNO
Latexfalt	Province of Overijssel	Q8 Research
Roelofs Groep	Province of Zeeland	AKC (Asfalt Knowledge Center)
Vertoro	Province of South Holland	
Avantium	Municipalty Wageningen	
Praj	Municipalty Bergen op Zoom	
Boskalis		
Biondoil		

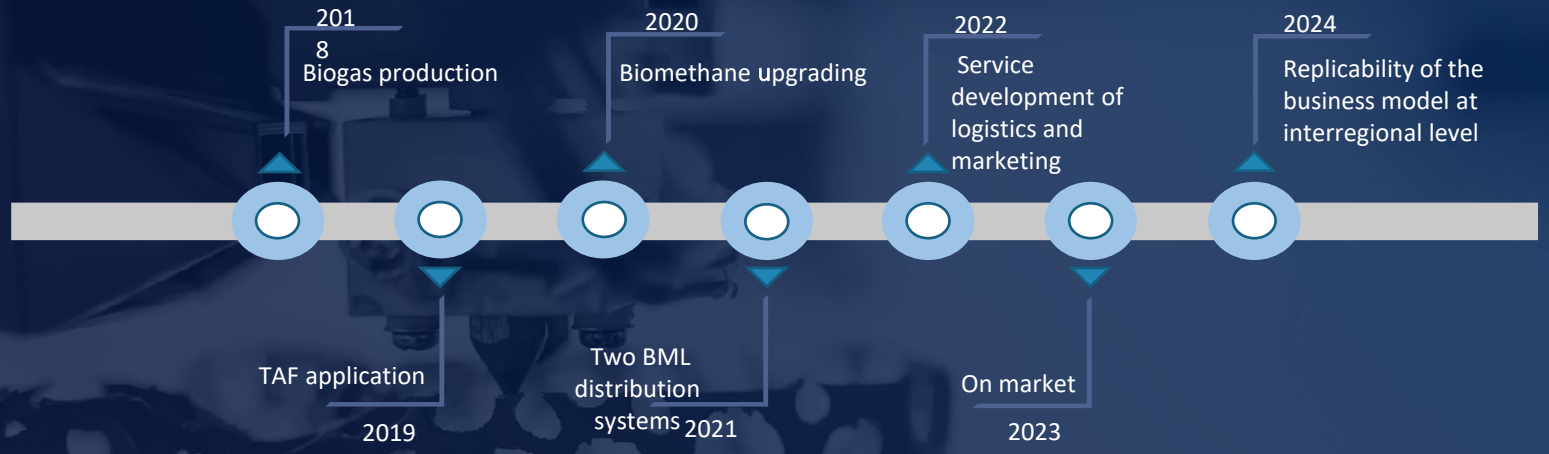
CHAPLIN

OVERVIEW OF THE LIGNIN ASPHALT TEST STRIPS IN THE NETHERLANDS UNTIL 2019

Location	Name	Road type	Length (m)	Lignin used	Bitumen sub-stitution (%)	Year of installation
Sas van Gent	Wervenweg	Industrial	70	Soda	50	2015
Terneuzen	Europaweg	Regional	400	Kraft	45	2016
Terneuzen	Finlandweg	Industrial	100	Kraft	45	2017
Wageningen	Bornsesteeg	Cycling path	1000	Soda, Kraft, Hydrolysis	45	2017
Beek en Donk Boxmeer	N272	Regional	2500	Kraft	32	2017
Oostburg	Rondweg	Regional	1000	Kraft	45	2018
Vlissingen	Schotlandweg	Industrial	500	Kraft	45	2018
Vlissingen	Ijslandweg	Industrial	400	Kraft	45	2018
Zevenaar	Witte Kruis	Cycling path	500	Soda	50	2018
Gent (B)	Industrieterrein	Industrial	200	Kraft	45	2018
Goes	Joachimkade	Industrial	300	Kraft	45	2019

Other use-case of the Bioeconomy Pilot

The Liquified Bio-methane demo-case



The Biopolymers demo-case

FOCUS ON APPLICATION

1. **Biopolymers for medical applications. Polyhydroxyalkanoates - PHA)** for medical and industrial applications from postconsumer feedstock and bio-based substrates
2. **Biopolymers for fashion**. Polyester and polyurethane-based synthetic leather from agricultural waste

FOCUS ON RAW MATERIAL SUPPLY

1. **PLA from food waste.** Demonstration plant project to produce Poly-Lactic Acid (PLA) biopolymer from waste products of bakery industry
2. **Lignin-derived biopolymers.** Goldilocks – Lignin-based platform for fuels, chemicals and materials

- Highlights of 2019 achievements
- Ongoing activities of 2020

Interregional cooperation for sustainable growth

Highlights of 2019 achievements / 1

2 New uses-cases established in the lignocellulosic biorefinery and Liquified Bio-methane demo-cases

- Local4Local biorefinery, based on small-medium biorefinery of wood, with cellulose to fiber and syngas production from the hemicellulose/lignin fraction.

- SMBio-LNG Shaping the future of Sustainable Mobility aiming at deploying a sustainable supply chain of liquefied biomethane for heavy vehicles mobility

2 Business Plans on bioaromatic and Liquified Bio-methane demo-cases produced

- Lignin to bio-aromatics (lignoValue plant).
- **Business Plan submitted to the to DG Regio under the Thematic Smart Specialization Platform with the involvement of several Vanguard regions and LOIs of companies from the different involved regions**

- SMBio-LNG Shaping the future of Sustainable Mobility
- **Business Plan submitted for Technical Assistance Facility service**

European Commission

SMART SPECIALISATION PLATFORM

Interregional cooperation for sustainable growth

Highlights of 2019 achievements / 2

7 Collaborative initiatives on the bioeconomy and bio-based sectors

- Bio-Based Industry Consortium (on the basis of a Memorandum of Understanding)
- The European Bioeconomy Network (on the basis of a Memorandum of Understanding)
- European Chemical Regions Network
- BIOMONITOR Project (on the basis of a Memorandum of Understanding)
- Pilots4U
- S3Chem Interreg Europe – Smart Chemistry Specialisation Strategy
- RUMORE Interreg Europe project – Rural-Urban Partnerships Motivating Regional Economies

5 Interregional matchmaking workshops and 3 interregional conferences

- Matchmaking & Interregional workshops organization to stimulate new cooperation opportunities and projects active in bioeconomy and circular economy sectors
- Presentation of the most relevant achievements and at other interregional European networks.

→

- **650 attendees**
- **80 1:1 meetings** involving SMEs and large company operating in biobased and bioeconomy sectors
- **40+ companies from 20+ EU regions** involved

→ **Bioeconomy Pilot presentation in 24 European workshops**

Interregional cooperation for sustainable growth

Highlights of 2019 achievements / 3

VANGUARD INITIATIVE
New growth through smart specialisation

THE BIOECONOMY PLATFORM FOR REGIONS

Stimulating bio-based investments by connecting regions and industries.

The Bioeconomy Pilot and the Biobased Industry Consortium initiative

Biobased Industries Consortium

A digital partnering platform where **REGIONS** and **INDUSTRY** can make contact based on mutual interest. The platform focuses on **CREATING LOCAL VALUE CHAINS AND ACCESS TO FINANCE**, namely helping regions and industry bridge the gap about **BIO-BASED INVESTMENT OPPORTUNITIES** at the level of regions.

BENEFITS FOR REGIONS

- Easily identify INDUSTRY corresponding to the region's bio-based investiment priorities/ feedstock availability
- Make contact, build relationships with industry actors operating in a different region and attract private investment for local supply chains

BENEFITS FOR INDUSTRY

- Easily identify REGIONS offering opportunities for bio-based investment & associated financial incentives
- Make contact, build relationships and access alternative source of finance for excellent for demo and flagship projects

Interregional cooperation for sustainable growth

Highlights of 2020 activities

Validate a sustainable and portable route for bioaromatics molecules production. The LignoValue Pilot plant will cost € 4.3 mln and should be operational in 2021.
The plant will convert wood and lignin into aromatics and subsequent fractionation into monomers, dimers and oligomers. The pilot plant have a 200 kg/day production.

Encourage the industry operating in Vanguard regions on testing bioaromatics. The Diels-Alder chemistry platform and the LignoValue plant offered companies the opportunity to conduct application testing to evaluate the properties of these highly functionalised renewable aromatics.

Promote the conversion of biomass into biobased building blocks (through fermentation, chemical conversion and/or chemical catalysis) to the industry with tools to realise a stable and more sustainable (chemical) industry, enabling the creation of bioplastics, fibers, advanced biofuels, superabsorbents and medical materials from biomass.

Support an agrochemical coalition creation focused on design new sustainable value chains based on the connection between the agricultural and chemical industry. Several concrete products have already been brought to market, including bioasphalt, bioaromatics that are recognised as the best in class in Europe, fibre-based building materials, street furniture and park benches, and even a biobased viaduct.

Contribute to defining sustainable, circular and innovative value chains from biomass valorization by creation interregional partnership addressing a synergicThe Pilot's demo-cases are validating business models able to generate higher income for producers while keeping consumer prices affordable and improving the delivery of environmental and social benefits. integration of rural growth and use of biological resources.
More than **50 SMEs**, **10 EU economy clusters/agencies** and **15 university/research centres** were directly involved in the demo-cases activities and participated in the public events organised.

Many thanks for your attention

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